

Top 10 business risks and opportunities for mining and metals in 2023



Executive Summary



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Boom, bust, digital transformation and climate change

Fifteen years of the EY Top 10 business risks and opportunities for mining and metals

When our first report was released in 2007, the sector was quite different from what it is today. That year's report reflected the sector's declining prices, with cost reduction considerations, consolidation and capital management named as top risks amid a sharp focus on ensuring future growth. Just a few years later, we emerged into the supercycle, and risks changed as other factors came to the fore – including resource nationalism, a global skills shortage, a tightening economy and rising inflation. It was a period where the mining sector looked for growth at any cost.

The cycle turned again and, in 2016, we hit another downturn. At the time, we nearly decided to discontinue the report. It seemed as if there would be one set of risks for the good times and one set for the bad times. But, in 2017, things changed again. Our 10th report reflected miners' focus on digital transformation, which appeared as a genuine disrupter. There were questions as to who the Kodak or the Uber of the mining sector might be. But it turned out not to affect the mining sector too much. At least not at first.

It was the emergence of social issues over the past few years that proved truly disruptive. Last year's list of risks was topped by environmental, social and governance (ESG), reflecting miners' new focus on considering different business models. In fact, ESG-related issues made up the entire top three risks of last year's report – each with a significant, distinctive impact that made it impossible to treat them as one risk. The combination of these social and environmental issues with digital transformation is driving sector-wide transformation, prompting changes to portfolios and risk appetite, creating regional differences and some nationalization. As we head into 2023, the mining and metals sector is responding with more fundamental shifts to business and operating models.

This presents a rare opportunity for miners to analyze where optimal value can be found – and to redefine business models to capture that value. Companies that do this successfully will future-proof their business model to better deal with disruption and changing commercial relationships, and ultimately win competitive advantage.

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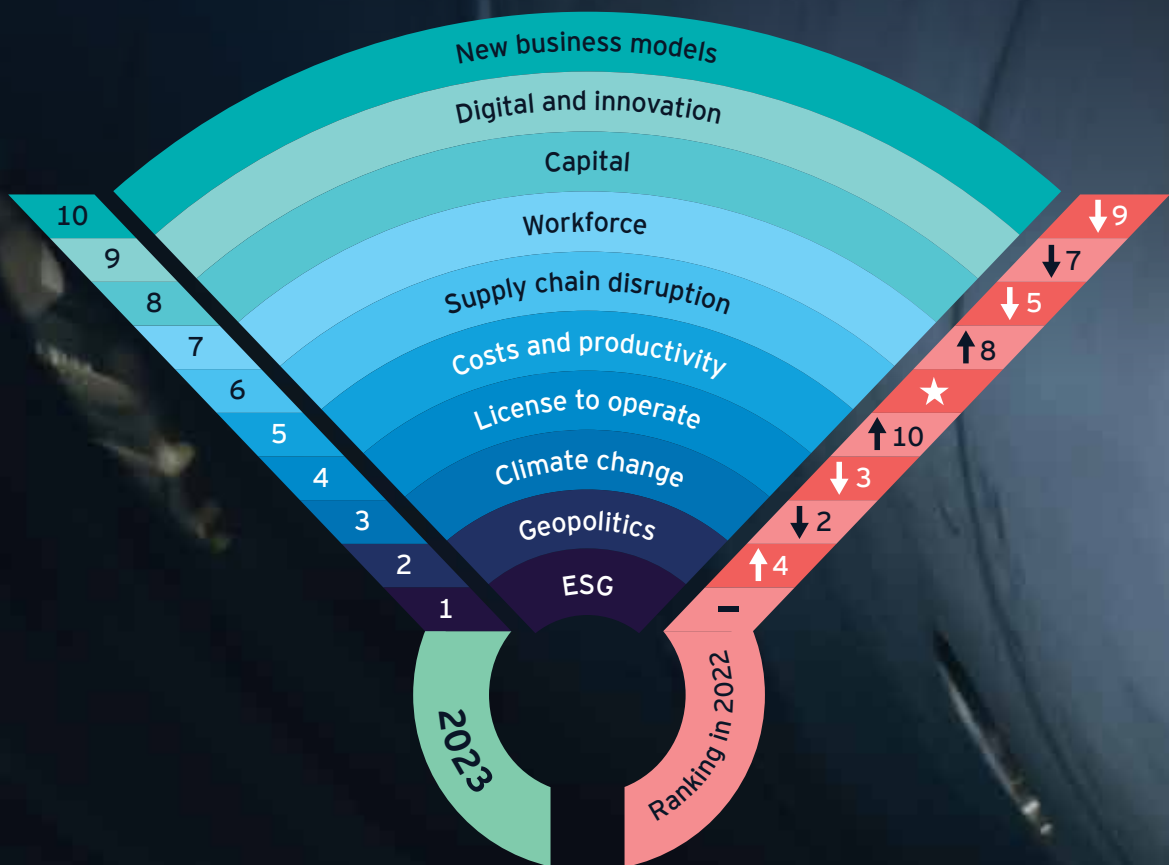
It is everyone's responsibility in the sector to make the sector better.

Senior mining executive

We surveyed global mining and metals executives, between June and August 2022, with the majority of respondents from the C-Suite.

The past 12 months have witnessed huge upheaval and change. War in Ukraine, climatic events, new governments in key mining regions and shifting relationships in others are all impacting the world's mining and metals companies. These external factors will continue to drive a shifting of the sector's risks and opportunities as stakeholder and capital market pressure hold miners accountable on multiple fronts. It's not surprising that this report's top risks and opportunities are ESG, geopolitics and climate change.

EY top 10 business risks and opportunities for mining and metals:



↑ Up from 2022 ↓ Down from 2022 — Same as 2022 ★ New to the radar

1 ESG

Key priorities include increasing credibility through disclosure, water stewardship, circular economy, addressing expectations on biodiversity and developing a long-term strategic vision for mine closure.

2 Geopolitics

Global uncertainty puts pressure on companies to quickly assess the impact of different alliances, trade flows, governments and taxes on business decisions.

3 Climate change

Net zero is still a focus, but miners are also mitigating broader transition and physical risks. Companies must play a role in enabling a just transition – achieving decarbonization targets while considering the long-term impact of mine closures on workers and communities.





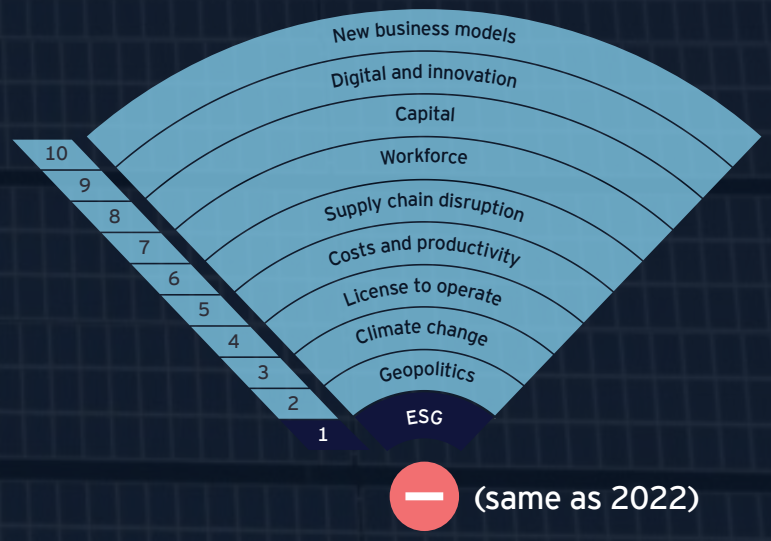
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Environmental, social and governance

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Good governance is always going to be a top trend, but investors and analysts are smarter. It's no longer a 'check the box' exercise.

Senior mining executive

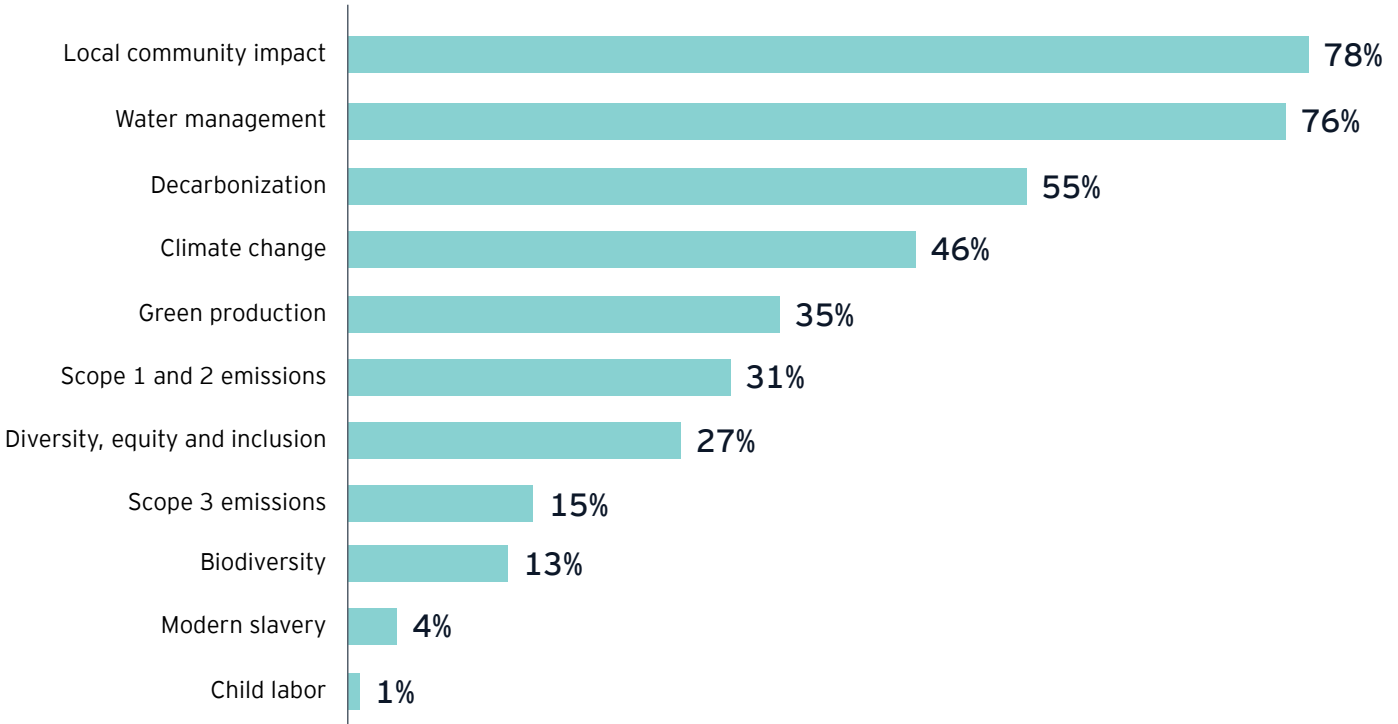


ESG remains the number one risk and opportunity in mining and metals, according to survey respondents. Across the sector, we see more evidence that miners are integrating ESG factors into corporate strategies, decision-making and reporting, as the issue becomes a priority for all stakeholders.

If companies think by 2050 net zero carbon will be the minimum expectation they will be mistaken. Differentiation will come to those that are net positive on all aspects of ESG.

Miners need to go beyond policy and have a holistic approach to ESG to gain investor confidence and community trust.

Which are the top ESG issues that the metals and mining sector will face the most scrutiny on from investors? Respondents could choose more than one option.



Source: EY Knowledge analysis of the business risks and opportunities survey 2023.

Prioritizing water stewardship

Seventy-six percent of our survey respondents cited water stewardship as their top ESG risk, as climate change and water scarcity concerns escalate. As one mining leader noted: “Access to clean water is a human right. We need to allow local communities access to clean water and make sure that we don’t contaminate the water sources around our operations.”

This critical issue will impact the sector for years to come. Coordination between organizations, and with government, needs to be a priority for miners.

The sector’s current trend of setting blanket targets around water usage often fails to acknowledge trade-offs – for example, water-saving technologies can be energy-intensive. Transparency around the water/energy nexus and a lifecycle approach can help miners assess and limit impact.



Overlooking the circular economy is a missed opportunity



Why mine new material, and have all of these impacts to nature and society, when there's so much material already in flow? Especially with critical minerals, and for highly recyclable metals like aluminium and copper, it's important that the circular economy is leveraged to the utmost.

Senior mining executive

Traditionally, mining operations follow a linear process of take (mine), make (process), dispose. In an example of the circular economy of take, make, use, recycle or reuse, ore is mined and processed, but opportunities are explored to create by-products from waste that can be used within mining or in other industries.¹ Many markets are exploring circular economic principles to increase mineral and metal self-sufficiency.

The circular economy offers opportunities for mining and metals companies to take ownership of their products throughout their lifecycle, finding ways to unlock new value. For example, a company that mines battery minerals can also play a role in ensuring they are retained and reused at the end of the battery's life, opening up the opportunity of new commercial models for battery disposal. Stewardship of minerals throughout their lifecycle can be an excellent differentiator for companies, particularly while recycling continues to develop. Glencore, for example, has smelting and refining assets that allow a wide range of recyclable materials to be processed, especially end-of-life electronics, batteries and battery metals.² We anticipate significant first-mover advantage for miners that manage to achieve this. But while almost 60% of survey respondents said engaging in circular economy strategies is a differentiator, only half of these plan to do so.

Addressing greater expectations around biodiversity

The Taskforce on Nature-related Financial Disclosures (TNFD)³ is accelerating its focus on biodiversity as a business risk, and we see moves to incorporate biodiversity into risk management frameworks. Mining companies are under increased pressure to assess biodiversity risks and opportunities across their business, using a similar structure as used for the Taskforce on Climate-related Financial Disclosures (TCFD),⁴ and yet only 13% of our survey respondents recognized this as a key area where they would see more scrutiny. We believe that miners will need to demonstrate that mines are considering the long-term impact on biodiversity.

As well as avoiding negative biodiversity consequences, miners must also articulate their net positive impact. For example, Teck Resources aims to be a "nature positive" mining company by 2030 through conserving or rehabilitating at least three hectares for every one hectare affected by its mining activities.⁵

Increasing credibility of disclosures through data and communication

Around the world, regulation of carbon emissions, sustainability and social governance is increasing, with miners subject to different regulatory and reporting frameworks across jurisdictions. The new International Sustainability Standards Board (ISSB) aims to help meet the demand for high-quality, transparent, reliable and comparable reporting by companies on ESG, including climate data.⁶ Rating agencies expect more quantitative information that is typically difficult to obtain from most miners' systems. Complying with new standards and expectations will require miners to improve the availability, rigor, trust and reliability of data.

Assessing capital increasingly depends on meeting ESG targets, with investors expecting comprehensive, accurate nonfinancial value included in company disclosures (covered in more detail in the "Climate change" section). Policymakers and companies need to work together to ensure the availability of

¹ "The circular economy: A sustainable future for mining and the world," Bruce Connell, University of Queensland, via <https://stories.uq.edu.au/smi/the-circular-economy/index.html>, accessed 29 August 2022

² "Glencore targeting recycling step change," *Mining Weekly*, 6 December 2021, <https://www.miningweekly.com/article/glencore-targeting-recycling-step-change-2021-12-06>

³ "Developing and delivering a risk management and disclosure framework for organisations to report and act on evolving nature-related risks," Taskforce on Nature-related Financial Disclosures, <https://tnfd.global/>, accessed 29 August 2022

⁴ Task Force on Climate-related Financial Disclosures <https://www.fsb-tcfd.org/>

⁵ "Becoming Nature Positive," Teck Resources, via <https://www.teck.com/nature-positive/>, accessed on 29 August 2022

⁶ International Sustainability Standards Board [IFRS – International Sustainability Standards Board](https://www.issb.org/)

better climate and other ESG data to create transparency and assurance of company actions or plans.⁷

Developing long-term strategic vision for mine closures



Too many companies don't do proper closure, which has substantially impacted the sector's image. Companies need to be more responsible in planning the full cycle and making sure that they have a positive impact.

Senior mining executive

As future mines will be carbon-neutral and sustainable, most environmental risks and opportunities lie in companies' management of existing assets.

A proactive approach to mine closure begins when a mine is first planned. Designing with closure in mind allows for effective ongoing engagement with traditional owners and communities, creates opportunities for progressive closure activities and ensures that decisions throughout the life of the mine consider the impact on closure options.

Mine closures impact a wide range of stakeholders, and expectations are increasing around how miners mitigate these impacts, including the socioeconomic effects on communities. There is a sharpened focus on creating a legacy. When miners take a strategic approach to engaging with communities and supporting their socioeconomic longevity, they can leave a positive legacy long after mines have closed

Collaborating across sector to manage tailings and toxicity

Tailings and toxicity management are important issues where greater collaboration could yield more effective solutions. In 2020, the International Council on Mining and Metals (ICMM) members committed to implement the Global Industry Standard on Tailings Management (GISTM). All tailings facilities operated by members with "extreme" or "very high" consequence classification need to conform with the GISTM by

August 2023, with all others to comply by August 2025. There are concerns that some mining companies may not be able to meet the deadline.

An additional concern is that space and water shortages are leading to a growing prevalence of dry stack tailing, which brings different challenges around filtration energy consumption and reliability. This is likely to become a critical issue as water shortages grow.

Consultation with communities is an increasingly important part of managing tailings risks (and is a requirement of the GISTM), but recent tailings dam failures make effective consultation difficult.

Improving diversity, equity and inclusion (DE&I)



We need to be much better in attracting women, and providing a safe and healthy workplace, especially for fly-in-fly-out (FIFO) workers.

Senior mining executive

DE&I remain critical challenges for mining. The landmark Respect@Work report, authored by Australian Sex Discrimination Commissioner Kate Jenkins,⁸ uncovered concerns around workplace culture that are apparent across the sector. Unless mining and metals companies can address these issues, they face significant risks in attracting the next generation of workers, and in sustaining their businesses into the future. Key DE&I issues include:

- ▶ **Increasing participation of women:** Mining and metals companies still struggle to attract, retain and promote women, depriving them of a huge talent pool as well as the proven benefits of a more gender diverse workforce. EY teams recently interviewed senior female leaders in mining to understand the greatest opportunities to accelerate change. Rethinking traditional recruitment tactics, creating equitable career paths, and breaking down barriers on-site and in corporate headquarters were cited as actions that could help raise female participation in mining. You can read the full report [here](#).

⁷ "Achieving net-zero emissions requires closing a data deficit," *International Monetary Fund*, 23 August 2022

⁸ "Sex Discrimination Commissioner launches Respect@Work report of the National Inquiry into Sexual Harassment in Australian Workplaces," *Australian Human Rights Commission*, 5 March 2020, via <https://humanrights.gov.au/about/news/sex-discrimination-commissioner-launches-respectwork-report-national-inquiry-sexual>, accessed 9 September 2022

- ▶ **Safety and support on-site:** Miners need to change how mining sites are built, operated and constructed to improve safety and support for all workers. For example, on-site childcare and local schools could attract different people to mining and make a positive contribution to the community. Workers who blow the whistle on inappropriate behavior and practices also need more protection.
- ▶ **Building a purpose-led brand:** As discussed in our “Workforce” section, mining must do more to build a brand aligned with the purpose and values of the next generation of talent, and we have begun to see some miners progress this.



Balanced approach to managing safety risks:

Considering the impact of major accidents in mining, it's not surprising that the focus has been on critical risk. But some miners are not paying adequate attention to small incidents, which are on the rise and can also prove fatal. A balanced approach to managing both critical risks and foundational workplace safety can help companies build a holistic, robust approach to keeping workers safe.

⁹ “ISO 45003:2021 - Occupational health and safety management – Psychological health and safety at work – Guidelines for managing psychosocial risks,” *International Organization for Standardization*, June 2021, <https://www.iso.org/standard/64283.html>

¹⁰ “2021 National Return to Work Survey Report,” *Social Research Centre*, Australia National University, Prepared for Safe Work Australia, February 2022 <https://www.safeworkaustralia.gov.au/sites/default/files/2022-02/2021%20National%20Return%20to%20Work%20Survey%20Report.pdf>

Health and safety

Mining and metals companies need a new approach to wellbeing

We have never explicitly called out health and safety as a top 10 risk or opportunity in our report, as it is inherent in how mining and metals companies operate. In recent years, Safety Philosophy has evolved to go beyond Zero Harm. It's an evolution of traditional ways of thinking about health and safety to focus on opportunity and positive contributions to build resilience, capability and efficiency, while still working to eliminate fatalities and reduce harm. This commitment to safety is reflected in positive progress made around the world in reducing serious incidents, fatalities and injuries over the past decade.

This year, however, we think there are several health and safety areas that require a callout:

Psychological health and safety: During the COVID-19 crisis, many mining and metals companies boosted mental health support for workers, but the sector still needs to do more to improve psychological health and safety. Fly-in-fly-out employees face challenges accessing social support systems, a problem that has escalated with pandemic-related seclusion and isolation. Bullying and harassment are endemic, and tied to ongoing issues around a lack of diversity, inclusion and respect.

Mining leaders we spoke to believe that policy is needed to bring the structural and cultural change that will make a genuine difference to employee wellbeing. The recently published ISO 45003:2021 standard, the first globally recognized framework for how to manage and protect mental wellbeing at work, may be an opportunity for reforming the mining safety culture. As one leader explained, policy helps bridge the gap between ambition and action: *“We have mental wellbeing policies, and loose guidelines around what you can and can't do. But when you create a policy, it creates a set of actions. There is a cost element, a legal element and a leadership element to it.”*

Holistic reintegration into the workforce: Australian data shows that 90% of people that suffer a physical injury return to work within 90 days, but only 50% of people that have taken leave because of mental health issues have returned after six months. Mining and metals companies need to develop a holistic approach to reintegrating these workers, particularly when work is a causal factor behind their illness. This may include, for example, reviewing workloads, creating a support network and ensuring a mentally safe workplace. As physical injuries at work can also trigger mental health challenges, offering both physical and mental health support can help employees return to work and to full health.

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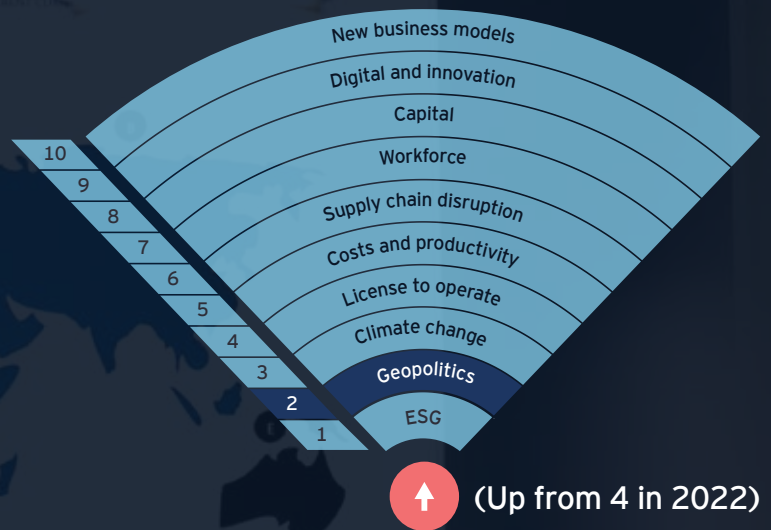
Geopolitics

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Geopolitical uncertainty makes it necessary for us to rethink the business models of our supply chain.

Senior mining executive





It is not surprising that geopolitics is the number two business risk for mining and metals companies heading into an uncertain 2023. The war in Ukraine has had an impact on the trade of minerals and metals, while increasing competition between China and the US, and newly elected governments in key mining markets, are affecting the long-term plans of miners. Companies are under pressure to quickly assess how different alliances, disrupted trade flows, new governments and taxes will affect business decisions. Further, as the interplay between ESG and geopolitics increases, so too does the amount of regulation the sector needs to comply with.

As miners consider strategic decisions, they should assess the implications of several geopolitical trends.

Understanding new governments in key markets

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The unintended consequence of internal political discussions forces investors to observe and wait.

Senior mining executive

New governments in Australia, the US, Chile and Peru bring new policies impacting the sector. In the US and Australia, governments have made sustainability and climate change key issues, in particular making or foreshadowing laws that affect coal miners and prioritize greener minerals and metals.

Over the next year, several important meetings and government changes are expected to impact the sector. In October 2022, the National Congress of the Communist Party of China will likely see Xi Jinping extend his term in power and address unbalanced development. China is also planning measures to boost economic growth after COVID-19, slowdown in the property market and power shortages. In Colombia, President Gustavo Petro has outlined plans to phase out coal production while boosting renewable power. And with Brazilian elections scheduled in October 2022, mining companies are lobbying for legal stability around regulations and taxes.¹¹

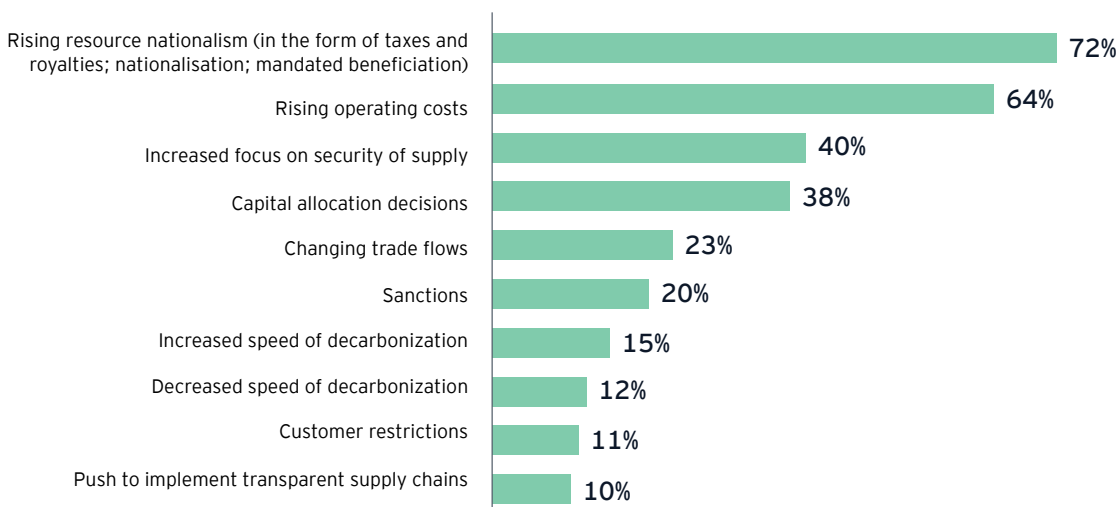
Responding to resource nationalism

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In a commodity business, you have to differentiate yourself because your product is literally identical ... We try to take care of the risks we can manage and make sure we do what we say we’re going to do. A huge part of that is having the confidence to say that tomorrow we’re still going to own the mines.

Senior mining executive

As governments seek to fill revenue gaps after spending throughout the pandemic, many are capitalizing on, or considering how to capitalize on, higher commodity prices through new or increased mining royalties. Seventy-two percent of respondents said this was the most likely impact of geopolitical uncertainty on their operations. For example, Chile’s government plans to increase copper royalties on companies that produce more than 50,000 tonnes annually^{12,13} and, in Australia, the Queensland state government has increased coal royalties.¹⁴ We may also see greater use of other instruments such as excess profits tax or windfall taxes.

How do you think the current geopolitical uncertainty will impact your operations? (Respondents could choose more than one answer)



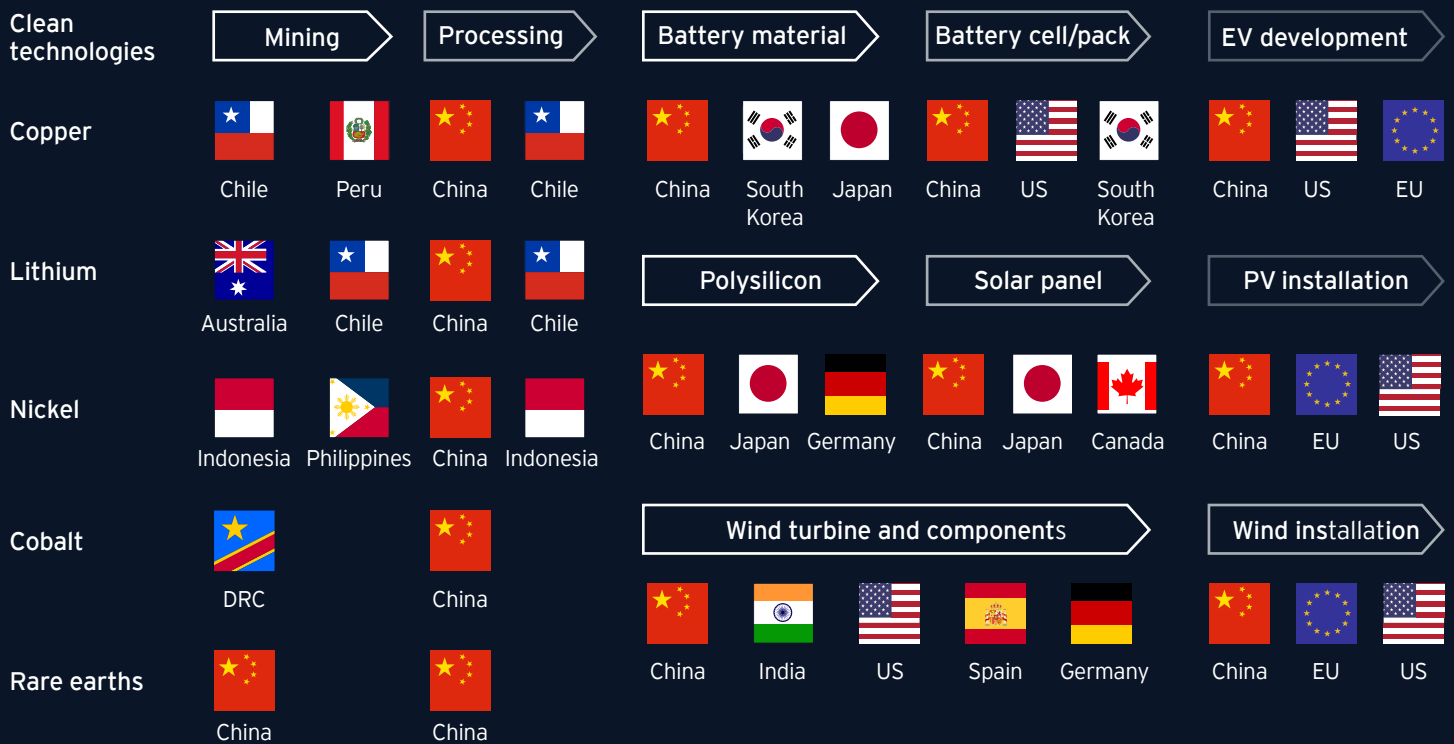
Source: EY business risks and opportunities survey 2023

¹¹ “From tax hikes to elections: What worries Brazil’s mining sector,” *BNamericas*, 27 May 2022 <https://www.bnamericas.com/en/interviews/fears-of-tax-hikes--the-pressures-facing-the-brazilian-mining-sector>
¹² “Chile plans to raise copper mining royalties and reform tax system,” *Reuters*, 2 July 2022, <https://www.reuters.com/world/americas/chile-plans-raise-copper-mining-royalties-reform-tax-system-2022-07-01/>
¹³ “Chile Mining Regulatory Development,” *Business Monitor International*, 22 August 2022 via AlphaSense
¹⁴ “Coal Royalties,” *Queensland Government*, <https://budget.qld.gov.au/highlights/coal-royalties/>

Mitigating the risk of China’s control of strategic minerals

China’s strategic control of many minerals, particularly rare earths, and the processing facilities for many others is of concern to governments and manufacturers in other jurisdictions: notably, the US, the EU and Japan. The Chinese government is also taking steps to increase its bargaining power in commodity markets in which it is heavily reliant on other countries or companies. For example, the state-backed China Mineral Resources Group will centralize the country’s buying of iron ore to improve negotiating power.¹⁵

Indicative supply chains of selected clean energy technologies show the changing trade patterns and geopolitical considerations



Notes: DRC=Democratic Republic of the Congo; EU=European Union; US=United States;Russia=Russian Federation; China=People’s Republic of China

Source: *The Role of Critical Minerals in Clean Energy Transitions*, IEA.

¹⁵ “How and why China is centralizing its billion-tonne iron ore trade,” *MINING.com*, 25 July 2022, <https://www.mining.com/web/how-and-why-china-is-centralizing-its-billion-ton-iron-ore-trade/>

Concerns over the security of supply of critical minerals will intensify as the nexus between climate change and political risk becomes more evident. As governments move to mitigate near-term climate change impacts and accelerate the energy transition, they are prioritizing policies that highlight the importance of metals and minerals needed for renewable energy production and storage. This could play out in several ways, including:

- ▶ **Increasing investment in critical minerals production:** Some markets, including the US, Europe and Australia, are developing critical mineral mines to mitigate potential risks that China may restrict the export of rare earths.
- ▶ **Local content rules:** The US Inflation Reduction Act is an example of legislation aimed at incentivizing companies to support local industry. This is likely to encourage the establishment of more mining, processing and manufacturing facilities that produce clean energy inputs, components and finished products.
- ▶ **Friendshoring:** Geopolitical control of minerals in friendly countries is becoming a policy tool to help secure future supply. For example, the US is engaging Africa in a more progressive way by promoting democratic governance across the continent as it seeks to counter the heightened influence of China, Russia and Middle Eastern countries.¹⁶
- ▶ **Cross-border cooperative value chains:** Companies along the electric vehicle, battery or renewable energy production value chains are collaborating to capture value in a region. For example, automakers are collaborating across African supply chains to secure supply of minerals through to electric vehicle manufacturing.

Rising interest from global automakers in securing minerals is driving cross-border investment into mining through, for example, securing offtake agreements and developing mines.

Navigating new taxes and carbon regulation

An evolving tax and regulatory landscape means miners must play close attention to how changes across jurisdictions will impact operations.

Global minimum tax: Major reform of the international tax system, led by the OECD, means that multinational enterprises (MNEs) could soon be subject to market-based taxation and a



minimum 15% tax rate. Once introduced, countries that had previously used a low corporate tax rate to attract investments will need to investigate alternatives and unwind some existing arrangements, such as tax holidays. Only 25% of our survey respondents said this was affecting their approach in valuing future investment decisions.

¹⁶ "U.S. Promotes Democracy in Africa as Rival Nations Expand Influence," *The New York Times*, 8 August 2022, <https://www.nytimes.com/2022/08/08/world/africa/us-policy-africa-blinken.html>



Carbon regulation: More countries are planning carbon taxes or regulation – 75% of G20 markets already have carbon pricing in place or scheduled. The EU's Carbon Border Adjustment Mechanism will impose a carbon tax on metals or minerals imported from countries where there is no carbon tax. This puts pressure on the EU's trading partners to introduce their own carbon taxes, to avoid losing revenue.

As governments increase efforts to reduce greenhouse gas emissions, we expect incentives to switch to renewable energy sources or boost innovation of low-carbon products and processes. These initiatives will have implications for both production and demand of certain metals for end-use applications.

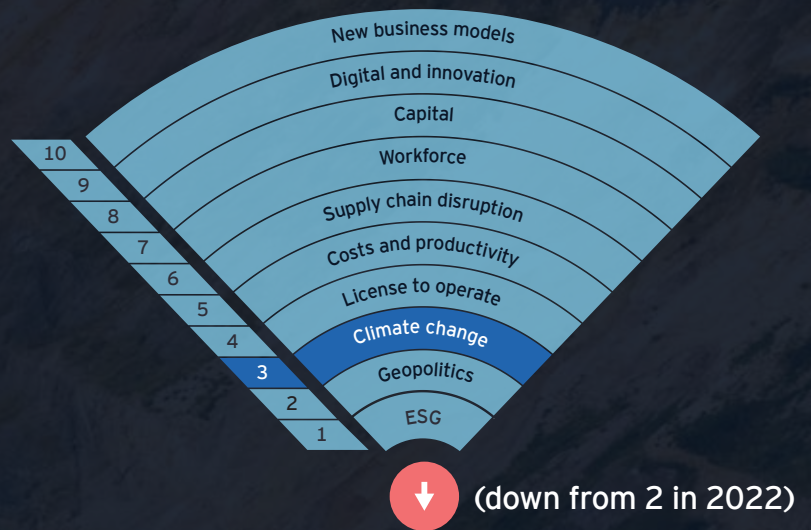
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Climate change

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Climate change is the threat multiplier for every other ESG issue — it's going to be the foundational driver for most trends.

Senior mining executive



Last year, the focus of climate risks was firmly on decarbonization. This year, while still targeting net zero, miners are also mitigating broader transition risks, and physical risks demonstrated through recent natural disasters.

Attaining net zero

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My concern is the energy crisis is affecting the willingness to stick to climate agendas — some coal-fired power plants are back online.

Senior mining executive

Many mining and metals companies have committed to highly ambitious decarbonization targets, but 2023 will reveal whether the sector is on the trajectory to net zero. As one mining leader admits: “We probably waited too long to get started ... If we haven’t done enough, there’s a reputational

and an investor risk.” Fifty percent of survey respondents said that they expected investors will put pressure on them to accelerate decarbonization. One executive flagged the challenge of “increased investor risk regarding return on investment on major energy transition-related investments without progress.”

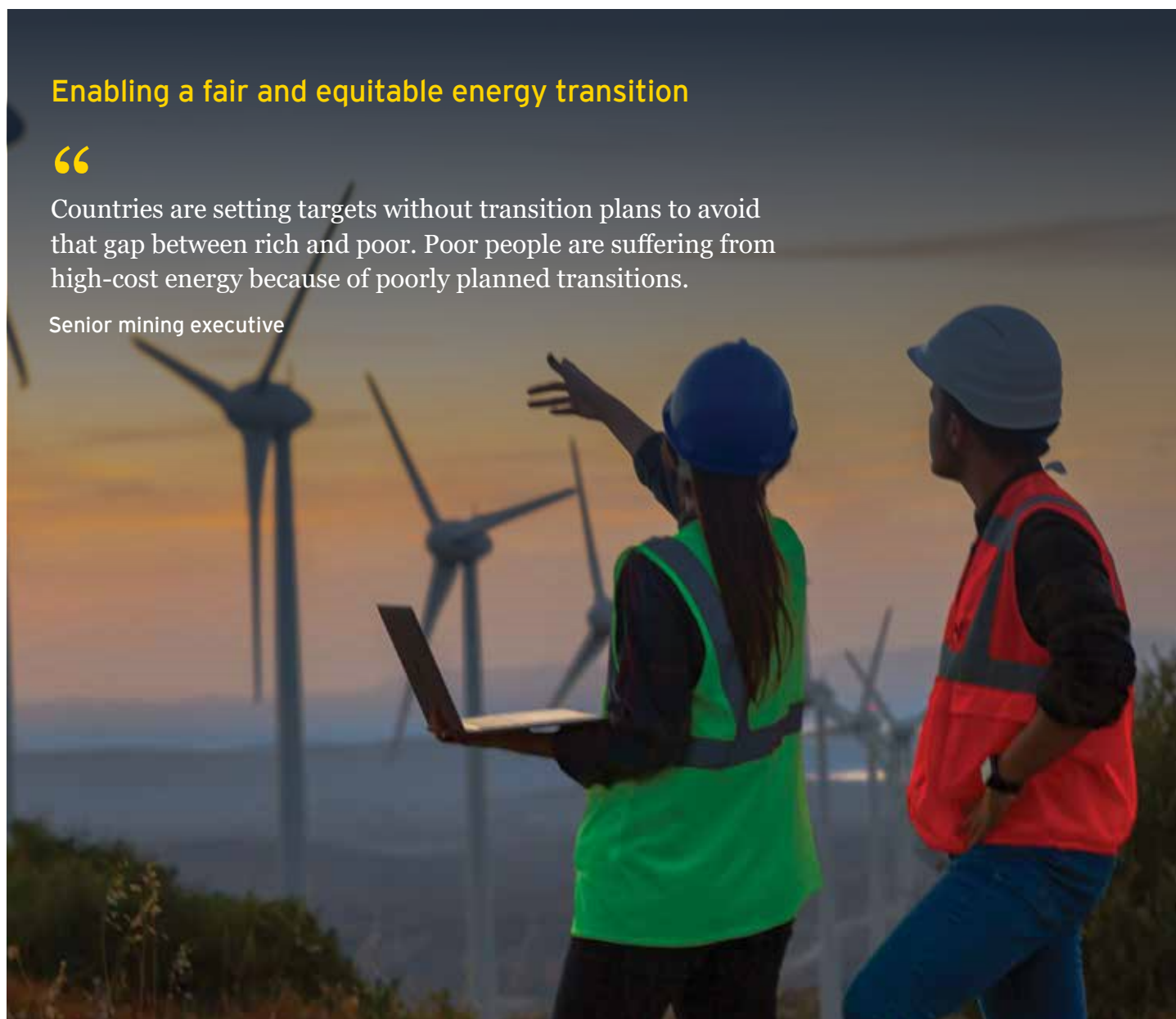
However, survey respondents were largely optimistic regarding progress, with only 34% saying current market volatility has changed their decarbonization strategy and pushed out net-zero timelines. Achieving targets will require clear pathways and a whole-of-organization commitment to treating climate change like any other strategic risk – dealt with at a board and executive level, and managed as part of the overarching business strategy, rather than addressed as a separate strategy delegated to a discrete team. Fifty-eight percent of respondents acknowledged that the energy transition may increase their costs.

Enabling a fair and equitable energy transition

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Countries are setting targets without transition plans to avoid that gap between rich and poor. Poor people are suffering from high-cost energy because of poorly planned transitions.

Senior mining executive



The energy transition is accelerating. In fact, according to the OECD,¹⁷ the transformation required to move to a zero-carbon world is on an unprecedented scale and within a time frame faster than any in human history.

But the transition is a major social risk. Nobody wants a mine in their backyard, but nor do most people want a wind or solar farm next door – this is a challenge to be overcome.

There are also concerns that there will be a major supply-demand imbalance in the provision of power, which will adversely impact poorer communities. One mining leader said: “Over the next few years, there is a good chance that parts of the world will not have access to sufficient power.”

Miners have a significant role to play in enabling a just transition, helping to achieve decarbonization targets while also ensuring no one is left behind as mines close. With many mines located in remote, underdeveloped parts of the world, mining and metals companies are accepting more responsibility to assure the long-term, sustainable economic growth and social progress of mine workers during and beyond the life of mine. Re-skilling mine workers to take different roles in renewable energy and new energy industries is one possibility, and one that miners can consider in collaboration with government, nongovernment organizations and communities.

Encouraging progress on Scope 1 and 2

Abating Scope 1 and 2 emissions is already in progress for most miners as they install renewable energy and more efficient equipment, electrify fleets and replace diesel with zero-carbon fuel options across the value chain. However, these measures will not fully decarbonize a mine. Emissions from processing, ventilation, heating and cooling, and backup power generation remain significant.

Transportation emissions are also an issue for larger bulk miners. In Australia, several miners in the Pilbara region are purchasing electric trains to reduce Scope 2 emissions. However, in other jurisdictions, these are likely to be Scope 3 emissions, as some railways are owned by governments or other organizations.

Adopting carbon capture and storage (CCS) for the last mile of net zero

CCS is necessary to achieve net zero, potentially alongside other carbon offsets. This technology is controversial due to high costs, the gap between its potential and actual

achievements, and its role in prolonging the use of fossil fuels. Some have also raised concerns about a lack of transparency around volumes of sequestered carbon.¹⁸ Companies will need to overcome the challenge of how to certify and account for sequestered emissions or credits.

Using carbon credits with caution

For sectors as energy intensive as mining and metals, carbon credits will be another essential tool in the decarbonization strategy, building in more flexibility, control and the potential to make greater cost savings. More miners are prioritizing carbon credits through investment in renewable energy, including on mine sites. But their use must be combined with action plans to reduce emissions if miners are to avoid greenwashing claims.

Collaborating to manage Scope 3

Scope 3 emissions account for most of the mining sector’s emissions, and pressure is growing from investors, communities and governments to take a strategic approach to their reduction.

Companies that have not yet begun calculating their Scope 3 emissions are already behind their competitors. Miners that identify the source of Scope 3 emissions, and which of these they can control and influence, can gain an advantage. For the first time, mining companies are factoring the emissions intensity of the processing and extraction when considering developing or acquiring new projects.

However, as one mining leader explained: “Decarbonization is not something we can do by ourselves – it involves collaboration. Governments are currently focused on energy reliability and energy security.” As well as government, collaborating with clients and vendors is critical to avoid greenwashing, and technology alliance strategies must consider Scope 3 emissions. One leader told us: “My biggest strategic issue is whether I think low-carbon technologies are going to be privileged or widely available. That determines almost everything I do in terms of Scope 3.”

We expect the trend toward partnerships to gather pace, as miners capitalize on their potential, beyond decarbonization, to position the business for a changing future. Miners are working with original equipment manufacturers (OEMs) and shipping companies to reduce haulage and transportation emissions. Others are looking to expand their control over the value chain by moving from minerals to materials.

¹⁷ “Just Transition: A Report for the OECD,” Samantha Smith for the Just Transition Centre, May 2017, <https://www.oecd.org/environment/cc/g20-climate/collapsecontents/Just-Transition-Centre-report-just-transition.pdf>.

¹⁸ “Over 500 Organizations Call on Policymakers to Reject Carbon Capture and Storage as a False Solution,” *Center for International Environmental Law*, July 2022, <https://www.ciel.org/organizations-demand-policymakers-reject-carbon-capture-and-storage/>

Overcoming key technology challenges

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There is a big gap between where we are now (decapitalization of fossil fuels) and the next generation of new possible solutions (which are not yet here). It will be rough in the next 10 years.

Senior mining executive

Fifty-five percent of survey respondents said that lack of timely technology and innovation is a key risk for energy transition.

For example, hydrogen and ammonia have yet to be used in large-scale vessels and are unlikely to be widely available for quite some time. The recent NASA Artemis 1 test flight delay, due to a hydrogen leak and difficulties in cooling the engines, highlighted the challenges with hydrogen.¹⁹

Miners that place the right bets on technology and innovation to mitigate climate risk can gain competitive advantage.

Staying on top of regulation

Miners need to monitor and conform to changing regulatory developments in Europe, the UK and the US, which aim to standardize and regulate climate change risk disclosure in securities filings. For example, the proposed SEC climate-related disclosure rules²⁰ and the new mandatory climate-related financial disclosure requirements²¹ in the UK will impact how miners report on emissions. Different regional regulations and programs may also create reporting challenges.

The International Sustainability Standards Board aims to deliver a comprehensive global baseline of sustainability-related disclosure standards,²² and may result in simplified processes. But ultimately, the transparent disclosure of carbon emissions across the value chain is in miners' best interests – it creates opportunities to obtain a green premium, secure valuable incentives and avoid costly breaches.

¹⁹ "Hydrogen leak forces multi-week delay for Artemis moon rocket," *CBSNews*, 3 September 2022, <https://www.cbsnews.com/news/artemis-1-moon-rocket-launch-scrubbed-hydrogen-leak-nasa/>

²⁰ "SEC Proposes Rules to Enhance and Standardize Climate-Related Disclosures for Investors," *US Securities and Exchange Commission*, 21 March 2022, <https://www.sec.gov/news/press-release/2022-46>

²¹ "Climate-related financial disclosures for companies and limited liability partnerships (LLPs)," *UK Department for Business, Energy & Industrial Strategy*, 21 February 2022, <https://www.gov.uk/government/publications/climate-related-financial-disclosures-for-companies-and-limited-liability-partnerships-llps>

²² International Sustainability Standards Board <https://www.ifrs.org/groups/international-sustainability-standards-board/>



Mitigating physical impacts

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The frequency and the duration of extreme weather events are going to increase, and that will affect our value chains, our communities and our economies.

Senior mining executive

Recent natural disasters, including bushfires and flooding in Australia, and heatwaves and wildfires across the northern hemisphere, have demonstrated the widespread impact of the climate crisis on production, supply chain and prices. Extreme climatic events are set to increase, and mining companies need to be prepared.

As we discussed in the [ESG section](#) of this report, water stewardship is already a major issue. Prolonged droughts will exacerbate this risk, resulting in conflict with local communities and increased operational costs.

Flooding can also cause major damage, including water supply contamination and tailings dam failures. Recently in Queensland, Australia, flooding caused miners to declare force majeure, which affected supply obligations. Climatic events need to be considered in mine planning and design due to their potential to reduce asset operating life.



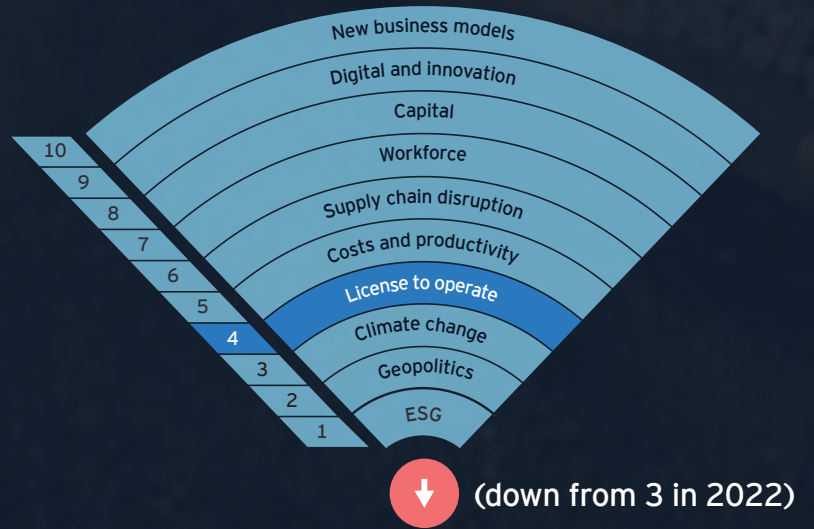
04

License to operate

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Something has to change. The practical realities mean that it's time to do things differently, and the broader communities in which we operate are saying enough is enough.

Senior mining executive



Evolving expectations around the sector’s impact on communities and the environment make obtaining and maintaining an LTO an increasingly complex issue to navigate. One mining leader likened community engagement to “a big spaghetti bowl – and trying to unravel that is chaotic and challenging.” Taking a whole of society view is key.

The EY survey of mining leaders highlighted specific LTO risks and opportunities:

Anchoring the brand to long-term impact

Miners need to think differently about how they build LTO and strengthen their brand and reputation. One leader suggested: “As a sector, we have to do a better job of telling our story and share the fact that the energy transition will start and end with mining and metals.”

Stakeholders expect to see mining and metals companies add value over the long term. One leader surveyed said: “It’s not about the investment, it’s about the impact in a community over the entire lifecycle of the mine.”

Contributing to more livable communities

The COVID-19 pandemic has changed the way people think about where they want to live and how they engage with colleagues and within the communities where they live and work. This is a challenge for miners who are now expected to take on the role of “place-makers,” creating livable communities where people want to live, forge connections and settle for the longer term.

As part of its sustainability plans, Anglo American has prioritized creating “thriving communities,” working with governments, nongovernment organizations and locals to create mining communities with the infrastructure and amenities that add long-term value.²³ Initiatives such as these are a powerful differentiator in the war for talent.

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Anti-mining sentiment could impact us in terms of the time it takes to get permits for development projects, or even if we get permits at all.

Senior mining executive

²³ “Sustainable change for our communities,” Anglo American, <https://www.angloamerican.com/sustainability/communities>

²⁴ “Protection of cultural heritage and FPIC,” Rachel Nicolson, Dora Banyasz of Allens Linklaters, 11 November 2022, <https://www.allens.com.au/insights-news/insights/2021/11/Protection-of-cultural-heritage-and-FPIC/>

Building Indigenous trust and reconciliation

Miners have a long way to go in building trusted relationships with local Indigenous communities. They are taking steps to move beyond doing just what’s required by regulation and instead fully commit to furthering truth and reconciliation. Building cultural knowledge and awareness across all levels of employees can help mitigate that risk, and using lessons learned from previous issues can better inform decision-making.

There is concern too around a lack of cohesion in consultation with Indigenous communities. Some mines are consulting with traditional owners too often, via multiple departments, frustrating communities that feel that, despite all the talking, they are not being heard. The issue highlights a common



issue of good intentions not aligning with outcomes. More synchronization around consultation and capacity building can achieve more value for both communities and mines. One way of tackling the problem is by building an impact framework around stakeholder value, which underpins the company's entire value chain. It's a trend we need to see more of as expectations around mining change.

Many miners have invested in employing and developing local Indigenous talent to build stronger connections with community and mitigate risks of operations. Some companies have KPIs and tangible metrics to measure progress, but others are yet to take real action in building Indigenous capacity. As LTO has an increasingly big impact, miners need to better identify, understand and report on the value they create for Indigenous communities, including capacity building.

Protecting cultural heritage

Miners are being challenged around the process of heritage space, not only from federal governments but also state jurisdictions and local communities.

The United Nations Free, Prior and Informed Consent (FPIC), recognized in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), is increasingly guiding miners' engagement with Indigenous people and their land.²⁴ FPIC gives Indigenous people the right to give, withhold or withdraw consent to a project that may affect them or their territories. It also enables them to negotiate the conditions under which the project will be designed, implemented, monitored and evaluated. This is embedded within the universal right to self-determination.





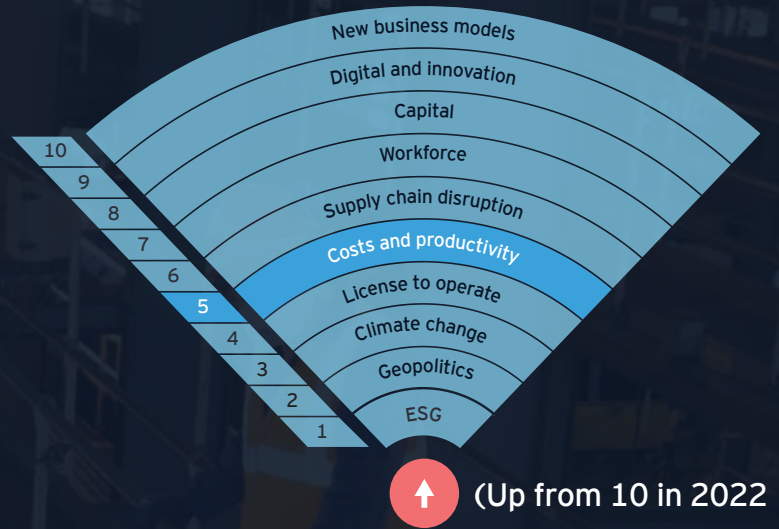
05

Costs and productivity

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We learned through COVID-19 that flexibility is a great way to drive productivity.

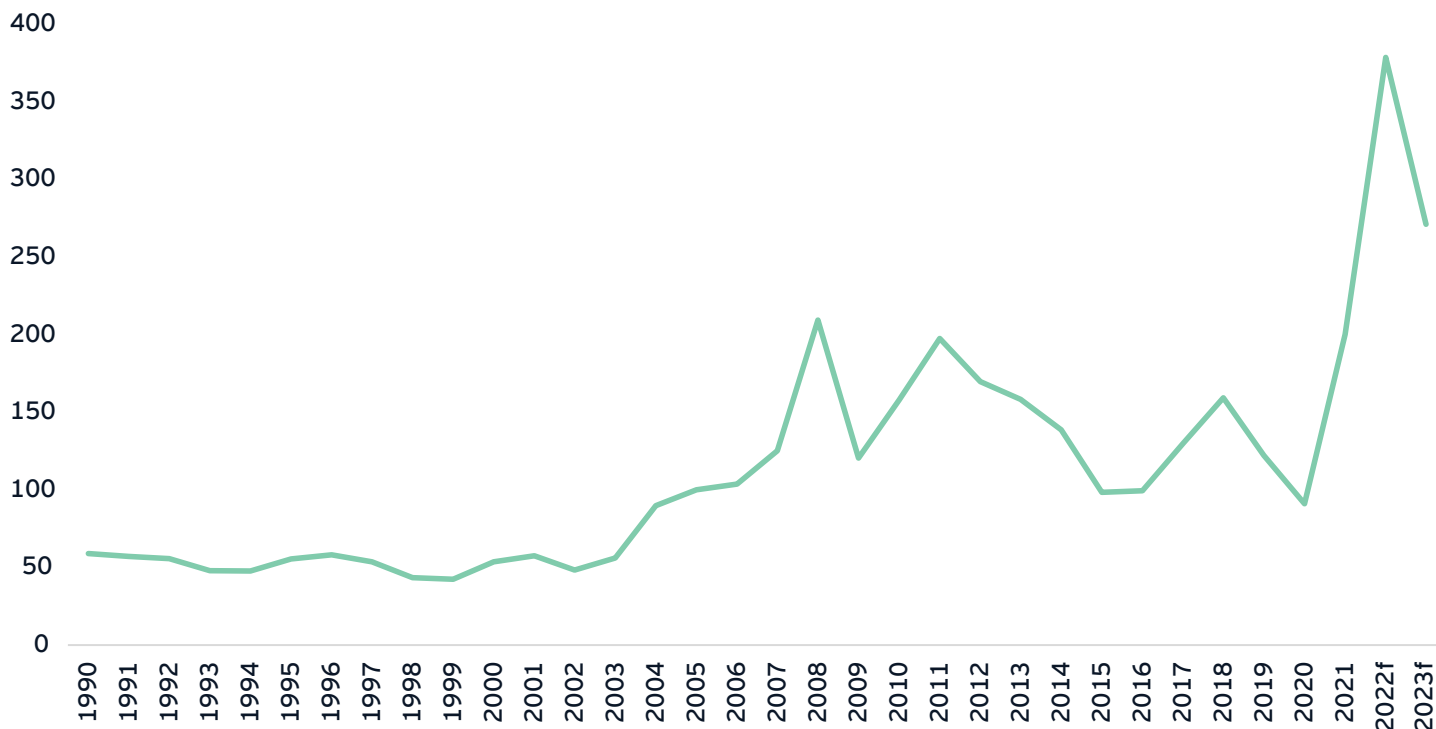
Senior mining executive



Costs and productivity have moved to fifth spot, as inflation affects costs of mining operations and may potentially delay growth plans.

Any cost reduction exercises need to be focused on value, and should avoid impacting ESG commitments.

World energy prices: oil, gas and coal, 1990-2026 (index = 2005)



Source: EY Knowledge analysis of Oxford Economics

Managing the impact of rising costs

Energy price inflation was a concern in Europe even before the war in Ukraine, as countries struggled with supply chain disruptions and the impact of COVID-19 restrictions. A surge in manufacturing activity in 2021 drove electricity prices to unprecedented highs. And more recently, the war has increased energy costs, with coal, gas and oil prices all rising significantly in the first half of 2022.

Central banks around the world are increasing interest rates to control inflation but, despite these efforts, structural energy issues in the UK and Europe are likely to keep inflation higher. One mining executive noted that “how governments deal with high inflation will significantly impact the sector.”

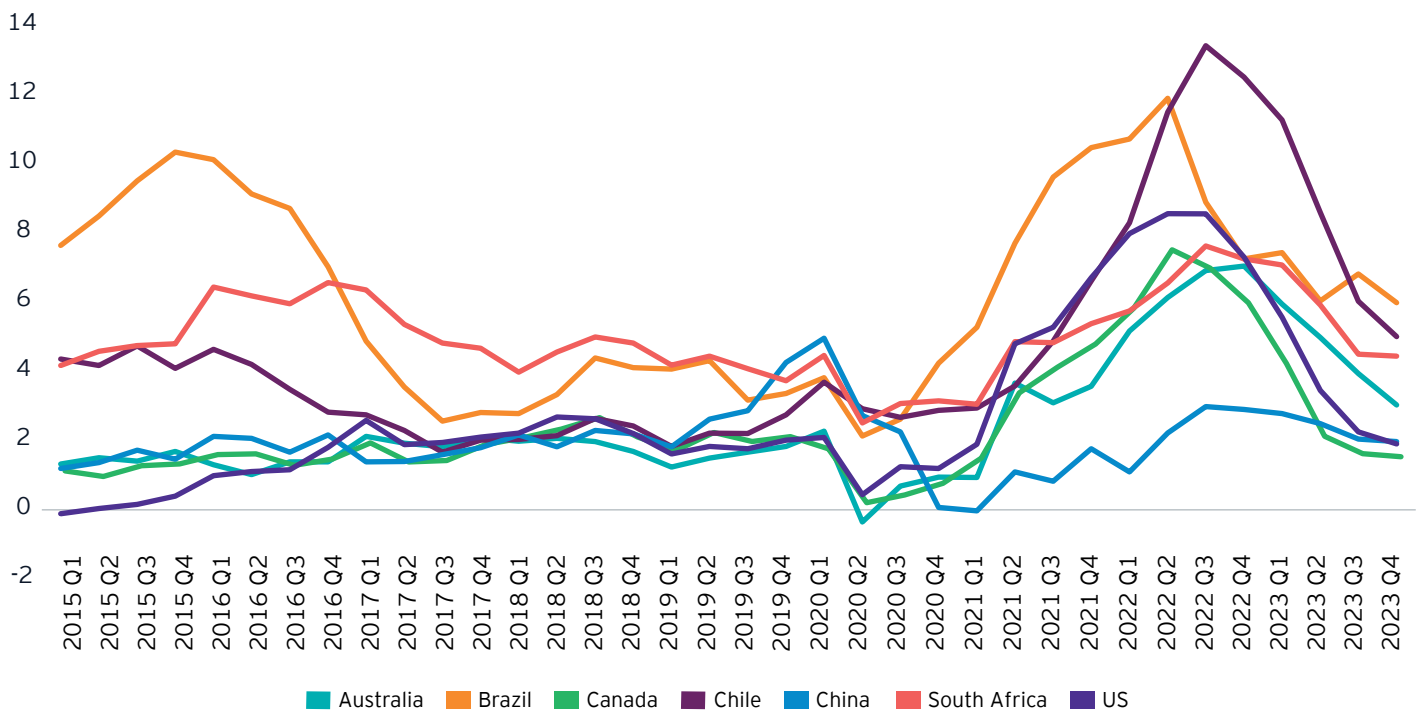
There may, however, be some signs that recessionary fears and softer demand will limit inflation as supply chains free up, commodity prices come off recent highs and freight costs begin to ease.

Aside from energy costs, miners have been facing higher input costs, including those of tyres, explosives and sulphuric acid. Higher costs will lower margins for metal producers and, in some cases, force capacity to be suspended – around 1,164kt of capacity is already suspended in Europe. Increased energy costs and tight supply are pushing up aluminium premiums on the continent.

The talent shortage is increasing wages as miners seek to retain existing employees, particularly those with critical skills. Rising wage costs tend to be structural and are often difficult to reduce. Capital costs are also rising and could delay new projects.



Consumer Price Index in select mining countries, y-o-y % change, Q1 2015 to Q4 2024f



Source: EY Knowledge analysis of Oxford Economics



Understanding productivity challenges

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Data analytics will improve our ability to connect people, machines and systems.

Senior mining executive

Mining companies are maintaining a focus on productivity and cost management, and despite current challenges, only 17% and 24% of our respondents have experienced a decline in asset or labor productivity.

The need to decarbonize operations to meet ESG targets while expanding production to meet forecast demand for the energy transition sees leaders face difficult questions around productivity. Is greener mining less productive than the status quo? Does creating value for stakeholders mean accepting lower levels of productivity?

An aerial photograph of a port area. A large red-hulled ship is docked at a pier, with a smaller barge or tugboat alongside it. The water is a deep blue, and the land shows some industrial structures and greenery. The overall scene is viewed from a high angle, looking down at the port.

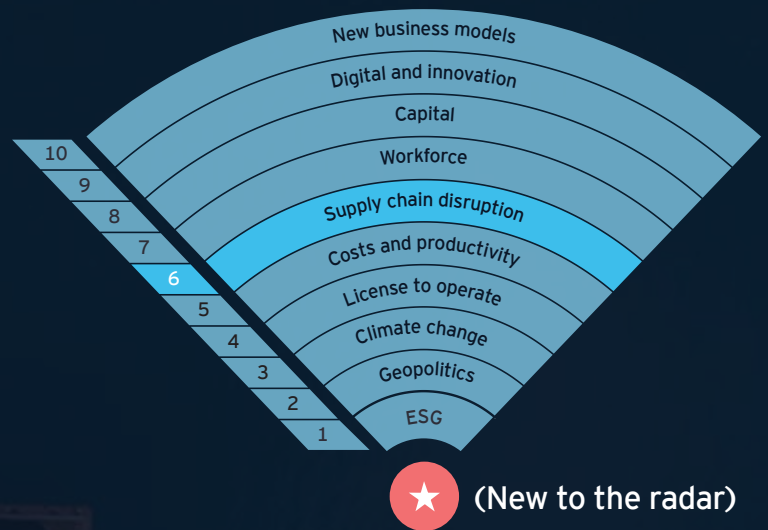
06

Supply chain disruption

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We need to improve our understanding of the risk profile associated with shipping routes and ports for both inbound and outbound shipping, and implement strategies to mitigate increasing risks.

Senior mining executive



Unsurprisingly, supply chain disruption is a new entry on the risks and opportunities radar. Around the world, all industries have been hit hard by the impact of the COVID-19 pandemic, the war in Ukraine, rising energy prices, workforce retention issues, and logistics and freight challenges. Prices are up and delays for raw materials are long, increasing the cost and complexity of operating a mining and metals organization.

But many of these pressure points have only intensified supply chain challenges that have been brewing for some time. With disruption likely here to stay, miners that adapt their supply chain and put relationships at the center can find new opportunities while mitigating risks.

Boosting resilience



We need to improve supply chain visibility to determine whether to increase inventories of critical parts or expand our sources of goods and services.

Senior mining executive

Before the pandemic, there was a heavy focus on “just-in-time” inbound supply chains, where inventory levels on-site were restricted, and goods and services were sourced to arrive at the point and time of use. When planned well and when supply chains ran smoothly, it was an effective model that reduced working capital costs. But recent disruptions have exposed the limited resilience of global supply chains and made clear the dangers of deploying the just-in-time strategy alone.

Instead, miners are pushing back toward a “just-in-case” supply strategy for critical goods to ensure continued effective operation, and accepting the increase in costs. As inflation increases cost pressure, we expect companies to balance the just-in-case and just-in-time models, through improved planning and integration along the value chain, strong supplier relationships, and innovation in both logistics and commercial sourcing models.

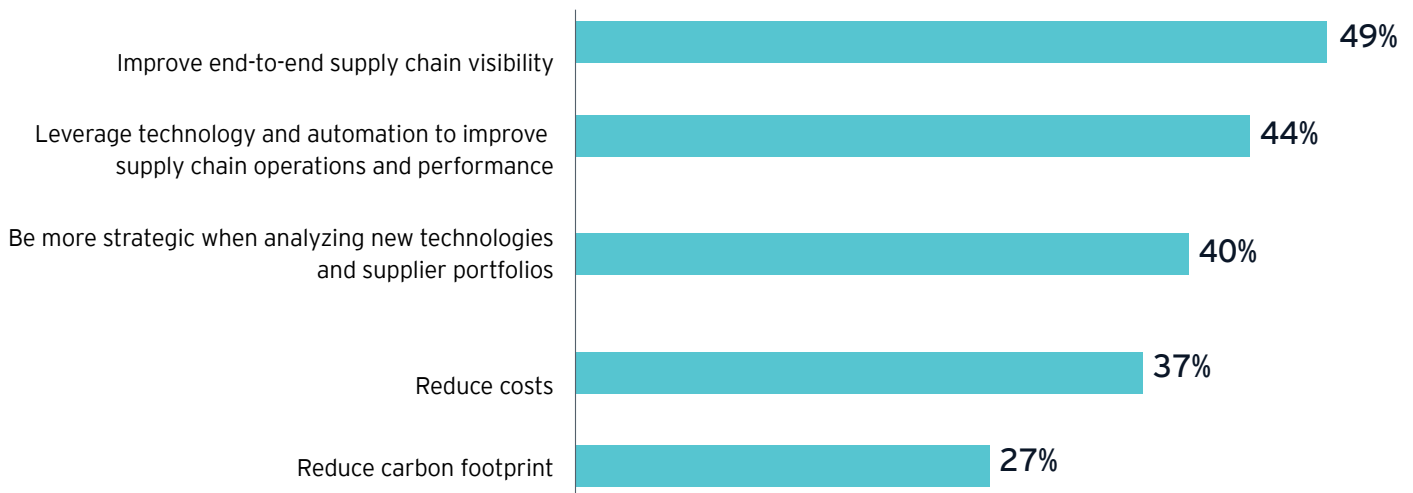
Boosting the resilience of outbound supply chains requires a different approach that considers factors such as improved sales and operations planning, and more integration with logistics providers and customers.

As miners transform supply chains, reducing costs is a key objective for 37% of respondents. Already, according to the mining and metals CEOs interviewed for the [EY CEO Survey 2022](#), around 30% of organizations have adjusted their supply chain to reduce uncertainty and costs. Supply chain strategies to manage ongoing price volatility should consider:

- ▶ **Think beyond prices:** Pressuring suppliers to reduce prices has its limits. A more sustainable strategy to control costs requires deploying other levers and investing in developing deeper supplier relationships. This helps better plan medium- to longer-term demand and usage, allowing for effective cost management.
- ▶ **Consider collaborative contracting:** We are seeing more mining and metals companies partner on supplier contracts to create greater transparency, reduce uncertainties and strengthen supplier relationships. While collaborative contracting offers huge potential to reduce costs and delays as well as change the risk profile, it will require some planning. Some contracts will need to be renegotiated, including those based on fixed prices, for example. It will also require understanding which circumstances are appropriate for collaborative contracting, taking into account risk ownership, logistics networks, company and supplier capabilities, and the presence of like-minded collaborative cultures.

Innovating to tackle supply chain costs

How are you looking to transform your supply chain amid disruption?



Source: EY business risks and opportunities survey 2023.

Creating connectivity across systems

Building connectivity across business systems can help mining and metals companies link procurement, logistics and work management. This enables more effective inventory management and cost-effective maintenance. More miners are adopting digital innovation in systems, but many are yet to link these in an orchestrated way and integrate with vendors.

Prioritizing relationships

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We need to improve our understanding of the financial viability of suppliers.

Senior mining executive

As discussed, the concept of using the price lever to get a lower price is not always a sustainable means to achieve cost certainty. Instead, investing in supplier and customer relationships can foster mutually beneficial partnerships that deliver value beyond lower prices. This requires an approach that puts relationships at the center of the supply chain. Several key themes emerged from our survey of leaders:

- ▶ **Foster relationships based around value:** During recent supply chain disruption, companies that best managed the impact were those that have invested time in building critical supplier and customer relationships. Successful relationship management requires companies to ask themselves: How can we foster a mutually beneficial relationship that is not just predicated on cost but extrapolated around prioritizing our business? Creating a culture of innovation, continuous improvement, team building, sharing information and creating social value requires engagement from the executive leadership to site operations. For example, an iron ore miner running a continuous improvement project with its fleet OEM to track and trace spares from the supplier's workshops around the world through to its site warehouse and forward stores. This is helping maintenance better plan and schedule repairs, optimizing equipment uptime.
- ▶ **Partner for innovation:** More than half of the miners we surveyed said they plan to deploy technological innovation to improve their supply chain. Many are investing heavily in digital even without seeing an immediate opportunity for returns. The problem is that many mining and metals companies lack the right workforce and capabilities to create and deploy the digital innovation they need. Partnerships with third parties, including startups, universities and think tanks, can help companies quickly and cost-effectively access the innovation that will drive their digital transformation. Companies will need to consider how they will manage intellectual property and ownership of innovation generated from these partnerships.

Considering ESG

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There will be a hyper focus on how you are interacting with your supply chain, not only to decarbonize but also to create supply chain resiliency.

Senior mining executive

ESG factors are increasingly impacting the mining and metals supply chain. In particular, mining's role in human rights issues, particularly modern slavery, and its impact on First Nations communities remain complex, with multiple considerations to navigate.

- ▶ **Modern slavery:** With supply chain disruption likely to be an ongoing issue, miners must find a way to both ensure continuity of supply and manage the risks of slavery, forced labor and human trafficking. Diversifying supply can mitigate risks of disrupted supply, but managing more suppliers can complicate modern slavery compliance. Finding a way to balance risks will be critical.
- ▶ **Indigenous and local suppliers:** Many mining and metals companies are actively sourcing more Indigenous or local suppliers to meet ongoing business requirements, as well as changing regulatory obligations and societal expectations. But this is still an emerging area, and many Indigenous businesses face challenges in accessing the knowledge and capabilities to compete with larger companies. There are opportunities for miners to develop commercial partnerships with Indigenous communities to help grow businesses that align with miners' needs and equip small business owners with the digital skills and other capabilities that will help secure market advantage.



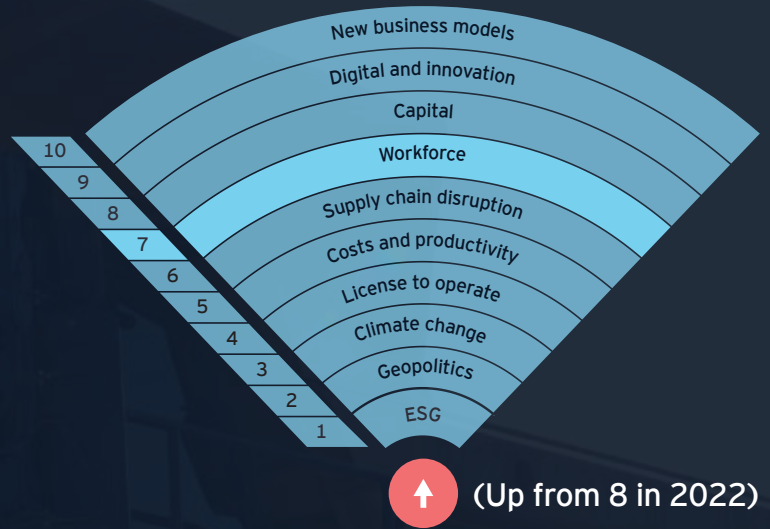
07

Workforce

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The brand of the sector is not attractive. Many candidates say it doesn't align with their sense of purpose and values.

Senior mining executive



Two forces are having a greater impact on the mining and metals workforce now than at any other time. First, the unprecedented demand for workers causing a global skills shortage. Second, mass retirement or resignation of workers in recent months has left miners scrambling to replace them. In Australia, the sector has more vacancies now than at any time in its recorded history. In May 2022, the US mining sector had 36,000 jobs to fill, up from 27,000 a year earlier.²⁵

²⁵ "Economic News Release: Job openings levels and rates by industry and region, seasonally adjusted," U.S. Bureau of Labor Statistics, <https://www.bls.gov/news.release/jolts.t01.htm>, accessed July 2022

The challenge is how to replace these workers when competition for talent, especially those with critical skills, is escalating. Globally, mining leaders we spoke to cited labor cost increases of between 6% and 15%, as wages and use of contractors increase.

The responsibility sits with mining employers to think outside the box, identify dislocated workers, expand workforce categories, map migration patterns, and review and redefine sector-specific certifications and experience requirements of future employees. Only then will the sector be able to target and meet the current labor requirements.

Attracting and retaining talent in a tight market



We need to align personal, corporate and sector values that attract and align to a common purpose.

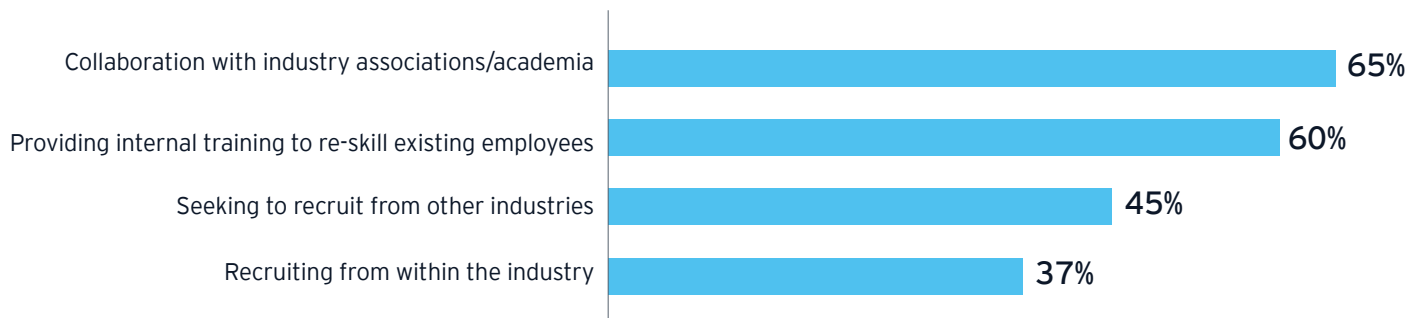
Senior mining executive

The next generation of talent just doesn't associate the mining sector with attractive jobs. Several leaders report that workers, especially younger ones, say mining does not align with their values. "They tell us: 'You can try and throw as much money as you want at me, but that's not going to attract me,'" said one mining executive. This perception of the sector, and often outdated employee value propositions, limits employers' ability to attract and retain workers.

Empirical evidence suggests that the sector is struggling to attract students to study mining relevant fields. According to a survey by the Society for Mining, Metallurgy and Exploration (SMME), enrolment in US mining engineering programs dropped 46% between 2015 and 2020. The same impact has been felt across other significant mining countries, including Canada, South Africa and Australia.²⁶

The sector's slow adoption of technology, particularly in frontline operations, is also a deterrent for new, younger potential employees who expect their work environment to reflect their digitally enabled everyday life. One mining executive said: "We need to be innovative around our use of technology to attract the next generation of workers."

What are you doing to attain the skills needed for the mine of the future? Respondents could choose more than one option.



Source: EY business risks and opportunities survey 2023.

Re-skilling and upskilling opportunities are overlooked

Re-skilling and upskilling are critical to combat the profound labor shortage. Re-skilling existing workers and upskilling sector newcomers could help fill talent gaps and create a more flexible workforce. However, anecdotal evidence suggests few miners have focused or invested in re-skilling

and upskilling, despite 56% stating it as a priority last year and 60% highlighting it again for the year ahead.

One barrier may be what many mining leaders describe as an entrenched mentality of "that's the way we do things around here." This lack of desire to change and improve conflicts with today's modern, flexible and dynamic workforce.

²⁶ "Analysis: Miners face talent crunch as electric vehicles charge up metals demand, Reuters, 11 December 2021, <https://www.reuters.com/markets/commodities/miners-face-talent-crunch-electric-vehicles-charge-up-metals-demand-2021-12-10/>

Miners have also suggested that there continues to be a conflict between mine-specific experience and skill-specific experience when acquiring new talent. One miner explained: "If we need someone who's got a certain skill set to operate in an iron ore mine, we might overlook a candidate who's worked in a diamond or copper mine and has eight out of 10 of the skills and capabilities required. This approach also deters women and minority groups from applying."

Taking a new approach to learning and development

Onboarding remains a critical element of a miner's employee lifecycle, especially for those with limited mining experience. More than just employee engagement, onboarding is paramount to ensuring mining safety, technical capability and production, as well as a positive experience within a physically challenging environment.

But there are few leading mining companies that have made significant positive changes to onboarding processes, which many mining leaders tell us are too slow and hinder productivity. Others note the need to revise current processes to maintain safety standards. One leader told us: "There is a large influx of people without mining experience ... Unfortunately, most organizations don't take a differentiated approach to onboarding those people, assuming they have had some form of heavy industry experience, and this could be to the detriment of safety."

Access to effective tools, processes and technology also enhances employee productivity, satisfaction and retention. But while employees in corporate offices have the tools they need, frontline workers may be at a disadvantage. Poor Wi-Fi and mobile networks, and sporadic access to technology, make onboarding and training difficult, and can negatively impact employee wellbeing and satisfaction.





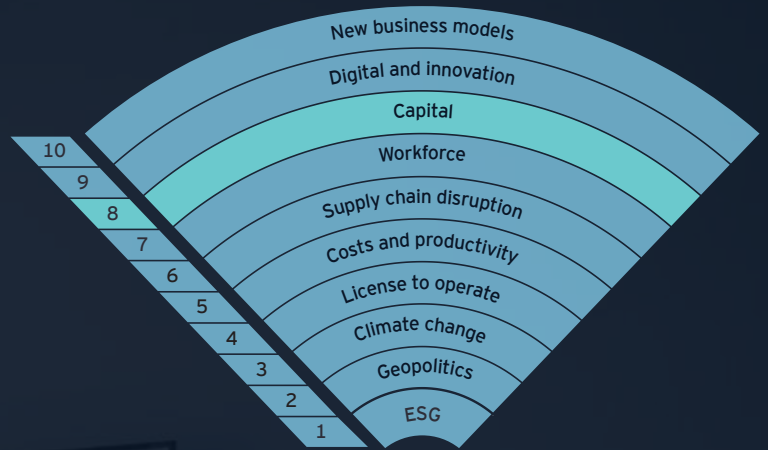
Capital



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We will see more capital being invested in managing ESG risks.

Senior mining executive



↓ (down from 5 in 2022)

Access to capital in mining and metals is increasingly tied to ESG performance and LTO, making it more important that miners articulate their commitment to, and achievements in, creating value beyond the bottom line. Companies are maintaining a focus on capital discipline but are increasingly looking at capital allocation for growth and transformation.

Linking capital to ESG

Increased competition for access to minerals is seeing a rise of new capital providers, giving mining and metals companies more opportunities to access capital. New investors include OEMs, automakers and sovereign wealth funds.

Several mining companies are accessing loans tied to specific ESG goals. For example, Anglo American has signed a US\$100m 10-year loan agreement with the International Finance Corporation (IFC) linked to the delivery of sustainability goals integral to Anglo American’s Sustainable Mining Plan.²⁷

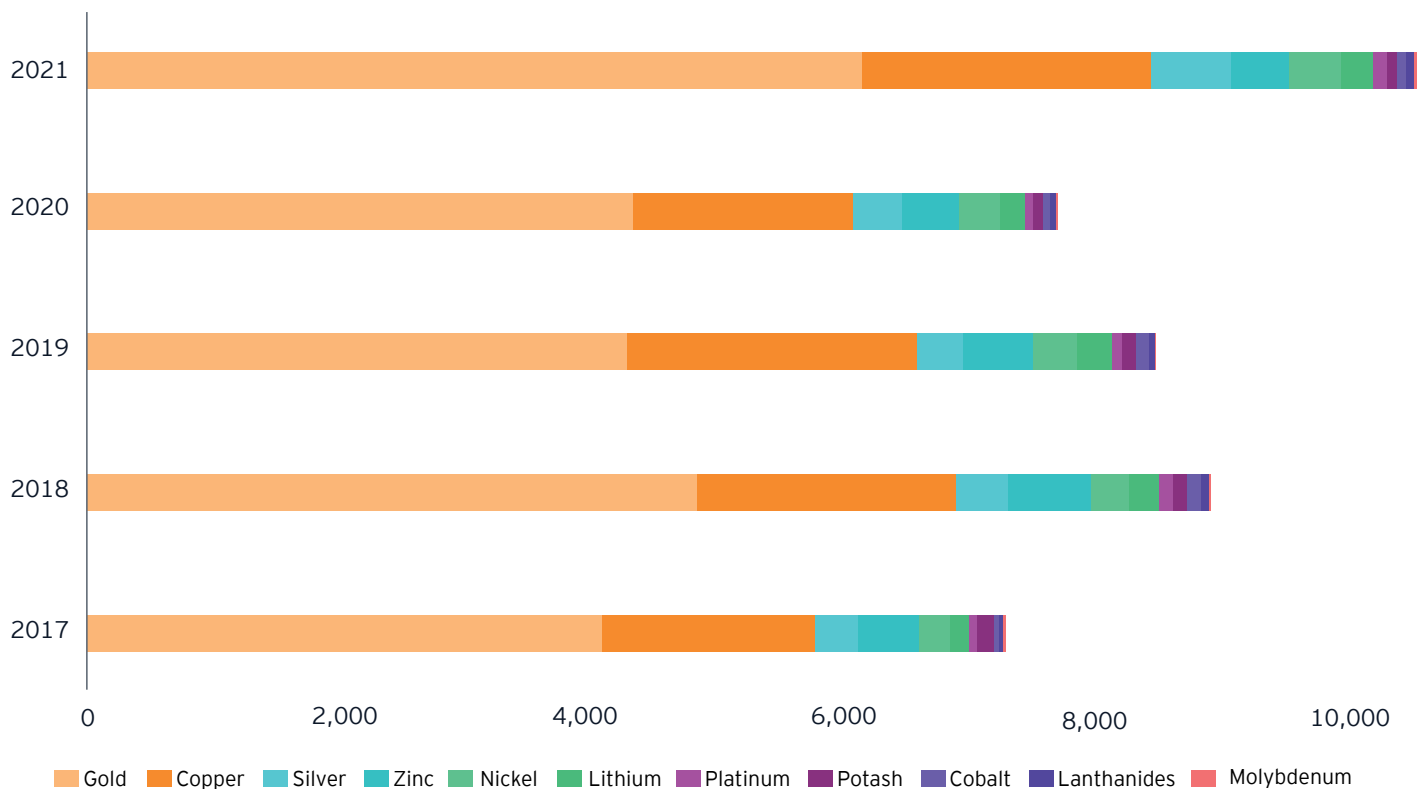
The use of green bonds is also growing, though the sector still lags others in this space. Only 1.2% of total

green bonds issued in 2021 were in mining and metals, mostly in metallic rolling and drawing products, iron and steel, and aluminium rolling. We expect demand to increase as companies use green bonds to help achieve sustainability goals.

Rising exploration spending

Capital allocated to exploration has doubled over the past five years, with most directed to gold and copper exploration. Smaller deals involving the acquisition of mineral exploration companies have also increased, reaching ~80 deals in 1H 2022 compared with 50 deals in 1H 2021.²⁸ We expect this trend to increase as mining companies seek to add copper, nickel and lithium assets to their portfolios through exploration and early stage entry.

Exploration budgets (US\$m), 2017-21



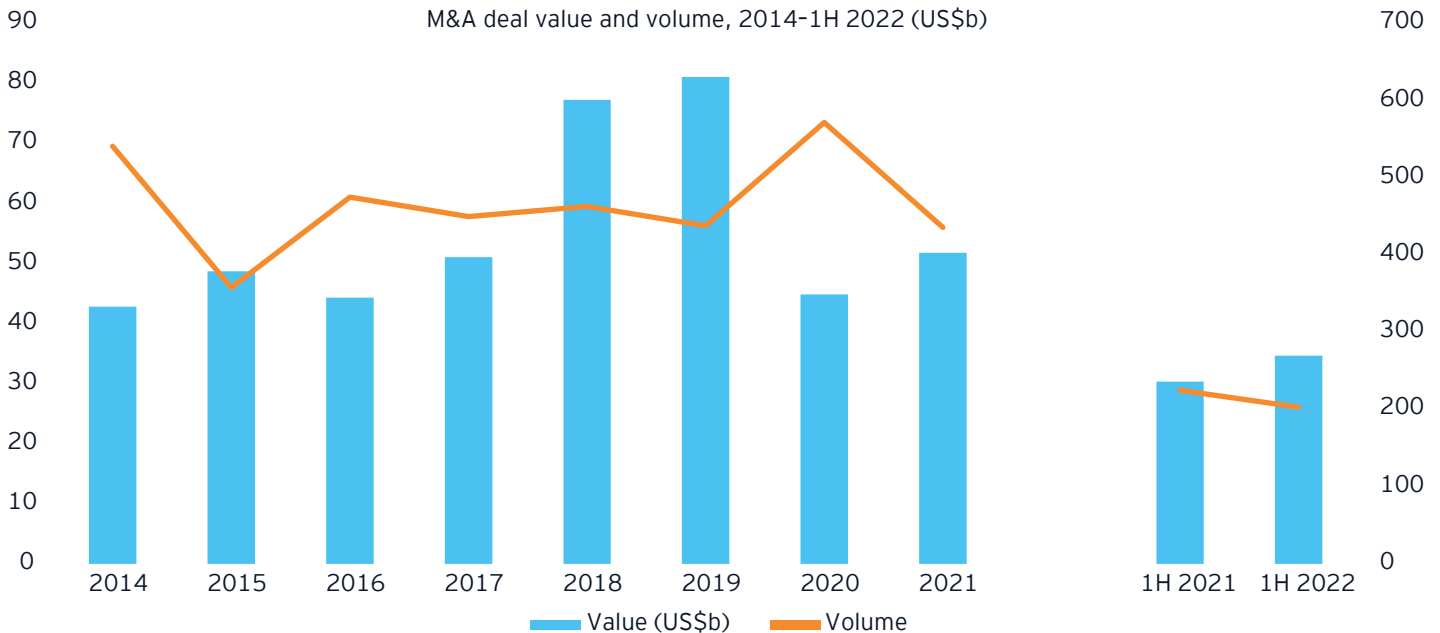
Source: EY Knowledge analysis of S&P Capital IQ Pro.

²⁷ “Anglo American agrees sustainability-linked loan with International Finance Corporation, *Anglo American Press Release*, 9 June 2022, <https://www.angloamerican.com/media/press-releases/2022/09-06-2022>

²⁸ EY analysis of Refinitiv deal data.

Increasing value of deals

In the first half of 2022, the value of completed deals in mining and metals was up by 14% to US\$34.6b, although deal volume was slightly lower.



Source: Refinitiv and EY Knowledge analysis.

A key merger and acquisition (M&A) trend is consolidation in the gold sector as prices rise and cashflow increase – the US\$10b merger of Agnico Eagle and Kirkland Lake Gold is one example.²⁹ We expect ongoing price volatility, recessionary risks and lower economic growth to have an impact on M&A decisions over the next year.

Changing portfolios driven by the energy transition

As the energy transition accelerates, miners are reshaping portfolios to align with changing strategies and shifting demand.

More miners divesting or phasing out coal: Investors are shying away from fossil fuels, making it increasingly difficult for miners to maintain or expand these assets. A number of conglomerates and larger miners have divested coal assets in 2022, and this is likely to continue in 2023.

However, coal will still be in demand until a critical mass of alternative energy sources is reached. Some are arguing for coal mining by responsible, transparent mining companies to continue with phased closures. Several analysts, and even activist groups, have noted that larger miners retaining coal assets and managing an earlier closure may be a better option than divestment, as it allows time for progressive rehabilitation and to help stakeholders and communities plan for transition.

Investing in the energy transition: Mining leaders have flagged investment in the “future facing” commodities – copper, nickel, lithium and cobalt – that will underpin the energy transition. We see significant capex allocated to expanding copper projects and some miners buying stakes in existing mines. For example, South32 recently acquired a 45% interest in Sierra Gorda in Chile from Sumitomo.³⁰ With analysts predicting a 40,000t deficit of lithium by 2026, many mining and metals organizations are planning investments in lithium mining, processing and supply. And coal companies are

²⁹ “Agnico Eagle and Kirkland Lake Gold complete merger transaction, *Agnico Eagle News Release*, 8 February, 2022, [https://www.agnicoeagle.com/English/investor-relations/news-and-events/news-releases/news-release-details/2022/AGNICO-EAGLE-AND-KIRKLAND-LAKE-GOLD-COMPLETE-MERGER-TRANSACTION/default.aspx#:~:text=TORONTO%2C%20Feb.,\(the%20%22Merger%22\)](https://www.agnicoeagle.com/English/investor-relations/news-and-events/news-releases/news-release-details/2022/AGNICO-EAGLE-AND-KIRKLAND-LAKE-GOLD-COMPLETE-MERGER-TRANSACTION/default.aspx#:~:text=TORONTO%2C%20Feb.,(the%20%22Merger%22)).

³⁰ “Investor presentation: South32 to acquire a 45% interest in the Sierra Gorda copper mine,” *South32*, 14 October 2021, https://www.south32.net/docs/default-source/all-financial-results/reports-and-presentations/investor-presentation---sierra-gorda-acquisition.pdf?sfvrsn=edd86229_2

also considering diversification into energy transition and other commodities. For example, Exxaro plans to invest and diversify into manganese, bauxite and copper.³¹

Mining companies are also forming consortiums with energy producers to invest in hydrogen-based solutions that can be used to store renewable energy to generate electricity, as well as powering trucks and other equipment.³²

While the sector needs to do more to embrace the circular economy (as outlined in the ESG section of this report), miners are increasing their investment in recycling.

Investing in managing ESG risk

More investors recognize the need to invest in managing ESG risk, through governance, strategy and compliance. Capital allocated to ESG-related initiatives might not show returns in the short term – and could even pose financial headwinds – but has the potential to deliver value in the longer term. Examples of these investments include new technologies aimed at preventing adverse events (e.g., tailings dam failure), creating venture capital arms to support startups, and investment in progressive rehabilitation and remediation of closed mines.

Investments are also being made into processing that increases lithium or nickel to battery grade. For example, Tianqi Lithium has announced it will produce battery-grade lithium at its plant in Western Australia, making it the first time it has been produced in Australia in commercial quantities.³³

Companies are vertically integrating mines with processing to reduce the volatility risk at the upstream end, as well as reducing the security of supply and balance of power risk at the processing end.

Investing in emerging technologies aimed at accelerating decarbonization requires careful consideration of risks and opportunities. Some new technologies may not work as expected, and miners should consider the impact of reduced mineral intensity on future investment. For example, battery technology is evolving, recycling is increasing, and some materials are being substituted with others.

Balancing short-term returns with long-term value creation

Shareholders are reaping significant returns as miners take advantage of the current upcycle in commodity prices to pay out long-awaited dividends. Typically, mining investors prefer higher dividend payouts or buybacks rather than keeping cash in reserve for tough times. Some analysts believe that now is the time for miners to focus on growing value and volume per share instead of on an absolute basis.³⁴

³¹“Our Resources,” Exxaro, <https://www.exxaro.com/operations/our-resources/> accessed 25 August 2022

³²“Hydrogen’s key role in decarbonising the mining industry,” CSIRO Resourceful magazine, Issue 21, <https://www.csiro.au/en/work-with-us/industries/mining-resources/resourceful-magazine/issue-21/moving-to-hydrogen>

³³“Tianqi produces Australia’s first battery-grade lithium hydroxide,” Government of Western Australia Media Statement, 20 May 2022, <https://www.mediastatements.wa.gov.au/Pages/McGowan/2022/05/Tianqi-produces-Australia%E2%80%99s-first-battery-grade-lithium-hydroxide.aspx>

³⁴Investors Ask if Miners Should Spend More on Buybacks, M&A, and Less on Dividends, Dow Jones Institutional News, 9 August 2022





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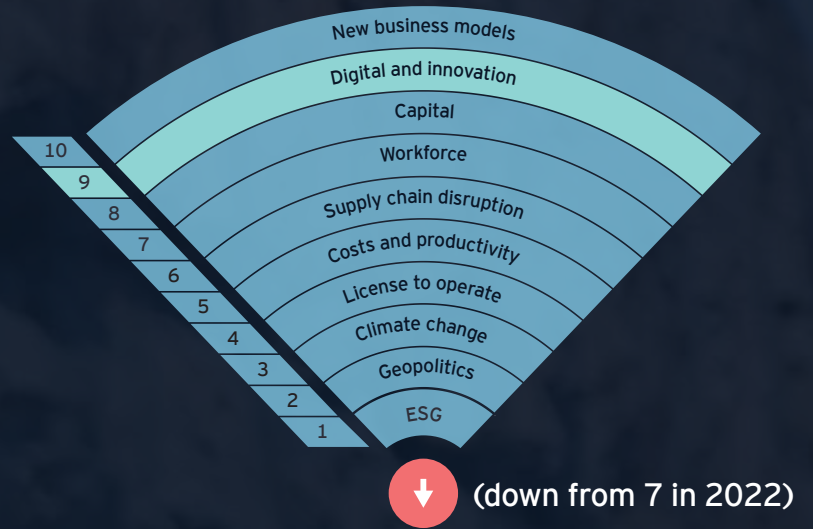
Digital and innovation



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We're monitoring and using drones using remote sensors — it's replacing hundreds of hours in the field. You cannot imagine the change in productivity.

Senior mining executive

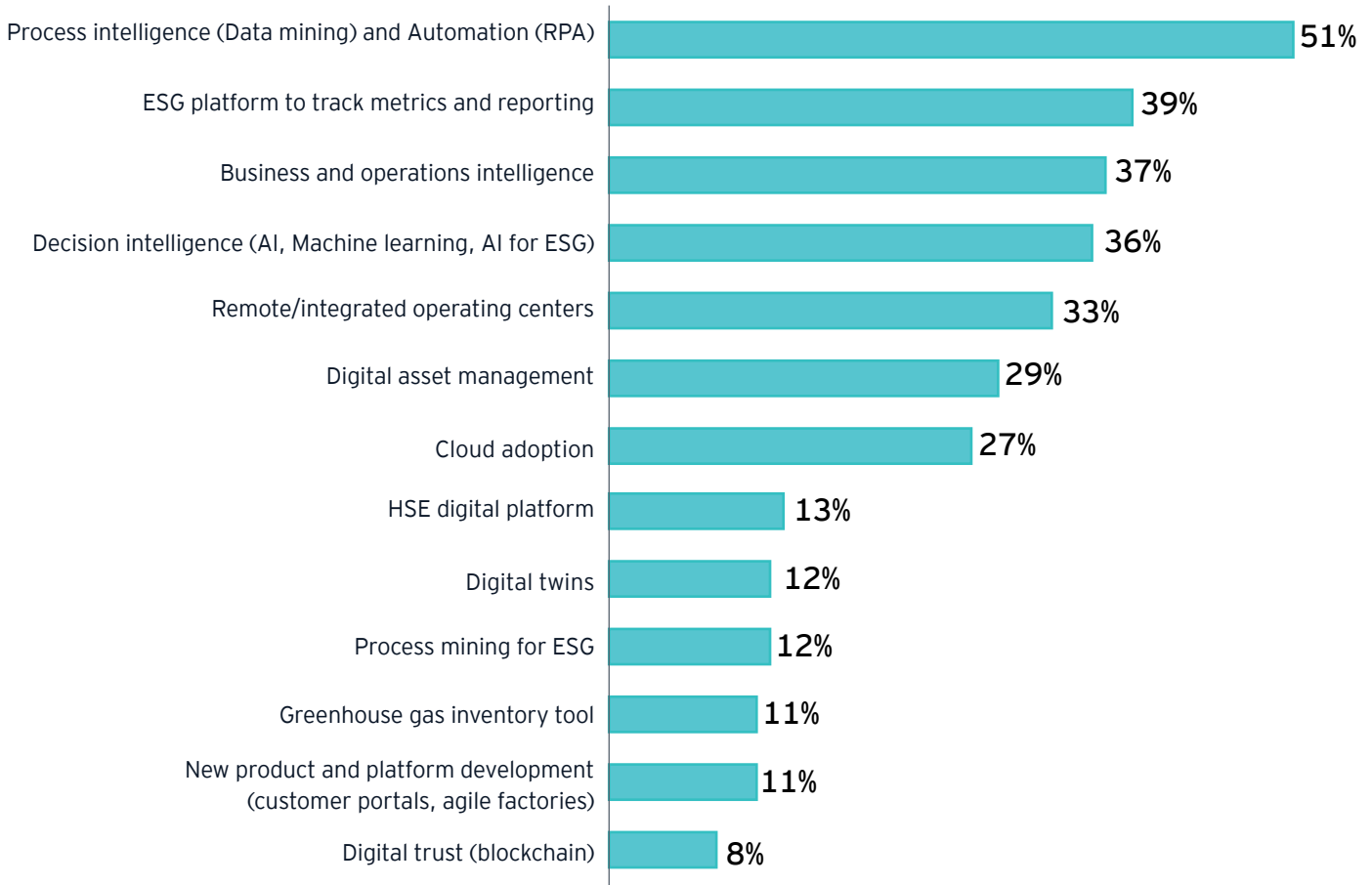


Digital and innovation has dropped to number 9 – an indication of how technology has become integral to today's mining and metal companies. Despite this, many miners still struggle to drive real value from their digital investments, largely because of a siloed approach to their deployment. An integrated value chain approach can support organizations in increasing ROI and identifying more opportunities to find digital solutions to some of miners' biggest challenges, including ESG, climate risk, productivity and costs.

Focusing digital investment on data

Mining and metals executives are focusing digital investment on developing data-driven innovation to inform evidence-based decision-making.

What are your digital priorities over the next one to two years? Respondents could select more than one option.



Source: EY business risks and opportunities survey 2023.

This aligns with findings of the CIO Imperative³⁵ in which four technologies – cloud, data and analytics, artificial intelligence (AI) and machine learning (ML), and the Internet of Things (IoT) – continue to be viewed as the digital foundation for a successful transformation. Respondents expect them to account for the largest share of investment and to deliver the most value over the next two years.

When we asked our survey respondents which new technologies excited them, responses varied from safety (AI and collision avoidance); ESG (dry stack tailings and solvents allowing mining without cyanide); decarbonization (hydrogen-

fueled trucks and carbon sinks in mine closures); mobility for connected workers (5G); and mineral extraction (new leaching and ore sorting materials). One respondent noted a concern that “societal acceptance will be a challenge if technology leads to workforce reduction.”

Expanding digital’s role in supporting ESG

Digital and data will play a key role in supporting miners to execute sustainability roadmaps, including through providing greater visibility across asset performance and operations,

³⁵ The CIO Imperative: Is your technology moving fast enough to realize your ambitions? | EY - Global

and better monitoring of energy and water consumption. For example, Barrick Gold Corporation embedded environmental compliancy rules within its real-time operational data platform, helping the miner reduce environmental deviations by 45%.³⁶

Digital tools can also support miners in tackling the challenge of reducing Scope 3 emissions. Data analytics, smart sensors and blockchain can help better track, monitor and manage Scope 3 (refer to the Climate risks section of this report for more details). Blockchain can also support ethical supply chains and enable product stewardship. One mining leader noted: “On-provenance blockchain is one way, but technologies that imprint a unique chemical fingerprint on the gold, allowing it to be traced, is another.”

While miners are making progress in using technology to advance sustainability, activities are siloed across the business. A centralized approach to understanding the integration and interdependencies of different technologies can help miners see common plans in real time, baseline and measure progress.

Adopting new culture and ways of working

Sustaining digital capabilities requires a change in mindset, including genuine cross-department collaboration. Capital-intensive companies, such as miners, are typically less agile than others, but there are tangible benefits in business and technology teams adopting new ways of working to build and sustain the capabilities that deliver value to frontline operations. Identifying desired ways of working, as well as identifying the IP and insourcing and outsourcing frameworks, are key steps toward truly sustaining digital investments.

Strengthening governance around data

Governance and assurance of sustainability data and ESG reporting also need attention. As compliance and statutory requirements increase, miners will need to adopt a more formalized approach to how they govern and audit sustainability data, as they do with data in other parts of the business, such as health and safety.

Increasing impact of IT/OT convergence

As digital transformation expands across mining, so too does the integration of IT and OT. An IT/OT asset management framework and strategy acknowledges technology's critical role in today's mining and metals organization. This helps the organization maximize the value of its technology investment while also mitigating the risks.

The good news is that, as the costs of technology come down, miners have more access to its benefits. The bad news is that many still lack the data capabilities to make the most of the value it offers. The challenge many organizations face is how to connect the enterprise with operations to make better real-time decisions. The issue is exacerbated by years of underinvestment in legacy systems that are no longer fit for purpose.

Accelerating focus needed on cyber

The greater integration of IT/OT raises the threat of cybersecurity attacks – 71% of miners surveyed for the EY Global Information Security Survey 2021³⁷ said they had experienced an increase in the number of disruptive attacks over the past 12 months. In addition, as geopolitical tensions rise, mining and metals companies are likely to become targets, because the sector is critical to the energy transition and governments' focus on security of supply.

Collaborating to nurture an innovation mindset

Those that are successfully innovating are leading the competition. Miners have spent more time this year with OEMs to cosponsor and pilot new commercial models that are mutually beneficial. And we still see more opportunities to collaborate with academia, which could add particular value around the need for data scientists.

Many miners are yet to develop formal innovation frameworks to capture ideas from outside and from within, and assess them through a reasonable framework. It's an issue discussed in a recent EY article around data's role in innovation amid change.³⁸

³⁶ “Three ways technology improves sustainability in mining,” *Australian Mining*, 25 January 2022, <https://www.australianmining.com.au/features/three-ways-technology-improves-sustainability-in-mining/>

³⁷ “Does cyber risk only become a priority once you've been attacked?” *EY*, 8 March 2022, https://www.ey.com/en_gl/mining-metals/does-cyber-risk-only-become-a-priority-once-you-ve-been-attacked

³⁸ “How data can help you innovate when change is constant,” *EY*, 18 June 2022, https://www.ey.com/en_gl/consulting/how-data-can-help-you-innovate-when-change-is-constant

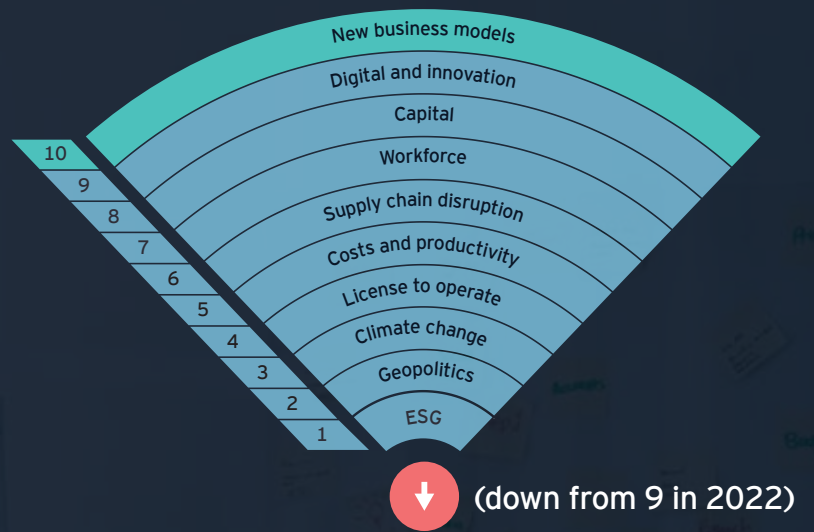
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New business models

“

Climate change is causing us to not just think about the commodities we mine but fundamentally how we shape our business and prepare for the future.

Senior mining executive



After 20 years of sector transformation, there are fewer diversified miners, holding smaller, focused asset bases in a reduced number of regions and geographies. The value chain of these mining companies is generally centered around producing minerals rather than primary exploration and metal production. And despite several mining conglomerates having commercial or trading arms, they appear to be no closer to the customer.

Balance sheets have improved and returns have increased, particularly for the top companies. However, with projected demand for certain commodities expected to increase and focus growing around sustainability, now is the time for mining companies to analyze where optimal value can be found – and to redefine their business model to capture that value. Companies that do this successfully will future-proof their business model to better deal with disruption and changing commercial relationships, and ultimately win competitive advantage.

Capital allocation strategies of top diversified mining companies, US\$b, 2005-21



Source: EY Knowledge analysis of data from Refinitiv® Datastream® and S&P Capital IQ.

Strategic options to capture optimum value

As mining and metals companies consider future scenarios, they face three potential routes: rationalize, grow or transform.

Rationalize

While many miners have already rationalized to focus on core value, ongoing technological, geopolitical and other external factors will require companies to re-evaluate locations and commodities to ensure continued growth. In particular, the success (or failure) of energy transition technologies will influence mining portfolios. In addition, analysis of performance of portfolios over time will be critical in making decisions around core assets. Our analysis shows that profitability growth will vary over time and by type of portfolio.

Grow

Future supply projections predict a deficit of many minerals required for the energy transition, with strong demand continuing to 2030 and beyond. Infrastructure projects will also ensure robust demand for many traditional commodities in the short to medium term. Technological advances and decarbonization may impact demand for metallurgical coal and iron ore, but they are likely to remain in the 2050 commodity/energy mix.

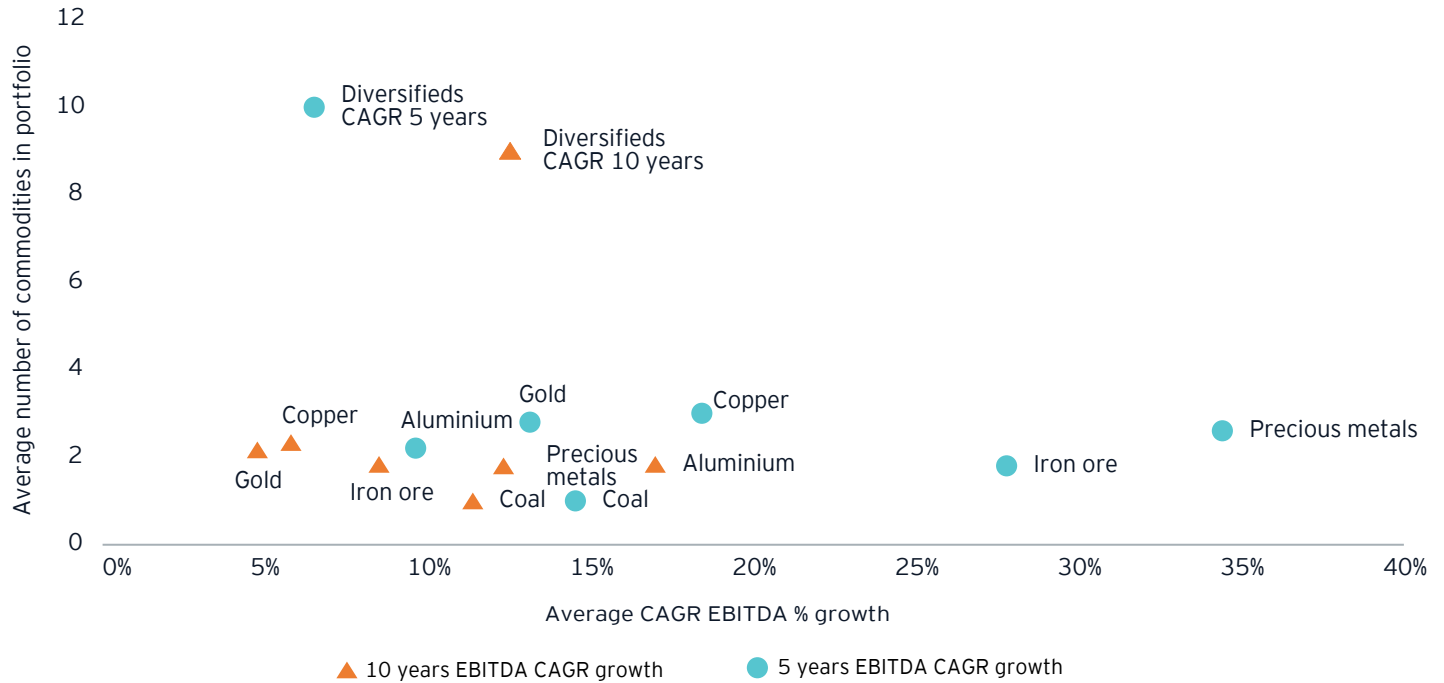
The question of where to invest for growth is not easy to answer. Scenario planning is vital to ensure agility. It helps underpin medium- and long-term business plans, prepare for alternative futures and forecast the impact of potential future scenarios on demand: for example, if technology progress slows or adoption of electric vehicles is lower than predicted. Scenario planning should also consider supply challenges, including location of reserves, access to water and renewables, geopolitical risk and competition from downstream customers as they invest to secure supply.

The following options for growth should be considered, though decisions will vary based on risk appetite and experience:

- ▶ Traditional brownfield or greenfield growth. Around 40% of survey respondents plan to allocate capital to building or expanding projects.
- ▶ Entry (or re-entry) to geographies once considered too complex or too risky.
- ▶ New commodities or materials. Developing sustainable products can secure a premium and competitive advantage. For example, the International Copper Association has introduced The Copper Mark assurance system for responsibly mined copper.
- ▶ Expansion along or across the value chain, including:
 - ▶ **Vertical integration:** A greater focus on exploration, beneficiation and materials production will improve

EBITDA growth vs size of portfolios and commodity market

Average percentage CAGR over five and 10 years for single commodity vs. diversified miners



Source: Refinitiv® Datastream® and EY Knowledge analysis of top five producers in each subsector.

mine to market flow, generate incremental demand for commodities and allow mining companies to leverage margins along the value chain while reducing volatility.

- ▶ **Horizontal integration:** Investing in adjacencies, particularly those that support or de-risk other investments – for example, in infrastructure, energy and technology – will enable capital investment. Horizontal integration allows miners to increase scale and investment by decreasing risk in a nonfamiliar geography or commodity, driving a value model change to gain competitive advantage. It is also an option for investing, rather than returning, a greater proportion of capital.
- ▶ **Circular economy:** Circular business models are closed material loops that minimize waste, carbon emissions and other pollutants, create by-products and keep materials and products in use. These models, and an integrated circular economy, require increased collaboration – the ESG section of this report includes more detail.

Transform

Traditionally, capital management has focused on “buy, build, return.” But investment is more than building – transformation is critical, particularly amid disruption – and needs a keen focus on creating long-term value for stakeholders.

In particular, transformation strategies should include:

- ▶ **Digital and data:** An integrated value chain approach to digital and data can identify more opportunities to find digital solutions to complex challenges, including ESG and costs (read more in the Digital and Innovation sections of this report).
- ▶ **Mining as a service:** Increased complexities and talent shortages are driving a move to a mining-as-a-service model, which can accelerate development of resources owned by less experienced owners and operators, e.g., customers or governments.
- ▶ **Changing or broadening the commercial model:** Several mining companies have established functions to manage commercial exposure (medium- or long-term hedge positions) and treasury (typically cash requirements and foreign exchange). We see this differentiation continuing to support miners as they manage Scope 3 emissions, forge closer customer relationships and develop premium products. Bundling minerals and products, rather than selling a single commodity, may help tighten customer relationship and gain greater control over Scope 3.



Next steps: mitigating risks and maximizing opportunities

Our ranking of risks and opportunities reveals that mining and metals companies face huge disruption and rapidly changing expectations that, together, may impact their ability to build sustainable value. Mitigating risks and making the most of opportunities requires companies to make significant changes to their business, through a proactive, diversified approach that is integrated into strategy and broader planning. Miners that do so successfully will gain a competitive advantage.

There are a number of key areas to focus on:

Strategy and planning

- ▶ Conduct scenario planning to build agility and ensure readiness for possible alternative futures.
- ▶ Include ESG factors in planning, particularly net-zero nature, water stewardship and circular economy opportunities.
- ▶ Plan for capital allocation by determining how much capital is needed to switch to a new market or model. Make decisions regarding where to invest and allocate capital long in advance.
- ▶ Take a structured approach to innovation. The supply of innovative ideas is not the constraining factor for mining companies. Rather, the challenge is to ensure these innovations are focused on delivering the company's strategy and driving a competitive advantage.

Capital

- ▶ Review your portfolio through the broader lens of changing talent and societal expectations. Prepare to divest or reshape for a different environment.
- ▶ Determine appropriate investment opportunities in tools, technology and innovation.
- ▶ Ensure balance sheet agility when considering optimum levels of gearing and dividend policy.
- ▶ Review funding and capital models, including funding sources, the role of government and internal allocation, and how to make best use of tax breaks and incentives.
- ▶ Make investment decisions based on a full stakeholder risk analysis, incorporating financial, technical and ESG considerations.

Stakeholders

- ▶ Focus on articulating your purpose and use this to build the brand.
- ▶ Align around a wider, stakeholder-driven agenda.
- ▶ Develop a stakeholder engagement plan that articulates the value proposition for each stakeholder group, designs appropriate engagement programs and ensures long-term value is delivered in line with expectations.
- ▶ Build strong ties with government, trade and sector groups. Increasing legislation, regulation and tax policy, both locally and globally, makes it critical that mining companies build better relationships to influence future policy.

Workforce

- ▶ Take a balanced approach to managing both critical risks and foundational workplace safety risks to build a holistic, robust approach to keeping workers safe.
- ▶ Rethink the employee lifecycle to attract and retain a diverse and connected workforce.
- ▶ Rethink traditional recruitment tactics, create equitable career paths and break down barriers to help improve diversity in mining.
- ▶ Change how mines are built, operated and constructed to improve safety and wellbeing for all workers.

Operational

- ▶ Measure and manage variability across the value chain, with a focus on unlocking genuine productivity gains.
- ▶ Manage costs with an eye on long-term value as well as short-term gains.
- ▶ Build supply chain resiliency by mapping both inbound and outbound supply chains and starting to consider just-in-case as well as just-in-time scenarios.
- ▶ Extract more insights from data – better decisions start with data.
- ▶ Collaborate and ally with technology and data management companies to develop and implement new digital solutions.
- ▶ Improve the efficiency and speed of onboarding people, while maintaining a focus on safety and competence.



How EY's Global Mining & Metals team can help you

The transition to a low-carbon future demands that mining and metals companies reshape their role in what will be a new energy world. Bolder strategies that embrace digital innovation can help overcome productivity and cost pressures, create long-term value and secure a stronger LTO. EY's Global Mining & Metals team brings together the breadth of experience and talent needed to approach the entire transformation process. By considering four key pillars of change – structure and culture, customers, technology, and skills and capabilities – we can help you adapt for today and reap the opportunities of tomorrow. And together we can build a better working world.

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