KPMG

2024 Global Metals and Mining Outlook

Strategies for decarbonization and operational excellence

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Contents

Foreword

Decarbonization is key to operational excellence for metals and mining companies. KPMG's 2024 Global Metals and Mining Outlook underscores the necessity of investing in decarbonization — not just for environmental benefits, but for transformative operational gains. This shift promises enhanced resilience, agility and a sustainable economy.

The 2024 report draws from the insights of over 450 C-level executives and interviews with leading industry thinkers, revealing that effective decarbonization can revolutionize business efficiency and profitability. Yet, despite some progress, the industry's greenhouse gas emissions remain stubbornly high, demanding urgent action.

As highlighted at the COP28 UN Climate Conference, slow progress in climate action threatens global targets.[1] Metals and mining companies must fast-track the development of low-carbon processes, despite growing supply chain challenges.

This report equips executives and stakeholders with crucial industry insights and best practices to navigate these challenges. With decarbonization goals driving operational and technological transformation, the time to act is now. Investing in decarbonization isn't just about sustainability — it's the pathway to unparalleled operational transformation.

[1] "UN Climate Change Conference: Reports and decisions," United Nations Climate Change, 12 December 2023.

Key findings

The opportunity potential is clear.

61%

are more confident than they were two years before about their company's growth prospects. Two-thirds say that this greater confidence is partly the result of increased optimism that their companies can meet their sustainability goals. Therefore, decarbonization is a significant business opportunity, especially when it is merged with operational transformation initiatives and social license to operate commitments. In fact,

57%

of executives say the most effective way of meeting their decarbonization goals is to integrate them into the overall corporate strategy.

But challenges abound. Metals and mining executives will need to raise billions of dollars to fund new production processes, amidst volatile commodity prices and ever shifting demand scenarios while searching labor markets for the vital skills to achieve carbon transformations.

Executives have identified many of the challenges they face.

47%

say skills shortages are the most important challenge that must be overcome when implementing the latest technologies.

They also need to hire more talent to address issues in the supply chain amid faster-changing markets, reflected in see-sawing prices. Commodity price volatility adds a new level of complexity.

66%

say that output prices have become more volatile, heightening business risks. Input-price volatility is more of a factor for mining companies (59 percent) than metals companies (46 percent).

These risks reflect the dramatic changes occurring in the sector in 2022 and 2023 that were highlighted in the KPMG *Mining and Metals Outlook*: severe supply chain disruptions, the war in Ukraine, and a surge in demand for battery materials. In 2023, we focused on the crucial role played by the mining and metals industries in enabling the global economy to shift to a carbon-free future. In 2024, our attention turns to examining efforts made by metals and mining companies to reduce their carbon emissions.

This year's report provides detailed insights into how companies are faring amidst these changes. It examines their priorities for the

next five years,

as they work to increase the cost-effectiveness of their operations while seeking to meet decarbonization goals. How do they balance managing short-term volatility against long-term objectives? How can they maintain confidence, while adapting to the realities of the market? The metals and mining industries have never been more challenging — or exciting.

About the research

In May to June 2024, KPMG conducted a global online survey of 453 executives, all of whom are in the C-suite or the board of directors. A third are chief executive officers. More than half (56 percent) of the executives work in roles directly related to decarbonization.

Executives in 20 countries responded to the survey.

41%
are in the Americas (17 percent in the US and 10 percent in Canada)

27%
in Europe, Middle East and Africa

32%
in Asia-Pacific (10 percent in Australia)

The responses are almost evenly divided between metals and mining companies, with three percent operating in both industries. Some 45 percent of the companies earn annual revenues greater than US$10 billion.

We interviewed six executives between June 6 and 13, 2024:

Mohammed Ali
Vice President, Sustainability & Regulatory Affairs, Agnico Eagle Mines

Sepanta Dorri
Vice President, Chief of Staff and Strategy Activation, Teck Resources

Patrick Drouin
President of Wheaton International and Chief Sustainability Officer, Wheaton Precious Metals

Craig Miller
Chief Executive Officer, Anglo American Platinum

Henning Opperman
Senior Vice President, Corporate Finance, Sibanye-Stillwater

Robert (Bob) Wilt
Chief Executive Officer, Ma'aden

We are grateful to the interviewees and the survey respondents for their time and insights.

About the authors

Trevor Hart
Global Sector Leader, Mining
KPMG International

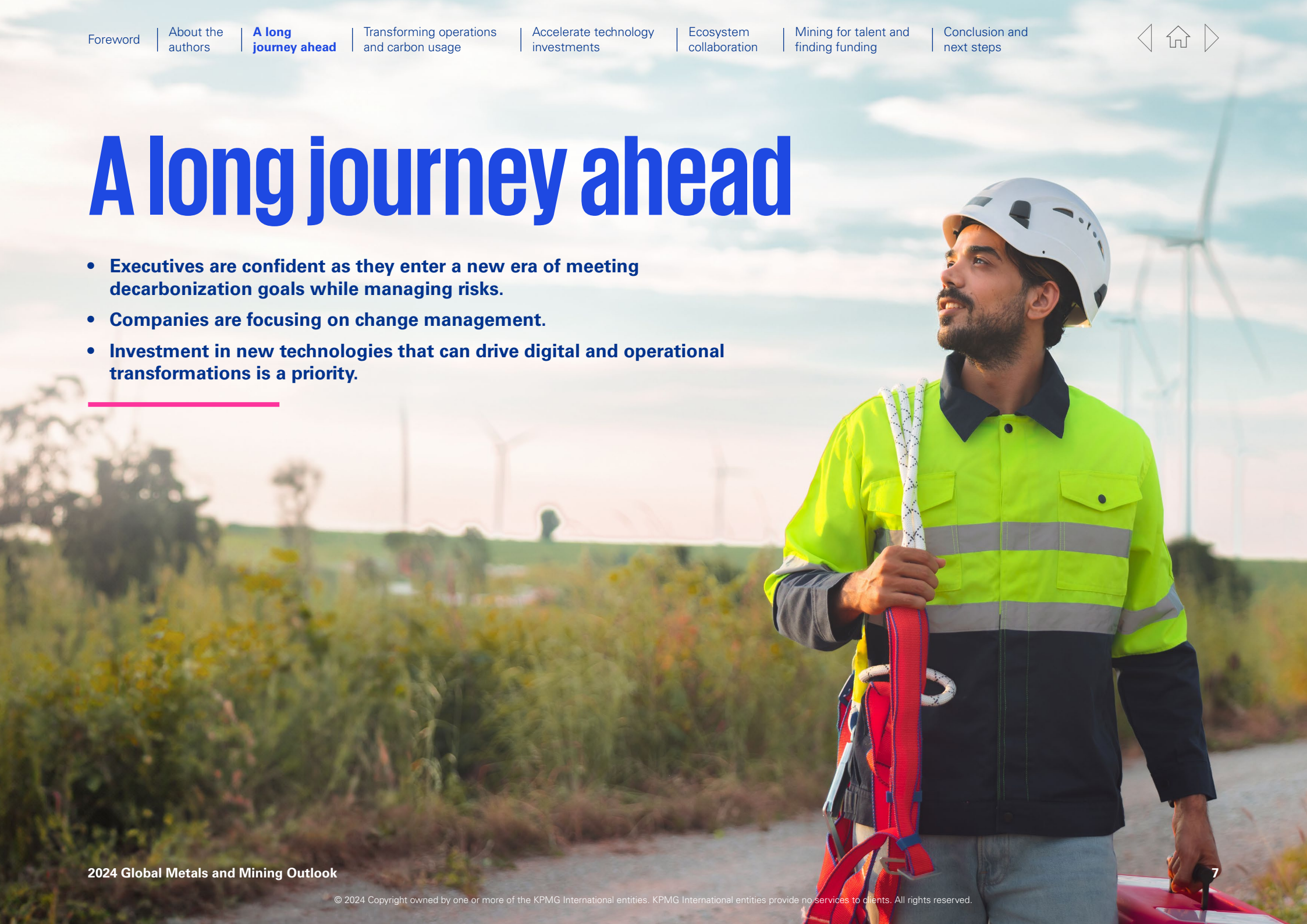
A West Australian, Trevor has worked with mining and metals companies as a Partner with KPMG in Australia for over 20 years. With significant Australian and international mining asset experience he ensures KPMG supports its clients in navigating complex capital markets transactions, business transformation and operational excellence initiatives. He has advised and audited ASX50 to ASX500 companies across commodities, including iron ore, coal, copper, lithium and gold. Trevor's extensive experience in the mining sector, combined with his leadership roles, ensures he understands the exploration, development, mining, and processing activities of the sector, as well as commodity markets.

Ugo Platania
Global Sector Leader, Steel
KPMG International

Ugo is the KPMG Global Head for the Steel & Metals sector. He joined KPMG in the UK in 2001, where he advised major global clients on strategic and transformational initiatives. In October 2017, he became a Partner at KPMG in Luxembourg, responsible for developing the Corporate Management Consulting practice and acting as the Client Lead Partner for global metals companies. Prior to joining KPMG, Ugo gained extensive experience in corporate strategy and development, working within multinational organizations and start-ups. His consulting work has focused on organizational development, corporate transactions, market entries and regulatory changes, with a strong emphasis on stakeholder engagement.

A long journey ahead

- **Executives are confident as they enter a new era of meeting decarbonization goals while managing risks.**
- **Companies are focusing on change management.**
- **Investment in new technologies that can drive digital and operational transformations is a priority.**



Pivot to address new realities

The metals and mining industries have entered a brave, new era in managing their operations by unlocking decarbonization opportunities while mitigating risk. The mood among industry executives is positive as they make progress in the energy transition toward a net-zero emissions target. But they will need to accelerate decarbonization to achieve their goals, as they navigate fast-moving geopolitical trends, uncertain demand in countries such as China, and high interest rates. A failure to do so is likely to make it harder for the global economy to meet decarbonization targets, so the stakes could not be higher.

Companies are striving to become more agile in response to the new pressures. This will require re-strategizing, change management and digital transformation. They face tough, new KPIs for tracking and evaluating initiatives to reduce cost and decarbonize operations, while raising production. To achieve this operational transformation, companies in the sector must invest in new technology because the pace of change is accelerating, while at the same time the market for materials is more complex than ever.

Industry stakeholders' views — on trend or counter-intuitive?

Building on previous KPMG studies, this research gathered insights from over 450 C-level executives, the largest survey in the series. Additionally, it features perspectives from six senior industry executives and four top KPMG specialists. This forward-looking survey targets metals and mining sector executives and their stakeholders, including technology companies, financial services, government agencies and non-profits.

As of early 2023, industry estimates indicated that 75 percent of companies in both sectors have set net-zero objectives. Forty percent aim to achieve this by 2040 and 29 percent intend to do so by 2025.[2] Leading companies in the International Council on Mining and Metals have set a collective goal to reach net zero by 2050 for their Scope I and II emissions.[3]

The November 2023 United Nations Climate Change conference, COP28, spurred action on accelerating aspects of net-zero plans. Many key players in the industry pointed to the importance of renewable energy sources both for their own operations and in expanding national grid capacities.

Accelerating goals amid new geopolitical and macroeconomic pressures

KPMG's *Mining and Metals Outlook* in 2022 and 2023 reflected the dramatic changes occurring in the sector: severe supply chain disruptions, the war in Ukraine, and a surge in demand for battery materials. Two years ago, approximately 90 percent of executives surveyed were confident in growth prospects for their company and their industry over the next two years. In 2023, we focused on the crucial role played by the mining and metals industries in enabling the global economy to shift to a carbon-free future. In 2024, our attention turns to examining efforts made by metals and mining companies to reduce their carbon emissions.

> **"Confidence in the future among mining companies goes from strength to strength, reflecting the global need for mining ores. To add to the bullishness, there is likely to be a shrinking pool of mining companies that will be called upon to deliver them."**
>
> **Trevor Hart**
> Global Mining Leader,
> KPMG in Australia

Perceptions of the sector are improving in acknowledgement of their important role in the energy transition. "A decade ago, mining and metals were considered difficult and dirty industries, but now they have become a very critical part of the solution to the energy transition," says Ugo Platania, Global Sector Leader, Steel, KPMG in Luxembourg.

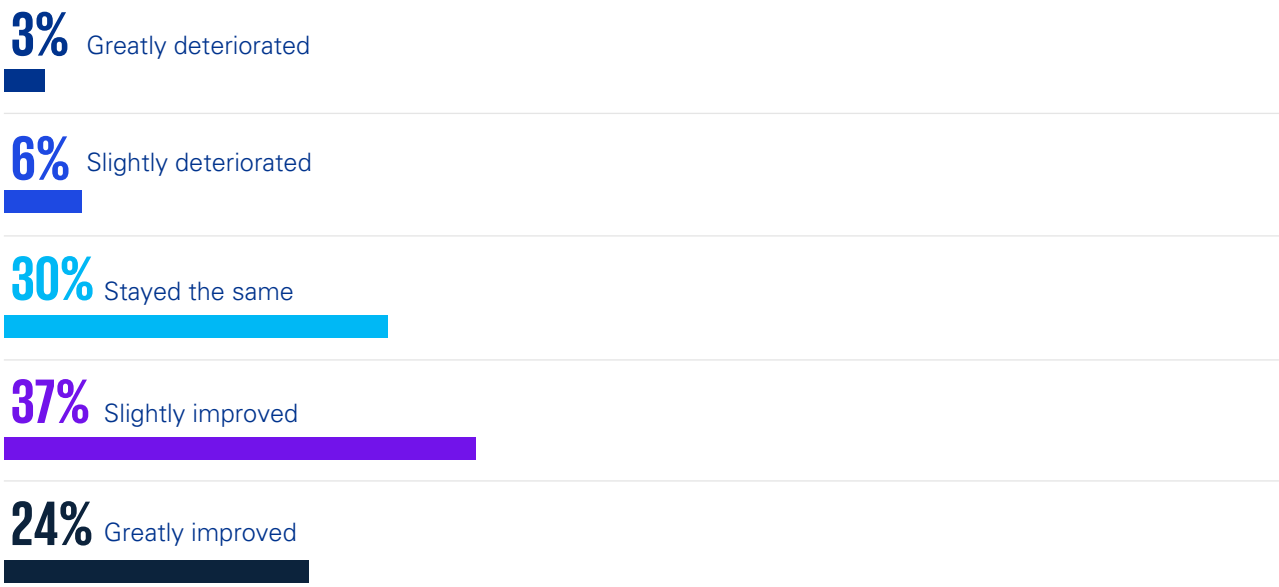
[2] "Net zero strategies in the mining sector," Research and Markets, February 2024.
[3] ICMM, "Our commitment to a goal of net zero by 2050 or sooner" (5 October 2021).

These hopeful signs, however, need to be seen in the light of tough realities. The KPMG Financial Performance Index for mining and metals shows a decline in the performance of mining and metals companies in the two years to the end of March 2024. Their index score has improved slightly in the most recent three quarters, but they continue to face headwinds from geopolitical disruptions and macroeconomic challenges. These include:

- Geopolitical risks continue to pose transportation and supply chain risks, along with the impact of continuing volatility on commodities (and energy) markets.
- Cooperation among some of the most sanctioned states in the international community, such as Iran, Russia and North Korea.
- Competition for critical minerals is disrupting globally integrated supply chains, demand trajectories and organizations across the globe.

In the KPMG Energy and Natural Resources Top Risks Forecast the outlook is for geopolitical volatility to continue to intensify, with disruptive events coming more frequently, lasting longer, and having deeper impacts.[4] Executives will likely need to redouble their climate change mitigation and containment efforts to prevent security, logistical, economic and business operating shocks from pushing them off course. These challenges will require better decision-making abilities and more sophisticated risk analysis. Artificial intelligence (AI) is one answer; more talented employees is another.

Has there been a change since 2022 in your level of confidence about growth prospects for your company's revenue over the next two years? It has:



> "A decade ago, mining and metals were considered difficult and dirty industries, but now they have become a critical part of the solution to the energy transition."

Ugo Platania
Global Sector Leader, Steel, KPMG in Luxembourg

[4] Energy and Natural Resources Top Risks Forecast, KPMG, 2024.

Creating value sustainably

Mining and metals companies are pivotal in the energy transition. Despite differing demand trajectories, regulatory environments and technology developments, strategic investments in new technologies for decarbonization and operational efficiency are crucial.

With clean energy technologies surging, global demand for critical minerals is set to double by 2040, and could even quadruple under sustainable development scenarios, according to the IEA.[5] This includes low-carbon power generation like solar, wind, nuclear, electric vehicles, battery storage and hydrogen for electrolysis and fuel cells.

Fuel cell electric vehicle growth will drive demand for lithium, copper and platinum group metals. The urgent need to combat climate change and the rapid evolution of clean energy technologies make large-scale investment commitments complex yet essential.

Changing commodity price volatility

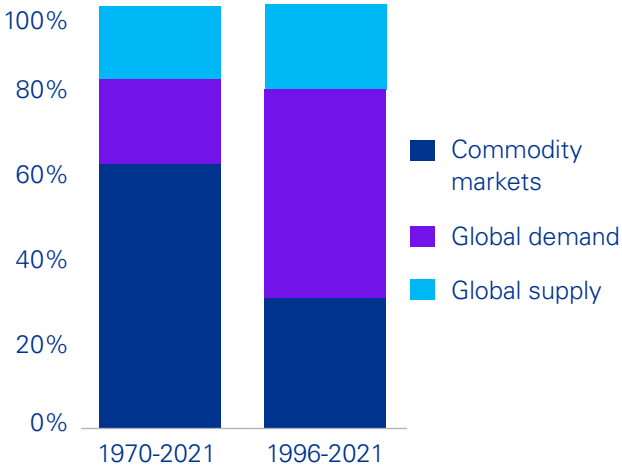
A simple way to understand the complexity of the sector's business environment is to consider the increased instability of input and output prices.

Sixty-six percent of executives say the volatility of output prices has increased in the past two years and 53 percent say input-price volatility has increased.

As the KPMG Financial Performance Index points out, record industrial commodity prices (by historical standards) carry a hidden threat. The last time there were such elevated levels was prior to the global financial crisis of 2008-09, when increased capital expenditure and higher cost structures led to subsequent asset write-downs, with much of the past decade spent rebuilding balance sheets. Executives should bear this in mind as they invest in new technology and decarbonization projects.

Commodity-price volatility has increased over the past 10 years, driven by various, new risks. Some industry analysis points to 10 to 20 percent commodity price volatility, on average, since 2017. A World Bank study[6] analyzes the drivers of change in commodity price volatility.It found that since 1996, commodity price shifts have been driven by macroeconomic shocks rather than changes specific to particular commodity markets. In recent years, global demand shocks account for 50 percent of the variance in commodity price growth. Global supply shocks account for only 20 percent and changes in commodity markets 30 percent.

Commodity price cycles: Causes and Consequences



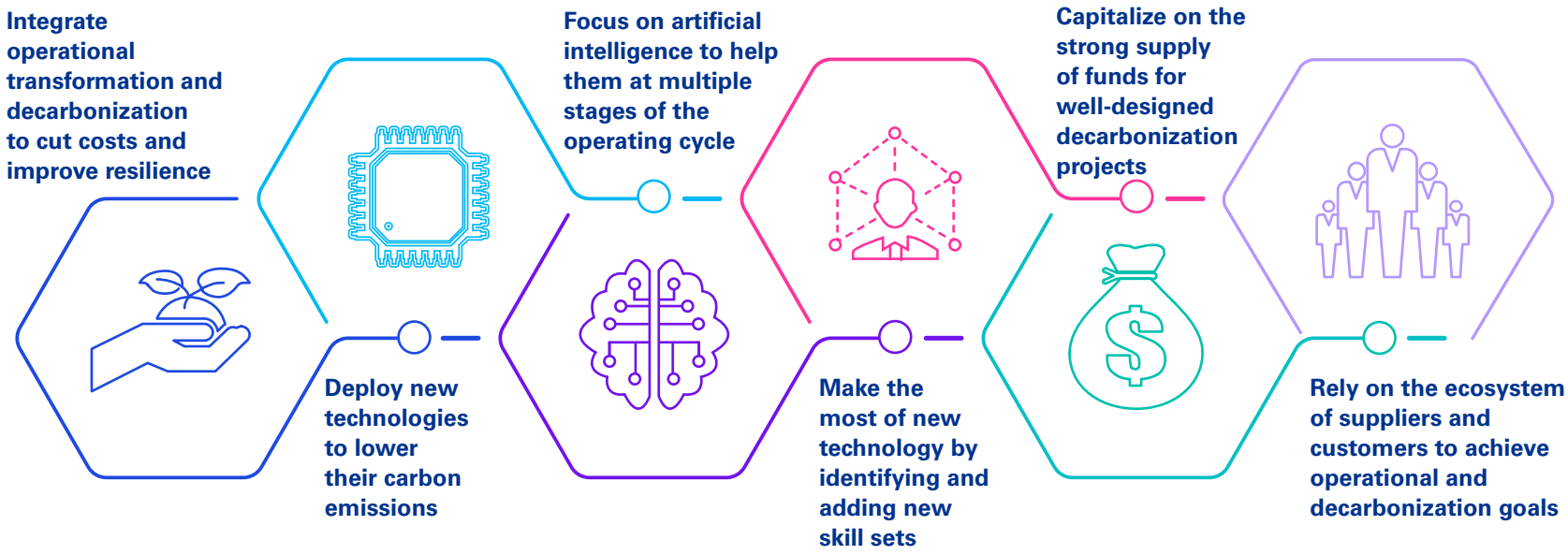
Sources: Baumeister and Hamilton (2019); Ha, Kose, and Ohnsorge (2021); Kabundi and Zahid (Forthcoming); World Bank.

[5] International Energy Agency, "The Role of Critical Minerals in Clean Energy Transitions". (May 2021).
[6] World Bank, "Commodity price cycles: Causes and consequences" (January 2022).

Companies respond to increased price volatility

Greater price volatility is therefore the result of abrupt changes in the external environment. This makes it more difficult to predict and adapt to short-term trends in the business environment while focusing on long-term decarbonization goals stretching into the next two decades. Despite the challenges, companies are urgently tackling their problems and are emerging in a stronger position than before.

Broadly, the strategic responses are to:

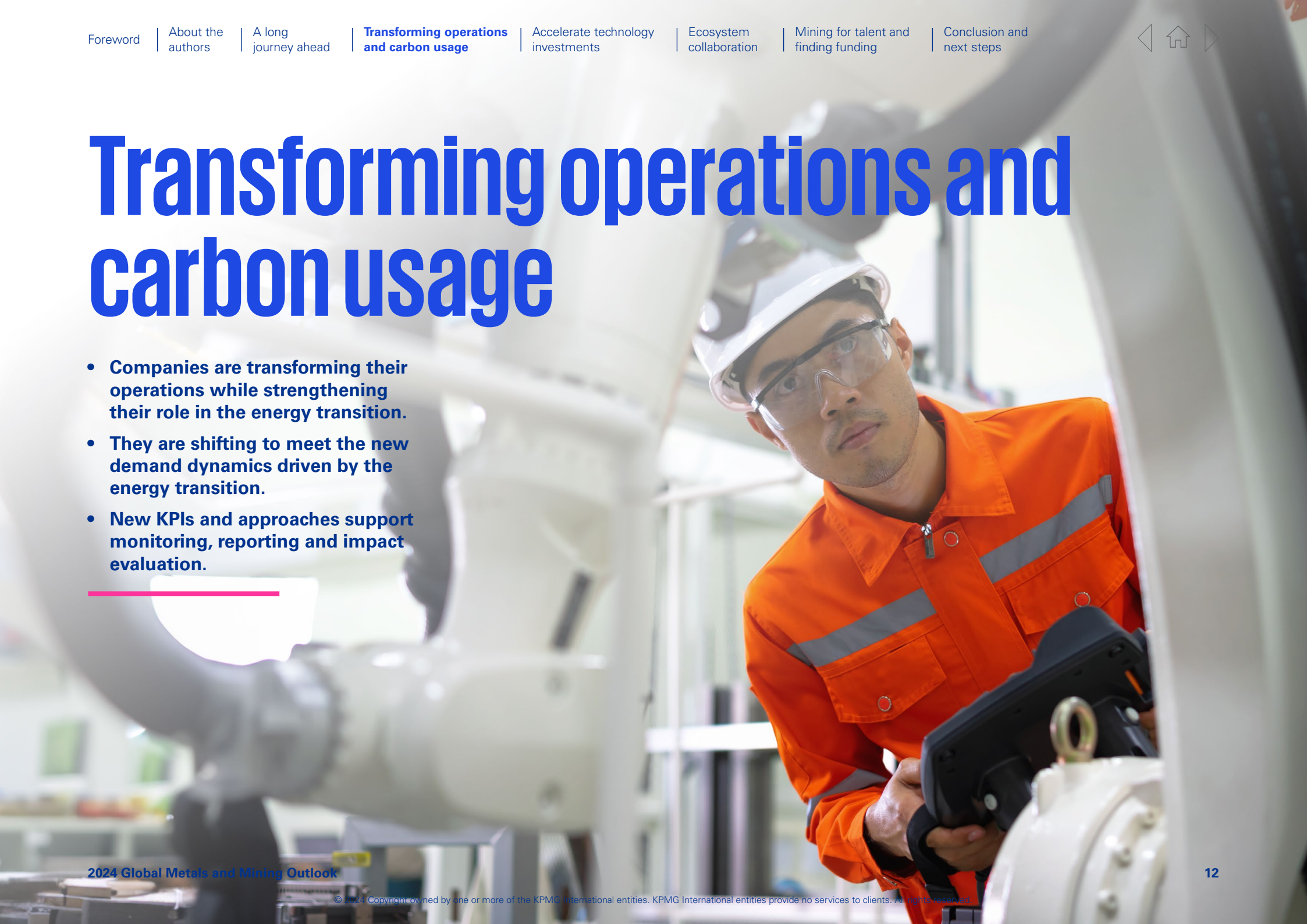


Key points

- Metals and mining companies should map out how they plan to meet and fund their long-term decarbonization goals and regularly assess the progress they are making. If they fall behind, they should recalibrate their plan accordingly.
- Mitigate heightened price volatility and business risks strengthening supply-chain relationships and focusing even more tightly on operational transformation.
- When companies take a careful and consistent approach to technology investments, companies are more likely to meet their sustainability goals.

Transforming operations and carbon usage

- **Companies are transforming their operations while strengthening their role in the energy transition.**
- **They are shifting to meet the new demand dynamics driven by the energy transition.**
- **New KPIs and approaches support monitoring, reporting and impact evaluation.**



Metals and mining industries will have to perform a remarkable feat if they are to play their full role in the energy transition: dramatically reduce carbon emissions while ramping up supplies of minerals. They play a crucial role in the global energy transition, producing materials such as lithium, copper and steel to help underpin the expansion of electrification, not only for transport, but also for solar panel supports and wind turbine facilities. Energy-related demand for metals and minerals is growing rapidly: Since 2010, the rise of renewables has led to a 50 percent increase in the average amount of minerals needed for each new unit of power generation.[7] Global demand for minerals indispensable to a low-carbon economy, such as copper, lithium, cobalt, nickel and graphite, is expected to increase four-fold by 2040.[8]

50%

Increase in the amount of minerals needed per new unit of power generation, since 2010.

At the same time, metals and mining companies are highly carbon intensive. The mining industry accounts for 2-3 percent of global carbon emissions[9] and metals production comprises an additional 8-10 percent.[10] Combined, metals and mining are responsible for more than half of greenhouse gas emissions from global industry.[11] This highlights the need for metals and mining executives to intensify their decarbonization efforts and many are doing so, as our in-depth interviews with sector executives convey.

More than 50%

Metals and mining's share of industrial greenhouse gas emissions worldwide.[12]

Given the massive quantity of supply of raw materials required for the energy transition and the carbon intensity of the metals and mining industries, companies will need to grow while reducing their emissions. The takeaway: executives do not need to make a tradeoff between growth and decarbonization. In fact, operational transformation goes hand in hand with decarbonization, and they mutually reinforce each other, especially if they are fully integrated into corporate strategy.[13]

> "In the past, the mining industry was totally dependent on the growth of economies. But the energy transition has added a huge pillar to the demand story for commodities that wasn't there five years ago."

Trevor Hart
Global Mining Leader,
KPMG in Australia

[7] IEA, "The Role of Critical Minerals in Clean Energy" (May 2021).
[8] "Turning the tide in scaling renewables," KPMG, 2023.
[9] Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development, "The impacts of climate change on the mining sector" (2022).
[10] International Energy Agency, "Emissions measurement and data collection for the steel industry" (April 2023).
[11] US Environmental Protection Agency, "Global Greenhouse Gas Overview" (April 2024).
[12] US Environmental Protection Agency, "Global Greenhouse Gas Overview" (April 2024).
[13] "Time to act now: ESG in metals and mining," KPMG, March 2024.

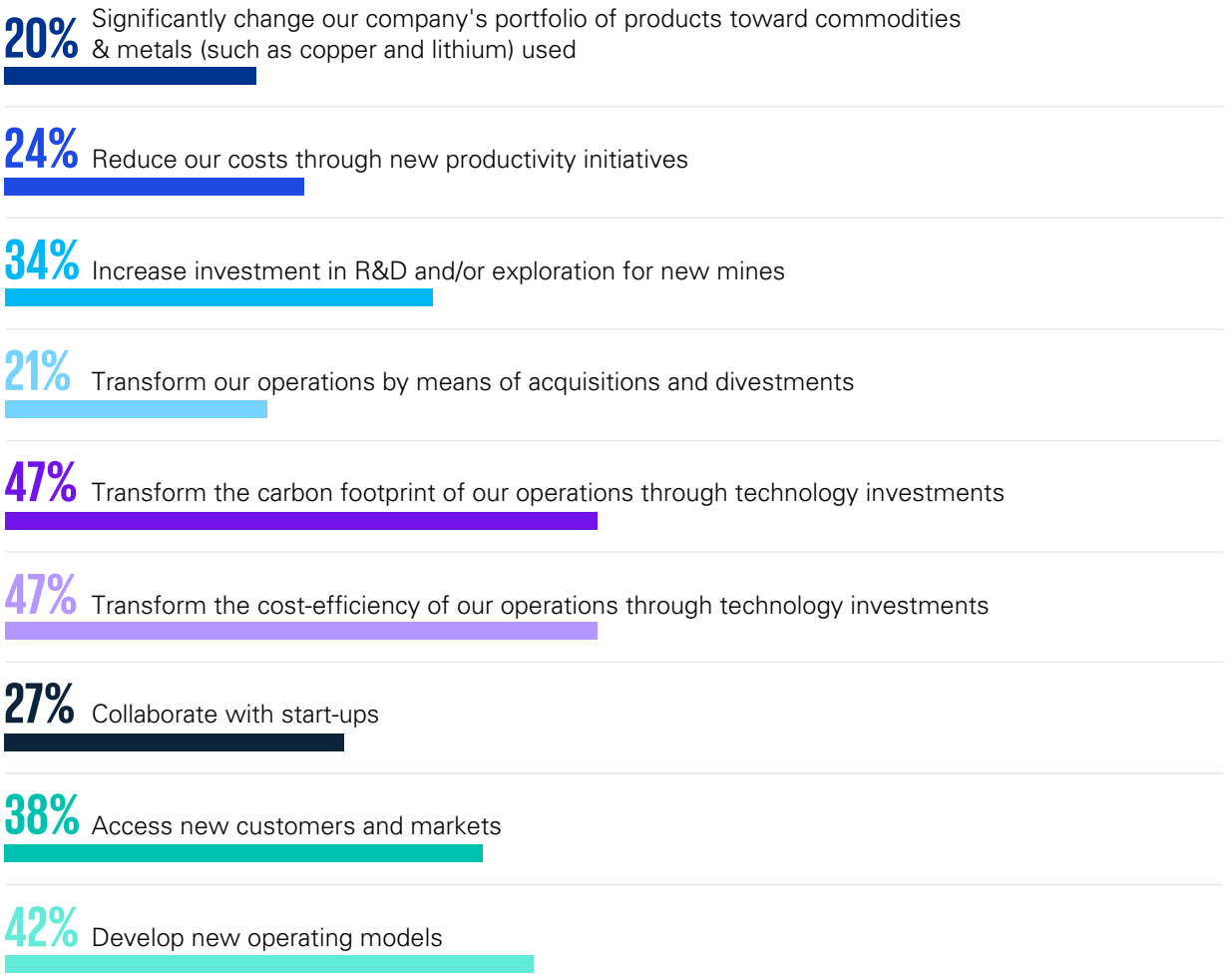
Decarbonization drives operational efficiencies

As mining and metals companies pursue the objective of attaining net-zero carbon emissions by 2050, transforming operations and transforming carbon usage must become increasingly intertwined. The relationship between the two is essentially this: The drive to reduce the carbon emissions of a company is leading to major benefits in the form of cost reductions, as it consumes less energy or uses it more efficiently. At the same time, the effort to decarbonize is most effective when a wide range of steps are taken to transform operations.

Andrew McHardy, National Decarbonization Hub Leader, KPMG in Canada, explains: "Mining and metals are highly technical businesses and depend heavily on technology and innovation to drive efficiency. A best practice we have seen with our clients is when decarbonization is an integral part of capital planning and operational excellence, enabling asset development and supporting improvements in productivity, yield and quality." He cites opportunities such as the electrification of haul trucks and trolley assist, where efficiencies can be gained through the optimization of mine design and strategic energy management while reducing site emissions.

Executives in both industries say that decarbonization is increasingly aligned with enterprise strategy. They say that by far the biggest business opportunities over the next five years are transforming the company's carbon emissions and improving the cost-efficiency of operations through technology investments.

What do you regard as your company's biggest business opportunities over the next five years? We have an opportunity to:



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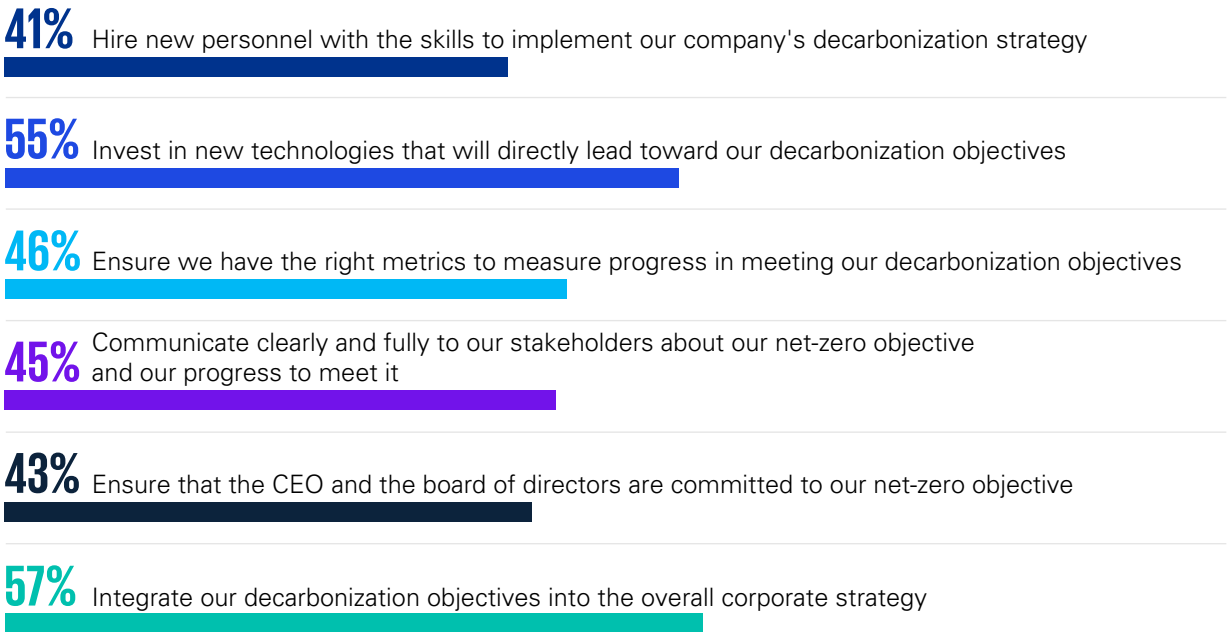
Andrew McHardy
National Decarbonization Hub Leader,
KPMG in Canada

Decarbonization is a business opportunity

Executives say that decarbonization is a significant business opportunity, especially when it is part of operational transformation. In fact, 57 percent of executives say the most effective way of meeting their decarbonization goals is to integrate it into the overall corporate strategy. It should, therefore, not be seen as an expensive add-on intended solely to comply with green government policies, but a key goal, subject to the same kind of cost-benefit analysis that applies to other strategic objectives.

The *2023 Metals & Mining Outlook* supported this trend by showing that 43 percent of metals and mining executives said transforming their carbon footprint through technology investments was the company's biggest business opportunity over the next five years. It added that improving energy consumption efficiency is the highest priority in tackling the environmental challenges from mining and metals processing. These statistics for both years show that executives understand the benefits of decarbonization, especially when it is part of enterprise strategy.

Which of the following measures will be most effective in helping your company to meet its decarbonization objectives?



> "The real benefits of decarbonization come from changing the way mining works, rather than merely deploying various marginal projects to decarbonize our existing properties."

Mohammed Ali
Vice President of Sustainability & Regulatory Affairs, Agnico Eagle Mines

"The real benefits of decarbonization come from changing the way mining works, rather than merely deploying various marginal projects to decarbonize our existing properties" says Mohammed Ali, Vice President of Sustainability & Regulatory Affairs, Agnico Eagle Mines.

"It means taking a long-term view of where the company will be in 25 years. If we aim for net zero in 2050, we must do so with the portfolio we will have then and work backwards. How we design the ventilation, how we will move the material, how we power these sites, and so on will be completely different then than it is now. But today, we can test technologies to see if they are worthwhile to invest in in the future", he adds.

Alignment headwinds to be tackled

Integrating decarbonization into business strategy is easier said than done, because the most important change needed to align the company's operations with decarbonization is transforming the end-to-end operating model. In fact 47 percent of executives say that it cannot be implemented in piecemeal fashion but must be integrated in everyday operations, including the entire supply chain, upstream and down, to ensure the organization maximizes the benefits from decarbonization.

Decisions on decarbonization investments are driven by comprehensive value analysis. Sepanta Dorri, Vice President, Chief of Staff, and Strategy Activation at Teck Resources, explains: "We are in a strong position to meet our decarbonization goals through a range of commercially viable technologies that effectively reduce carbon intensity and minimize the carbon tax burden."

She highlights Teck's renewable Power Purchase Agreements in Chile as an example of a cost-efficient decarbonization initiative, supporting Teck's 2025 Net Zero Scope 2 and 2030 33 percent carbon-intensity reduction targets.

"Operationalizing decarbonization is complex, and it's essential not to lead for the sake of leading; we aim to create value for our shareholders by implementing decarbonization measures that are both commercially and technologically viable," she adds. Teck has made other decisions that help it reach its decarbonization goals. In November 2023, Teck announced the sale of its entire steelmaking coal business to Glencore for an implied enterprise value of $9 billion.[14]

Along with companies that are leading in the race to decarbonize, there are many others that need to redouble their efforts to capture the full benefits of the transformation. Overall, metals and mining companies have a long way to go to fully operationalize their decarbonization efforts. KPMG's report in 2023 said that if they are to achieve their net-zero objectives, they must do more to integrate them into enterprise strategy. But only 28 percent have already done so, and 34 percent say their company has only just begun. They should act urgently to set decarbonization goals to meet, because they are likely to miss out on a business opportunity if they do not do so.

Saving energy

Metals companies are also beginning an unprecedentedly large investment program to decarbonize. They are making advances, but few have yet to bear fruit. Almost three quarters of metals executives, asked which energy-saving technology they are investing in,

> **"Operationalizing decarbonization is complex, and it's essential not to lead for the sake of leading; we aim to create value for our shareholders by implementing decarbonization measures that are both commercially and technologically viable."**
>
> **Sepanta Dorri**
> Vice President, Chief of Staff and Strategy Activation, Teck Resources

[14] "Teck announces the full sale of steelmaking coal business," Teck Resources, 13 November 2023.

chose the recycling of metal using fossil-free electricity and biogas. The second most frequent answer was the direct reduction of iron ore into metal using green hydrogen. In Australia, Rio Tinto, BHP and BlueScope are jointly developing the country's first ironmaking electric smelting furnace pilot plant.[15] SSAB and Electra, a consortium, are competing to develop a process to make sheets of iron without using coking coal or fossil fuels. If the latter becomes commercially successful, the industry will be on the way to producing steel with virtually no fossil carbon emissions.[16]

Buoyed by their transformation efforts, 61 percent of metals and mining executives are now more confident about revenue-growth prospects than they were two years ago, because customer orders have increased, and executives expect to meet their sustainability goals, they say. There is an ever-tighter link between the consumption of key metals and minerals and the drive toward environmental sustainability. It mirrors the relationship between operational transformation and decarbonization.

But this optimism among executives is tempered by increasing risks and pressures weighing on corporate decisions. Executives acknowledge that the market environment is difficult because, as noted earlier, there has been a rise in price volatility in the past two years, particularly for output prices. They also note that there has been an increase in the incidence and severity of business risks.

One factor causing heightened price volatility and business risks is that the supply of key minerals needed for the energy transition is geographically concentrated. In 2023, Asia-Pacific and Latin America produced just over 50 percent of the key metals and minerals needed in the global energy system. Asia-Pacific produced nearly 70 percent of the materials critical to the manufacture of Li-ion batteries.[17] Given heightened geopolitical tensions, governments have encouraged their nation's companies to diversify the sources of supply.

What factors in the past two years have caused this change in confidence?

[15] Business Wire, "Australia's leading iron ore producers partner with BlueScope on steel decarbonization" (8 February 2024).
[16] SSAB, "Fossil Freedom is just around the corner" available at https://www.ssab.com/en-us and Electra, "Clean Iron for Green Steel",30 June 2023.
[17] Energy Institute, in association with KPMG International and Kearney. "2024 Statistical Review of World Energy." 2024.

Sharpened price volatility and greater business risks make the case for operational transformation even more urgent. A transformed company tends to be not only leaner, but also more agile and resilient. Greater agility will help overcome the risks and price volatility seen in metals and mining markets.

> **“Nobody was prepared for the sharp drop in commodity prices we’ve seen in the past two years, but we operate our business to be sustainable throughout the price environment.”**

Henning Opperman
Senior Vice President of Corporate Finance at Sibanye-Stillwater

“Nobody was prepared for the sharp drop in commodity prices we’ve seen in the past two years, but we operate our business to be sustainable throughout the price environment,” explains Henning Opperman, Senior Vice President of Corporate Finance at Sibanye-Stillwater, one of the world’s biggest producers of platinum group metals (PGM), as well as a range of critical base metals.[18] “We are optimistic for most of metals we produce but need to take a considered approach,” he adds.

[18] Sibanye-Stillwater, https://www.sibanyestillwater.com

Agility is both a short-term and long-term strategy

Agility means something different for a fast-moving consumer-goods manufacturer compared with mining and metals firms, for whom investment cycles last decades. "It takes years to build a mine, so it's really difficult to pivot. Agility for mining and metals, therefore, needs to be focused on managing the other opportunities and risks around what you're able to bring to the sector," says Hart. Technologies and talents that can improve the speed and quality of executive decision-making are crucial.

Operational transformation entails painstaking analysis of where process improvements are possible. "Mining companies pick apart each piece of the production chain to see what works best. This will involve automation and AI up to a point, but a big part of the solution is understanding your own business, the cost structure, and maintaining production assets. Equipment sensors closely monitor the integrity of assets, and they are using systems to self-diagnose problems, but AI can provide a predictive model of your production chain," he adds.

Decarbonization also makes business sense in meeting customers' needs. "End-user industries like infrastructure and construction are grappling with the challenge of embodied carbon. Hence for their Scope III emissions, it would also be incumbent upon metal majors to decarbonize. Green positioning and the related pricing premium are becoming strongly embedded in the customer value propositions," says Amit Bhargava, National Leader, Metals and Mining, KPMG in India.

The same is true for mining companies. The opportunity to be a leader in ESG comes back to what our customers are requiring," says Craig Miller, Chief Executive Officer at Anglo American Platinum. "They want us to produce PGM and base metals that are sustainably mined. The same goes for the community around the mine. This is how we think through the whole ecosystem around leading in ESG.

"The opportunity to be a leader in ESG comes back to what our customers are requiring," says Craig Miller, Chief Executive Officer at Anglo American Platinum. "They want us to produce PGM and base metals that are sustainably mined. The same goes for the community around the mine. This is how we think through the whole ecosystem around leading in ESG."

Craig Miller
Chief Executive Officer,
Anglo American Platinum

Miller sees "a big opportunity around PGM linked to the energy transition. Currently 65 percent of PGM is used in internal combustion engines. With the rollout of EVs and new alternative-energy vehicles, there is a role for PGM in hybrid cars, both the battery and the engine. Longer-term, there is an opportunity around hydrogen fuel cells and the deployment of green hydrogen to power fuel cell electric vehicles, where PGM could have a meaningful role. PGMs can also improve the longevity or capacity of batteries."

Anglo American has entered a partnership with Toyota and SafeDriver Group, which operates a fleet of taxis in Berlin powered by hydrogen fuel cells.[19] "The aim is to create awareness of the benefits of hydrogen power, but also to understand the pain points of refueling and the entire infrastructure to understand the pain points for our partners," says Miller.

Key points

- Integrating decarbonization into enterprise strategy requires careful analysis of every aspect of the operating model and for most is likely to take years to accomplish.
- Diversification of supplies cannot be done quickly either. In the meantime, build closer relationships with suppliers so that there are contingency plans if commodity flows are interrupted.
- Customers are becoming more demanding about the sustainability of their supplies, to which the best response is to be as transparent as possible about the carbon content of products, while redoubling efforts to decarbonize.

[19] Anglo American, "Powering a better way. Berlin pilot shows the potential of hydrogen-fuelled passenger transport" (12 June 2023).

Accelerating technology investments

- **Mining and metals companies see investments in new technologies as crucial to their decarbonization strategy.**
- **Implementing digital systems to measure and report decarbonization KPIs for executives and the board is the highest priority.**
- **This requires investments in a robust digital architecture and an AI strategy aimed at future-proofing operations.**

Technology of transformation

Technology is at the core of efforts by metals and mining companies to improve their operations, decarbonize and innovate new products. They will need to invest billions in new technologies if they are to accelerate decarbonization. All the more reason to make wise choices, when so much money is at stake.

Fifty-five percent of executives say that the most-effective method of attaining net-zero emissions is to invest in relevant, new technologies, such as those that reduce the carbon emitted in steel production.

Just this one stage of the end-to-end process is expected to lead to dramatic cuts in greenhouse gas emissions for metals companies, but the shift in production processes is complex and risky.

KPMG's Global Tech report 2023 highlights the fact that investment in new technologies is key to business growth, and that commitments to technology investment have grown, despite economic uncertainty. In the face of these headwinds, digital transformation leaders that are committed to innovation priorities continue to realize value.

Four ways technology drives transformation

Despite economic uncertainty, mining and metals companies are making new investments. These investments drive a range of needs and opportunities. There are four main ways that new technology drives transformation in the sector, says Amit Bhargava, KPMG in India.

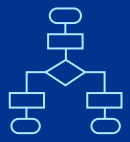
Optimize processes

Achieve the best possible operating regime to have the leanest carbon footprint for the current operating configuration. KPMG in India is applying AI models to help metal majors in improving their operational performance in terms of throughput, quality and specific consumption. The idea is to bring predictability and consistency of operations, thereby reducing the specific consumption of energy and carbon usage in the operations.

KPMG in India recently deployed advance analytics and AI/ ML models for a major iron company, thereby reducing the coke rate and, through a comprehensive set of use cases, increasing EBITDA by 15 percent. Likewise in mining, KPMG in India is leveraging advanced analytics across value chain, in mine planning, drilling, blasting and evacuation. These help to reduce energy consumption and increase fleet and machine productivity leading to better and leaner carbon.

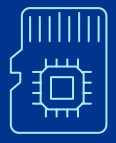
Transition to renewables

There are storage and generation technologies emerging that enable renewable energy providers to meet continuously the needs of industrial consumers. This and a reduction in tariffs are making energy transition a reality. Many major manufacturing companies in India are now aggressively replacing fossil-based energy with that of renewables.



Transform operating models

Advanced technologies can disrupt operating models, where we see routes to manufacturing of metals based on recycled scrap. Also mining and smelter residues are being processed to recover metals. KPMG in India assisted a large metals and mining company in identifying technologies and partners to recover metals from process residues across the value chain.



Technology disruptions

The most impactful and toughest to commercialize are the leaner carbon technologies that help deploy newer process technologies to reduce carbon intensity. For example, one of the technologies that is stated to be commercialized over the next few years is one for iron reduction route wherein iron could be produced through direct electrolysis, powered through renewables. Such technologies would provide a fundamental lean carbon route vis-à-vis conventional blast furnaces. Using hydrogen based DRI would also be a similar lean carbon process technology.

Although mining faces different challenges as it works to decarbonize, new technology is playing a similar role to streamline operations, shift to renewable electricity, and alter product portfolios. A good example is Australia's first ironmaking electric smelting furnace pilot plant, to be developed by BHP, Rio Tinto and BlueScope.[20]

[20] Business Wire, "Australia's leading iron ore producers partner with BlueScope on steel decarbonization" (8 February 2024).

New leaders in reporting decarbonization

Implementing digital IT systems to measure and report decarbonization KPIs for executives and the board of directors was the highest priority over the past two years for metals and mining companies (43 percent), especially to meet decarbonization goals. In the next two years, it will become even more important (48 percent). This reflects the urgent need to move faster.

What key operational changes has your company made in the past two years to meet its decarbonization goals?

- **31%** Adopted a value-driven approach to project management, selection and execution
- **33%** Put decarbonization goals at the center of our operating model
- **23%** Set new KPIs for performance, efficiency and change management
- **33%** Reviewed and restructured the organization's leadership to achieve long-term goals
- **38%** Established procurement policies that prioritize eco-friendly and sustainable resources
- **43%** Implemented IT systems to measure and report decarbonization KPIs for executives and the board
- **29%** Instituted company-wide programs to measure and track carbon footprint with the goal of reduction
- **35%** Developed a large-scale change-management strategy
- **30%** Appointed a C-level officer in charge of managing decarbonization

What key operational changes does your company plan to make in the next two years to meet its decarbonization goals?

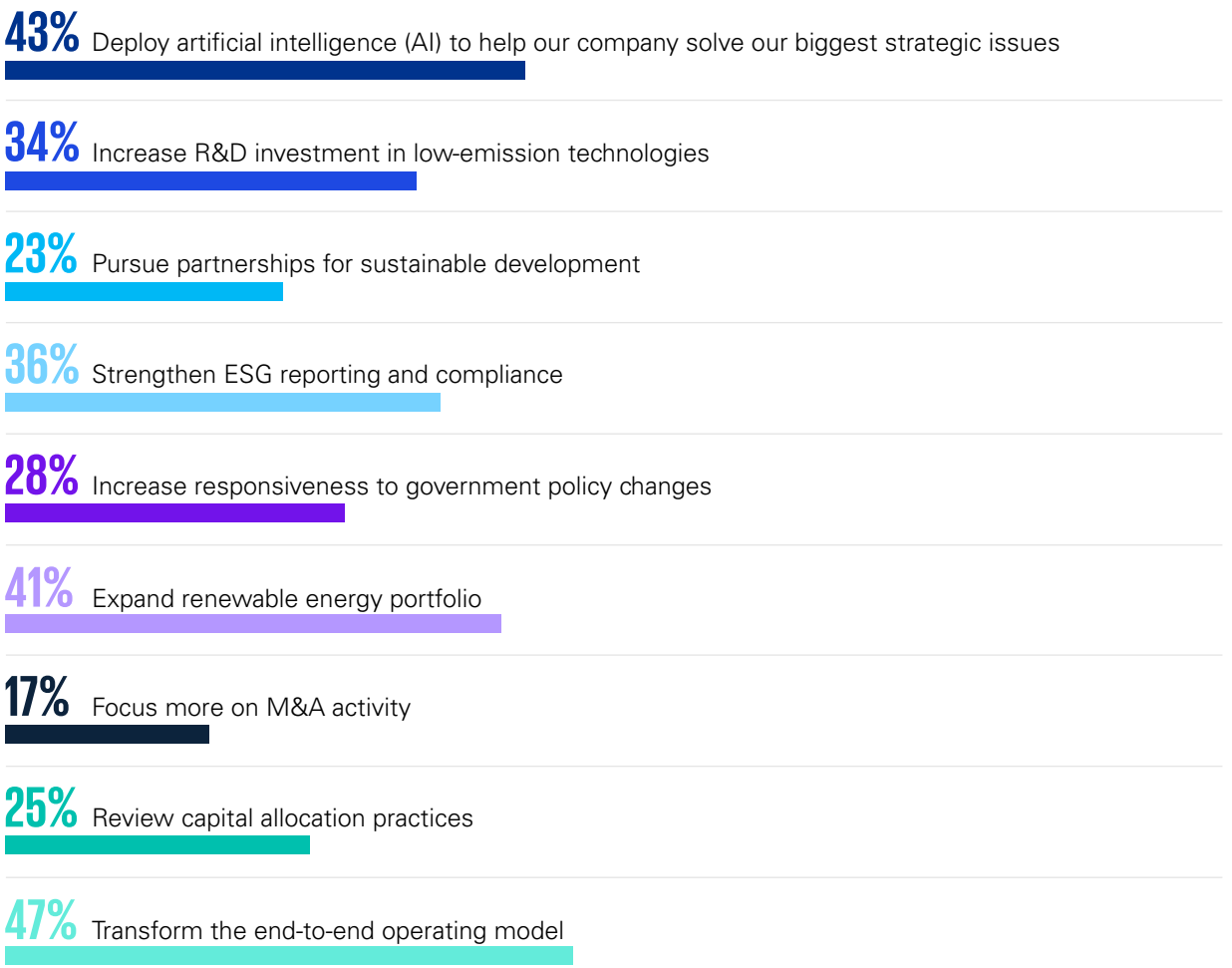
- **29%** Adopt a value-driven approach to project management, selection and execution
- **42%** Set new KPIs for performance, efficiency, change management
- **35%** Establish procurement policies that prioritize eco-friendly and sustainable resources
- **48%** Implement IT systems to measure and report decarbonization KPIs for executives and the board
- **43%** Institute company-wide programs to measure and track the carbon footprint with the goal of reduction
- **40%** Develop a large-scale change-management strategy
- **32%** Invest in equipment and processes that reduce carbon emissions
- **28%** Appoint a C-level officer in charge of managing decarbonization

AI is the top tech priority

For the enterprise, artificial intelligence (including Generative AI) is regarded by executives as the most important technology, because it can be deployed at many stages of the process and used in a wide variety of ways. Forty-three percent say it will be deployed to help the company solve some of its biggest strategic issues, as well as for more tactical purposes. In fact, 45 percent say all forms of AI and machine learning will be key if companies are to capitalize on their business opportunities. Major mines are all reported to be investing strongly in AI as use cases continue to be refined for deployment. This is being actively supported by 'sandpit' style organizations supporting them.

Steel companies are also implementing AI technology in the non-manufacturing parts of their operations, but up till now, steel plants have not been highly digitized or connected. "Engineers are still turning handles and even smelling the quality of the molten mix. In the past 10 years, companies have worked on such things as temperature sensors that work at 3000 degrees Fahrenheit, the internet of things, and 3D visualization. Now they are investing in equipment to enhance connectivity, record production data and control quality," says Platania.

What are the most important changes needed to align the company's operations to decarbonization goals?

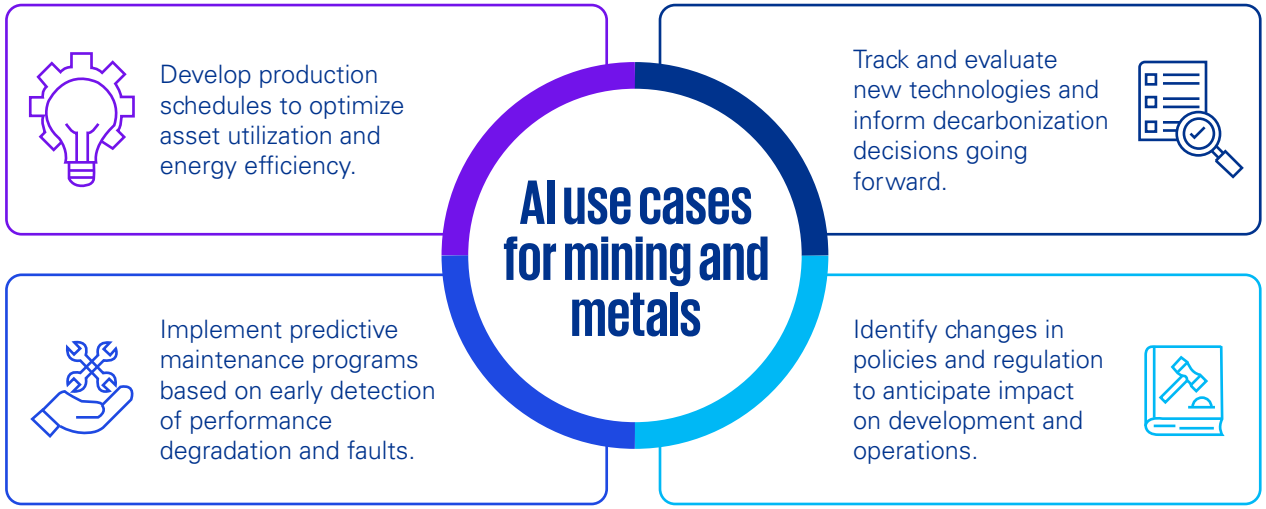


Which types of technology are most important for capitalizing on your opportunities?

- 13% Not-yet-commercialized processing technology
- 14% Not-yet-commercialized energy technology (such as hydrogen-powered smelters)
- 22% Enterprise resource planning
- 16% IoT
- 25% Robotic process automation
- 32% Cloud
- 24% Geology and orebody definition technology
- 45% All forms of AI and machine learning
- 30% 5G
- 39% Decarbonizing technologies
- 41% Data analytics

AI use cases for mining and metals

AI in the context of heavy industrial operations such as mining and metals presents a significant opportunity to drive operational outcomes, says Andrew McHardy of KPMG in Canada. Its potential applications include:

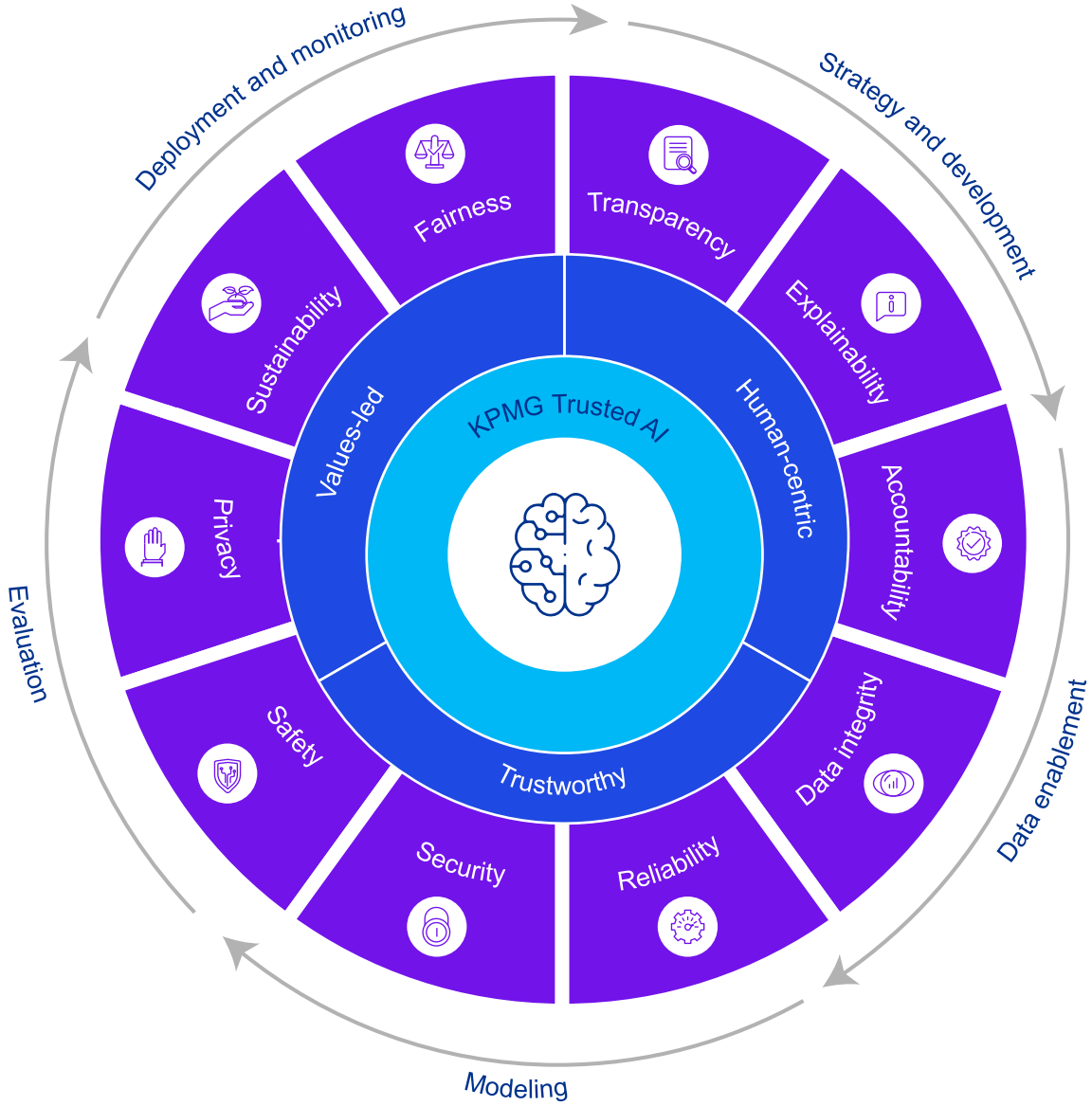


AI is already making a big impact on mining exploration. "Analysis has always been done by a human, but vast amounts of data can now be loaded into computer systems and then they can use technology to refine their search for ore bodies or the water that can support mining operations," says Hart.

The attention paid to AI marks a slight narrowing of focus since the 2023 survey of mining and metals companies. At that time, executives acknowledged that a main driver of the changes that characterize this new phase of the mining and metals industry has been the introduction of new technologies and innovations. Technological changes are seen as the most important factor affecting executives' five-year demand projections. This remains the case, but AI has become a paramount technology, just in the past year or so.

KPMG's Trusted AI framework

As AI investment and adoption grows, business leaders must ensure that trust is embedded within their AI applications, as well as address implementation barriers. Mining and metals industries are no different from other sectors in this respect, even if the specific requirements and uses will vary. KPMG International embeds trust at every step of the AI lifecycle, applying our strategic framework to help clients develop their trusted AI programs while also applying it to our own AI strategy.[21]



[21] KPMG, 'KPMG Trusted AI Framework,' 2024.

According to KPMG International's Generative AI Consumer Trust Survey, 48 percent of consumers believe there is not enough regulation of Generative AI. Sixty percent of consumers see risks with Gen AI, but applying a range of practices could help organizations gain their trust.[22]

Key considerations for metals and mining executives include:

- Amid the excitement around Gen AI opportunities, there appears to be a lack of preparedness, according to the survey.
- There is a lack of the right people and skills to enforce responsible deployment and use.
- Insufficient infrastructure and tooling to host and monitor AI use will hamper integration.
- Companies are challenged to build trust that they will develop and use AI ethically.
- Governance models and policies for Generative AI are inadequate.

Addressing these issues is crucial if AI solutions are to be implemented successfully. With the right partner and strategy, companies can overcome these challenges and implement AI with confidence.

Mining companies are already seeing the benefit of the new technology. "AI and advanced analytics have cut the time it takes from exploration to commissioning a mine from 16 years down to nine," observes Robert (Bob) Wilt, the Chief Executive Officer of Ma'aden, Kingdom of Saudi Arabia, which has an annual exploration program of $130 million. "Processing geophysical data used to take two years to do manually and now takes a matter of weeks. Evaluating core samples used to take 45 days and now takes 12 minutes."

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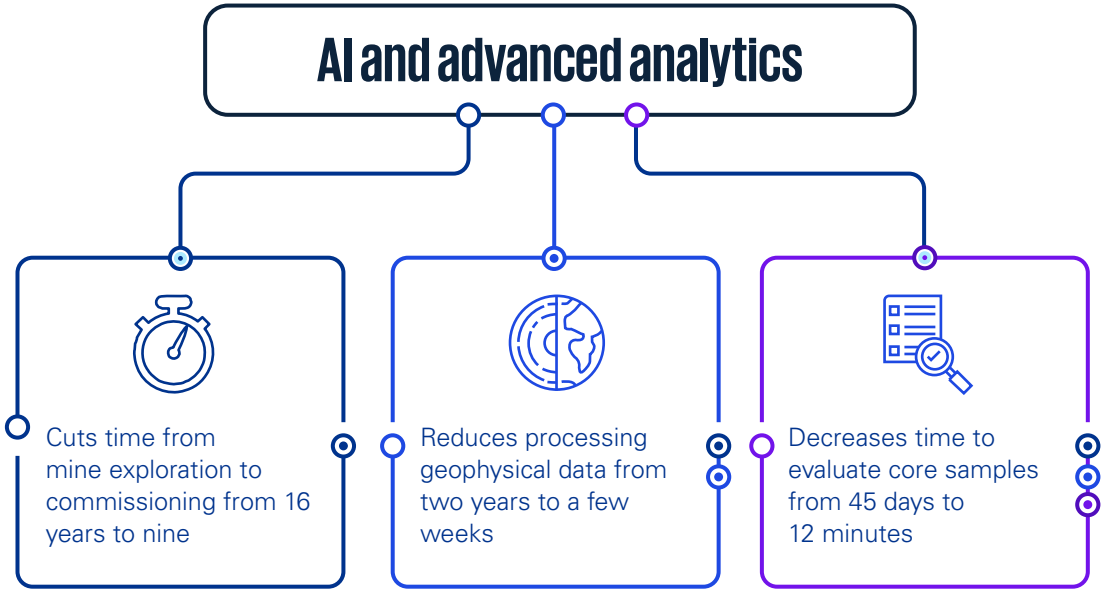


[22] Generative AI Consumer Trust Survey, KPMG International, January 2024.

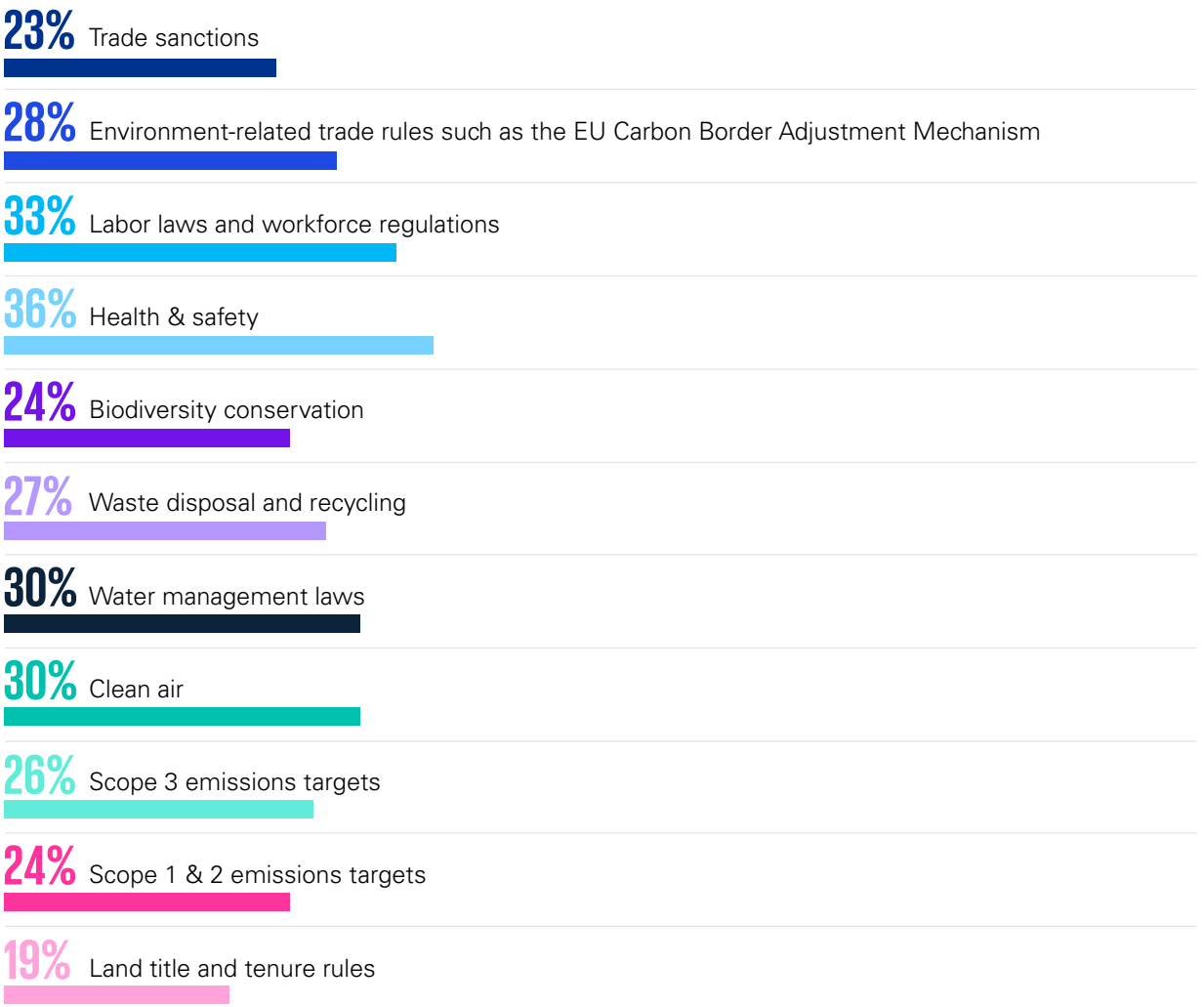
Carbon capture is gaining ground

New decarbonization technologies are making their mark too. For Ma'aden, carbon capture, utilization and storage (CCUS) is "the biggest lever driving most of its decarbonization efforts," says Wilt. It also plans to plant 20 million trees in the kingdom, by which it can absorb 20 percent of its total emissions.

There are no publicly available estimates of CCUS expansion in metals and mining, but for all industries, announced capture capacity for 2030 increased by 35 percent, while announced storage capacity rose by 70 percent in 2023, according to an April 2024 report by the International Energy Agency.[23]

[23] International Energy Agency, "Tracking Carbon Capture, Utilisation and Storage" (April 2024).

What type of policies (or regulations) create the biggest risk for your operations?



What sort of problems are the policies leading to?

- **35%** Investment uncertainty
- **31%** Slow down innovation and R&D
- **38%** Disruption to supply chain
- **35%** Difficulty in developing 5 to 10-year production plans
- **51%** Increasing operating costs
- **36%** Hard to raise finance
- **38%** Difficulty in hiring talent
- **36%** Slowing down approvals of new mines, new plants and expansions

What are the best ways to manage compliance?

- **56%** Improve compliance prediction through AI and scenario planning
- **32%** Work with community organizations and NGOs
- **38%** Collaborate with industry and trade organizations to lobby makers of policies and rules on behalf of your company
- **33%** Collaborate with the public sector (e.g., on nature-positive measures)
- **41%** Train more compliance officers and cross-train others
- **47%** Invest in compliance software to achieve regular compliance audits
- **53%** Integrate compliance into business strategy

Technology and managing risk

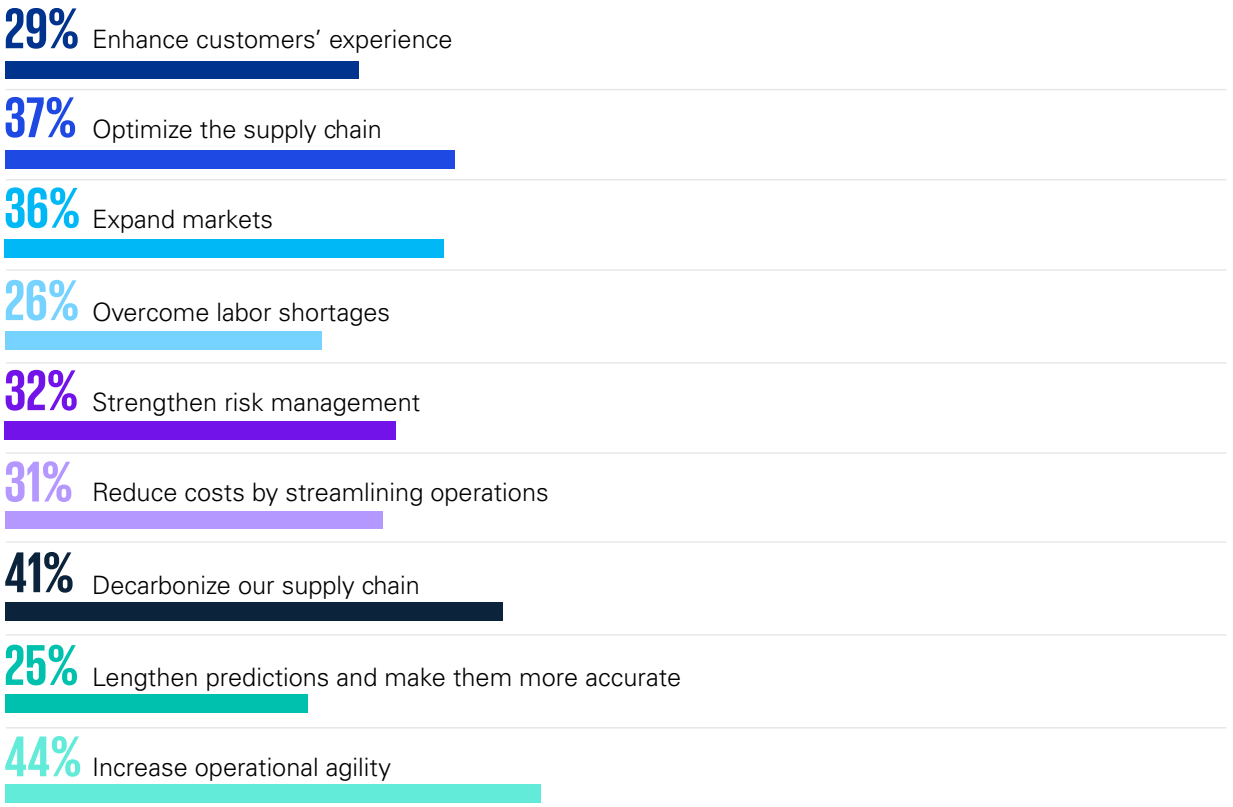
Technology can also help mitigate the growing risks metals and mining companies face, according to executives polled. The best way to manage compliance is to improve the ability to predict regulatory changes by using AI and scenario planning, 56 percent of executives say. If companies can anticipate alterations in government policies and the rules that apply to metals and mining, then the changes may be less disruptive and costly.

Nonetheless, technology is best implemented alongside changes in processes and practices that only humans can undertake. Health & safety regulations create the biggest risk for operations, according to 36 percent of executives, and are uppermost in executives' minds as they aim to develop a risk-aware culture at their companies. At the end of the day, operating plants to minimize hazards to people, whether employees or community members, requires human judgement as much as the best technology. The two most important outcomes of the new technologies are:

- an increase in operational agility
- decarbonization of the supply chain.

These are tall orders for any company, large or small. But it is not impossible if organizations take an integrated approach to decarbonization, deploying new technologies for narrowly focused objectives and broader ones.

What are the most important outcomes new technology will help to achieve?



Key points

- To take full advantage of new technologies such as AI, corporate leaders need to understand the emerging opportunities and promote people who can make the most of them. Critical to this is using AI/advanced analytics to drive decarbonization, while improving performance.
- Skills are needed to capitalize on the advantages AI offers to accelerate decarbonization and to ensure the technology's risks are carefully mitigated.

Ecosystem collaboration

- **Closer partnerships with suppliers, customers and others are central to managing decarbonization.**
- **Massive investments in new operating systems require seamless deliveries of inputs and careful cost controls.**
- **New technology and new skills go hand in hand as companies manage the energy transition.**

New energy partners for steel

Metals and mining companies are going to have to rely more on the help of their ecosystem of suppliers, vendors and partners if they are to decarbonize. To reduce carbon emissions, many steel companies are shifting, or are planning to shift, their inputs from iron ore and coking coal to iron pellets. By doing so, the consumption of electricity will increase dramatically, so this power will need to be generated by non-fossil fuels if they are to meet their net-zero emissions targets.

To achieve their decarbonization goals, the ecosystem has never been more important as companies focus on new sources of energy. "There are significant logistical challenges in how to obtain the huge amounts of electricity needed to perform processes at scale. They need clean power as well as clean steel," says Ugo Platania of KPMG in Luxembourg.

The need for non-stop zero-emissions electricity is enticing steelmakers to regions where lower-emissions grid electricity is already available, including locations in Norway, Sweden, Brazil and Canada. For example, H2 Green Steel (H2GS), is building a large-scale green steel production facility in Sweden, using renewable electricity and green hydrogen. The green steel produced will reduce carbon dioxide (CO2) emissions by up to 95 percent compared with traditional steelmaking.[24] The plant is due to begin producing steel in 2025, and several automotive companies have agreed to purchase steel from the company over the next few years.

H2GS and Fortum have established a partnership to supply carbon-free electricity. Blastr Green Steel is

another Nordic green steel initiative. In October 2023, it signed a letter of intent with power supplier Sogn og Fjordane Energi to power its planned pelletizing plant in Norway. The clean electricity will be based on hydro and wind power.[25]

Steelmakers are developing new facilities for the production of green, direct-reduced iron (DRI), based on low-cost renewable electricity and plentiful supplies of green hydrogen. Steel producers are planning to invest tens of billions of dollars in electric-arc furnaces, powered by renewables. In May 2024, for example, Arcelor Mittal began building an electric arc furnace at its Gijón plant in Spain, costing 213 million euros ($228 million).[26] The investment is expected to reduce carbon dioxide emissions by more than 35 percent at the plant.

"These are investments that quickly mount up to nine-digit figures to transition to sustainable production processes like DRI around the world," says Platania. "This is a highly complex capital investment program where spending must be kept under tight control, given the intricate and multi-stakeholder nature of the financing. It's extremely important to accurately measure the positive impact this program will have on carbon emissions."

He adds: "When shovels hit the ground, then our work primarily becomes project advisory. We support clients in the execution of very complex projects with many suppliers. Clients are advised on program governance and effectiveness, financial controls, procurement, accounting and internal controls."

[24] H2 Green Steel, "Powering a new, clean industrial revolution."
[25] Institute for Energy Economics and Financial Analysis, "Competing for green steel," 11 January 2024.
[26] Arcelor Mittal (website), "ArcelorMittal starts the construction of an electric arc furnace at its Gijón plant," (10 May 2024).

Circular steel

Steel recyclers are in a stronger position regarding decarbonization, but they, too, face challenges. They do not have to produce iron first since their primary input is steel. By using DRI and electric-arc furnaces, they are able to eliminate as much carbon dioxide as possible from recycling steel. But they have a different supply chain problem: their ecosystem of suppliers tends to be highly fragmented, which makes it difficult to obtain a consistent supply of the right quality of steel scrap.

One answer is to buy up their suppliers and become more vertically integrated. Cleveland-Cliffs and BlueScope have invested in ferrous scrap yards. ArcelorMittal acquired 10 facilities in Germany in 2022, which process about 400,000 mt/year of mostly steel scrap.[27] "Consolidation in that part of the sector is coming on very strongly," says Platania. "We will also see a lot of imports and exports of scrap to ensure steady supplies." In the long term the automotive and construction industries are going to have to redesign their cars and buildings to make it easier to extract the steel for recycling. All these changes will require close collaboration among companies at every stage of the supply chain.

But if steel recycling is to make a big impact on decarbonization, the industry will need to take much bolder steps. "Companies will need to develop steel products for the construction and automobile industries that are more easily recyclable. A lot of steel is inside concrete walls, for example, and so it is very challenging to extract it for recycling. Buildings and automobiles will need to be redesigned to make it easier to recycle the steel contained within them," says Platania.

Miners partner with renewables

Mining companies face the same urgent objective of lowering carbon emissions in their ecosystem and partnerships with power suppliers can accelerate decarbonization.

One of Sibanye-Stillwater's biggest decarbonization opportunities is its renewable energy portfolio of projects in South Africa, where 92 percent of its emissions come from.

"We are building out a 600MW portfolio of renewable energy projects in wind and solar, of which 407 MW is in construction through third-party purchase agreements. This gives us access to green electricity with no capital outlay from ourselves and cost savings from day one," says Henning Opperman, Senior Vice President of Corporate Finance at Sibanye-Stillwater.

Anglo American Platinum aims to be carbon-neutral by 2040. To achieve this, the first phase is a renewable energy partnership with EDF Renewables to launch 600MW of wind and solar projects in South Africa, which will lead to a 35 percent reduction of carbon emissions, says Craig Miller, the Chief Executive Officer of Anglo American Platinum. The second phase is to expand renewable energy production in the country to 3-5GW. These types of efforts show the benefits of investing in low-carbon solutions.

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> **Henning Opperman**
> Senior Vice President of Corporate Finance at Sibanye-Stillwater

[27] ArcelorMittal, "ArcelorMittal acquires German steel scrap recycling businesses from Alba International Recycling," 11 May 2022.

Short-term and long-term goals

Transforming the ecosystem to lower carbon emissions is just one part of the long-term management of the supply chain. In the short term, metals and mining companies are tackling many issues disrupting their supply chains. These changes are more immediate than the drive to electrify their processes, but just as consequential.

The events of the past four years, from COVID-19 to geopolitics to natural and man-made logistical disasters, have heightened awareness of the vulnerability of the supply chain of metals and mining companies. In response, metals and mining companies have had to step up their game, but this has not been easy.

Steelmakers have specific supply chain issues. Production cannot be switched on and off easily, so they tend to produce constantly at maximum capacity and focus on cutting input costs, particularly electricity fees, through hedging strategies and long-term contracts. Some steelmakers are integrating coal and iron ore to gain more control of costs. There is also a big effort to cut the distribution costs of rail and ship transport. There is very little fat left to be trimmed," says Platania.

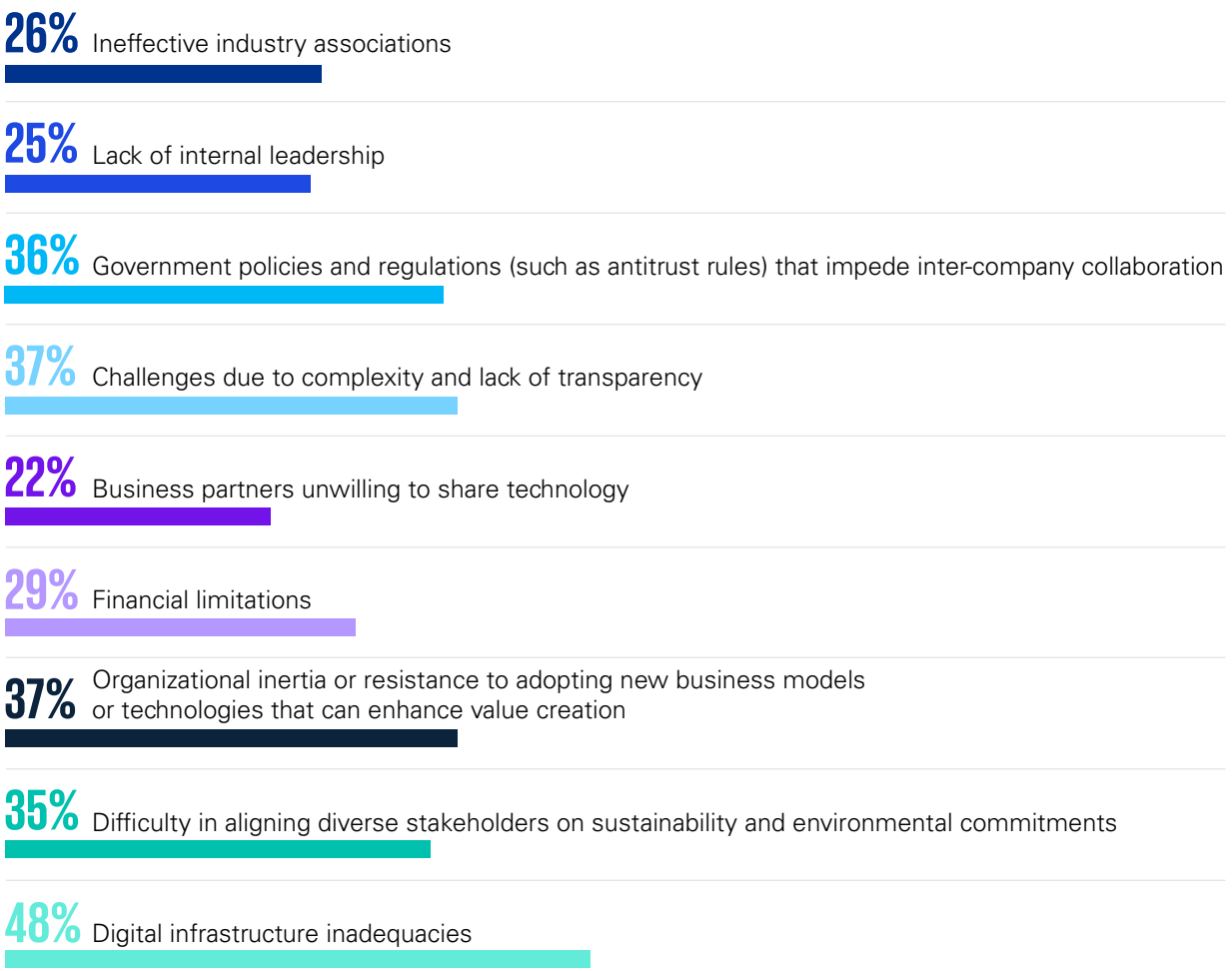
For metals and mining companies in general, there are some issues they face in common. Executives were asked to select the most important supply chain problems that need to be tackled over the next two years. Eight challenges clustered at the top, including decarbonization, sharp price movements, and logistical issues, but the number-one choice (31 percent) is a lack of skills in supply chain management.

What are the most important supply chain problems that need to be tackled over the next two years?

Executives do not regard hiring skilled professionals as the main answer, however; investing in technology is the most popular choice by 10 percentage points. But, in any case, automation is only a partial solution to skills shortages. Companies still need people with the know-how to operate the technology and to apply human judgment when faced with intricate ecosystem challenges.

Technology is nevertheless crucial in helping to track, measure, and analyze the immense amounts of data generated by the ecosystem. If AI and data analytics can help companies to predict future disruptions in the supply chain, this would help to smooth the flow of inputs and outputs. As the chart shows, there are several challenges companies face from their ecosystems in achieving their decarbonization objectives. The biggest problem by a wide margin is the inadequacy of digital infrastructure, but many of the challenges highlighted in the chart are linked to this, which hampers real-time decision-making. Investments in new technology to manage supply chains are therefore a high priority.

What are the top challenges your company faces from its ecosystem in achieving decarbonization objectives?



> **When we undertake a digital transformation program for a client, data readiness is a key initial step. This necessitates assessing the data sources and access of data at the granularity and frequency as is needed to bring the identified use cases to live. This implies assessing the availability, accuracy, accessibility of data and required hardware including platform to run, manage and secure the developed ML/advance analytics models. Such underlying data infrastructure is a must to digitally enhance operations/business.**

Amit Bhargava
National Leader, Metals and Mining, KPMG in India

The electrification of mining and metals is only one of the big shifts that are straining ecosystems. Another is a long-term change in the direction of trade flows, as the global economy decarbonizes. The Indian government, for example, wants to increase the share of electric vehicles from 2 percent of the total in 2023 to 30 percent by 2030, partly by offering tax and other incentives to EV companies to manufacture their cars in India.[28]

This will entail securing long-term supplies of key raw materials. "Production of electric vehicles will grow in India, as long as it has access to the materials needed for batteries, such as lithium and cobalt. The country has identified regions around the world that can supply critical minerals to India and there will be an increasing number of industrial alliances, possibly in the form of corporate joint ventures, with raw-material suppliers in places such as Australia and Latin America," Bhargava says. The global map of mineral supply and demand is changing rapidly, and the sector must improve its forecasting to keep up.

Key points

- Mining and metals companies must break down barriers between themselves and their energy suppliers. The result is likely to be greater energy efficiency and stronger resilience.
- Collaboration among ecosystem members needs to continue to strengthen if they are to make full use of the opportunities open to them.
- To foster new thinking, companies need to share best practices and the latest know-how with companies in their ecosystem.

[28] Reuters, "Electric vehicle plans of Indian automakers" (15 March 2024).

Mining for talent and finding funding

- **The demand for tech skills is stronger than ever and harder to fill. Metals and mining companies are competing for talent with each other as well as for STEM talent, according to KPMG's A new dawn for human capital in ENR, with organizations in consulting, manufacturing and healthcare.**
- **There are positive signs as emerging markets build their skills base and companies strive to create an attractive work culture.**
- **Companies report that there are plenty of sources of funding for capital projects, including innovative financial instruments, but mergers & acquisitions seem somewhat neglected.**

Bridging the skills gap

New technology cannot be effective without new talent. If companies are to make the most of their investments in new technologies, then they need more of the skills that will help maximize the benefits. Executives concede there are gaps to be filled here. Skills shortages are the most important challenge that must be overcome when implementing the latest technologies, 47 percent say.

What are key challenges that must be overcome when implementing the latest technology?

This is a global issue. In the US alone, half the nation's mining workforce, about 221,000 workers, is expected to retire by 2029, according to the Society for Mining, Metallurgy & Exploration.[29] In South Africa, mining companies are struggling to hire suitably skilled entrants to the industry, despite a youth unemployment rate of 55 percent.[30]

New regional talent pools

But in certain countries the picture may be less bleak. India and Brazil are investing heavily in training and educating future engineers for the mining and metals industries. Some companies have succeeded in hiring large numbers of workers in regions where mining is not a tradition. Robert (Bob) Wilt, the Chief Executive Officer of Ma'aden Saudi Arabia, says his biggest challenge is to fill vacancies for skilled labor. But he is optimistic his company can continue to attract talented Saudi nationals. "I have seen here an amazing adaptability of talent to new industries and concepts," he says.

Align human capital readiness with sustainability goals

Trevor Hart of KPMG points out that, "increasingly, major mining companies operate in remote locations and are rolling out significant training programs, or they build alliances with educational institutions in the countries where they operate. Mining companies must understand what skills they need and have a plan on how to acquire them. Money alone won't do the trick."

Metals and mining companies are also finding that improved ESG practices help attract the best and brightest. "In Australia, there is a workplace culture focused on mine safety," Hart says, "But now that concept is going deeper into the quality of life of those employees, the respect they have for each other, and how the corporate culture will encourage people to stay."

[29] CNBC, "Why the U.S. has a serious mining worker shortage" (8 December 2023).
[30] Engineering News, South Africa, "Mining's inability to absorb youth raises questions about its sustainability" (16 June 2023).

One reason is that metals and mining companies have, in the past, been slow to change focus from regarding labor as a cost to viewing it as human capital.[31] What is needed is stronger leadership from the CEO down. Companies that optimize their human capital have three distinctive capabilities:

- They plan for future human capital needs.
- They invest to maintain the productive capacity of existing human capital assets.
- They make strategic investments to build new human capital assets.

A sense of purpose for employees is essential

Globally, mining and metals companies have dramatically changed their work practices and culture in recent years, but their reputation as employers may not have kept pace. "Mining companies must create an environment, a strategy, and a story that gives employees a sense of the purpose of an industry you want to work for and why. You need to have a very clear value proposition if you aim to hire the right skills," says Hart.

This message has to resonate not only with workers at the mine face, but also among people in high-technology jobs. "At the top of the digital organization, there is a need for leaders with the skills to understand both information technology and operating technology. The role of chief digital officer has emerged out of this need," says Bhargava of KPMG in India. "When executing the strategy, an understanding of digital technology has to be embedded across the organization. One way of doing this is by organizing 'reverse mentoring' sessions, in which the younger employees can help the tenured and senior colleagues to develop their digital skills."

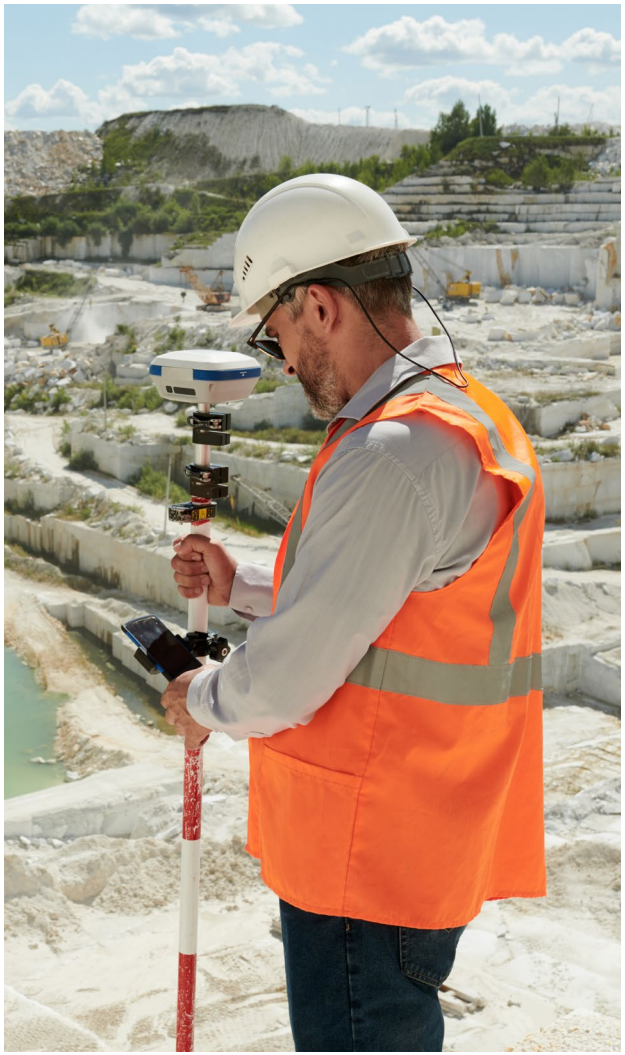
Financial rewards

The search for capital

Companies need to raise billions of dollars of capital if they are to invest in the technologies that will transform their operations. Significantly more executives say it has become easier than say it's become harder to finance large decarbonization projects over the past two years, notwithstanding the global rise in interest rates since 2022. Finance executives are more likely to say it has become a lot harder than those in general management and on the board of directors.

The most promising sources for funding capital projects are loans, grants and incentives from government-backed organizations. Recent financial innovations, such as 'green' bonds linked to sustainability targets, come second.

For producers of precious metals, the fall in prices since 2021 has induced financial caution. "We are looking at the balance sheet proactively, but we need to prepare for low prices for a longer time," says Henning Opperman of Sibanye-Stillwater. "We have got banks to uplift covenants on our debt to give us more headroom and flexibility, and we are looking at alternative financing options, such as streams and pre-pays, so if we need to raise capital, we can do so in a measured way." Streaming has certainly proven lucrative for some financial intermediaries (see sidebar on page 42).



[31] "A new dawn for human capital - energy and natural resources," KPMG in Australia, 21 July 2022.

> **Awareness is growing of 'green' financing options and hence one more avenue of funding is emerging. This is especially relevant for markets such as India, where majors are looking to expand internationally and across metals.**

Amit Bhargava
National Leader, Metals and Mining, KPMG in India

Streaming success

Wheaton Precious Metals, one of the largest precious metals streaming companies in the world, shows how mine financing is changing. It has entered into agreements with 18 operating mines and 23 development projects to purchase all or part of the precious metals or cobalt production for an upfront payment and an additional payment upon delivery of the metal. Patrick Drouin, Chief Sustainability Officer and President of Wheaton Precious Metals, says that its 75 percent profit margins since inception in 2004 have attracted competitors.

Wheaton is a life-of-mine investor. "In terms of due diligence, it's critical we get it right," says Drouin. "As a streamer, we are not debt or equity, but we do exert some influence on the mines even though we have no operational control. We have seen thousands of mines, so we know the best practices and we share them with our partners." Wheaton assumes a price for the commodity produced by the mine and assumes the price will decline by 10-15 percent over five years and then remain stable for the years beyond.

It then calculates the cashflow over the life of the mine and a discount rate that includes such factors as ESG performance and carbon intensity. The discounted rate can range from four to nineteen percent depending on the risk profile of the operation/project and the mining partner. Over, say, a 25-year mine life, "all we need is one cycle in which the commodity price goes higher than the assumed price. We are fairly certain we're going to see at least one upward cycle, maybe two or three," he says.

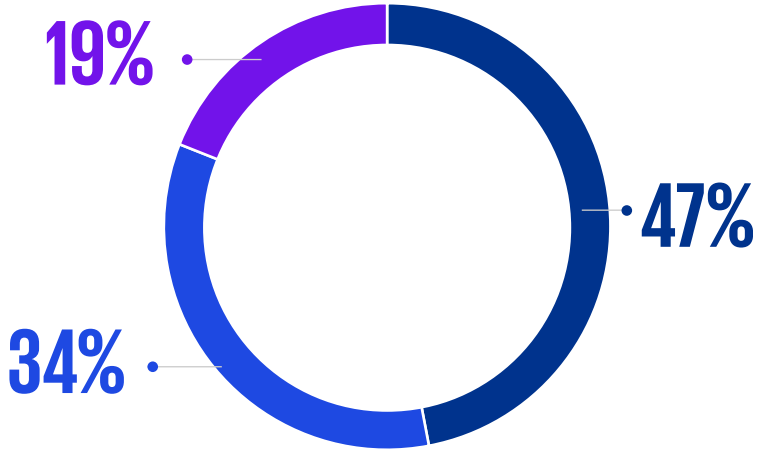
A key to a successful investment in a mine is careful preparation, including on-site visits. "When we do our due diligence, no matter how good a track record the mine says it has, we really dig into it. We want to understand all aspects, from its environmental track record to health and safety, what local communities are saying, what grievances were filed, and what mechanisms there are to deal with them," says Drouin. There are 11 categories and 13 subcategories in its due diligence framework.

Along with financing comes greater scrutiny than in the past. Lenders, investors, streamers and operators are all paying more attention to ESG issues.

Mergers and acquisitions help companies restructure

When it comes to mergers and acquisitions, executives in the survey are not emphasizing them to improve efficiency. M&A receives the lowest priority in terms of driving the transformation of costs and operations. Nor is it seen by executives as an important business opportunity over the next five years. This is surprising because M&A activity in metals and mining, particularly among smaller companies, has been growing, as companies rebalance their asset portfolios to streamline their operations.

Has financing large decarbonization projects or investment in decarbonization technology in your sector changed over the last two years?



- Yes — it's a lot easier to attract debt or equity finance
- Yes — it's a lot harder to attract debt or equity finance
- No — the ease/difficulty of financing has stayed about the same

What are the most promising sources and types of finance for funding capital projects and tech investments?

- **32%** Investments from suppliers, customers and business partners
- **26%** Asset monetization
- **24%** Net profit interest
- **31%** Sale of future output at a discount (e.g., stream financing, off-take agreements, long-term contracts)
- **27%** Insurance companies and pension funds
- **32%** Private equity
- **38%** Loans, grants and incentives from government-backed organizations (e.g., IFC)
- **28%** Customized project finance structures
- **28%** Equities and other types of bonds
- **34%** Recent financial innovations, such as green bonds linked to sustainability targets

> **The unsuccessful bid by BHP for Anglo American is likely to stimulate M&A activity, especially if companies think commodity prices are likely to improve.**

Henning Opperman
Senior Vice-President, Corporate Finance, at Sibanye-Stillwater

"There is a question, though, about when interest rates will begin to decline in the US. But we will see a lot more M&A activity in the latter part of 2024 and into next year."

M&A can be an effective strategy if companies proceed with care. M&A should be seen by executives as an important means of restructuring operations to deliver more value. "If you can acquire existing mines, gaining access to deposits is a lot quicker and more certain than finding, evaluating and constructing a mine, which can take 20 years," says Hart of KPMG.

Metals companies are active, too, sometimes driven by the need to decarbonize or to help others do so. "There is considerable M&A activity among metals companies at the medium-to-lower end of the revenue scale, and they are often acquired by larger and better-capitalized competitors," according to Platania of KPMG in Luxembourg. "This subsector of the industry is highly fragmented, and many will have to merge to afford the cost of decarbonization. We are advising companies on assessing their portfolio of assets and strategically reorganizing them. This does not just mean divestitures, but also the acquisition of strategic capabilities, access to market sectors, and know-how."

One example is Rio Tinto's acquisition in July 2023 of a 50 percent stake in Giampaolo Group's wholly owned Matalco business for $700 million to form a joint venture to manufacture and market recycled aluminum products.[32] Rio Tinto says the joint venture will enable it to provide a broader range of high-quality and low-carbon, primary, recycled, and blended aluminum products, at a time when customers are looking for solutions to lower their carbon emissions.

Key points

- Young entrants to the labor market are seeking intellectual challenges, strong corporate values, and a commitment to rapid decarbonization. Metals and mining companies offer these advantages and need to demonstrate the attractions clearly.
- To compete for talent, metals and mining companies must continue to make progress in modernizing their image for prospective job candidates.
- Metals and mining companies must be fully transparent to financial institutions about the progress they are making toward net-zero goals. They should also adopt the highest standards of work practices, plus a robust plan to reduce carbon emissions.

[32] Rio Tinto, "Rio Tinto and Giampaolo Group enter into Matalco aluminium recycling joint venture" (21 July 2023).

Conclusion and next steps

Five ways to future-proof metals and mining

The metals and mining industries must accelerate the reduction in their carbon emissions while striving to meet the growing demands of customers that are decarbonizing their operations. This is extremely challenging, but there is a big payoff: If they manage a successful decarbonization program, it is likely to transform their overall operations and add business value.

To achieve the goals of metals and mining companies, here are five takeaways for executives:

It's the ecosystem

Metals and mining companies have never needed to collaborate as closely with their customers, suppliers and business partners as they do now. Mining companies are working with car manufacturers to test hydrogen-powered taxis. Metals and mining companies are becoming deeply involved in the electricity-supply business. Open innovation should become the order of the day as executives search for the most effective partnerships in their drive to decarbonize.

Transformative AI

Artificial intelligence and its associated technologies of machine learning and predictive analytics are going to revolutionize every aspect of mining and metals, from surveying ore bodies to the predictive maintenance of electric arc furnaces. To ensure the benefits of this revolutionary technology are maximized and the risks minimized, metals and mining companies must use AI wisely and learn from others in their ecosystem about best practices.

Humans at the heart

Highly skilled people are required not only to keep AI and other new technologies on the rails but also to maximize the benefits and minimize the risks. Metals and mining industries have made great strides to clean up their dirty image to attract the best and brightest. They have a great story to tell, and they need to tell it well. Opening mines and smelters in new regions offers the opportunity to attract new workers who are keen to be part of the energy transition.

Many financial levers

There is an array of financing opportunities, indicating that banks and other financial intermediaries are keen to work with metals and mining companies to help fund their operational transformation. But the area of greatest divergence between expert opinion and the survey findings is mergers & acquisitions. Polled executives do not seem to be paying sufficient attention to the importance of mergers, acquisitions and divestitures as important means of rationalizing asset portfolios. Mining and metals executives must deploy all the financial arrows in their quiver, including M&A, if they are to meet their carbon goals.

Strengthen staying power

The story of the next quarter century for mining and metals companies is essentially one of resilience. They are rightly focused on long-term sustainability for themselves, for their customers, and for the planet. But supply chains are fragile, prices are volatile, and investments take years to bear fruit. Even the most powerful AI systems cannot predict the future with any certainty, given the speed of change. It will require human judgment and human ingenuity to build companies that can recover quickly from adversity, take advantage of new, disruptive trends, and play their full part in the global energy transition.

How this connects with what we do

KPMG firms help mining and metals companies achieve operational excellence and decarbonization through a wide-ranging approach. Leveraging our expertise in transformation and regulatory compliance, we guide companies in navigating the complex landscape of environmental regulations and implementing sustainable practices. Our professionals work across the entire mining lifecycle, from exploration and evaluation to closure, helping clients reduce costs, integrate digital tools, manage asset portfolios, and assess climate-related risks.

The impact of ESG issues cannot be denied. That's why we're committed to strengthening our global ESG offering — backed by the recognition of our responsibility to help build a better future for all.

ESG is the watermark running through our global organization — from empowering our people to become agents of positive change, to providing better solutions and services to clients of KPMG member firms.

KPMG has been recognized as a global leader in the Verdantix Green Quadrant: ESG and Sustainability Consulting 2024.[33] "Through the integration of sustainability into its broader offerings," the report states, "KPMG has enhanced its ability to support large firms seeking to address sustainability concerns holistically."

KPMG has also been named a global market leader by ALM Intelligence in their latest Pacesetter research, "ESG: Environmental, 2023-2024."[34] For KPMG, the report explains, "ESG is everything a business does and how it does it. Therefore, authenticity in an organization's ESG approach is critical to developing a sustainable future.

In addition, to optimize ESG and build sustainability, KPMG works with organizations to embed ESG into the business strategy with board-level support to drive financial value, and effectively communicate goals throughout the organization using ESG metrics to understand KPIs. As a result, KPMG provides an integrated and all-inclusive ESG framework that is embedded throughout the organization to ensure a successful transformation.

Our financing services enable clients to secure the necessary capital for decarbonization initiatives, ensuring they have the financial backing to implement sustainable projects. KPMG firms' digital transformation provisions streamline operations, enhance efficiency, and reduce carbon footprints. By integrating cutting-edge technologies and digital tools, we help companies optimize their processes and improve overall performance.

KPMG's human capital advisory services ensure that organizations are equipped with the right talent and leadership to drive these changes effectively. We work closely with companies to develop strategies for talent acquisition, leadership development, and workforce planning, ensuring they have the skills and capabilities needed to thrive in a rapidly changing industry. This comprehensive approach ensures that companies are not only meeting their current operational needs but are also positioned for long-term success.

Our specialists collaborate closely with organizations to tackle day-to-day operational challenges while crafting long-term growth strategies. This approach is detailed in our latest report, showcasing how our services align with industry needs to foster resilience and growth.

[33] KPMG, KPMG firms recognized as a global leader in ESG and Sustainability Consulting, 2024.
[34] KPMG, KPMG recognized as 'a global market Leader in ESG Environmental Services', Nov 2023

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