How to recognize opportunity when others see risk

Top 10 business risks and opportunities for mining and metals in 2026

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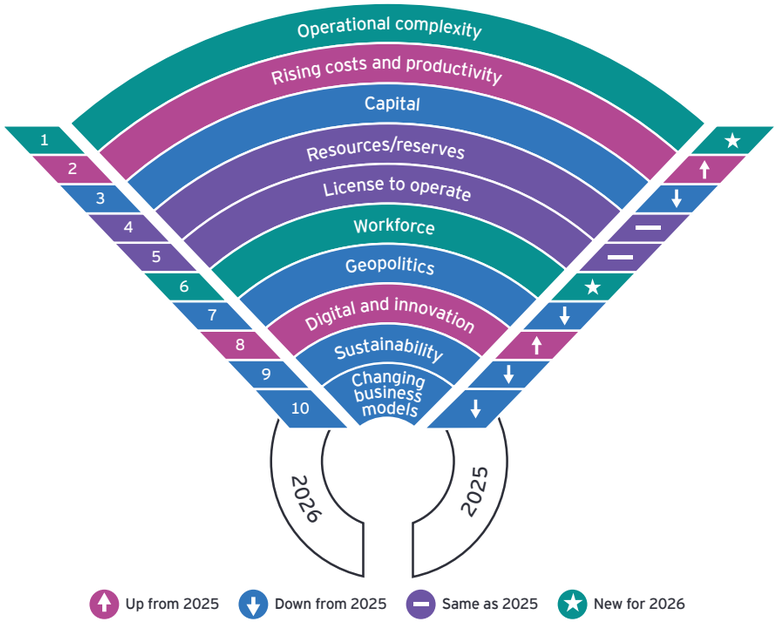


Last year's report showed a shift in miners' focus from external issues, primarily ESG-related pressures, to longer-term strategic risks, such as capital, reserve and resource depletion, and new projects. We interpreted this move as a reaction to increasing demand, supply gaps, issues around traditional capital and a growing focus on sustainability.

As the mining and metals sector enters 2026, organizations are navigating a climate of instability created by factors including ongoing wars in Europe and the Middle East, the election of Donald Trump to a second term and increased geopolitical tension. This uncertainty is reducing risk appetite, creating a cautious, short-term mindset that prioritizes cost reduction and capital preservation. Miners face a new era of operational risk, persistent cost pressures and an evolving global landscape — just as the urgent need to supply materials for energy transition, defense and new data centers reshapes risks and opportunities in the sector.

For those willing to take on the risk, opportunities await. However, companies will need to ensure their approaches remain both strategic and operationally robust amid uncertainty and the intense focus on cost reduction.

Operational complexity is now the top challenge

Operational complexity, a key topic of discussion in executive meetings, is now the No. 1 risk and opportunity. Declining ore grades, deeper and more complex orebodies and aging assets make reliable output harder to achieve. Regulatory delays, labor shortages and infrastructure bottlenecks are equally weighted as production constraints and exacerbated by rising production costs. Restoring predictability — and investor confidence — requires a focus on maintenance discipline and alignment between planning and execution.

Rising costs and productivity pressures demand urgent action

Rising costs and productivity have moved up the ranking from No. 6 to No. 2 this year. Higher prices in some commodities have boosted revenue but masked underlying productivity losses. Energy and labor costs, royalties and trade tariffs — combined with structural challenges such as declining ore grades and sustainability obligations — put pressure on margins. Digital and innovation are critical enablers, offering integrated, data-driven operations and automation to unlock cost savings and improve productivity.

Capital allocation definitively shifts toward future-facing minerals and growth strategies

Companies are increasing capital expenditure and reducing shareholder returns in the ongoing shift toward growth-focused strategies. The industry continues to favor brownfield over greenfield exploration, reflecting longer development cycles hampered by regulation, sustainability and permitting. Miners are exploring joint ventures (JVs) and partnerships to create long-term value while retaining cash to capitalize on opportunities.

Of course, achieving growth is not simple. While the majority of transactions are smaller, the announcement of the Anglo American–Teck merger underscores how strategic imperatives, especially in the copper sector, can still drive significant industry transactions. This deal, which is set to establish one of the world's top five copper producers, could be a pivotal moment for industry consolidation and portfolio optimization as miners aim to secure essential minerals and metals. However, large deals such as this are complex. Companies need to convince shareholders of the accretive value while also winning regulatory approval at a time when every country seeks more control over critical minerals. Successful growth strategies include both buy and build components.

Geopolitics remain relevant despite a lower risk ranking

Geopolitics may have dominated headlines, but it has dropped to No. 7. We believe this is because miners have accepted that assets — and to some extent, markets — are where they are. However, companies should remain vigilant to the impact of geopolitical uncertainty, particularly the medium- to long-term implications of tariffs and trade disruption. Building robust relationships with local governments and communities is critical.

Workforce and digital have returned to the radar this year, ranking No. 6 and No. 8 respectively. The sector is struggling to attract a diverse workforce amid a tightening labor market. Digital is also in focus as miners address an urgent need to transform operations for cost, productivity, safety and sustainability gains. Artificial intelligence (AI) is the next frontier, but successful investment requires tighter alignment with business priorities and a clear business case.

Significant transformation of the sector is gaining pace, requiring more innovation, collaboration and agility. This is not the time to stand still — it's time to reimagine mining.

1. Operational complexity ★

Declining ore grades and complex conditions highlight the need for innovation

Operational complexity — and the associated risks and production predictability — is now the top risk for miners. The challenges of complex orebodies deeper mines, declining grades and greater variability in geometry, grade and geotechnical conditions are heightened by aging assets, capability gaps and adverse weather. Deeper mines are more complicated, requiring specialized knowledge in geotechnics, logistics and hydrology.

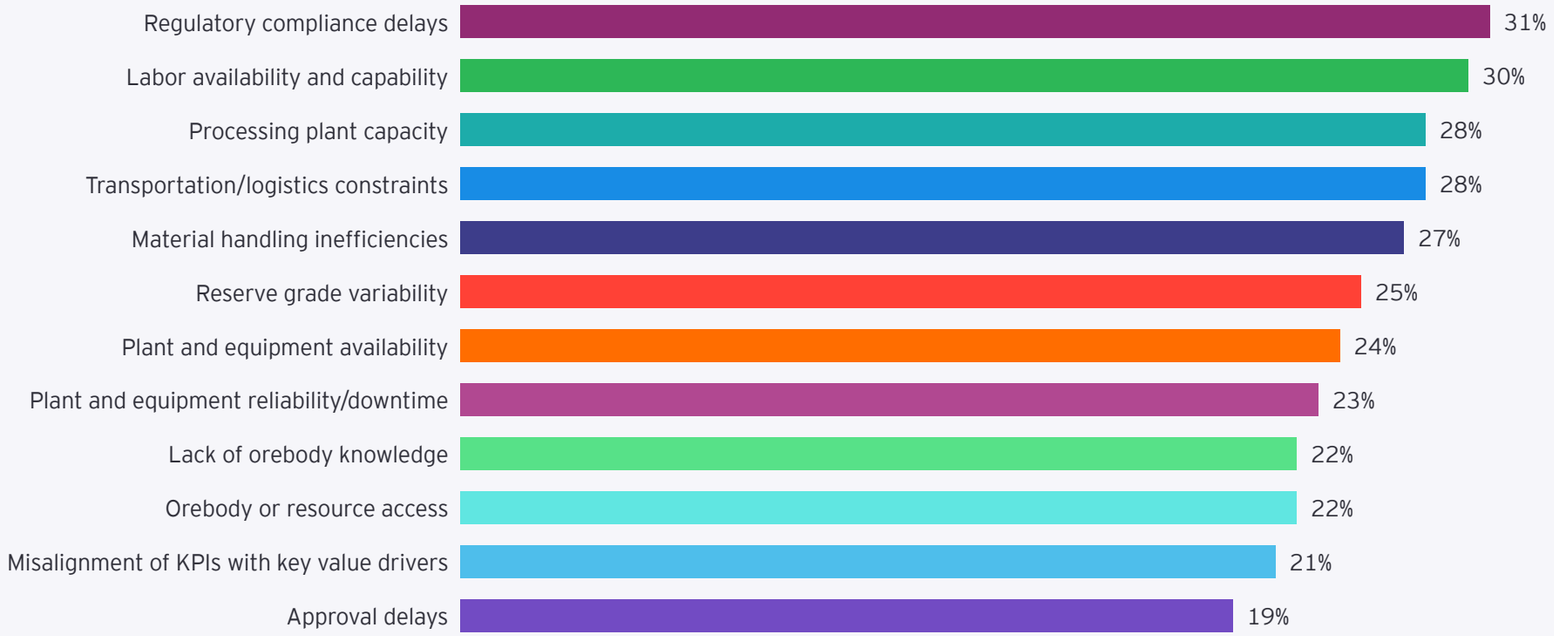
This means reliable output is much harder to achieve, and predictability drives investor confidence and capital access. Across sectors, missing earnings by just 1% typically triggers a 0.2% share price dip. In the latest season, misses underperformed the S&P 500 by 3.6 points, while beats outperformed by 1.7 points — the widest spread since Q3 2022.[1] In mining, shortfalls often stem from operational and external factors. How the market responds depends on the size and persistence of the shortfall, as well as the company's transparency, communication and history of delivering on its promises.

A reliance on traditional mining methods hinders solutions. Miners should rethink mine design and operations, exploring alternative approaches, such as smaller trucks, in-pit crushing or ore pre-treatment.

Diverse factors create multiple bottlenecks

The mission to improve mining production is complex, as outlined by survey results — miners gave almost equal weighting to multiple, diverse factors impacting throughput. Creating gains requires organizations to consider an end-to-end approach to tackling this challenge.

Chart 1: Which operational bottlenecks most significantly impact your production throughput? (respondents could select up to three)



Source: Mining & Metals Business Risks and Opportunities Study 2026.

Key issues include:

- **Declining head grades** are affecting output. The average grade of copper mined worldwide has declined by about 40% since 1991, and the 62% iron ore benchmark price, particularly for Pilbara Blend Fines (PBF), has recently transitioned to a 61% Fe specification.[2] Impurity levels (silica, alumina and phosphorus) are also increasing.
- As high-grade orebodies are depleted, miners are increasingly **moving into remote and geologically complex regions** that lack infrastructure, pose environmental and political risks, and demand deeper and more technically challenging, extraction. This is driving up costs, complicating logistics and straining workforce availability.
- **Skills gaps and shortages** are eroding both frontline execution experience and capability. Automation can help relieve pressures but requires stable schedules and execution — this is difficult to achieve amid frequent plan changes and the lack of experienced workers.
- **Processing plant capacity** is an underestimated bottleneck. While nameplate capacity may be understood, actual capacity is impacted by feed variability and declining grades outside the original design windows, which worsen as an asset ages. Disconnects between the downstream impact on beneficiation from the ore body, schedule and executional variability undermine value chain optimization.
- **Infrastructure bottlenecks** can cap value even when site execution is flawless. For example, rail constraints saw iron ore stockpiles grow for Kumba Iron Ore, forcing production cuts due to a lack of space.[3]
- **Maintenance discipline is slipping,** with preventative maintenance often sacrificed for short-term gains, despite evidence suggesting long-term benefits. One Canadian underground nickel mine estimated that optimal preventative replacement would yield an average cost saving of 15%.[4]
- **Planning and execution may be misaligned** due to conflicting priorities and siloed decision-making. Some reports suggest spatial compliance to optimal schedules is as low as 30%, with almost real-time optimization technologies, a short-term focus and narrow KPIs driving reactionary behaviors that undermine enterprise value. The disconnect between executed schedules and the optimal resource and reserve exploitation strategy leads to grade cliffs, waste-bound areas and, ultimately, another feed constraints and sales shortfalls.
- **Functional silos undermine schedule predictability and asset productivity.** The lack of integration among key operational areas, such as operations, asset management, supply, people and infrastructure (as shown in Chart 2), creates several adverse consequences. These include volatility in tons, grades and recovery; unplanned downtime; inefficient use of resources; and short-term optimization that erodes long-term value, particularly in complex orebodies. Disconnects can even undermine safety and increase the risk of catastrophic events.

The impact of functional silos on key areas includes:

- **Planning and scheduling:** Schedule instability undermines asset management tactics and execution, impacting core asset reliability.
- **Asset management:** Unreliable assets affect the integrity of the schedule and necessitate changes to execution and execution discipline.
- **Execution management:** The resulting breakdown in execution discipline undermines the short- and medium-term schedules, and the cycle continues.

Strategic opportunities

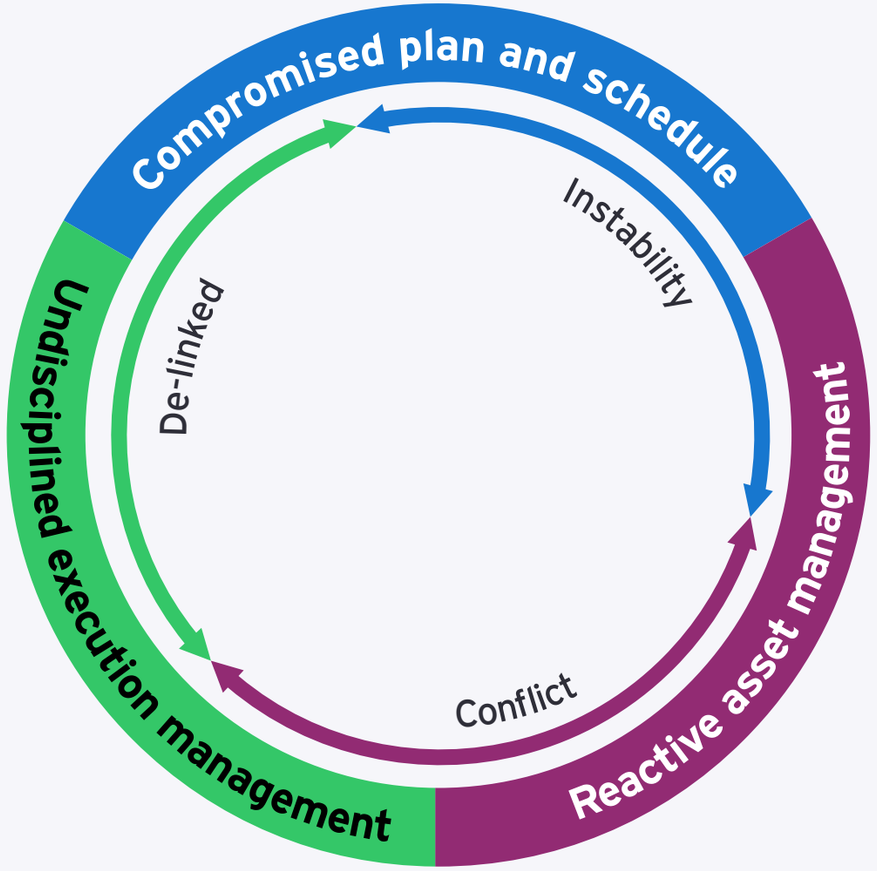
Strategic planning and targeted investment can mitigate operational risk, improve productivity and offer miners a huge source of value creation. Key considerations include:

Deploying a robust management operating system (MOS) that aligns planning, asset management and execution is essential for improving operational efficiency. Prioritizing end-to-end integration over functional optimization can protect longer reserve exploitation strategies. In oil and gas, similar systems have been in place for decades, strengthening resilience and performance in safety, reliability and ESG.[5]

Planning and execution discipline involves aligning short-, medium- and long-term plans to maximize value and manage ore body exploitation in relation to market demands.

Defining supervisor capabilities and roles, including distinguishing between technical and people leadership positions, can help supervisors concentrate on operational responsibilities and increase efficiency.

Chart 2: Impact of functional silos on productivity



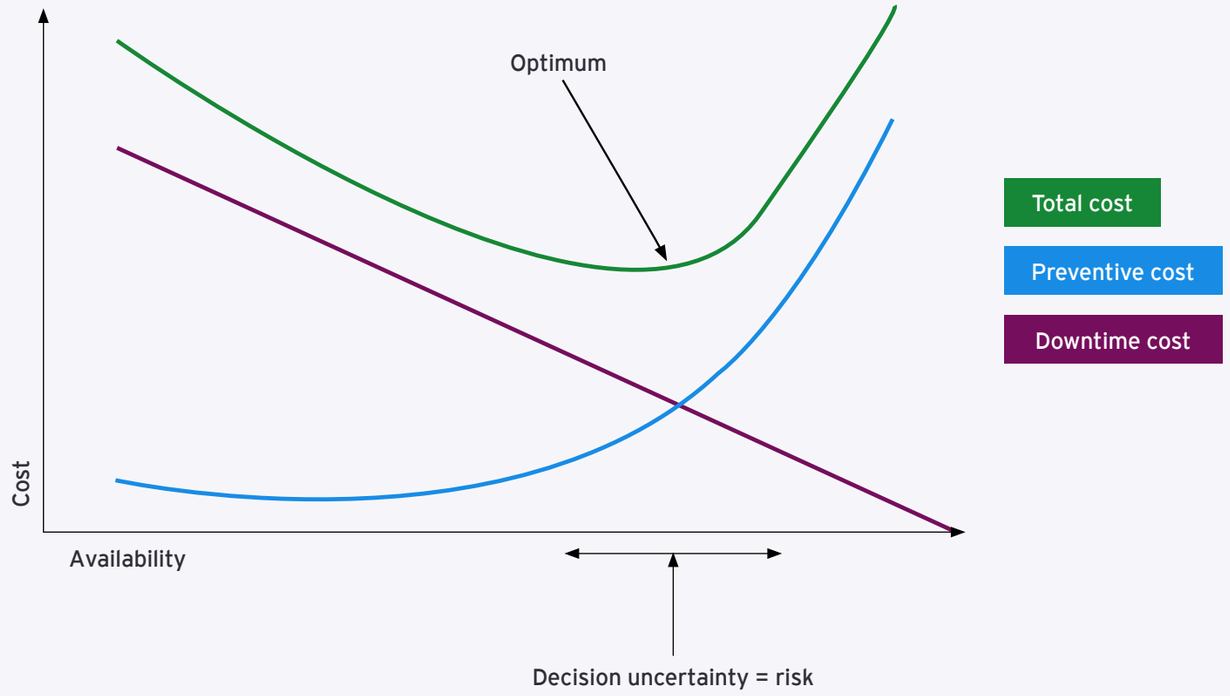
Improve recovery from lower-grade ores through advanced processing technologies, such as enhanced flotation, leaching and ore sorting, to extract more value from each ton of material. Previously uneconomic waste can also be reassessed, now that prices are higher and technology has improved.

Asset management to extract more value from existing assets drives productivity and manages risk. Areas of focus could include a shift from calendar- to condition-based maintenance with appropriate overall equipment efficiency (OEE) metrics, prioritizing sustaining capital and adopting a top-down approach to allocating capital and controlling risks.

Utilizing predictive tools to anticipate disruptions and monitor leading indicators of instability in real time can reduce variability and improve throughput.

Following through on predictive maintenance schedules cuts downtime, enhances production, reduces overall maintenance costs and extends equipment life. For example, the Albian Sands mine extended the life of their 400 metric ton trucks from 80,000 to 170,000 hours through proprietary maintenance.[6] There is an optimum point where combined preventative maintenance and downtime costs are at a minimum (as described in Chart 3). A maintenance policy should be established to identify the level of preventive work that minimizes costs. Due to inherent uncertainty, assessing and balancing risks in relation to costs is key.[7]

Chart 3: Preventative maintenance optimization curve



Source: Asset Management excellence, second edition.

2. Rising costs and productivity ↑

The rising cost of operations demands urgent productivity solutions

Higher prices for some commodities, such as iron ore and coal, have boosted revenue but masked underlying productivity issues. Rising prices can also be offset by structural challenges, including declining ore grades, skill shortages, and community and regulatory demands. Urgent cost control and productivity solutions are needed, especially with bulk prices expected to fall. Margins are further pressured by persistently high energy and labor costs, additional royalties and new trade tariffs.

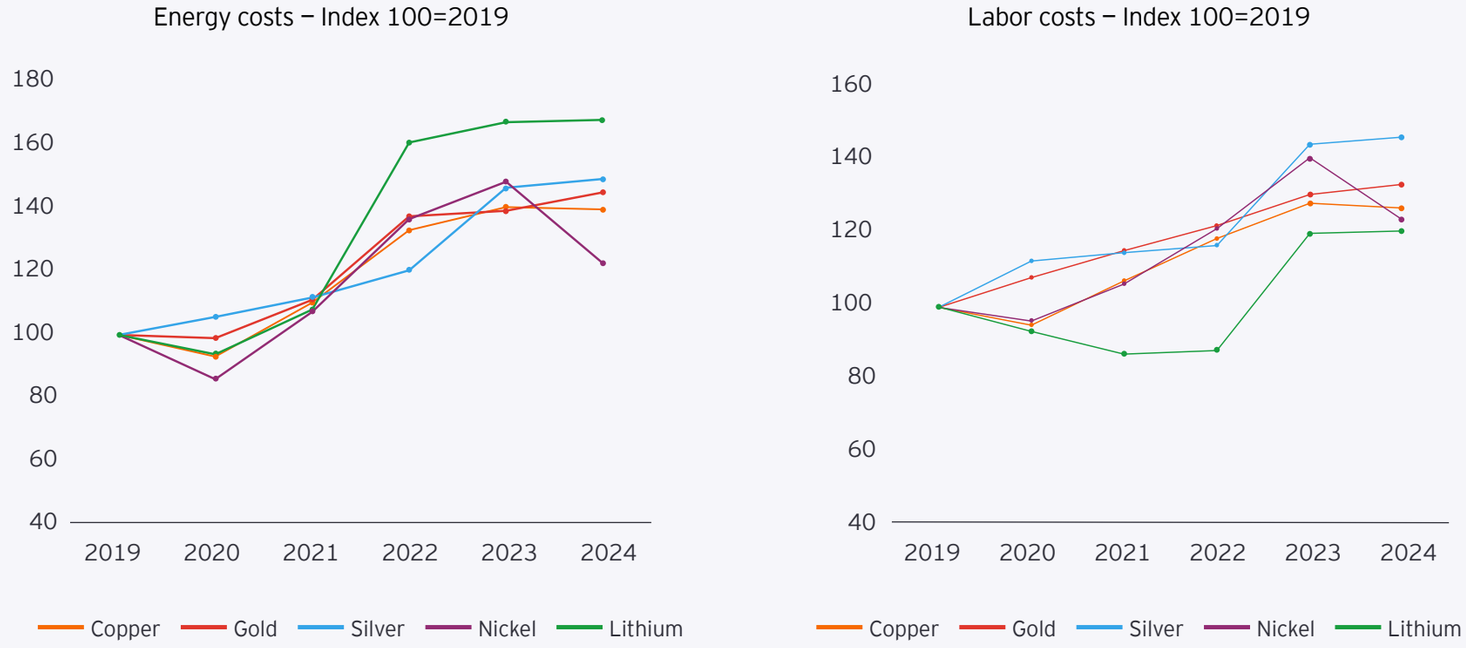
Inflation eases, but energy and labor costs remain higher

In 2025, average energy costs remained higher than pre-pandemic levels in most markets except nickel, where lower prices have led to reduced production from high-cost miners and lower average costs. Many companies are responding by optimizing energy use and adopting renewables to cut costs and improve sustainability. With hybrid systems and financing options, including power purchase agreements (PPAs) and leases, renewable energy projects are becoming increasingly affordable.[8]

As discussed in "Workforce," a skills crisis, combined with rising living costs, is keeping wages elevated. In Australia, for example, the Western Mine Workers Alliance petitioned for collective bargaining for the first time in 20 years to secure annual wage increases. In 2024, workers at Escondida in Chile secured significant bonuses to end a labor strike.[9]

At the same time, the push for greener, socially responsible operations increases costs relating to decarbonization and sustainability compliance.

Chart 4: Energy and labor costs 2019-24 (Index 100=2019)



Source: EY Insights analysis of data from S&P Global Market Intelligence.

High royalties and trade tariffs intensify cost pressures

In 2024, the average corporate income tax and royalty rate for ICMM members climbed to 40.6%, an increase of 7.7% from 2023, as governments sought to maximize revenues from high-demand transition minerals.[10] A key example is Indonesia's shift to value-based royalties, which are tied to commodity prices. This change pushes potential effective rates to over 10% for some commodities and significantly increases cost volatility.[11]

Escalating tariffs and disrupted supply chains are driving up logistics and procurement costs. The knock-on effect of reconfiguring sourcing, routing and inventory strategies is creating inefficiencies, eroding margins and hindering operational agility.

End-to-end challenges constrain productivity

Miners are challenged by diverse productivity pressures across operations. In addition to the Operational Complexity issues discussed in the previous section, key issues include:

- **The integration gap:** A siloed operating model, with little integration between operations and maintenance, along with a lack of inventory optimization, undermines strategies and plans.
- **Asset reliability:** A lack of real-time visibility into asset health increases the risk of costly, untimely breakdowns and lost productivity.
- **Data maturity gap:** The sector is quick to adopt technology but slow to become truly digital. Without trusted data, digital transformation gains are episodic and fragile, as explored in "Digital and Innovation".
- **Workforce issues:** As explored in "Workforce," tight labor markets and skills gaps elevate onboarding, safety and change management risks.

Strategic opportunities

Diverse productivity barriers highlight the need to consider new solutions:

- **Improve productivity through a holistic end-to-end approach** that includes managing variability, asset reliability, operations and integration. Advanced analytics and predictive maintenance can reduce asset downtime, while clear operating models and behavioral changes enable consistent productivity improvements. Integrated operating models and scenario planning allow miners to adapt quickly to changes and market needs.
- **Identify opportunities to harness digital and innovation** to improve throughput and drive end-to-end productivity.
- **Keep humans at the center of productivity improvements.** An integrated operating model with humans at the heart enables, encourages and locks in sustainable productivity gains. People-centered change is supported by technology that aligns with all elements of the value chain and broader business objectives.
- **Accelerate renewable energy integration** to stabilize energy costs, mitigate supply risks and bolster sustainability. In regions with high tariffs and volatile supply, such as southern Africa, hybrid and off-grid renewable models are becoming standard. Securing long-term renewable energy PPAs enhances energy security and reduces exposure to fossil fuel price swings, supporting both financial predictability and sustainability targets.
- **Build investor confidence with strategic alignment.** Proactive engagement with investors on issues such as inflation, policy uncertainty and sustainability — along with transparent reporting — enhances confidence and access to capital.

3. Capital ↓

Miners evaluate strategic alternatives as investors support reinvesting for growth

For three consecutive years, companies have increased capital expenditure while reducing returns, reflecting a growth mindset supported by shareholders who acknowledge the need to reinvest, particularly due to supply gaps and favorable commodity prices. Copper is a key focus for many companies, but these assets are expensive. Growth strategies should include both buy and build approaches.

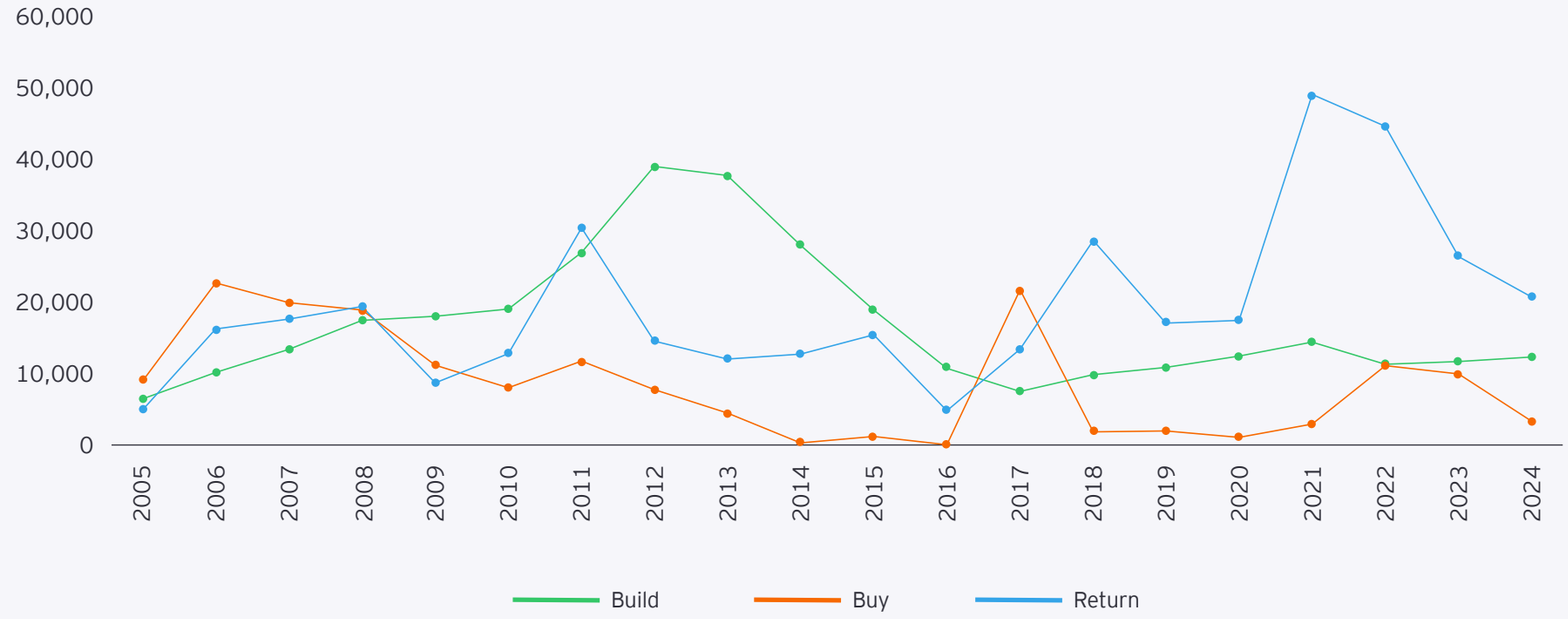
M&A activity is targeting future-facing minerals

Miners are considering all options to secure future-facing minerals. The announcement of the Anglo American–Teck merger underscores how strategic imperatives, especially in copper, continue to drive significant industry transactions, even when large-scale M&A is often viewed as too complex or difficult due to regulatory approvals. This deal will establish one of the world's top five copper producers, with Anglo Teck expected to offer more than 70% copper exposure and substantial embedded growth optionality. The synergies from the integration of adjacent Collahuasi and Quebrada Blanca operations as part of this deal reinforce the value of JVs and "district" strategies.[12]

Mining companies are also divesting lower-growth or carbon-intensive assets. For example, South32 is divesting Cerro Matoso to further streamline the company's portfolio toward higher-margin strategic minerals and metals that are critical to the energy transition.[13]

Saudi Arabia's broad strategy includes partnerships with the UK, Australia and the US, along with agreements worth US$28.5b focused on exploration, mining, financing, R&D, innovation, sustainability and value chains within minerals.[14]

Chart 5: Capital allocation strategies of top five diversified mining companies, 2005–24



Analysis includes BHP, Rio Tinto, Vale, Anglo American and Teck Resources. Buy (M&A) is based on completed deals in the period.
Source: EY Insights analysis of data from LSEG DataStream and S&P Global Market Intelligence.

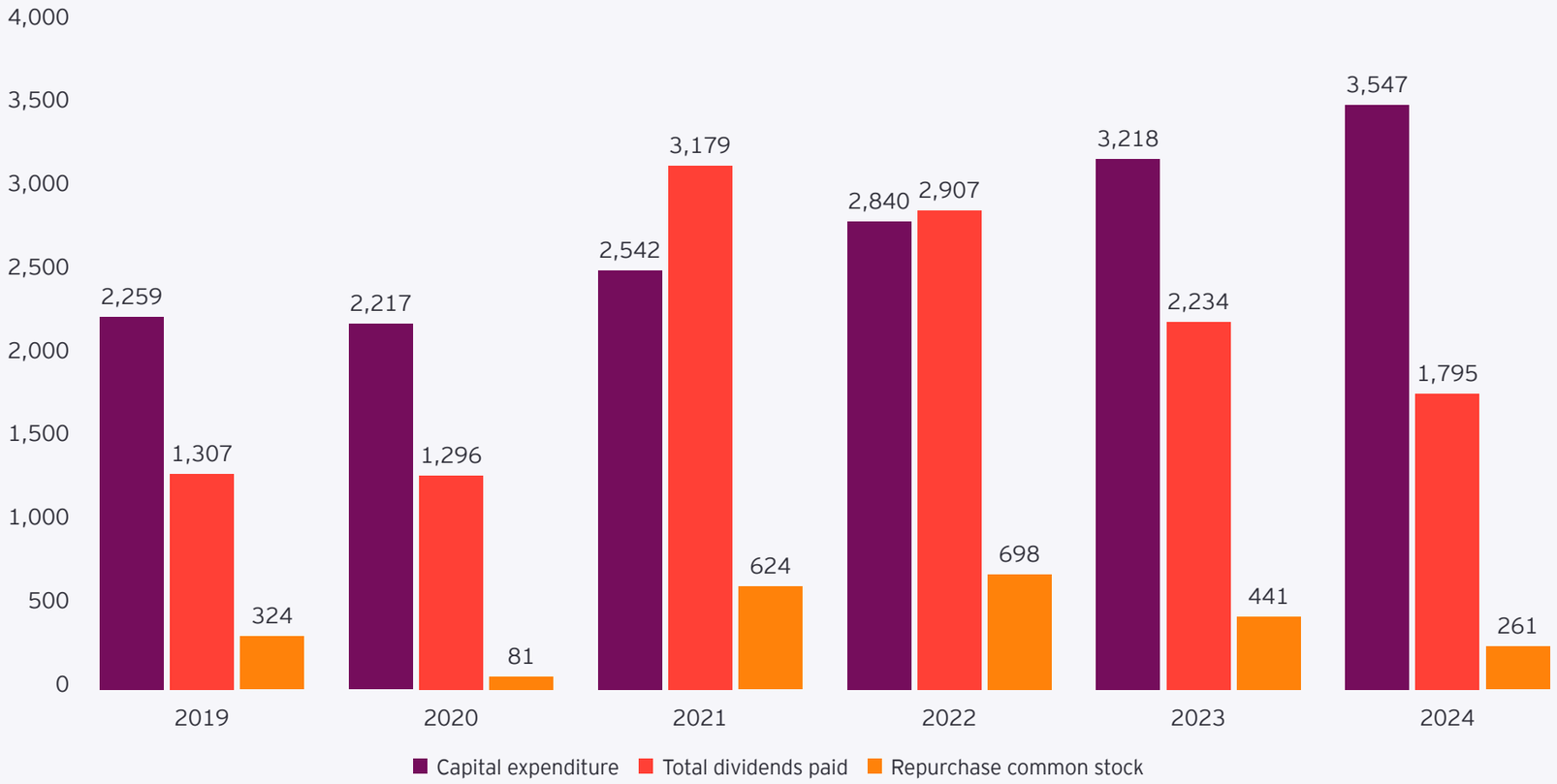
Organic growth remains a priority

Barrick Mining's emphasis on "growth through the drill bit" highlights the sector's continued focus on organic growth. The company is targeting a 30% increase in gold-equivalent reserves by 2030 at a fraction of the cost of acquisitions.[15] Yet discovery challenges persist: Since 2020, only six major gold discoveries have been made, with none occurring in 2023–24. The industry favors brownfield drilling over riskier greenfield exploration, raising concerns about long-term reserve sustainability and supply. Rethinking exploration strategies will be crucial, such as building alliances to explore infill opportunities between mines or looking for smaller deposits that can be integrated. Recent development and expansion capex has concentrated on copper, including the Kamoa-Kakula project (approximately US$3b) and the Oyu Tolgoi expansion (approximately US$7b).[16]

New projects face rising cost of capital and longer timelines

Higher interest rates and capital intensity mean the sector's weighted average cost of capital (WACC) is now 8% to 10%, more than double that of large technology peers.[17] This puts pressure on management teams to build the case for investment and amplifies the risk of bridging longer-term supply gaps in key commodities such as copper. The average mine takes nearly 18 years from discovery to production, almost triple the time required in the 1990s.[18] Regulatory delays, sustainability requirements and permitting challenges slow capital deployment even when funding is available.

Chart 6: Average capital expenditure and shareholder returns, 2019–24, (US$m)



Note: Based on analysis of data for the top 20 mining and metals companies by market capitalization as of 8 August 2025 (excluding coal and consumable fuels from 2019–24).
Source: EY Insights analysis of S&P Global Market Intelligence data.

Financing in flux highlights the need for innovation and discipline

Access to capital is uneven. Higher interest rates have led to a more cautious use of debt, with capital flowing only to strategically critical, financially resilient projects in stable jurisdictions.[19]

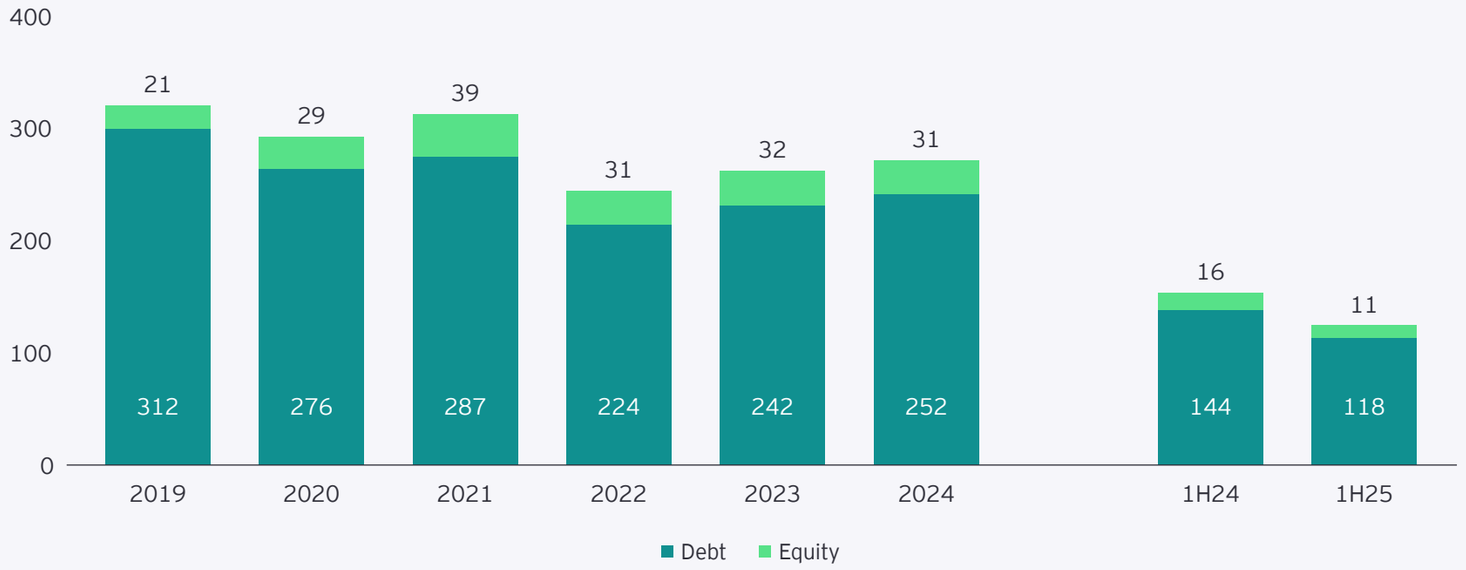
As traditional capital sources tighten, miners with high-quality assets are blending public support with alternative financing models, such as royalty and streaming agreements, offtake agreements, partnerships, sustainable finance and government incentives. Zijin Mining's launch of China's first streaming investment fund, targeting US$200m to US$400m in 2025, is one example.[20]

Strategic opportunities

Overcoming the challenges of capital access and allocation requires a range of strategies, including:

- **Leverage district-level partnerships** to co-invest in developing neighboring assets. Codelco and Anglo American's joint mine plan for adjacent copper projects in Chile aims to increase copper production with minimal additional capital required.[21] Partnerships such as this are difficult and time-consuming to execute but can effectively reduce risk, lower costs and create value through shared infrastructure and resources.
- **Optimize portfolios to retain selective, high-impact investments.** Divesting low-growth assets frees up capital for reinvestment into projects better aligned with long-term value creation.
- **Strengthen sustainability and community engagement** through transparent sustainability reporting and deeper stakeholder dialogue. Robust LTO credentials give miners a strategic edge in districts critical to portfolio development.
- **Improve capital and operating efficiency.** Leveraging AI, real-time analytics and digital tools can improve capital allocation discipline and modular project execution. Stringent cost controls and productivity improvements help offset rising input and financing costs, safeguarding the economic viability of projects.
- **Tailor risk management approaches for regions and commodities.** Adaptive risk management strategies that align with commodity cycles, regulation and political landscapes optimize investment decisions.

Chart 7: Capital raised by debt and equity, 2019–1H25 (US$b)



Note: Debt includes bonds and loans; equity includes convertible, IPO and follow-on.
Source: EY Insights analysis of data from LSEG DataStream.

4. Resource and reserve depletion –

Looming supply shortfalls could be a catalyst for innovation

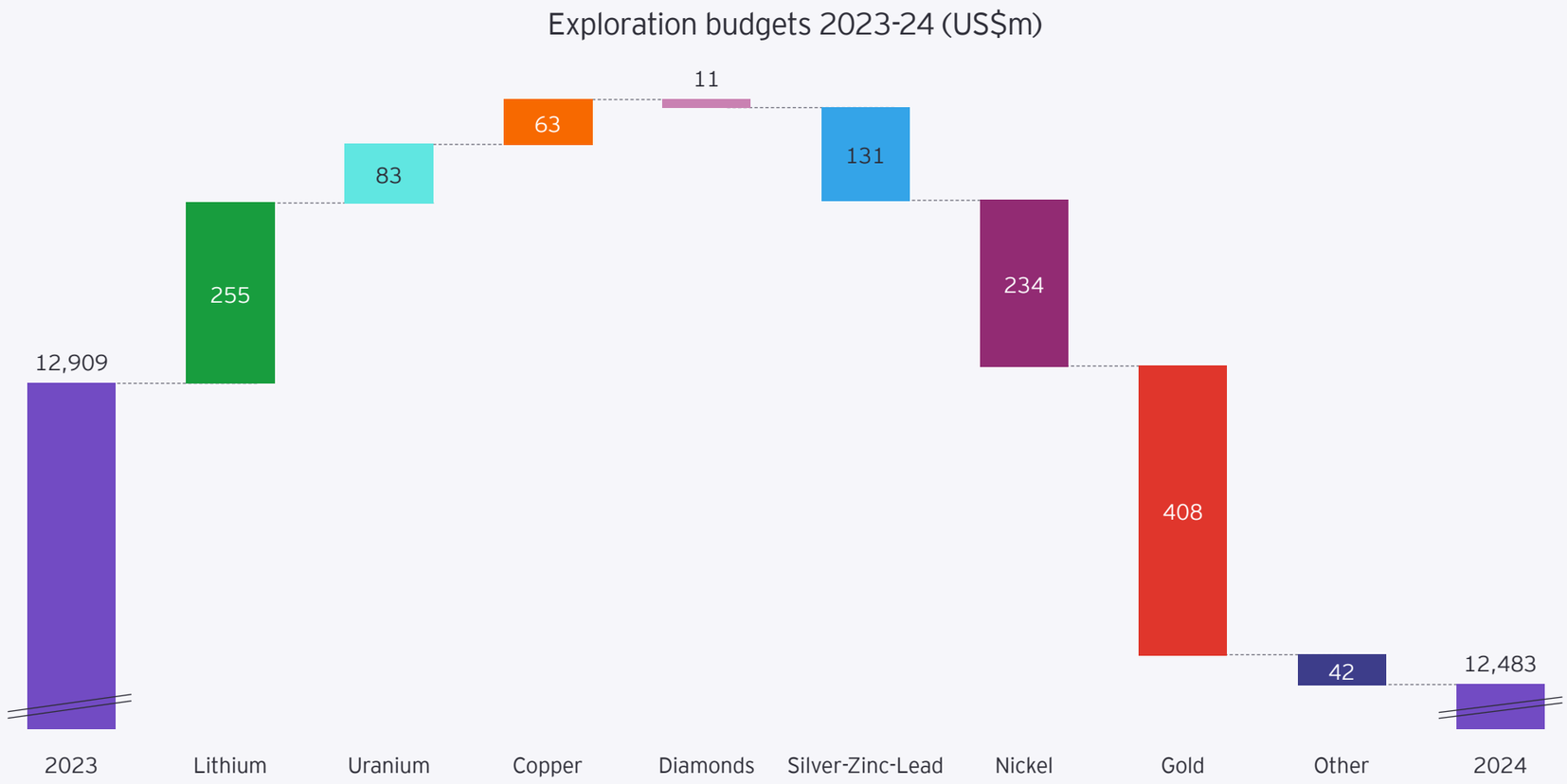
There has only ever been a finite amount of resources in the earth but, over time, innovation has turned more into reserves. However, ore grades are declining, and resource replacement is further complicated by remoteness, accessibility and political factors – just as demand outstrips supply and some markets move into deficit.

A new approach is needed as depletion outpaces discoveries

A recent report estimates that meeting growing commodities demand will require US$5.4t of investment by 2035.[22] However, exploration budgets have declined, dropping to US$12.5b in 2024 from US$12.9b in 2023.[23]

This trend is expected to further widen supply gaps as depletion outpaces discoveries and development. Economically viable reserves will likely be depleted well before geological resources are exhausted.[24] With the average annual depletion rate of many mines at around 3%, a typical life of mine (LOM) is, under current supply conditions, just 30 years. Chart 9 highlights the challenge of replacing reserves, even in the short term, particularly when some markets are seeing lower incentive prices. In a sector already seen as slow to build new mines, this underscores an urgent need for a different approach to assessing and managing resources.

Chart 8: Exploration budgets down – but lithium bucks the trend



Source: S&P Global Market Intelligence.

Declining ore grades push up costs

Global average copper grades have declined by approximately 40% since 1991, pushing up costs and operational complexity, which threaten margins and project viability. Mining distances to crushers and waste sites are growing, pits are becoming steeper, and operations often shift from open-pit to deeper underground mining. Extending mine life often requires massive capital commitments. For example, Teck Resources' Highland Valley Copper extension beyond 2040 is estimated to cost between US$2.1b and US$2.4b.[25]

Increased capital intensity means higher incentive prices for replacement projects. The cost of new copper mines has increased to an average of approximately US$25,000 per ton, according to former Vedanta Base Metals CEO Chris Griffith. "A large copper mine with an annual production of 250 kiloton would require between US$5b and US$6b to develop."[26]

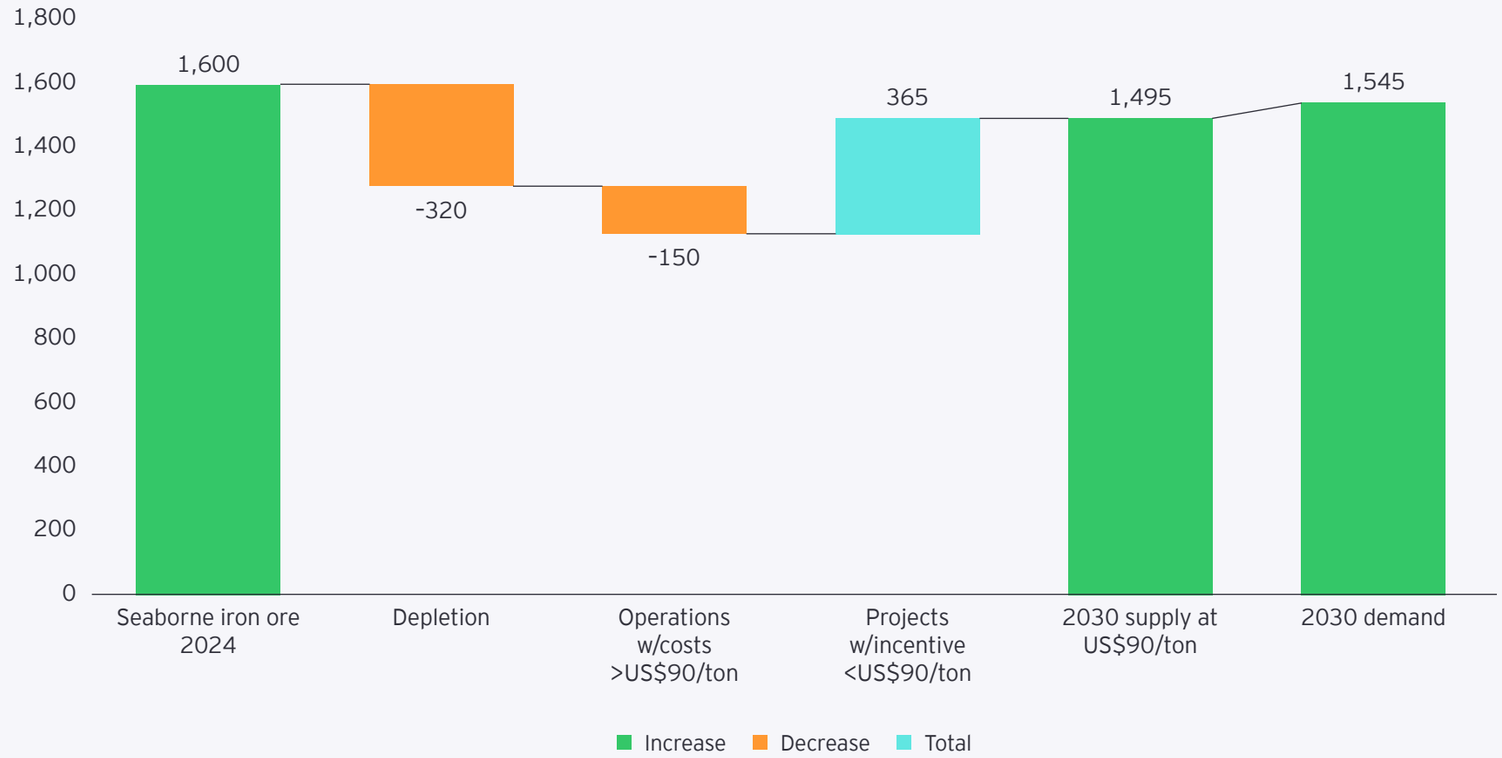
The implications of higher costs on miners' ability to replace depleted reserves extend far beyond the sector. Shortfalls could create price volatility, supply chain bottlenecks, increased geopolitical tensions and environmental damage in the race to access reserves.

Strategic opportunities

Depletion is a growing risk for miners but also a powerful driver to accelerate investment and innovation. We see key opportunities in:

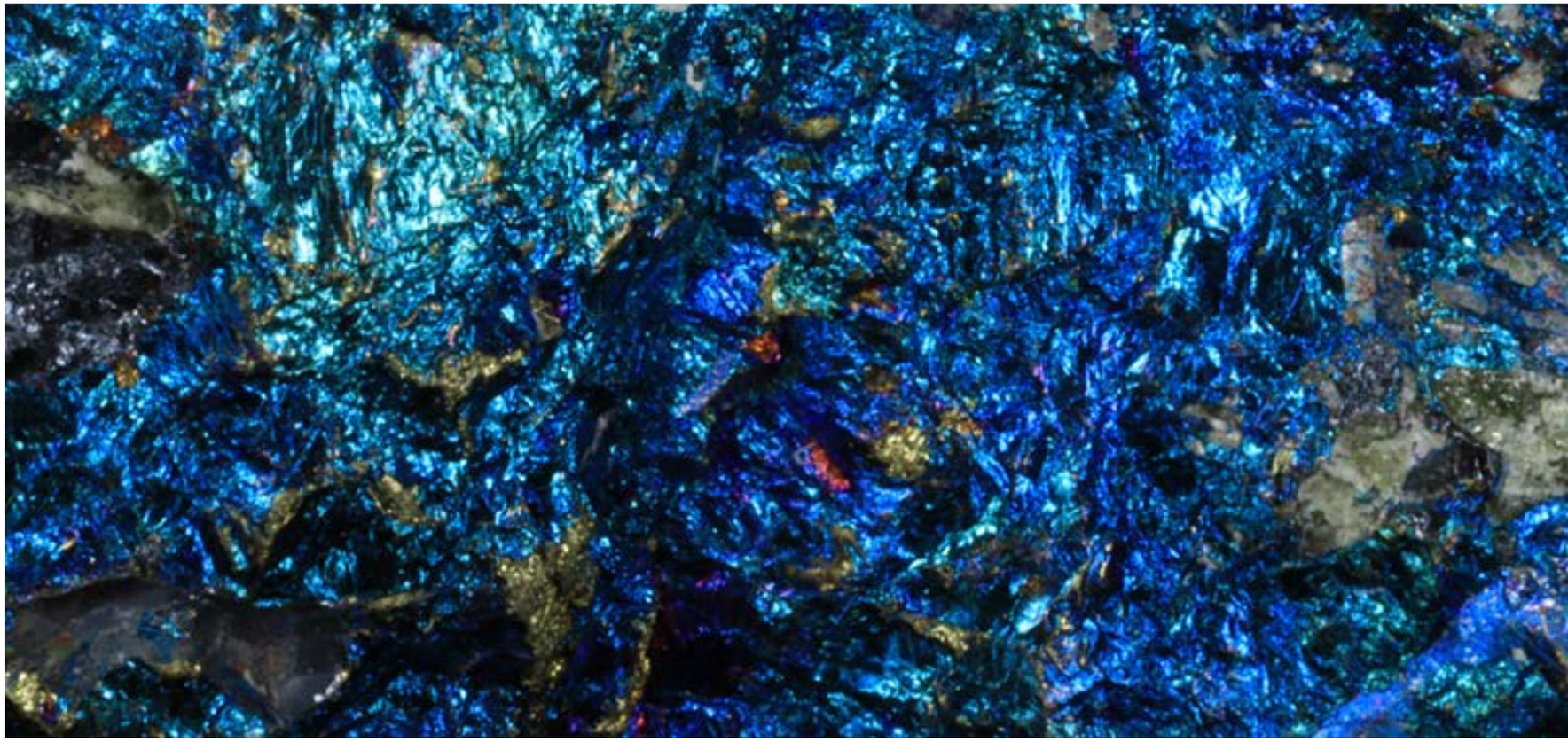
- **Accelerating exploration in new regions,** at greater depths and in unconventional areas — including legacy sites and tailings — to discover new reserves and the "next big deposits," often aided by innovative technology.

Chart 9: Depletion and lower prices impact seaborne iron ore outlook



Source: Vale Investor Presentation, December 2024.
Assuming an average annual depletion rate of approximately 3%, meaning an average LOM of 30 years based on the current supply.

- **Progressing brownfield exploration** to replace depleted reserves. Since the end of 2019, Barrick Mining has successfully delivered replacement of 180% of its gold reserve depletion, adding almost 46 million ounces of attributable proven and probable reserves.[27] Anglo American's near-asset discovery projects demonstrate the potential scale of brownfield success, with Los Bronces drilling increasing contained copper resources by 180% to approximately 49 million metric tons since 2009.[28]
- **Driving technological innovations** to extend mine life and improve yields through automation, advanced ore processing and AI-driven analysis to more efficiently exploit lower-grade ores.
- **Forming partnerships and JVs** to share the cost and risk of new mines and technologies. Collaborating with peers, junior explorers, technology firms and governments can help unlock difficult deposits, implement new solutions and sustain growth. Anglo American and Codelco's joint mine plan will bring together around 2% of the world's global copper resources and reserves – approximately 60 million metric tons of contained copper.[29]
- **Buying and diversify** to replenish reserves. Major miners are making strategic acquisitions of assets or entire companies to secure long-life resources. Newmont's US$16.8b takeover of Newcrest expanded its gold and copper reserves, creating an unmatched portfolio of long-life mines for decades of production.
- **Recycling metals to extend resource life.** Recycling is a scalable, lower-cost pathway to secure critical minerals. Urban mining of end-of-life electronics, batteries and infrastructure can supplement primary supply, especially for copper, lithium, nickel and rare earths.
- **Exploring the potential of ultra deep mining** – a new frontier that could be enabled by innovation and new technology. Nanorobotics and improved orebody targeting can facilitate access to deeper reserves while addressing key challenges, such as the high cost of ventilation.



5. License to operate –

Higher expectations keep focus on LTO performance

LTO remains in fifth place, as higher expectations from communities, investors and governments push miners to meet commitments around responsible mining. We expect this focus on LTO to intensify as government budgets tighten and corporations are expected to do more.

Community opposition delays critical projects

Around the world, miners make positive contributions to communities. Teck Resources, for example, maintains 85 agreements with Indigenous peoples, guided by the UN Declaration on the Rights of Indigenous Peoples,[30] and Vedanta has pledged to uplift 100 million women and children through social welfare programs and 2.5 million people through enhanced skill sets.[31]

Yet negative incidents still damage LTO. Global Watch reports that, between 2021 and 2023, mining of transition minerals was linked to 334 protests, deaths and violent events – 90% of these occurring in emerging economies.[32] In Latin America, community opposition has delayed copper and lithium projects, while environmental protests led to the Indonesian government revoking four of five nickel mining permits in the Raja Ampat Islands.[33]

Miners expect more scrutiny around sustainability and LTO

Our survey found respondents expect governments to increase control over mining, with sustainability and governance as the priority focus areas. Trends impacting miners include:

- **Permitting is increasingly shaped by regional objectives,** particularly around securing a sustainable supply of critical minerals. Miners must navigate the complex, interconnected factors of building strong relationships with government stakeholders, managing increased costs of sustainability compliance, and maintaining market access and LTO, even in jurisdictions with weaker rules and regulatory enforcement.
- **Approvals remain slow** despite government promises. Litigation, multiagency review approvals, environmental and sustainability regulations, access to land and community objections delay obtaining licenses. While project approvals ultimately rest with the state, in countries with weaker laws and ancestral policies, removing red tape can damage mine operators' reputations and spark community unrest.

Chart 10: Expected government action in mining and metals (respondents could select up to three)

Source: Mining & Metals Business Risks and Opportunities Study 2026.

- **Embedding local communities in decision-making is critical,** as 50% to 80% of energy transition minerals are located on or near Indigenous land. Updated ICMM guidelines emphasize engagement with Indigenous people at a project's inception, respecting their rights and reaching agreements "through a process that recognizes free, prior and informed consent."[34]
- **Improve transparency to demonstrate commitment to shared value and social welfare.** With local governments expecting greater value from their mineral wealth, miners must regularly articulate contributions to communities and economies: for example, local employment and suppliers, engagements to minimize pollution and environmental harm, and investment in education and healthcare. ICMM members reported US$42b in tax and royalty payments to host countries in 2024, alongside 609,300 jobs, US$41.1b in wages and US$1.5b in community and social programs.[35]
- **Reframe closure as a value driver rather than a cost center.** Leading miners collaborate with stakeholders to repurpose mine assets, restore ecosystems and ensure a sustainable value-added legacy beyond LOM.

Strategic opportunities

Miners that approach LTO as an opportunity rather than an obligation can build trust, create shared value and leave a positive legacy. Strategic actions that bolster LTO include:

- **Engage systematically with the community** throughout the mining lifecycle to help build trust and strengthen LTO. Regular, consistent interactions foster relationships from exploration to development, supporting closure design and the post-mining transition. Vale, for example, has community engagement processes across 97% of its operations and has conducted its first Community Perception Survey in Brazil.[36]
- **Create legacy beyond the life of the mine** from a project's inception. A commitment to sustainable jobs, environmental stewardship and local infrastructure strengthens miners' reputations and positions communities to thrive during and beyond the LOM.
- **Do what is right, not just what is regulated.** Miners that listen and make communities part of decision-making reap benefits beyond a stronger LTO. Barrick Mining, for example, has community development committees (CDCs) at all operations, with former President and CEO Mark Bristow noting, "Mining done right is a powerful force for development. When our host communities succeed, we succeed too."[37]

6. Workforce ★

Labor shortages push up costs and delay critical projects

Miners are facing a worsening skills crisis as retirements increase and new talent looks elsewhere. With the sector struggling to fill key roles in planning, process engineering, sustainability, closure and regulatory compliance, many lack confidence in their ability to resolve labor shortages.

A diminishing pipeline for new graduates comes at the same time as a global "grey tsunami"[38] – more than half of the US and Canadian mining workforces are expected to retire over the next decade.[39] When critical roles are vacant or filled with less-qualified staff, companies are challenged with reduced productivity, increased costs, and the risk of increased safety and environmental incidents.

10%

increase in Australian mining workforce required to meet the demand from over 100 new projects in the next five years.[40]

Making mining attractive to a broader pool of talent

A new approach to talent is needed to attract and retain a diverse workforce. Outdated perceptions of mining as a dirty, male-dominated digital dinosaur deter potential workers. To counter this, the sector must better articulate its role in the energy transition and digital future, highlighting the advances transforming operations, such as remote operations centers and automation. Showcasing the sector's global nature and exciting, future-focused roles – in everything from digitalization and AI to sustainability, community relations and social responsibility – can help.

Consider diversity in its broadest sense

Improving diversity, equity and inclusion (DEI) can help close the talent gap, and it is encouraging to see the sector's continued commitment to DEI objectives despite political headwinds. Anglo American's ranking as one of The Times Top 50 Employers for Gender Equality (for the fifth consecutive year) is an exceptional achievement in a male-dominated sector.[41] BHP reached 40% female representation in April 2025 – a world first for a globally listed mining company and a significant industry milestone.[42]

Indigenous workers remain an untapped talent pool. In addition to operational jobs, roles in other areas where values align – such as sustainability – could raise mining's appeal to Indigenous talent.

Time to reimagine training and education

Training across the sector needs an overhaul. Companies cannot address this challenge alone, vendors don't have systems to provide broad-based training, and institutions lack the capital to invest. Instead, an ecosystem approach, where players contribute in their areas of strength, can uplift training and alleviate the skills gap.

Understanding the impact and potential of AI and technology is also critical. Technology can upskill employees and free them from repetitive tasks, but only with careful management. As the industry evolves and reshapes its talent profile, innovative education, supported by government investment, will be vital. Collaboration with universities, training providers and schools can build new talent pipelines and agile education pathways, including through apprenticeships and micro-credentials.

Critical control management approaches are still immature

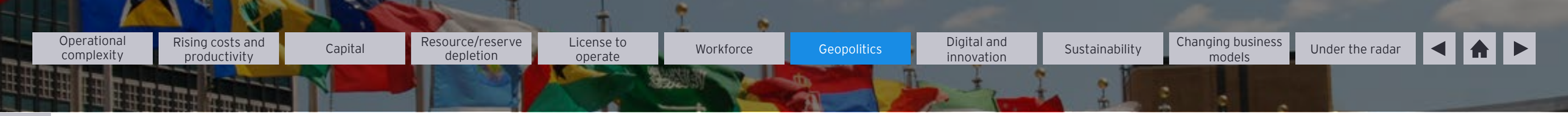
Even with better training, the mining industry must do more to embed controls that protect workers. The ICMM's annual report on fatalities revealed 2024's figures rose by 17% compared with 2023, with 83% of these fatalities attributed to a failure to implement identified critical controls.[43] This gap between policy and in-field practices highlights a drift from the importance of safety and necessitates organizations to adopt a critical control management approach.

Strategic opportunities

Now is the time for mining to secure the talent that will shape its future. By articulating the value of a career in mining, showcasing nontraditional pathways, incentivizing training and fostering a safe, inclusive culture, the sector can attract and retain the people it needs to thrive.

Key considerations include:

- **Move from short-term to long-term workforce planning** to align a strategic workforce plan with the broader mine plan — mapping talent and predicting needs is key.
- **Reframe talent as a strategic, not HR, issue.** Consider giving HR a bigger voice at the board table to better articulate the value of an upskilled workforce, particularly around AI and new technologies.
- **Re-evaluate the employee value proposition** (EVP) and recruitment practices to focus on attracting a diverse workforce with future-focused skills. The days of remuneration alone attracting workers into mining are diminishing, as employees now prioritize career development, culture, wellbeing and a commitment to responsible mining. Implats' comprehensive EVP (which includes a specific EVP for women) is featured on its website.[44]
- **Build out career pathways** to stem attrition. A fly-in-fly-out role isn't for everyone — offering different pathways attracts different workers. Outlining career journeys and showcasing people who have followed these paths brings the EVP to life.
- **Adopt technology** to support onboarding and just-in-time learning. Eldorado Gold's subsidiary, Hellas Gold, has a training center that uses simulators and augmented reality to replicate underground conditions, build specialized skills, strengthen safety culture and optimize production.[45]
- **Invest in continuous learning and agility** to build change capability into the workforce, helping to embed different ways of working and new technology.
- **Make mining a sought-after sector for top talent** by promoting the criticality of this dynamic sector and its exciting roles.



7. Geopolitics ↓

Rising trade barriers threaten supply and growth

Geopolitics' fall in the ranking may seem surprising, but this is a sector accustomed to volatility. Geopolitical risk is not declining, but it's likely some level of risk has already been "priced in." Miners may also be adopting a pragmatic perspective, accepting that assets and, to some extent, markets are where they are.

The need for minerals for energy transition, defense, data centers and semiconductors creates supply gaps with both security and economic implications. Competition has intensified across key stages of the mining supply chain, with governments escalating tariffs, restricting exports and implementing industrial policies to secure control over mining, processing and refining to safeguard national interests.

China has doubled down on securing supplies of strategic minerals through successive five-year plans since 1949, evolving its export policies from straightforward to strategic, shaped by domestic priorities, international market dynamics and geopolitical considerations. For example, Chinese restrictions on the export of specific heavy rare earth elements and related downstream materials are a direct response to US tariffs that have the potential to disrupt supply of minerals vital to everything from smartphones to batteries.[46]

In the US, national security concerns are the stated reason behind tariffs on steel and aluminum imports and on semi-finished copper products and copper-intensive derivative products.[47]

Beyond specific tariffs on minerals and metals, reciprocal tariffs on key mining jurisdictions such as Canada and BRICS countries are likely to increase costs and impact the availability of equipment, chemicals and other inputs. While the sector may be able to weather the primary impact of tariffs, the broader implications for global economic growth will be a concern.

Trade dynamics reshape geopolitical influence

Disrupted trade routes and supply relationships are allowing new players to fill the void. Saudi Arabia is positioning itself as a "swing investor" in critical mineral supply chains, partnering with Western governments (e.g., the UK, Australia and the US) and progressing opportunities in Africa.[48]

Resource nationalism increases as governments seek maximum value from key minerals

Across Africa and Latin America, resource nationalism is intensifying as governments tighten control through higher taxes, royalties and investment by state-backed enterprises. Support from institutions, such as the UNDP and IMF, may lead African governments to apply more scrutiny to the effective tax treatment of by-products (e.g., ruthenium from platinum) to prevent revenue leakage.

In Chile, the state keeps a tight control over lithium mining; however, recent municipal election results may indicate a shift to the right.[49]

Brazil has also seen election results favor right-wing candidates. Since Argentina's election of Javier Milei in 2023, the country has cut red tape and fast-tracked permitting to attract investment.

Carbon pricing as an economic lever

Several major economies and middle-income countries have introduced, or are working toward, implementing carbon pricing, with Asian countries playing an increasingly significant role. Countries with carbon pricing represent almost two-thirds of global GDP.[50] Carbon pricing can be a revenue source for fiscally constrained governments and may become a key economic lever, either through direct pricing mechanisms or in tariff regimes, such as the EU carbon border adjustment mechanism. Intensifying climate change impacts are shaping national sovereignty debates and driving governments and industries to reassess global supply chain resilience, critical mineral access and sustainability obligations.

Strategic opportunities

A proactive approach to mitigating geopolitical risks positions miners to leverage shifting dynamics as opportunities to consider new markets and growth opportunities. Key areas of focus include:

- **Monitoring the geopolitical environment and actively manage potential risks.** Miners should continue to incorporate geopolitical sensitivities into scenarios or analytical frameworks — covering economic, commodity price or cost of capital assumptions. This helps companies understand how potential options might play out and pivot as circumstances change.

- **Considering the medium- to longer-term implications of tariffs and trade disruption,** not just the obvious short-term issues. For example, tariffs impact markets, capital costs and investment decisions and, over time, they will influence talent and innovation.
- **Diversifying export destinations,** realigning trade routes and redirecting products to alternative markets when necessary. Australia's coal producers, for example, turned China's unofficial 2020 import ban into a strategic reset, diversifying exports into India, Japan, South Korea and countries in Southeast Asia, reducing dependence on any single buyer. Meanwhile, China is signaling strategic interests by boosting infrastructure investment in Latin America, especially around the Panama Canal, as part of its Belt and Road Initiative.
- **Capitalizing on downstream interest in the security of mineral and metal supply.** Between 2020 and 2024, the advanced manufacturing and automotive sectors invested close to US$65b in mining and metals.[51] African and Australian stakeholders are exploring deeper integration between mining and automotive value chains.
- **Building strategic relationships with host governments.** Engaging in purposeful dialogue can align mining activity with geostrategic and economic priorities. Strong relationships will unlock regulatory support, PPPs, infrastructure investment, trade agreements and partnerships to develop a skilled workforce. Miners should also explore funding opportunities, such as grants, subsidies, tax incentives or R&D credits, particularly for minerals deemed critical.

8. Digital and innovation ↑

AI tops the investment agenda, but ROI depends on alignment to business

The digital transformation imperative is gaining pace as companies seek better solutions to enhance cost management, productivity, safety and sustainability in a more complicated environment. Gains have been realized within core operations, but more value will come from an end-to-end approach that leverages a unified data and AI backbone.

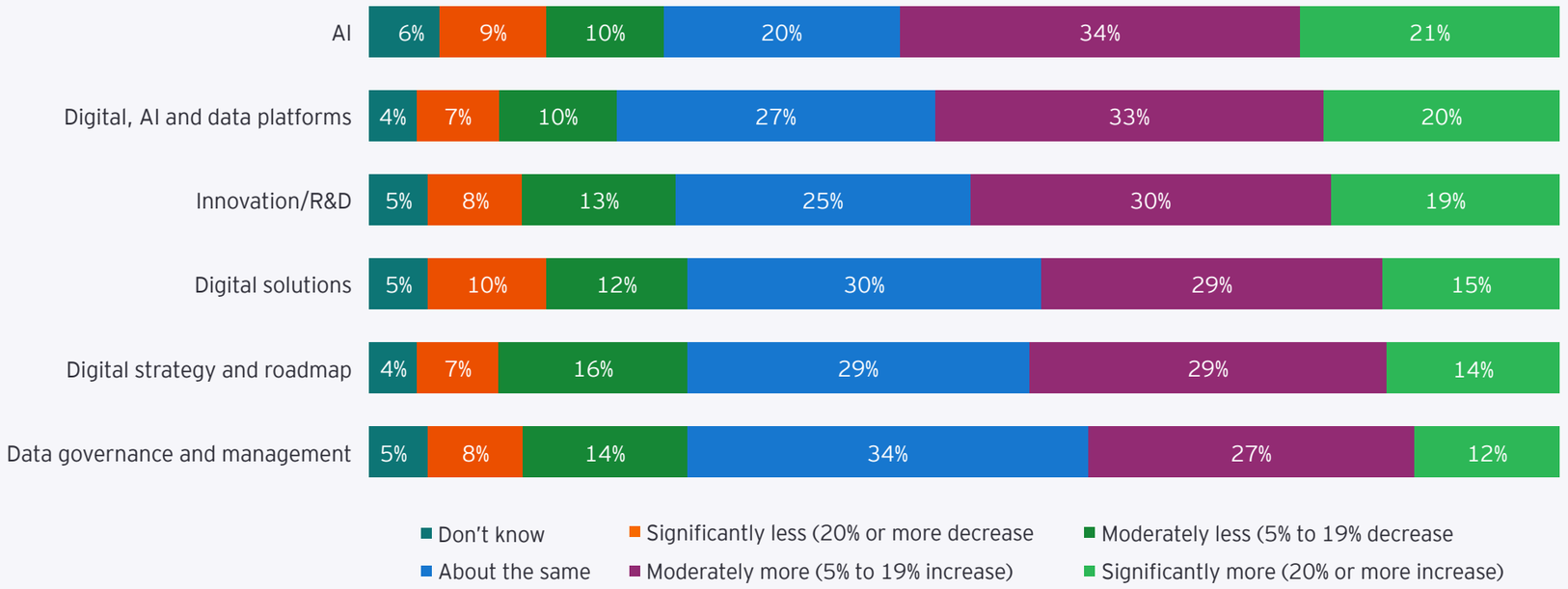
Miners achieving success share common traits: digital initiatives aligned with business issues and targeted use cases; strong governance; and a common data and technology platform. Together, these elements create a foundation for consistent, scalable and trustworthy solutions.

AI is the immediate next frontier

AI tops the digital agenda – 21% of miners surveyed say they will invest more than 20% of their additional budget over the next 12 months to build AI capabilities. AI initiatives to date have focused on proof of concepts (in areas such as health and safety sustainability and planning) and the art of the possible rather than scalable solutions. Big wins will come when AI is scalable and deployed closer to core operations.

Implementing AI is not like deploying other technologies – it's a journey, rather than a "one-and-done" exercise. Specific AI governance and controls as described in the EY organization's Responsible AI principles are critical as functionality becomes more sophisticated and investment increases – but less than one-third of miners say they have established governance frameworks for AI use.[52]

Chart 11: Budget priorities over the next 12 months



Source: Mining & Metals Business Risks and Opportunities Study 2026.

In alignment with Microsoft's recent report,[53] we believe there are three key stages of AI deployment in mining:

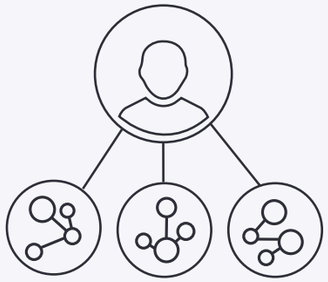
Now – **Supporting the business**

Today, AI acts as "an assistant" to operators and engineers.

Mainly back office

Next – **Managing the business**

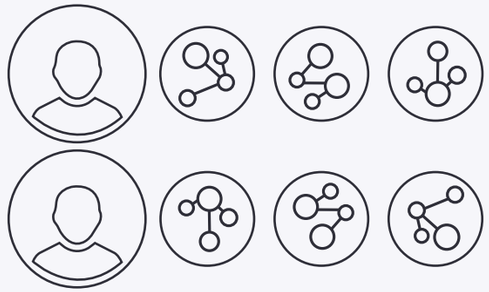
More prevalent GenAI features agents working under the direction of humans.



Move to operations

Beyond – **Running the business**

Agentic AI refers to agents that autonomously run the business, monitoring end-to-end, identifying issues and taking necessary action.



End-to-end

Agentic AI can augment human capabilities to add value

Agentic AI offers huge potential for miners to augment human capabilities to create greater value across the business. However, a recent survey found half of executives admit current risk management approaches won't cope with these more powerful systems.[54] Managing the risk of agentic AI depends on making sure business users have oversight and accountability of system outcomes and final decisions.

Unlocking value depends on strong foundations and talent

Sixty-nine percent of miners report their greatest skills need is in digital capabilities. This challenge is compounded by a reported lack of preparedness for the adoption of advanced technology and equipment.[55]

To stay ahead of change and maximize digital transformation, it is crucial to focus on creating a talent pipeline, breaking down organizational data silos and building technology foundations — such as unified data platforms, integrated systems and secure scalable technology. As AI deployment shifts toward running the business, a human-centric approach becomes even more critical.

Collaboration across the broad ecosystem is key to driving innovation

Universities can act as a conduit for innovation, working with mining companies and other industries to break traditional silos and create innovative solutions. Digital solutions could be adapted from other industries — for example, military drones — while non-technological innovations can boost productivity and sustainability performance. As the sector transforms, the need for more innovation around water management, the circular economy, net-zero emissions and biodiversity will increase.

We already see new processing techniques emerge, such as Rio Tinto's Nuton using micro-organisms to recover copper from copper sulphides, faster, cheaper and with less water and tails.[56]

Strategic opportunities

Miners that take a targeted, business-focused approach to digital transformation and innovation can solve long-standing challenges and unlock new opportunities. Key areas to consider include:

- **Focusing on initiatives that unlock value,** accelerate the delivery of company strategy and create competitive advantage. This requires alignment with the business and the development of use cases that solve business issues and drive real transformation.
- **Establishing a common technology platform** to support cutting-edge digital, data and AI capabilities, providing a foundation for hosting digital applications while building interoperability across solutions.
- **Building the foundations** by breaking down organizational data silos and establishing teams to identify digital priorities, drive change and lead successful transformation. Executive sponsorship is key, as is a management operating system that includes accountability, decision rights, and balance of central and site-led innovation.
- **Collaborating and partnering** through alliances around business priorities and challenges. Miners should consider broad partnerships, working with universities and companies outside the sector.
- **Supporting a culture of innovation.** Success requires building a cross-functional team and a "safe-to-fail" culture of innovation, backed by leadership and governance, and underpinned by an end-to-end approach across operations. Linking KPIs and bonuses to innovation, along with protected budgets, helps maintain a long-term focus on transformational projects.

9. Sustainability ↓

Nature-positive commitments remain strong even as sustainability stalls

Sustainability initiatives are slowing — though not stopping — across the sector as other priorities come to the fore and political shifts take effect. Nature-positive commitments remain strong, particularly among the global diversified miners, which are deploying digital and innovation to solve long-standing sustainability challenges.

More than half of survey respondents have reassessed or delayed commitments, likely due to market volatility but also because of a lack of premiums for green materials. The business case for sustainability relies heavily on hard-to-measure aspects, such as LTO, access to future opportunities, continued permitting, and the retention and attraction of staff.

Miners battling to measure nature-positive progress

Leading mining companies have demonstrated their commitment to supporting a nature-positive future by 2030, but only 56% of survey respondents are confident they can meet nature-positive obligations. Many tell us they aren't sure what to measure and how to report. New ISSB standards around nature, biodiversity and human capital are set to be enacted in the next few years and should improve clarity. In the meantime, the ICMM's good practice guide aims to help miners build an actionable roadmap through a seven-step process that embeds nature-positive actions across operations at all stages of development.[57]

The rise of innovation to solve sustainability challenges

As sustainability standards evolve, digital solutions can help improve the availability, rigor, trust and reliability of data. We are seeing greater use of data analytics, smart sensors and blockchain to help miners track, monitor and report Scope 3 emissions. However, solutions to reduce these emissions remain elusive.

Miners are also looking to other sectors for innovative solutions. As part of a biofuels project, Rio Tinto is growing pongamia trees to produce oil-rich seeds for processing into renewable diesel.[58] Exxarro is planting spekboom trees, known for their high carbon absorption qualities, to offset emissions and restore ecosystems.[59]

Long-term water-free mining is a key sector goal and conservation is critical, especially post-mine closure, to support local communities. Vale is aiming for waterless iron ore processing by 2027 at its Carajás mine, using dry magnetic separation technology that enables iron ore to be separated from waste rock without the use of water.[60] This innovation could set a new standard for the industry — not only does it reduce water consumption, but it also eliminates the need for tailings dams, uses less energy and supports stronger LTO.

Transparency is key to avoiding greenwashing claims

Evidence suggests there has been an improvement in transparency, disclosure and third-party verification of sustainability performance, with the latest Global IEA Critical Minerals Report noting that the number of companies using third-party frameworks has increased tenfold over the past five years.[61] Canada's Competition Bureau has released guidelines to help companies comply with new anti-greenwashing laws about environmental claims.[62]

Adoption of regulations is a positive step toward transparency

While the adoption of ISSB's IFRS S1 and S2 standards is a positive step toward transparency, multinational companies with JVs in different regions are challenged by inconsistent disclosure standards. For example:

- Australia adopted IFRS S1 and S2 in July 2025, with companies now required to make rigorous climate-related financial disclosures. Biodiversity, ecosystems and ecosystem services (BEES) and human capital standards are currently being explored for development.
- In December 2024, Canada issued its own voluntary sustainability disclosure standards — CSDS 1 and CSDS 2 — which are largely aligned with the ISSB, but gives companies more time to meet requirements, e.g., three years to report on Scope 3 emissions rather than one year under ISSB.[63]
- Brazil has incorporated IFRS S1 and S2 into its regulatory framework, mandating compliance for publicly listed companies from January 2026.[64]

Miners also navigate a proliferation of mining-specific sustainability standards and voluntary certification schemes. The project to merge a number of these (CM, ICMM, TSM and RGMP) into the Consolidated Mining Standard Initiative (CMSI) aims to reduce confusion, duplication and simplify requirements.[65]

Strategic opportunities

Despite a changing appetite for sustainability, miners that remain committed to these issues can reap multiple benefits, including improved productivity, talent attraction and retention, and LTO. Key opportunities for miners include:

- **Considering sustainability across the entire mining lifecycle,** from exploration to closure, and identifying opportunities to leverage knowledge of traditional owners.
- **Detemining strategies to use technology and data.** Enhanced use of digital can improve sustainability monitoring and measurement, particularly in areas of greater investor scrutiny, such as water stewardship and tailings management.
- **Integrating sustainability risks and opportunities across the business.** Embedding sustainability into existing governance and oversight models mitigates the risk of potential gaps in risk coverage.
- **Reframing sustainability and climate-related financial reporting requirements as opportunities.** Miners that demonstrate how they integrate sustainability considerations into the LOM to increase resilience and reduce risks can win better access to capital and credit conditions.

10. Changing business models

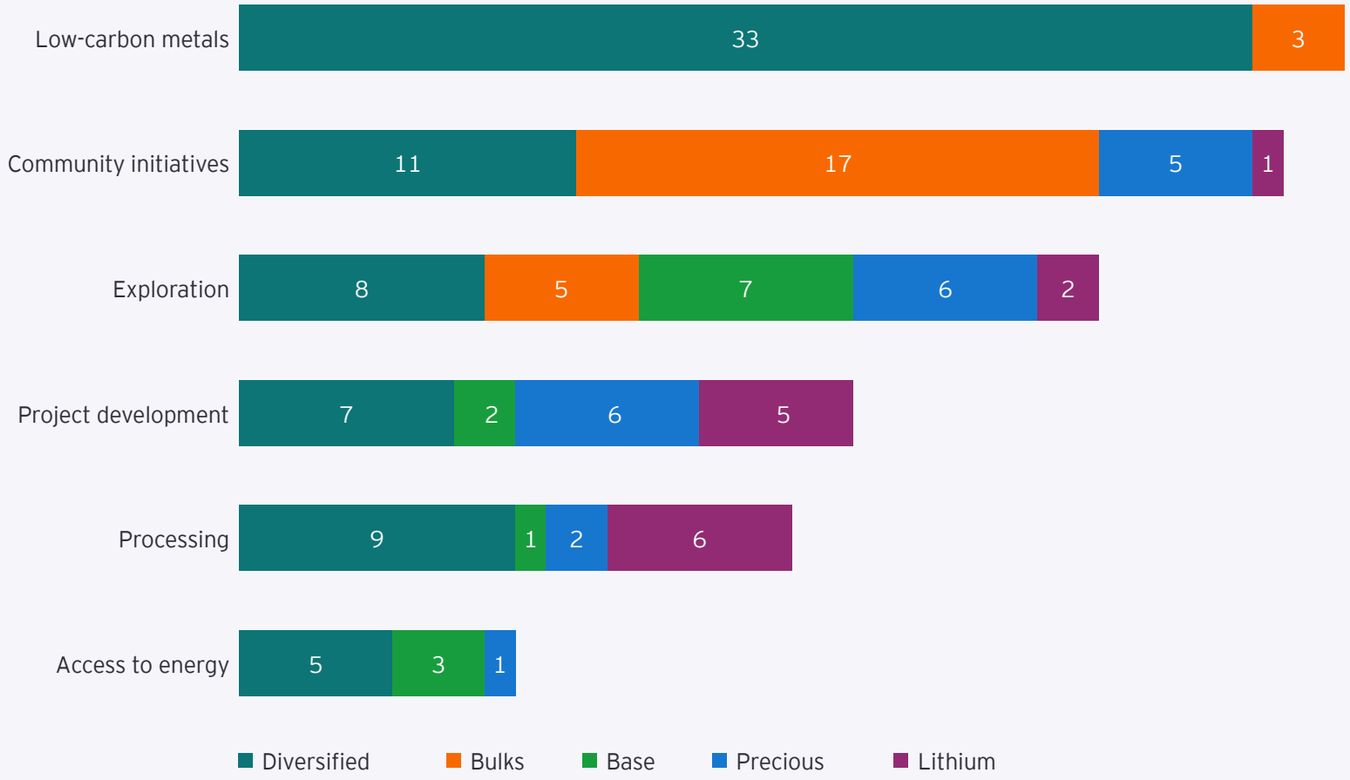
Miners are exploring new models that boost supply, resilience and competitive advantage

Companies are shifting toward business models that allow them to quickly boost supply by capturing more of the value chain, including through domestic processing and refining, innovative JVs to share costs or increase production, and recycling waste.

Vertical integration was the top capital allocation option for 26% of the miners surveyed. Vertical integration into midstream or downstream processing — often through partnerships and local collaboration — allows companies to capture more of the value chain, particularly in battery minerals and rare earth elements. This helps reduce dependence on overseas processing and adds value closer to the source. However, onshoring refining is capital intensive and complex, involving high upfront costs, regulatory hurdles, long development timelines and environmental complexity, making it a longer-term rather than immediate solution.

Collaboration, through JVs, or other partnerships and alliances such as "district strategies," helps miners expand capacity and access strategic resources with lower capital outlay, and is emerging as a key lever for resilience and agility in a rapidly evolving landscape.

Chart 12: Top areas of collaboration in mining (2020-24)



Source: EY Insights analysis.

Miners are using innovative JV agreements or "district" strategies to address capital costs, technical complexities, and environmental and social challenges of large-scale projects. These partnerships allow companies to share risks, pool resources and leverage complementary expertise, unlocking value that would be difficult to achieve on their own.

Some notable examples include:

- The joint mine plan between Codelco and Anglo American for their adjacent Los Bronces and Andina copper mines in Chile. The collaboration aims to increase copper production by an estimated 120,000 tons per year from 2030 to 2051, without additional capital investment from either company. A new 50–50 joint operating entity will coordinate the execution of the plan and optimize their shared processing capacity. Both companies retain full ownership of their respective assets and continue to extract ore independently, but coordinating processing creates synergies.[66]
- The respective rights holders in Simandou in Guinea have set up a complex, multistakeholder JV, La Compagnie du TransGuinéen, which will own and operate a shared 600km multiuse rail line and new port.[67]

A circular economy approach helps miners reduce reliance on extraction and lower their environmental impact. Circular economy strategies include reprocessing tailings, extracting metals from waste rock, scrap metal processing, e-waste recycling and integrating closed-loop systems. For example, Vale's Gelado Project in Brazil repurposes tailings to produce high-grade iron ore, while Carajás is transitioning to 100% dry processing to eliminate new tailings.[68]

Strategic opportunities

New business models can help miners address long-standing challenges, unlock new supply and even strengthen LTO, but companies will need to take a strategic approach to reap sustainable value. Miners can do this by:

- **Building partnerships and investing in communities** to boost LTO, drive growth, and enable lasting regional and national socioeconomic value. Strategic partnerships with governments, OEMs, technology providers and communities allow miners to codevelop infrastructure, foster local supply chains and generate skilled employment. Through commitment to long-term community development — supporting education, healthcare and local entrepreneurship — companies can articulate the value mining brings to communities.
- **Leveraging policy and funding incentives** to capitalize on policies and incentives aimed at boosting domestic capacity in critical minerals, clean energy and circular economy projects. Several jurisdictions, such as the US, Canada and Australia, offer tax credits, grants and regulatory reforms to uplift refining capacity.
- **Building an effective circular economy strategy** by using systems thinking to map interdependencies across the value chain, from resource extraction and processing to waste management and product reuse. This approach helps identify waste streams as resource inputs, improving material efficiency and reducing environmental impact.

Under the radar

Some risks have fallen out of the top 10 this year but should remain on miners' agenda.

- **Cyber threats:** This is a growing weak spot for the sector. In 2024, cyber attacks tripled, and GenAI is driving more convincing phishing and deepfakes.[69] With 76% of breaches originating from third-party suppliers, cybersecurity is no longer IT's job; it is core to resilience, reputation and LTO.[70] Time will tell if the confidence of the 61% of respondents who say they are well positioned to take on future cyber threats is justified.
- **New projects (down from 8):** Filling the demand gap will require overcoming multiple complex barriers to new projects, including permitting, higher taxes and royalties, higher capital intensity and higher costs. Almost a third of respondents to this year's survey think governments are likely to amend laws to speed up the granting of licenses, which is probably why the issue moved down the ranking. However, as noted in "Capital," even when funding and licenses are available, regulatory delays, skill shortages and sustainability requirements also slow new projects.
- **Climate change (down from 7):** Mining faces intense climate risks as floods in Australia, wildfires in Canada and droughts in Chile disrupt operations. Companies are advancing decarbonization efforts through renewables, electrification and technologies such as carbon capture, utilization and storage (CCUS), with over 50% of survey respondents confident in meeting their Scope 1 and 2 targets. We were surprised that 52% say they are confident in meeting Scope 3 targets — no large, diversified miner has yet validated their science-based targets initiative (SBTi) targets. The industry's response to the SBTi Scope 3 discussion paper suggests a broad acknowledgment that achieving net zero by the target dates is unrealistic and largely beyond miners' control.[71]

Chart 13: Confidence in meeting climate commitments (very or extremely confident)

Source: Mining & Metals Business Risks and Opportunities Study 2026.

1. "The stock market Is taking a tougher line on earnings misses," Barrons, 28 July 2025 https://www.barrons.com/articles/stocks-earnings-reaction-profits-70073f98.

2. "Lower-grade Australian iron ore sparks global benchmark change," Mining.com, 11 June 2025, https://www.mining.com/web/lower-grade-australian-iron-ore-sparks-global-benchmark-change/.

3. "Integrated Report 2024," Kumba Iron Ore Ltd, 2024, https://www.angloamericankumba.com/~/media/Files/A/Anglo-American-Group-v9/Kumba/investors/annual-reporting/kumba-integrated-report-2024.pdf.

4. "Uptime: strategies for excellence in maintenance management," *John D. Campbell and James V. Reyes-Picknell, et al.*, third edition, 2015.

5. "Benchmarking study on Operating Management Systems in the Oil and Gas sector," EY Insights, 2021-24; "ExxonMobil: Operations Integrity Management System," *ExxonMobil website*, 7 January 2022, https://corporate.exxonmobil.com/who-we-are/technology-and-collaborations/energy-technologies/risk-management-and-safety/operations-integrity-management-system.

6. "Canadian Natural Resources: Albian Mine Tour," *CIBC Capital Markets*, 11 July 2025, via AlphaSense.

7. "Asset management excellence: optimizing equipment life-cycle decisions," edited by *John D. Campbell, et al.* second edition, 2010.

8. "Transitioning the mining sector: A review of renewable energy integration and carbon footprint reduction strategies," *Applied Energy*, Volume 384, 2025, https://www.sciencedirect.com/science/article/abs/pii/S0306261925002144; "Renewable power generation costs in 2024," *International Renewable Energy Agency*, 2025, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2025/Jul/IRENA_TEC_RPGC_in_2024_2025.pdf.

9. "Workers sign petition for collective bargaining at Rio Tinto's Pilbara mine," *Reuters*, 13 March 2025, https://www.reuters.com/markets/commodities/workers-sign-petition-collective-bargaining-rio-tintos-pilbara-mine-2025-03-13/; "Union suspends strike at BHP's Chile copper mine after sweetened wage offer," *Reuters*, 17 August 2024, https://www.reuters.com/markets/commodities/bhp-says-strike-ends-escondida-copper-mine-2024-08-16/.

10. "ICMM members report US$42 billion in tax and royalty payments to host countries in 2024," *ICMM*, 3 February 2025, https://www.icmm.com/en-gb/news/2025/tax-and-royalty-payments-2024.

11. "Indonesia raises royalties for nickel and other metals to fund national policies," *Mining Technology*, 17 April 2025, https://www.mining-technology.com/news/indonesia-metal-royalties/.

12. "Anglo American and Teck to combine through a merger of equals to form a global critical minerals champion," *Anglo American press release*, 9 September 2025, https://www.angloamerican.com/media/press-releases/2025/09-09-2025.

13. "South32 enters agreement to sell Cerro Matoso," *South32 Press Release*, 7 July 2025, https://www.south32.net/news-media/latest-news/agreement-to-sell-cerro-matoso.

14. "MoUs aplenty at Future Minerals Forum 2025 in Riyadh," *International Mining*, 17 January 2025, https://im-mining.com/2025/01/17/mous-aplenty-at-future-minerals-forum-2025-in-riyadh/.

15. "FQ1 2025 Earnings Call Transcripts - Barrick Mining," *S&P Global Market Intelligence*, 7 May 2025, accessed on 25 August 2025.

16. "Rising capital costs threaten new copper mine developments," *Copperbelt Katanga Mining*, 26 June 2025, https://copperbeltkatangamining.com/rising-capital-costs-threaten-new-copper-mine-developments/.

17. "Rising Capital Costs Threaten New Copper Mine Developments," *Copperbelt Katanga Mining*, 26 June 2025, https://copperbeltkatangamining.com/rising-capital-costs-threaten-new-copper-mine-developments/.

18. "From 6 years to 18 years: The increasing trend of mine lead times," *S&P Global Market Intelligence*, 11 April 2025, https://www.spglobal.com/market-intelligence/en/news-insights/research/from-6years-to-18years-the-increasing-trend-of-mine-lead-times.

19. "Second Quarter 2025 Conference call – Hecla Mining," *Hecla Mining*, 7 August 2025, https://ir.hecla.com/News--Media/events-webcasts/events/event-details/2025/Q2-2025-Hecla-Mining-Company-Earnings-Conference-Call/default.aspx.

20. "Zijin to Take on Precious Metals Streaming as Gold Price Soars," *Nasdaq*, 27 May 2025, https://www.nasdaq.com/articles/zijin-take-precious-metals-streaming-gold-price-soars.

21. "Anglo American and Codelco to unlock significant value from joint mine plan for Los Bronces and Andina copper mines," *Anglo American press release*, 20 February 2025, https://www.angloamerican.com/media/press-releases/2025/20-02-2025b.

22. "$5.4tr investment in mining needed by 2035 to meet new energy demand – report," *Mining Weekly*, 4 December 2024, https://www.miningweekly.com/article/54trinvestment-in-mining-needed-by-2035-to-meet-new-energy-demand-report-2024-12-04.

23. "World exploration trends 2025: PDAC special edition," *S&P Global Market Intelligence*, March 2025.

24. "Guest commentary: Solving the riddle of resource depletion," *Canadian Mining Journal*, 28 January 2025, https://www.canadianminingjournal.com/news/guest-commentary-solving-the-riddle-of-resource-depletion/.

25. "Teck Announces Construction of Highland Valley Copper Mine Life Extension to Proceed, *Teck Resources Limited*, 23 July 2025, https://www.teck.com/news/news-releases/2025/teck-announces-construction-of-highland-valley-copper-mine-life-extension-to-proceed.

26. "Copper projects hamstrung by spiralling cost of capital," *MiningMx*, 25 June 2025, https://www.miningmx.com/news/base-metals/61547-copper-projects-hamstrung-by-spiralling-cost-of-capital/.

27. "Annual information form," *Barrick Mining Corp*, 14 March 2025.

28. "Annual report 2024," *Anglo American*, 28 February 2025.

29. "Anglo American and Codelco to unlock significant value from joint mine plan for Los Bronces and Andina copper mines," *Anglo American press release*, 20 February 2025, https://www.angloamerican.com/media/press-releases/2025/20-02-2025b.

30. "2024 sustainability report, Metals that matter," *Teck Resources*, 12 March 2025, https://www.teck.com/media/2024-Sustainability-Report.pdf.

31. "Community development," *Vedanta website*, https://www.vedantalimited.com/eng/esg_community_development.php, accessed 15 August 2025.

32. "In numbers: Critical mineral production, ownership, and social unrest," *Global Witness*, https://globalwitness.org/en/campaigns/transition-minerals/in-numbers-critical-mineral-production-ownership-and-social-unrest/, accessed 15 August 2025

33. "Pushback grows against nickel mining in Indonesian marine paradise of Raja Ampat," *Mongabay News*, 9 June 2025, https://news.mongabay.com/2025/06/pushback-grows-against-nickel-mining-in-indonesian-marine-paradise-of-raja-ampat/

34. "Position statement: Indigenous Peoples," *ICMM*, 8 August 2024, https://www.icmm.com/en-gb/our-principles/position-statements/indigenous-peoples

35. "ICMM members report US$42bn in tax and royalty payments to host countries in 2024," *ICMM*, 3 February 2025, https://www.icmm.com/en-gb/news/2025/tax-and-royalty-payments-2024.

36. "Local communities," *Vale*, https://vale.com/esg/local-communities, accessed 13 August 2025.

37. "Barrick's Sustainability Update Showcases Six Years of Transformational Impact," *Barrick Mining Corp*, 1 August 2025, via AlphaSense.

38. "Colorado School of Mines warns of 'grey tsunami' of mining industry retirements," *Mining.com*, 29 August 2023, https://www.mining.com/colorado-school-of-mines-warns-of-grey-tsunami-of-mining-industry-retirements/.

39. "Mining industry dogged by retirements and lack of new recruits," *Mining.com*, 7 February 2024, https://www.mining.com/web/mining-industry-dogged-by-retirements-and-lack-of-new-recruits/; "Overcoming the Mining and Manufacturing Labor Shortage: Proven Strategies for HR Professionals in 2025," *TPD*, 27 February 2025, https://tpd.com/blog/overcoming-the-mining-and-manufacturing-labor-shortage-proven-strategies-for-hr-professionals-in-2025/.

40. "Industry Workforce Plan Moving ahead together," *Mining & Automotive Skills Alliance*, 2024, https://ausmasa.org.au/media/5vxngfo2/ausmasa-industry-workforce-plan-2024.pdf.

41. "The Times Top 50 Employers for Gender Equality," *Business in the Community*, https://www.bitc.org.uk/the-times-top-50-employers-for-gender-equality/, accessed 13 August 2025.

42. "Inclusion and diversity," *BHP*, https://www.bhp.com/careers/inclusion-diversity, accessed 14 August 2025.

43. "Safety Performance: Benchmarking progress of ICMM company members in 2024," *ICMM*, 10 July 2025, https://www.icmm.com/en-gb/research/health-safety/benchmarking-2024-safety-data.

44. "Our employee value proposition (EVP)," *Implats*, https://www.implats.co.za/about-EVP.php, accessed 15 August 2025.

45. "Hellas Gold Virtual and Augmented Reality Innovation Shines at Euromines Safety Awards," *Eldorado Gold*, 19 October 2025, https://www.eldoradogold.com/news-and-insights/our-stories/hellas-gold-virtual-and-augmented-reality-innovation-shines-euromines.

46. "China hits back at US tariffs with export controls on key rare earths," *Reuters*, 5 April 2025, https://www.reuters.com/world/china-hits-back-us-tariffs-with-rare-earth-export-controls-2025-04-04/.

47. "Fact Sheet: President Donald J. Trump Takes Action to Address the Threat to National Security from Imports of Copper," *The White House*, 30 July 2025, https://www.whitehouse.gov/fact-sheets/2025/07/fact-sheet-president-donald-j-trump-takes-action-to-address-the-threat-to-national-security-from-imports-of-copper/.

48. "Saudi Arabia in Africa: the Kingdom courts the continent," *Institute for Security Studies*, 25 August 2025, https://issafrica.org/iss-today/saudi-arabia-in-africa-the-kingdom-courts-the-continent; "Saudi Arabia Has a Strategic Advantage in Sourcing Critical Minerals from Africa," *Center for Strategic and International Studies*, 5 December 2023, https://www.csis.org/analysis/saudi-arabia-has-strategic-advantage-sourcing-critical-minerals-africa.

49. "Latin America's rightward shift," *Americas Quarterly*, 13 May 2025, https://www.americasquarterly.org/article/latin-americas-rightward-shift/; "Chile's leading presidential candidates agree to disagree on mining," *Bnamericas*, 8 August 2025, https://www.bnamericas.com/en/features/chiles-leading-presidential-candidates-agree-to-disagree-on-mining.

50. "State and trends of carbon pricing 2025," *World Bank*, 2025, https://www.worldbank.org/en/publication/state-and-trends-of-carbon-pricing.

51. "Inside the Metals and Mining sector: Opportunities from the investment strategies adopted by Metals and Mining majors as well as insights on cross sector investments," *EY Competitive Edge*, March 2025.

52. "Responsible AI principles," *EY*, September 2024, https://www.ey.com/content/dam/ey-unified-site/ey-com/en-gl/insights/ai/documents/ey-gl-responsible-ai-principles-09-2024.pdf; "CEO Outlook Wave 10 survey," *EY*, May 2025.

53. "2025: the year the Frontier Firm is born," *Microsoft*, 23 April 2025, https://www.microsoft.com/en-us/worklab/work-trend-index/2025-the-year-the-frontier-firm-is-born.

54. "How responsible AI can unlock your competitive edge," *EY*, 3 June 2025, https://www.ey.com/en_gl/insights/ai/how-responsible-ai-can-unlock-your-competitive-edge.

55. "Breaking New Ground: Shaping a Successful Future for Mining: Exploring how miners can overcome their operational challenges and embrace their role in helping create a sustainable future for society," Shell, https://www.shell.com/business-customers/lubricants-for-business/sector-expertise/mining/discover-mining-sector-overcome-challenges/_jcr_content/root/main/section/item/links/item0.stream/1749831447743/f618eecf256cfc881bb7e65fd19eee12eadf0826/shel-sls-mining-breaking-new-ground-whitepaper-v13-os-ready.pdf, accessed 11 August 2025.

56. "Nuton: a better way to produce copper," *Rio Tinto*, updated 8 November 2024 https://www.riotinto.com/en/news/stories/nuton-a-better-way-to-produce-copper.

57. "Achieving No Net Loss or Net Gain of Biodiversity: Good Practice Guide," *ICMM*, 10 March 2025, https://www.icmm.com/achieving-nnl-or-ng-biodiversity.

58. "Investing in biofuels," *Rio Tinto*, https://www.riotinto.com/en/news/trending-topics/investing-in-biofuels, Accessed 18 August 2025.

59. "Exxaro Resources Limited, Integrated report 2024: creating sustainable growth and impact," *Exxaro Resources Limited*, 15 April 2025, https://investor.exxaro.com/integrated-reports2024/creating-sustainable-growth-and-impact.php.

60. "Vale to end water use in iron ore processing at Carajas by 2027," *Mining Technology*, 26 June 2025, https://www.mining-technology.com/news/vale-end-water-use-iron-ore-processing-carajas-by-2027/.

61. "Global Critical Minerals Outlook 2025," *International Energy Agency*, May 2025, https://www.iea.org/reports/global-critical-minerals-outlook-2025.

62. "Competition Bureau issues final guidelines regarding environmental claims," *Competition Bureau Canada*, 5 June 2025, https://www.canada.ca/en/competition-bureau/news/2025/06/competition-bureau-issues-final-guidelines-regarding-environmental-claims.html.

63. "Unlocking value: the strategic importance of Canada's new sustainability standards," *EY*, 23 May 2025, https://www.ey.com/en_ca/insights/assurance/canadas-new-sustainability-standards; "Canadian Sustainability Disclosure Standards (CSDS 1 and CSDS 2): Now Available," *Financial Reporting and Assurance Standards Canada*, 18 December 2024, https://www.frascanada.ca/en/cssb/news-listings/csds1_csds2_launch.

64. "IFRS® Sustainability disclosure standards (ISSB standards) – application around the world. Jurisdictional profile: Brazil," *IFRS Foundation*, https://www.ifrs.org/content/dam/ifrs/publications/sustainability-jurisdictions/pdf-profiles/brazil-ifrs-profile.pdf, accessed 15 August 2025.

65. "Consolidated mining standards initiative," https://miningstandardinitiative.org/, accessed 27 August 2025.

66. "Anglo American and Codelco to unlock significant value from joint mine plan for Los Bronces and Andina copper mines," *Anglo American press release*, 20 February 2025, https://www.angloamerican.com/media/press-releases/2025/20-02-2025b.

67. "Africa's largest mining and related infrastructure project," *Rio Tinto website*, https://www.riotinto.com/en/operations/projects/simandou, accessed 9 September 2025.

68. "Vale to eliminate water use in Carajas iron ore processing by 2027," *Reuters*, 25 June 2025, https://www.reuters.com/sustainability/climate-energy/vale-eliminate-water-use-carajas-iron-ore-processing-by-2027-2025-06-25/.

69. "Cyber threats in mining: the hidden cost of digitalisation," *Mining Technology*, 17 March 2025, https://www.mining-technology.com/features/cyber-threats-in-mining-the-hidden-cost-of-digitalisation/.

70. "The Global State of CPS Security 2024: Mining & Materials," *Claroty*, https://web-assets.claroty.com/resource-downloads/cps-security-survey-mining-materials.pdf, accessed 5 August 2025; "How can cybersecurity go beyond value protection to value creation?," *EY*, 28 May 2025, https://www.ey.com/en_gl/insights/consulting/how-can-cybersecurity-go-beyond-value-protection-to-value-creation.

71. "Industry Response to SBTI Scope 3 Discussion Paper," *Fortescue, Anglo American, Rio Tinto, BHP*, South32, https://www.south32.net/docs/default-source/general-library/climate-change/sbti-scope-3-statement-2024.pdf?sfvrsn=bdb993a5_1, accessed 27 August 2025.

About this report

During June and July 2025, the EY team surveyed senior mining and metals leaders from organizations with at least US$1b in revenue through an anonymous online survey. In total, 500 unique responses were collected, with 24% of respondents at board or C-suite level, 38% leading departments, business unit, or commodity groups, and 38% at president, vice president or director level.

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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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