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جولات تجارة
Tejarah Talks

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REAL CONVERSATIONS
REAL IMPACT

DIGGING INTO THE FUTURE

INNOVATION & SUSTAINABILITY IN MINING

About Tejarah Talks

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Tejarah Talks is organized by Oman Business Forum in association with the Ministry of Commerce, Industry & Investment Promotion. With a firm focus on Oman's current and future business, export and investment environment, Tejarah Talks is a series of informal, interactive discussions that brings together some of Oman's most inspirational and innovative thinkers and doers to share their stories, insights and ideas with an enthusiastic crowd. It is a platform for positive interaction.

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Talking Point 1

ECONOMIC DIVERSIFICATION & INVESTMENT

Resource-rich nations are moving beyond simple extraction and export. With industrial strategies inspired by Switzerland or Singapore, they are turning geology into policy, using resource wealth to fuel diversification instead of dependency. No longer content to ship raw copper or lithium abroad, they aim to capture value at home and make mining an engine of growth.

Resource Sovereignty

Indonesia provides the textbook example. Its 2019 decision to halt raw nickel exports was no gamble, it was a calculated national strategy that attracted US$2.3 billion in foreign and domestic investment over five years.[1] Smelting capacity expanded, from just two plants in 2016 to more than 60 by 2024. Chile, with its lithium resources has followed a similar path, signalling nationalisation plans to safeguard downstream revenues.[2] The Democratic Republic of the Congo (DRC) whose cobalt output anchors the global EV supply chain has designated strategic minerals to secure higher royalties.[3] These measures are not tactical manoeuvres but strategic plays, signalling to investors and consumers alike that resource sovereignty is now a global reality.

Meanwhile, developed economies are scrambling to secure supply. The US has signed agreements with Mongolia, Zambia and the DRC to guarantee mineral access, while the EU's Critical Raw Materials framework has prompted deals with Kazakhstan, Namibia and others.[4] The pace of this diplomacy underscores a hard truth - the energy transition in Western capitals depends on materials controlled by countries no longer willing to be passive suppliers.

Footnotes

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2 www.gob.cl, National Lithium Strategy
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4 European Commission, EU and US welcome new members to Minerals Security Partnership
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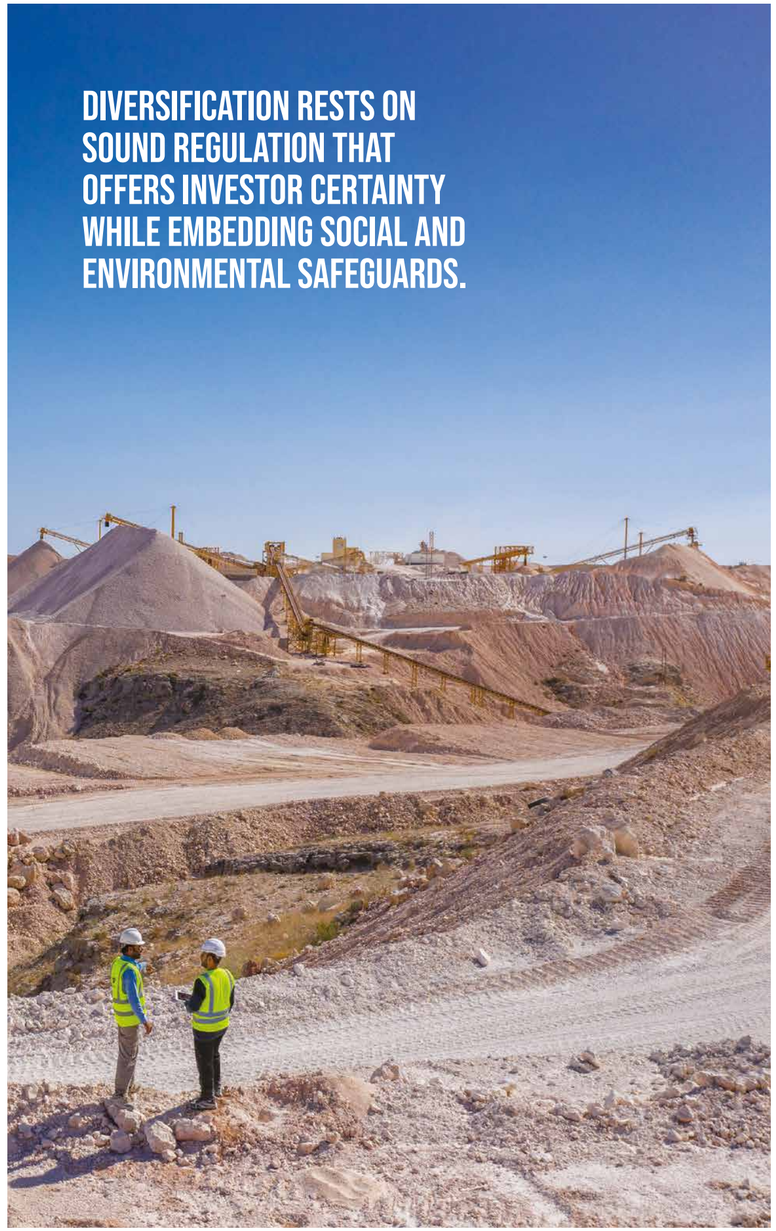
8 World Economic Forum, The green transition requires an upskilled workforce. Here's why

Resource Curse

Yet the path from extraction to transformation is fraught. Except for gold miners, 2024 was a challenging year for the mining industry, revenues and EBITDA - earnings before interest, taxes, depreciation and amortization - for the top 40 global mining companies were down 3% and 10%, respectively.[5] Prices remain volatile - cobalt dropped from US$40 to US$17 per pound between 2022 and 2023, forcing Glencore to cut output.[6] Such turbulence destabilises economies reliant on a narrow mineral base. More troublingly, the resource curse still haunts many countries - weak institutions and poor governance often convert mineral wealth into corruption, enclave economies and worsening poverty once mines close.[7]

Learning from past mistakes, forward-looking governments are building resilient frameworks. Diversification rests on sound regulation that offers investor certainty while embedding social and environmental safeguards. ESG standards, once dismissed as compliance hurdles now function as entry tickets to global capital. While multiple standards create confusion, governments that can harmonise them enjoy a competitive edge. Technology transfer and workforce development are equally important. The World Economic Forum emphasises that training, upskilling and capacity-building generate longer-term economic benefits than extraction alone.[8] Countries that miss this opportunity risk embedding dependence on foreign operators.

DIVERSIFICATION RESTS ON SOUND REGULATION THAT OFFERS INVESTOR CERTAINTY WHILE EMBEDDING SOCIAL AND ENVIRONMENTAL SAFEGUARDS.



Talking Point 1 - Economic Diversification & Investment

Footnotes

9 Muscat Daily, RO192mn mining agreements to boost sector growth

10 Mining.com, Oman's first copper-concentrate export in 30 years

11 MoEM, Establishing a National Company for Mineral Exports: A Strategic Move to Boost Oman's Mining Value

12 US Department of State, Minerals Security Partnership

In August 2025, the Ministry of Energy & Minerals (MoEM) signed three exploration agreements worth RO192 million - US$500 million

Symbolic Milestone

For Oman, this lesson has become central to its mining ambitions. In August 2025, the Ministry of Energy & Minerals (MoEM) signed three exploration agreements worth RO192 million - US$500 million - covering copper, chromite, soda ash, salt and hydrated lime.[9] Earlier this year, Oman exported copper concentrate for the first time in nearly 30 years, a symbolic milestone underscoring its intent to reassert itself in global copper markets.[10] At the same time, Ministerial Decision 18/2025 established the Oman Minerals Trading Company, granting it authority to oversee gypsum and chromite exports, enforce local content and ensure transparent pricing.[11] These are not small adjustments but foundations of a broader framework designed to integrate mining into national industrial policy under Oman Vision 2040.

Globally, the race to secure minerals is driving a new form of diplomacy. The US has paired mineral agreements with development aid, blending hard and soft power.[12] For middle-tier producers without the scale of Chile or Indonesia, stability and geographic advantage are key. Success rests on building integrated value chains that capture margins and skills rather than exporting raw value.

Nothing's Easy

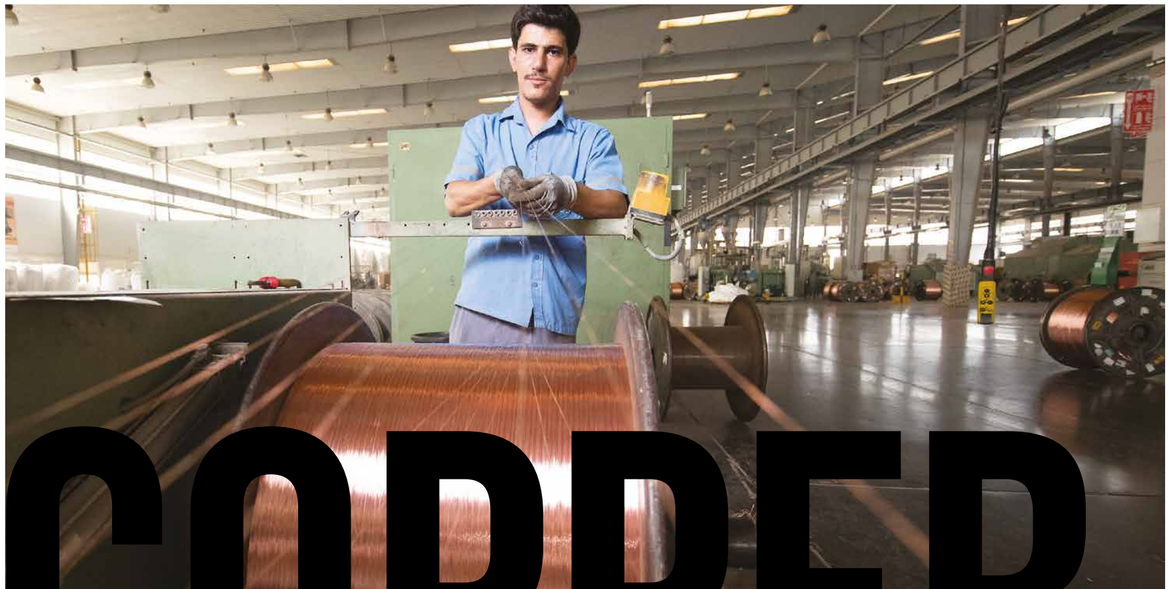
Needless to add, none of this is quick. Economic diversification through mining requires patient investment in education, infrastructure and institutional capacity. Outdated mining codes designed for simple concessions must evolve into frameworks that balance environmental standards, local content and investor clarity. Development agencies are adapting, expanding from poverty relief to supporting industrial policies and technical assistance.

Examples already exist. Botswana's diamond beneficiation program, Rwanda's mineral processing initiatives and Kazakhstan's diversification strategy each show that resource wealth can become a launchpad for broader growth. Though contexts differ, the common threads are long-term planning, institutional strengthening and partnerships. Oman's recent policy developments and re-entry into copper supply chains echo these strategies, suggesting it could very well emerge as a model for mineral-driven diversification in the Gulf.

Talking Point 2

COPPER REVIVAL

Copper has quietly become the linchpin of the global energy transition. Behind the debates about net-zero targets and renewable milestones lies a blunt truth - the clean-energy economy cannot materialise without copper. Unlike other metals, its value lies not in novelty but in ubiquity. Copper is the bloodstream of electrification, woven into every EV, every wind turbine and every transmission line.



Electricity Demand

Global electricity demand is projected to rise 86% by 2050, requiring grid capacity to double.[13] That expansion alone will demand an estimated 427 million tonnes of copper and nearly US$1 trillion in infrastructure spending. Urbanisation compounds the challenge. Underground cabling requires twice the copper content of overhead systems. As cities expand and modernise, copper becomes the invisible architecture of development.

EVs & Copper

EVs are the most striking illustration of copper intensity. Each EV requires around 53 kilograms of copper, 2.4 times the amount used in a conventional car. Wiring alone can stretch to more than 1.6kms per vehicle. By 2030, EV demand is expected to consume 2.8 million tonnes of copper annually.[14]

Renewable energy installations push this number even higher. According to the International Energy Agency, solar and wind projects require 2.5 to 7 times more copper than fossil fuel equivalents with offshore wind the most copper-intensive of all.[15] Solar accounted for 69% of all new electricity-generating capacity added to the US grid in Q1 2025, underscoring the upward pull-on demand.[16]

Supply Can't Keep Up

Yet supply is struggling to keep pace. Chile and Peru, the world's dominant producers, face declining ore grades, labour unrest and social opposition.[17] Russia and the DRC, ranked among the top 10, present geopolitical uncertainty. Exploration spending in the mining sector peaked in 2012 and has since declined for over a decade.[18] The average project now takes 16.5 years from discovery to production.[19] However, experts expect global mining output to grow by 3.5% annually, reaching US$2.3 trillion this year.[20]

This scarcity has redefined copper as a strategic asset. M&A activity has accelerated with BHP and Rio Tinto paying premiums of over 20% to secure new reserves.[21] Automakers, traditionally distant from mining are now investing directly in copper projects, a signal of supply anxiety unprecedented in industrial history. China, meanwhile, dominates refining capacity while consuming more copper than any other country.[22] This concentration of demand and processing capability adds another layer of fragility to global supply chains.

Processing capacity itself is a constraint. Concentrates often travel thousands of kilometres for refining, stripping producing nations of value. Without domestic smelting, many exporters capture only a fraction of copper's worth. Tech advances offer partial relief. AI-driven exploration improves discovery, automated mining systems enhance productivity and new recovery techniques make low-grade deposits viable. Recycling, which currently provides about 30% of copper supply, offers another cushion, though not enough to meet future demand.[23]

Ultimately, price sets the pace. Higher prices encourage new development, spur efficiency and prompt substitution. Yet they also increase costs for renewable energy and EV deployment, potentially slowing the very transitions copper is meant to power.

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Talking Point 2 - Copper Revival

Mid-tier Opportunities

For mid-tier producers this presents opportunities. Countries with modest deposits but political stability and access to Asian markets can attract investment seeking secure alternatives. Oman fits this profile. In early 2025, it exported copper concentrate for the first time in 30 years, a small but symbolic step toward re-entering a critical global supply chain.[10]

Exploration concessions in Al Batinah and Al Wusta are being advanced with plans for a concentration plant capable of processing one million tonnes annually.[25] Together with reforms mandating local content and transparent marketing via Oman Minerals Trading Company, these developments indicate a deliberate strategy to couple copper's revival with domestic industrialization.[11]

Water & Geology

Water scarcity complicates the picture. Many of the world's largest copper deposits lie in arid regions where agriculture and communities compete for limited resources. Oman faces this challenge, making water recycling technologies and efficient processing central to its copper ambitions. Balancing resource development with stewardship will define whether copper becomes a bridge to sustainable prosperity or another fleeting boom.

What is clear is that copper is no longer just another industrial metal. It has become the bottleneck of the clean-energy transition, the test case for how the world manages the tension between ambition and supply.
For Oman, re-entering copper markets at this point provides leverage beyond the tonnes it produces. By anchoring copper to domestic processing and downstream industries it has the potential to turn geology into lasting advantage.

Footnotes

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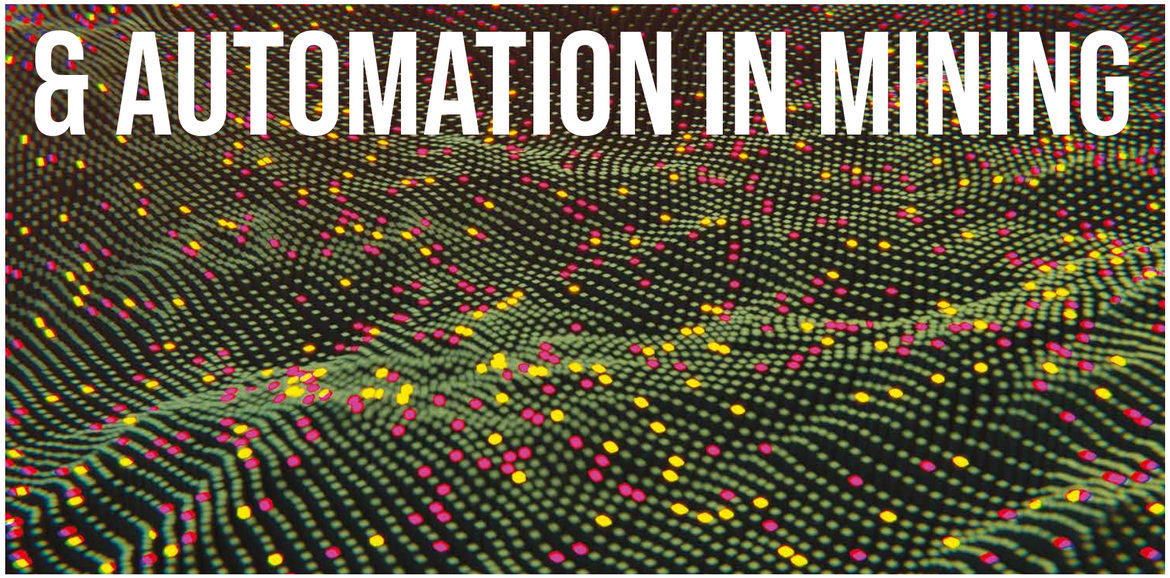
Talking Point 3

ARTIFICIAL INTELLIGENCE & AUTOMATION IN MINING



Mining's digital transformation has moved beyond pilot projects to become an operational necessity. Global spending on AI platforms in the sector reached US$29.9 billion in 2024 and is projected to reach US$685 billion by 2033, growing at a CAGR of 41.87% from 2025 to 2033.[26]

This increase is not technology for its own sake but a strategic response to declining ore grades, remote deposits and rising costs that threaten traditional mining economics.

AI applications now permeate the mining value chain, driving improvements in efficiency, accuracy and safety. Exploration has been transformed by machine-learning algorithms capable of analysing geological, geochemical and geophysical datasets at scale. Firms like KoBold Metals use these models to predict mineral occurrences vital for EV batteries.[27] By focusing drilling on high-probability targets they reduce both exploration costs and environmental disruption.

Eliminating Fatigue

Operational performance has seen equally impressive gains. Predictive maintenance systems interpret sensor data to identify anomalies before equipment fails.[28] This approach lowers downtime, cuts maintenance expenditure and improves safety. Rio Tinto's autonomous haulage systems exemplify this - heavy trucks now run continuously without human drivers, eliminating fatigue risks and reducing exposure to hazardous conditions.[29]

BHP's deployments underscore the industrial potential. At its Spence mine in Chile the company converted its entire truck fleet to autonomous systems in 2024, reporting gains in productivity and safety. At Escondida, AI-powered processing saved more than three gigalitres of water and 118 gigawatt hours of energy in just two years.[30]

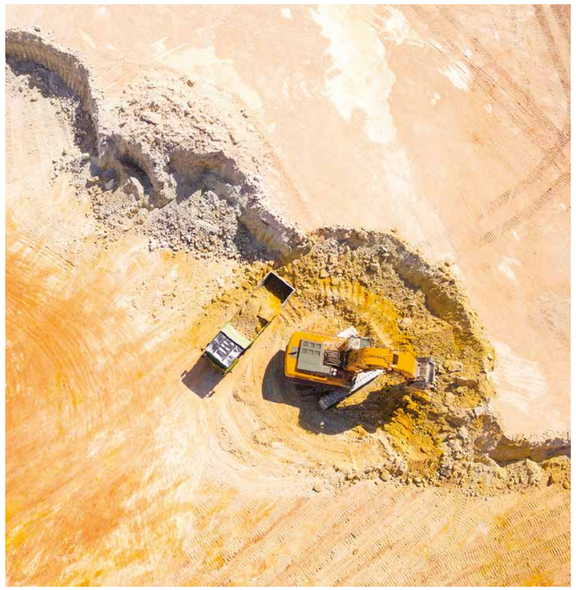
Such advances show how automation is not only boosting profits but also contributing to ESG objectives. Even in safety, innovation is evident - sensor-equipped hard hats now monitor truck driver fatigue through brainwave analysis, alerting operators before accidents occur.

The scale of global adoption is striking. By mid-2024, GlobalData's Mining Intelligence Centre reported 2,080 autonomous haul trucks in operation worldwide. These vehicles reduced accident rates by 80%.[31] Computer vision systems support ore quality monitoring and environmental assessments using real-time image analysis to detect malfunctions or hazards. Drones extend oversight further, surveying vast areas autonomously, gathering geological data and inspecting equipment. Machine-learning models optimise ore processing parameters dynamically, maximising recovery rates while cutting energy use.

Productivity Up 10 to 15%

Mines integrating AI systems typically report productivity improvements of 10–15% and far lower safety incidents. Yet adoption is not without obstacles. Implementation requires heavy upfront investment, from hardware to retraining. Many companies lack the internal expertise to manage AI systems effectively. Data quality presents another hurdle, large volumes of clean, well-structured data are key but many operations do not yet have the collection systems in place. Integration with existing machinery is often complex, given equipment from multiple manufacturers with incompatible systems.

Workforce transformation is another challenge. Traditional mining roles are giving way to new digital jobs requiring advanced technical expertise. Companies must fund retraining while competing for talent against technology industries. Cybersecurity risks multiply as operations become interconnected, creating new avenues for attack. Mines are having to invest in robust defences to avoid digital sabotage.



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Talking Point 3 - Artificial Intelligence & Automation in Mining

Leaders vs Laggards

Despite these hurdles, the competitive advantage of AI is undeniable. Early adopters not only improve output but also build institutional knowledge that develops over time, creating a widening gap between leaders and laggards. For emerging mining jurisdictions, AI provides an opportunity to leapfrog into advanced practices, bypassing older inefficiencies. Success however, demands coordinated planning, investment in infrastructure and workforce training.

Oman is laying groundwork for such an approach. In early 2025, the government announced a revised national AI policy featuring an open-data platform, an AI studio and plans to develop a local large-language model.[32] These initiatives, though broad in scope, will have direct implications for mining by creating a culture of technological capability. Local events like COMEX and DLive 2025 have highlighted automation, cybersecurity and AI integration as priority themes, encouraging collaboration between government and the business community.[33]

The combination of Oman's US$500 million in new mining exploration agreements and its ambitious AI agenda demonstrates intent to align technological adoption with resource development.[9] While mining companies in Oman have yet to deploy autonomous fleets on the scale of Rio Tinto or BHP, the groundwork is being laid. By embedding AI into regulatory frameworks, workforce programs and industrial planning, Oman can ensure its mining revival is not only resource-rich but tech-enabled.

Those who integrate AI and automation will control costs, improve ESG outcomes and secure market confidence. Those who do not will see competitiveness erode. For Oman, where resource potential is emerging alongside a national commitment to digital transformation, adopting AI is key to converting geology into lasting prosperity.

Footnotes

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33 AI Hub News, COMEX 2025: Oman's Premier Tech Exhibition Returns with Global Focus and Five Future-Ready Ecosystems

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Talking Point 4

DIGITAL & CYBERSECURITY CHALLENGES

As mining becomes more digital, it simultaneously exposes itself to risks that extend far beyond IT departments. Mines are now reliant on interconnected systems, remote operations and real-time monitoring. These innovations improve efficiency but also create vulnerabilities where a single cyber incident could disrupt production, compromise safety systems or even cause environmental damage. In this situation, digital infrastructure and cybersecurity are no longer peripheral considerations they are strategic priorities.

Modern mining requires robust connectivity. AI-driven monitoring, remote-controlled operations and predictive analytics all demand high-bandwidth, low-latency internet. Yet many mining regions are remote and lack reliable telecommunications infrastructure. Satellite systems often provide coverage but suffer from latency issues and can be disrupted by weather. Edge computing offers a partial solution by processing data locally, ensuring real-time responsiveness even when connections fail. Still, this requires new investment in hardware and technical expertise at mine sites.

Terabytes of Data

Data management is another challenge. A single mine can generate terabytes of data daily from equipment sensors, drones and environmental monitors. Storing, processing and protecting this volume of information requires scalable systems. Cloud platforms provide flexibility but many companies remain wary of handing sensitive operational data to third parties. Concerns over sovereignty and security push some to build private data centres with redundancy and disaster recovery systems, an expensive undertaking.

Under Attack

Today, mining companies are increasingly targeted by organised crime. The motives range from financial ransom to disruption of critical supply chains. Industrial control systems which often run on outdated software are especially vulnerable. An attack that disables these systems could bring operations to a halt. Supply chains introduce further risks, since compromised software or hardware supplied by third parties can open the door to attackers.

Human factors compound the problem. Phishing attacks remain one of the most common entry points for cyber breaches and mining employees are not always trained to recognise them. Regular awareness programs are key. Regulatory compliance adds another layer of complexity, as companies working across multiple jurisdictions must adapt to varying standards for data protection and cybersecurity.

Defensive strategies require comprehensive planning. Incident response systems must be ready not only to restore IT functions but also to safeguard worker safety and environmental standards in the event of a cyberattack. Insurance for cyber risks has become more expensive and harder to secure with insurers demanding stronger safeguards before granting coverage.

Investment in cybersecurity infrastructure cannot be a one-off expense. Threats evolve constantly, requiring continuous upgrades to detection systems, firewalls and employee training. Partnerships across borders are also vital, given that many cyber threats originate in other jurisdictions. Industry groups and government agencies play a role in facilitating intelligence-sharing.

Digital resilience is emerging as a central pillar of Oman's development strategy. The country ranked fourth globally among developing economies for attracting FDI in ICT infrastructure projects between 2020 and 2024, according to UNCTAD's World Investment Report 2025.[35]

Central Cyber Defence

To strengthen security, the Oman National CERT serves as the central cyber defence hub for both public and private institutions.[36] Oman Vision 2040 places digital transformation at the forefront, while the Ministry of Transport, Communications & Information Technology is driving entrepreneurship in AI, blockchain and IoT technologies critical to building secure digital mining operations.[37]

As mentioned earlier, in early 2025, Oman introduced its new national AI policy which includes provisions for data governance and transparency.[38] While not specific to mining this framework is important to the sector which will increasingly rely on AI-driven operations and data-intensive decision-making. COMEX 2025 also placed digital resilience, automation and cybersecurity at the heart of discussions, signalling that industry stakeholders understand the risks and opportunities.[39]

By building secure digital infrastructure now, Oman positions its mining sector as a trusted environment for investment. With new exploration projects valued at over US$500 million, ensuring that operations meet global standards for cybersecurity will be a prerequisite for attracting international partners.[40]

Footnotes

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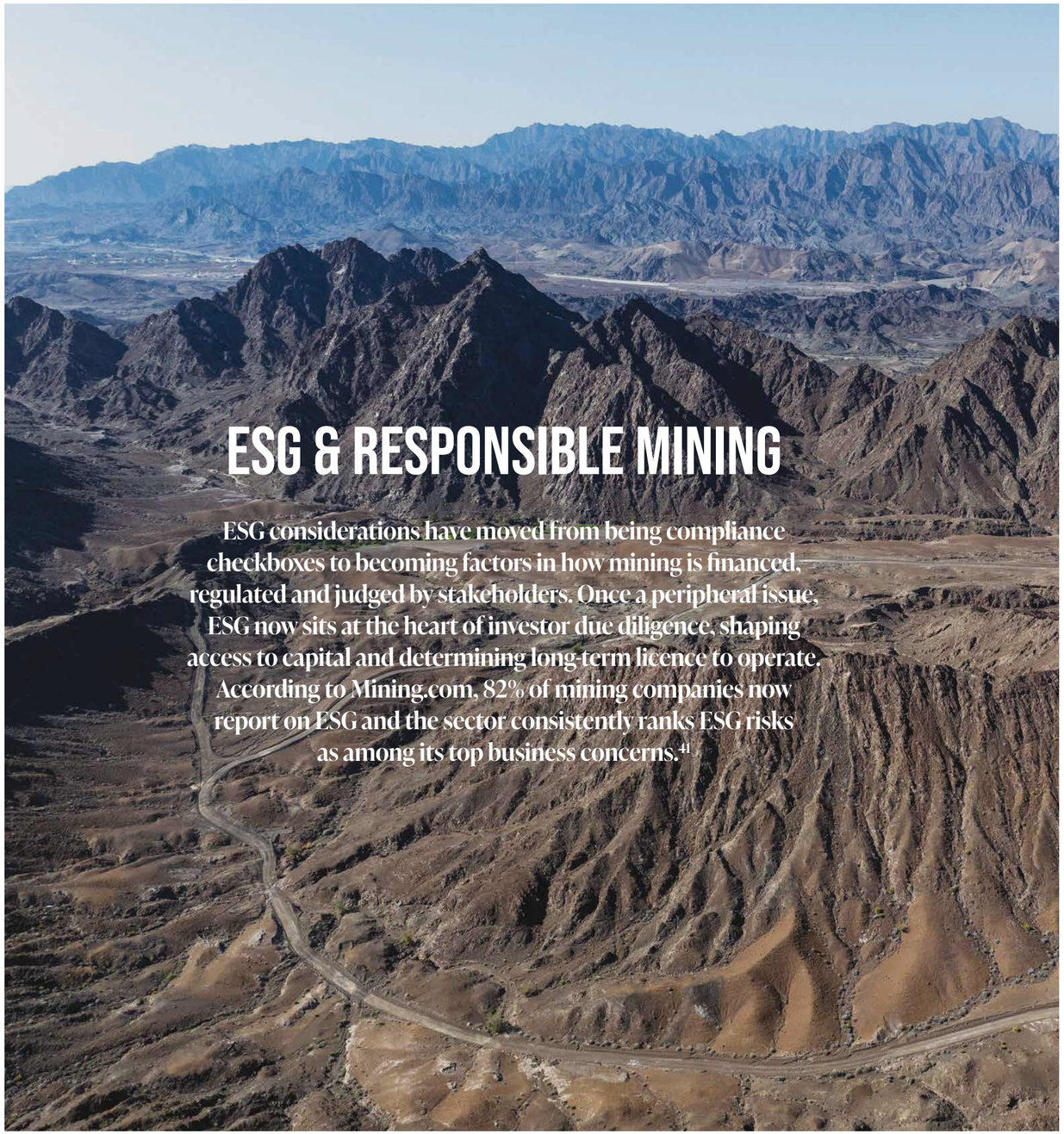
Talking Point 4 - Digital & Cybersecurity Challenges

DIGITAL RESILIENCE IS EMERGING AS A CENTRAL PILLAR OF OMAN'S DEVELOPMENT STRATEGY. THE COUNTRY RANKED FOURTH GLOBALLY AMONG DEVELOPING ECONOMIES FOR ATTRACTING FDI IN ICT INFRASTRUCTURE PROJECTS BETWEEN 2020 AND 2024, ACCORDING TO UNCTAD'S WORLD INVESTMENT REPORT 2025.

Talking Point 5



ESG & RESPONSIBLE MINING

ESG considerations have moved from being compliance checkboxes to becoming factors in how mining is financed, regulated and judged by stakeholders. Once a peripheral issue, ESG now sits at the heart of investor due diligence, shaping access to capital and determining long-term licence to operate. According to Mining.com, 82% of mining companies now report on ESG and the sector consistently ranks ESG risks as among its top business concerns.[41]

Sustainability-linked Finance

This change is not cosmetic. A White & Case analysis found that 80% of surveyed executives believe growth and decarbonisation are not mutually exclusive.[42] Increasingly, companies demonstrate this alignment through sustainability-linked finance. Canadian Lundin Mining, for example, restructured US$2.5 billion of credit facilities to include performance targets tied directly to ESG metrics, affecting the interest rates applied.[43] Financial markets are embedding ESG into the cost of capital itself.

Climate action remains the leading focus. Net Zero Tracker notes that half of the world's largest companies have announced net-zero commitments, though questions remain about the credibility of their implementation.[44] Investors are no longer satisfied with vague promises. They expect detailed, credible plans that address not only Scope 1 and 2 emissions but also Scope 3 across the value chain.

Alongside climate, biodiversity has moved up the agenda. The Taskforce on Nature-related Financial Disclosures (TNFD) is guiding institutions to integrate natural capital considerations into decision-making.[45] Mining companies are responding by addressing ecosystem preservation alongside emissions reduction. The connection is now widely recognized - climate stability and biodiversity resilience are mutually reinforcing goals.

Handling Waste

Tailings management has become an urgent ESG issue. High-profile failures have drawn global attention, prompting the International Council on Mining & Metals (ICMM) to align its members with the Global Industry Standard on Tailings Management.[46] The newly established Global Tailings Management Institute will enforce compliance, supported by technological innovations like real-time monitoring, bioremediation and biomining. Today, investors now demand assurance that tailings risk is systematically managed.

Footnotes

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44 MSCI, Charting Transition Finance: Our Transition Finance Tracker
45 TNFD, TNFD Essentials: A Beginner's Guide to Nature-Related Financial Disclosures
46 ICMM, Tailings Management: Good Practice Guide

Talking Point 5 - ESG & Responsible Mining

1 Ethical Business	2 Decision Making	3 Human Rights	4 Risk Management
5 Health and Safety	ICMM Mining With Principals		6 Environmental Performance
7 Conservation and Biodiversity	8 Responsible Production	9 Social Performance	10 Stakeholder Engagement

Diversity, Equity & Inclusion

The social dimension is evolving too. Diversity, equity and inclusion frameworks are gaining traction. The ICMM's DEI commitments and the Towards Sustainable Mining protocol on equitable workplaces reflect recognition that diverse teams not only improve safety and decision-making but also strengthen community relationships.[47] Workforce diversity is no longer treated as a reputational matter but as a driver of operational performance.

Governance is catching up too. The IFRS Foundation's new global sustainability disclosure standards merge previous frameworks such as SASB and TCFD, creating a baseline expected to be adopted by regulators in dozens of jurisdictions.[48] This harmonisation will improve comparability but also expose companies with weak ESG performance to sharper scrutiny. Board competence is another issue. A PwC/BCG/INSEAD survey found that only 27–47% of directors have sufficient ESG knowledge across key issues like climate, human rights and diversity.[49]

Tech & ESG

Technology is being enlisted to improve ESG performance. Satellite monitoring, predictive analytics and AI-driven systems allow for real-time tracking of emissions, water use and biodiversity impacts.[50] This enables proactive interventions rather than reactive compliance. Supply chain responsibility is also gaining momentum. Regulations such as the EU's corporate due-diligence laws will increasingly demand traceability of sourcing, human rights protection and environmental safeguards.[51]

Footnotes

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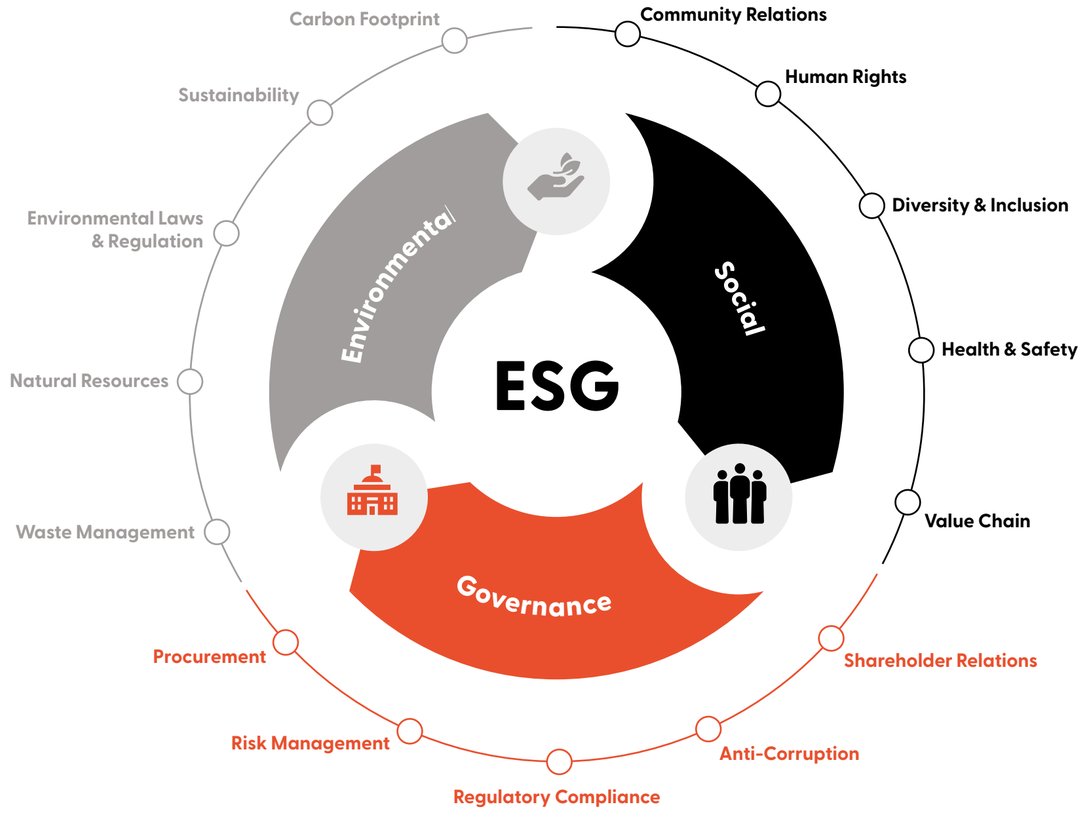
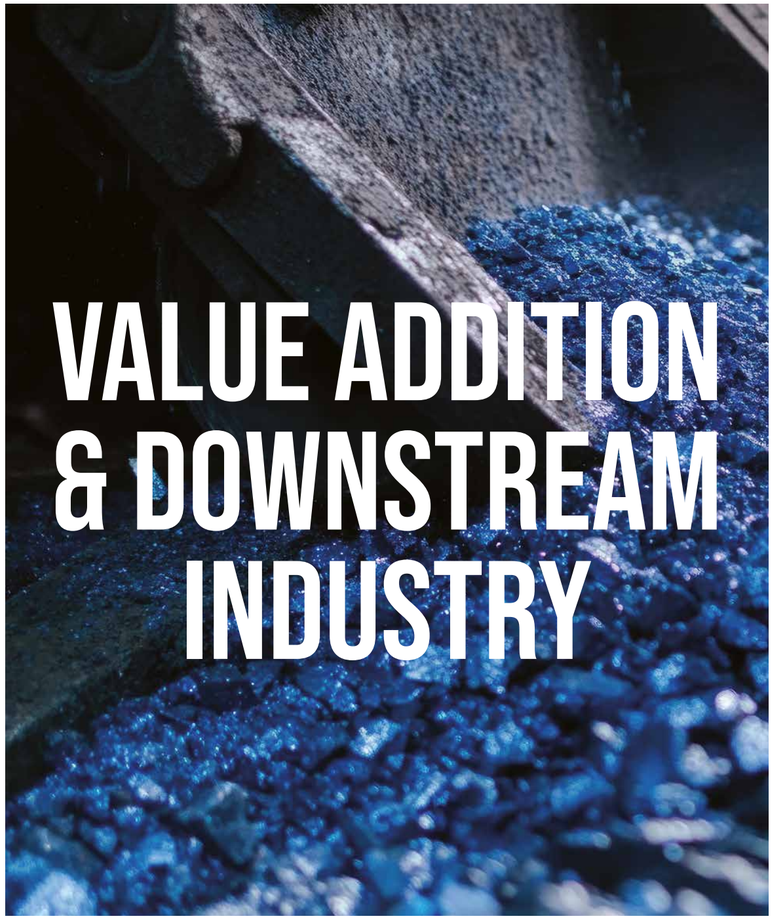
Industrial Policy

For Oman, ESG is now built into industrial policy. In June 2025, Oman inaugurated its first industrial-scale facility in Suhar that converts copper tailings into high-purity cathodes using renewable energy.[52] Beginning at 60 tonnes per year with a target of 12,000 by 2026, the plant embodies the ESG promise of turning waste into value while reducing environmental footprints. Oman's exploration agreements worth US$500 million explicitly reference job creation, sustainability and downstream value, ensuring that growth aligns with community and environmental goals.[53] Ministerial Decision 18/2025, establishing the Oman Minerals Trading Company also integrates ESG concerns into regulation by enforcing transparency, local content and environmental safeguards.[54]



Talking Point 6



VALUE ADDITION & DOWNSTREAM INDUSTRY

Value addition is where mineral policy stops being a conversation about royalties and becomes a discussion about industrial development. Countries that once shipped ore now ask a tougher question - how much of the process can sit at home while still staying competitive. As mentioned earlier, Indonesia's long-running experiment tightened export rules and catalysed a wave of smelting.

The DRC is attempting the same play in copper and cobalt. The Buenassa deal introduces the country's first integrated refinery with a state golden share, a model designed to keep upside at home while inviting private capital to carry technical risk.[56] Mali's new gold refinery near Bamako follows a similar logic, aiming to process up to 200 tonnes a year and formalise trade that once leaked across borders.[57] These moves are not copy-paste. Energy pricing, logistics and skills decide what kind of processing is viable in each place.

This is where ambition often collides with physics. Smelting and chemical conversion are energy-hungry. A comparative study shows that industrial electricity prices and reliable generation are decisive in downstream competitiveness, more so than tax holidays or licensing tweaks.[58] Even where power is affordable, the right technology is not guaranteed. The Natural Resource Governance Institute notes that the optimal depth of value addition varies by mineral - coarse beneficiation can make sense for some ores, whereas advanced chemical processing for battery materials demands sophisticated engineering, strict quality control and consistent feedstock. It also warns that blunt export bans can unintentionally reduce mine investment where local processing is not viable.[59]

Community Backed

Environmental and social impacts also change when processing arrives. Facilities sit closer to towns than open pits do. Air emissions, water intake, waste acid and tailings call for new monitoring regimes and public engagement. Community support becomes a daily practice, not a clause in a license. Quality assurance is another hurdle. Buyers expect tight specifications and reliable delivery, meaning laboratories, certification systems and trained operators who can keep a plant inside tolerances at all hours.[59]

Done well, value addition anchors clusters. Skills migrate across companies, suppliers grow around the plant, logistics improve and the tax base broadens. Done poorly, expensive assets idle when power flickers or reagent prices spike.

Upstream Activity

Oman is building its own downstream path with an eye on these lessons. Three exploration and industrial agreements signed in August 2025 covering copper, chromite, soda ash, salt and hydrated lime, ties concessions to domestic processing and jobs.[60] Earlier in 2025, Oman exported copper concentrate for the first time in 30 years, signalling that upstream activity is back on the map.[61]

Oman is advancing industrial-scale mineral projects that showcase both innovation and scale. In Suhar, a new plant converts copper tailings into high-purity cathode using renewable energy and closed-loop water systems—starting at 60 tonnes a year and expanding to 12,000 tonnes by 2026. In chemicals, the Sohar Titanium project is set to produce 150,000 tonnes of titanium dioxide annually once operational. Meanwhile, the Al Shuwaimiyah initiative in Dhofar will tap abundant deposits of limestone, dolomite and gypsum targeting export markets in India, East Asia and Southeast Asia where demand for industrial minerals continues to rise.[62]

For such projects to succeed, however, sequencing matters. Power must come first, followed by logistics then plants aligned with both mineral mix and market demand. Training has to move beyond the classroom onto the factory floor while financing must account not just for capex but also for working capital and regular upgrades. Countries that follow this path build capabilities that endure long after a single deposit is exhausted.[59]

Footnotes

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Talking Point 7

BATTERY MATERIALS & SUPPLY CHAIN DEPENDENCIES

The clean-energy economy turns on a handful of minerals, yet the production and processing of those materials remain concentrated in a few places.

Under climate-driven scenarios, lithium demand could be 40 times today's level by 2040, with graphite, cobalt and nickel rising roughly 20 to 25 times.[63] Supply chains are long and fragile. Nevada based Redwood Materials estimates that active materials can travel tens of thousands of kilometres before they land in a cell and that China controls large shares of lithium and cobalt refining and an overwhelming share of rare-earth processing.[64] The US now lists around 50 minerals as critical for batteries and clean-tech manufacturing which frames the scale of coordination required across mining, processing and logistics.[65]

Extraction alone will not solve bottlenecks. Processing capacity is the tighter chokepoint because it requires chemistry, quality control and reliable utilities. Lithium-iron-phosphate chemistries help by removing cobalt from many entry-level EVs while improving safety and cost, though energy density is lower than in nickel-rich systems.[66]

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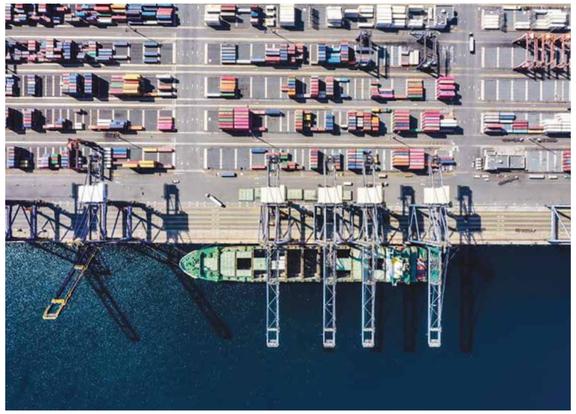
Change Underway

Policy is still moving resources into place, but the mix has moved. The 2022 US Inflation Reduction Act created large-scale incentives for EVs and batteries. However, in July 2025 Congress repealed the consumer EV credits with effect after 30 September 2025, while most manufacturing support remains in place under tighter foreign-entity-of-concern rules. Meanwhile the Bipartisan Infrastructure Law has already awarded more than US$3 billion to projects for battery materials, components and recycling, with additional Department of Energy funding opportunities this year.[67] In parallel, the US, the EU and partners continue to build mineral-supply alliances. For example, through the Minerals Security Partnership to diversify sourcing and encourage responsible production standards.[68] Tech firms are also closing gaps, American Battery Technology Company is commercialising integrated extraction and refining routes intended to lower cost and environmental impact for battery-grade materials.[69]

Even with this momentum, time remains the enemy. From site permit to commercial output, most new facilities will not arrive until the latter half of the decade, exactly when demand accelerates.[70] Financing is another constraint. Each plant can cost hundreds of millions of dollars and investors want offtake certainty and clear environmental standards.

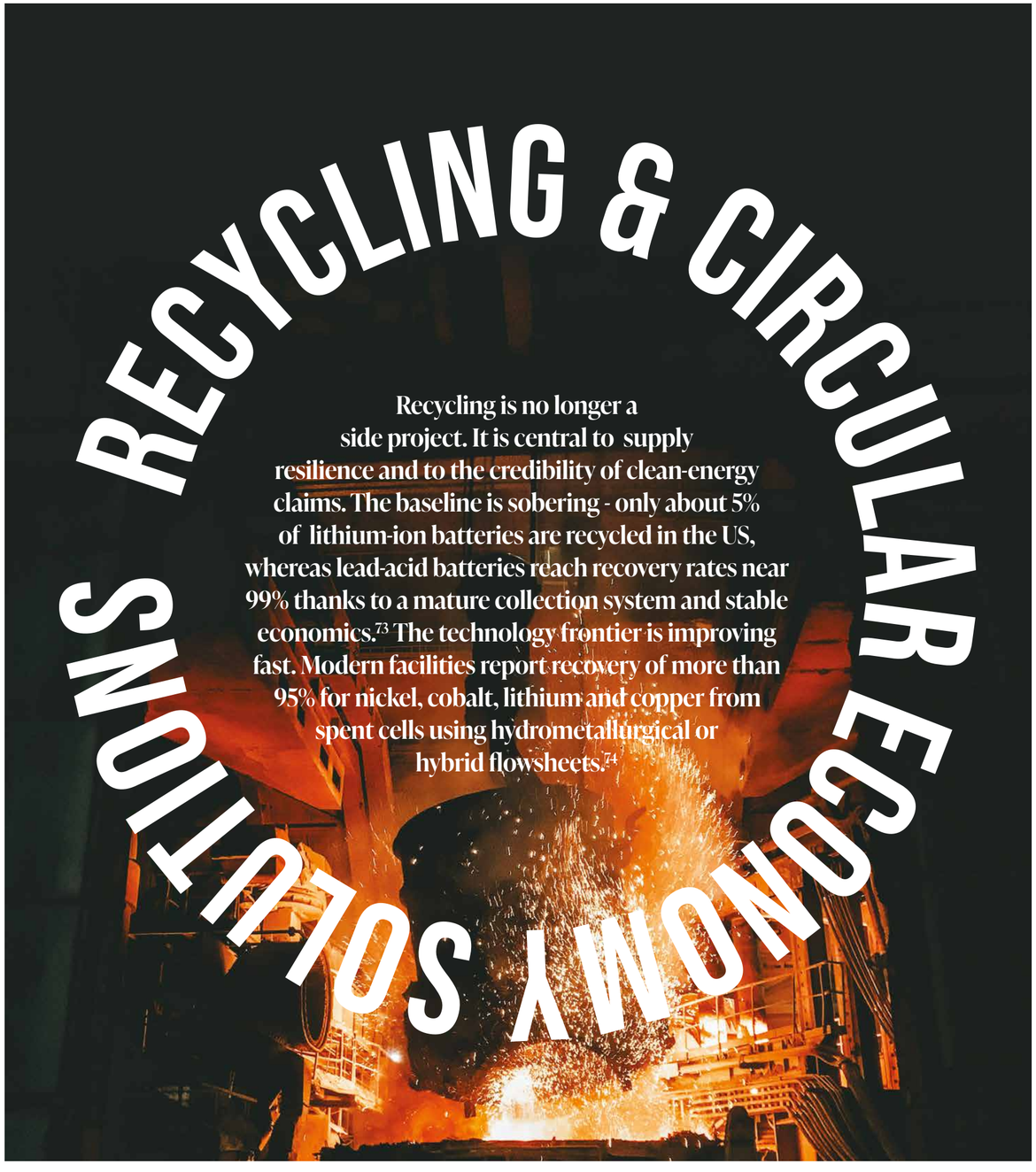
Sohar Freezone



This is where Oman has started to position itself. In June 2025, Zhongke Electric committed about US$1.1 billion to a lithium-ion battery anode materials complex on Sohar Freezone, planned in two phases with total capacity of 200,000 tonnes a year.[71] On the circular side, Starsun Sohar obtained land for a US$3 million lead-acid battery recycling facility and the Al Thail Group operates a greenfield plant that refines roughly 10,000 tonnes per annum of lead bullion under advanced environmental controls.[72] These projects sit alongside new exploration agreements positioning Oman on the map not only as an exporter but as part of the regional materials network.

The supply chains that win will be diversified rather than cheapest on paper. They will embed ESG standards from mine to cathode, invest in recycling at scale and build quality systems that can survive commodity cycles. Geography still matters, yet the edge will come from industrial discipline and the ability to learn quickly across extraction, processing and logistics.

Talking Point 8



Recycling is no longer a side project. It is central to supply resilience and to the credibility of clean-energy claims. The baseline is sobering - only about 5% of lithium-ion batteries are recycled in the US, whereas lead-acid batteries reach recovery rates near 99% thanks to a mature collection system and stable economics.[73] The technology frontier is improving fast. Modern facilities report recovery of more than 95% for nickel, cobalt, lithium and copper from spent cells using hydrometallurgical or hybrid flowsheets.[74]

Footnotes

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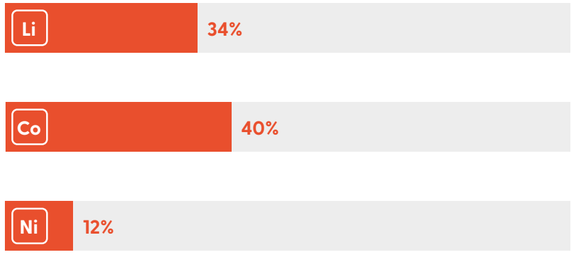
The economics are turning. Benchmark Minerals Intelligence projects that recycled feed could meet roughly 34% of global lithium demand by 2040, around 12% of nickel and about 40% of cobalt with the market for recycled energy-transition minerals growing several-fold to approach US$200 billion by mid-century.[75] Regulation is pushing in the same direction. The EU's Battery Regulation 2023/1542 mandates minimum levels of recycled content in active materials by 2031 then raises the bar again in 2036, a timetable that is already shaping investment decisions.[76] In the US, over US$3 billion from the Bipartisan Infrastructure Law targets battery materials and recycling capacity, while state-level rules on producer responsibility are spreading.[77] Automakers are building closed-loop models with Tesla and Redwood Materials among the early examples where end-of-life cells feed new production lines.[78]

Global Demand of Recycled Feed by 2040



Chemistry & Formats

The bottlenecks now are collection, safe handling and sorting. Lithium-ion batteries arrive from phones, e-bikes, storage systems and cars, each with different chemistries and formats. Logistics companies need training for fire risk, recyclers need diagnostic tools to identify state of charge and plants need flexible flowsheets that can handle mixed black mass without losing yield. Direct-recycling routes which preserve cathode structure could reduce energy use and chemical consumption further, although they demand consistent sorting and quality control to work on a commercial scale.

Reduce Reuse Remake

Oman's early moves show how a mining jurisdiction can plug into the circular economy. The Suhar facility that converts legacy copper tailings into high-purity cathode uses renewable electricity and closed-loop water, which turns waste into feedstock while cutting environmental footprint.[52] On the battery side, the lead-acid ecosystem is taking shape through Al Thail Group's operating smelter and the planned Starsun plant, anchoring a domestic loop for a product that already enjoys high global recovery rates.[72]

Recycling will not replace mining but it will reduce peaks in primary demand, stabilise prices and cut exposure to geopolitical chokepoints. The winners will invest early in collection, data and safe logistics then pair that with adaptable plants and strong quality systems. That is how recycling becomes a core supply source rather than a public relations line.

Talking Point 9

TALENT SHORTAGE & SKILLS GAP CRISIS

Mining now faces a people problem. Enrolment in mining engineering courses in Australia, for example, has fallen by about 63% since 2014, while US mining graduations are down roughly 39% since 2016.[79]

The trend is structural. Young professionals weigh purpose, lifestyle and location differently from previous generations and the industry's reputation has not kept pace with its technical evolution.

At the same time, work itself is changing. McKinsey estimates more than 100 million workers worldwide may change occupations by 2030 as automation and digital tools spread.[80] In mining, as much as 30% of predictable manual tasks could be automated with roles moving from pit to control room and from remote camps to city-based operation centres.[81] Firms now need people who can read data, manage algorithms and collaborate with environmental scientists as easily as they can plan a blast.

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Education – Industry Links

The education response is uneven. Universities are adding AI, ESG and data modules to classic mining degrees but curricula often trail industry needs. Apprenticeship models that blend classroom and site rotation remain the most reliable way to build competence quickly, an approach the Mining Industry Human Resources Council highlights in its work on structured pathways and assessment.[82] Professional credentials are being updated to include digital literacy, environmental stewardship and community engagement so licences reflect new realities.

McKinsey&Company

McKinsey estimates more than 100 million workers worldwide may change occupations by 2030 as automation and digital tools spread

Money's Not the Answer

Compensation alone will not fix the problem. Many graduates want hybrid work options, clear advancement routes and employers that can prove environmental performance.
Safety training has to expand beyond falls and vehicle incidents to include autonomous equipment protocols and cyber hygiene for connected systems. Mobility of skilled professionals brings both risk and benefit, draining some countries while spreading know-how globally.

Oman views human capital as a strategic asset. MoEM graduated the first cohort of its two-year Mining Competencies course in 2024, run with instOG and built around geology, design, feasibility and site visits that expose participants to international practice.[83] In the wider labour market, the National Employment initiative, supported by advisory partners, aims to align training with industry demand and build routes into technical and supervisory roles.[84] Avoiding a narrow focus on entry-level hiring, these efforts target transferable skills so workers can move across sectors as Oman's economy diversifies.

The companies that win the next decade will be those that take workforce planning as seriously as they take reagent supply or fleet maintenance. That means investment in early outreach, modern training, mentors who can translate old craft into new tools and leadership development that prizes curiosity alongside safety.

Talking Point 10

DIVERSITY TRAINING & FUTURE WORKFORCE MODELS

Diversity and training are no longer side projects, they are the backbone of a workforce model that can keep pace with autonomous fleets, AI-driven planning and tougher ESG expectations. Women remain under-represented across mining roles even though research shows mixed teams make better decisions, improve safety and build stronger community relationships.[85]

The Mining Industry Human Resources Council's (MiHR) Gender Equity in Mining eLearning tackles obstacles head-on, from diagnosing structural barriers to preventing harassment to applying inclusive practice in day-to-day operations.[86]

Training methods are changing too. Virtual and augmented reality let teams practise heavy-equipment operation or emergency drills without stepping into hazardous areas, a boon for remote sites where classroom time can be rare and travel costly.[87] Public-private partnerships help translate these tools into careers. The Mining Potential pathway, designed with MiHR and industry partners, targets women, youth and newcomers with essential skills training and site-based learning so graduates can move into real jobs quickly.[88]

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Local Headcount

Careers will not be linear. Micro-credentials and online badging allow workers to assemble skill stacks that match specific roles, then refresh those skills as technology evolves.[89] Local content policies are also widening expectations. Countries such as Ghana, South Africa, Tanzania and Zambia now embed localisation into permits, yet the intent is not just local headcount. The goal is a ladder into technical and management positions, which means companies must co-invest in training facilities, mentoring and transparent promotion criteria.[90]

Community-based models add another layer. In Canada, partnerships with First Nations demonstrate how culturally grounded training and mentorship can respect traditional knowledge while building technical capability.[91] UNCTAD argues that mining towns should leave with more than pits and tailings, they should graduate with skills that work in other sectors so local economies survive mine closure.[92] New delivery systems make this easier. Tablet-based modules and satellite links push learning into remote camps and track progress in real time so nobody is left behind.[93]

Talent Pipeline

Oman's tertiary ecosystem - including Sultan Qaboos University, GUtech and Majan University College - offers engineering, geoscience, IT and AI courses that map well to modern mining needs, while national employment initiatives encourage employers to build talent pipelines that last. Omanisation policies are being paired with capability building so companies hire locally, then help those hires develop into specialists and supervisors.[94]

At the end of the day, an employer's brand matters. People compare industries on purpose, flexibility and culture as much as pay. That is why mental-health support, family leave and flexible rosters are no longer perks but part of core retention. Leadership training has to evolve too, preparing mining managers who can run distributed teams, integrate new tech and work with communities as partners rather than audiences.

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THANK YOU
TO OUR PANELISTS & ALL
THOSE WHO ATTENDED

1. Jamal Al Asmi, session moderator
2. Panel deep in discussion
3. Q&A
4. Dr. Salah Al Dhahab, Ministry of Energy & Minerals
5. Eng. Musabah Al Hamdi, Minerals Development Oman

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