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Tracking the trends 2023
The indispensable role of
mining and metals

Introduction

The indispensable role of mining and metals

The world is at a critical point in time, socially, environmentally, and economically. The latest projections by the United Nations suggest that the global population could hit 8.5 billion in 2030 and 9.7 billion in 2050.¹ With a growing population comes a growing demand for the metals and minerals that underpin societal progress. From civil infrastructure to transportation, and technology to agriculture, the products that the mining and metals sector produces, support and enable virtually every sector globally.

The paradox is that, while the need for mined products has never been greater, public opposition to mining activities has never been higher. The green energy transition is expected to be a mineral-intensive one—the International Energy Agency estimates that the demand for minerals used for electric vehicles and battery storage will grow tenfold by 2040.² Yet, at the same time, approvals for projects that could become important providers of critical minerals, such as lithium (see Rio Tinto's Jadar project in Serbia³), are being hampered due to protests. The juxtaposition between need and want is stark, and the gulf between them creates a very real threat to global climate change mitigation.

For too long, the stories told about the mining and metals industry have centered on the negatives. However, the opportunities

that mining and metals companies can offer to provide for and enhance the prospects of the population, as well as the environments they reside in, are vast. Mining underpins approximately half of the global economy⁴ and therefore, it has the greatest potential of any industry to positively influence social, environmental and economic development.

This year, Deloitte Global's Tracking the trends 2023 focuses on the indispensable value that mining and metals companies can deliver, with the emphasis on taking action now for a better tomorrow. In each of these 10 trends, our network of Mining & Metals sector professionals globally offer up expertise, insights, and examples to spark conversations about how mining and metals organizations can make a difference in the world.

Changing perceptions of the industry by putting people and natural capital front and center in strategies; designing organizations and products for circularity; creating safer, more respectful places of work; and innovating together to make the possibility of ultra-efficient mines a reality will be key to creating a healthy, regenerative ecosystem inclusive of people, planet and industry.

We're excited to discuss these trends with you and explore how they will shape your company's future. Thank you for your ongoing support.

Endnotes

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Trend 6

Making change more holistic

Using systems thinking to drive next-level operational excellence

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Achieving operational excellence is a perennial matter in mining and metals. The long-term convergence of factors, including depleting ore grades, waste management challenges, rising costs and labor shortages, have seen companies double down to generate efficiency improvements in recent years. Most now lean heavily on advanced analytics and artificial intelligence-based solutions to produce more minerals with fewer resources and a minimal footprint.

These initiatives have risen even higher up the agenda over the past 12 months driven by the global energy crisis and booming demand for critical minerals—mineral demand for clean energy technologies alone is expected to quadruple by 2050.¹

To sustain important future industrial activities, including manufacturing, civil infrastructure and agriculture, and to support the green energy transition, mining and metals companies must once again step up their quest for operational optimization. In doing so, there is a chance to provide even greater value to stakeholders, speak to new sources of talent and investment, and change perceptions of an industry that is wrongfully thought to shy away from leading edge innovation.

To deliver next-level operational performance requires a new, more integrated, dynamic approach to mining and metals—one that considers the impact of new energy sources, extraction methods and processes holistically across all systems, roles and functions within the business and beyond. This is where systems thinking, design and modeling can add value.

Understanding and navigating complex systems

Systems thinking involves understanding and characterizing a whole system (including the smaller systems within it) by examining the linkages and interactions between its different elements. In practice, it encourages the exploration of interrelationships (context and connections) and the perspectives of each actor, as well as boundaries.²

Systems thinking is widely considered to be critical in handling the economic complexity facing the world in the coming decades.³ It helps us to see the bigger picture, which is useful when seeking to understand how macro-level disruptions, such as climate change or economic evolution, could affect individual companies and their ecosystem of suppliers, customers and stakeholders. Conversely, it also helps us to understand how seemingly micro-level changes in companies or operations can contribute to larger-scale improvements.

The positive power of mining and metals

Increased uptake of integrated systems design and modeling in mining and metals could create a number of new and exciting roles for younger generations—enterprise and business architects, modeling specialists and data scientists—who are looking to contribute to societal and environmental progress in an impactful way. No other industry has the potential to effect positive change to the same degree as mining and metals.

Systems design is a method that is useful when dealing with complex adaptive challenges and events where value conflict is common.⁴ It combines design thinking (an iterative process that seeks to understand users, challenge assumptions, redefine problems and create and test innovative solutions)⁵ with systems thinking.

Dr. Adriaan Davidse, director, Consulting, Deloitte Canada, explains: “Integrated systems design thinking is under-appreciated in mining today, because it’s a design technique rather than a technology. It offers significant potential for improvement, but integrated design thinking needs to go hand-in-hand with integrated systems modeling. The mining industry tends to focus on deploying point solutions, for instance, battery-electric or hydrogen trucks, rather than fundamentally rethinking the mine design, material movement and energy systems to create the best possible system solution. Point solutions may appear simpler, but they tend to be more expensive and often leave inherent inefficiencies and waste in the existing system intact.

“When transitioning to clean renewable energy, for instance, integrated systems redesign could allow mines to capture the benefits at a lower system cost compared to adapting the new energy sources to the incumbent system with minimal change.”

From operational optimization to value chain redesign

Some mining and metals companies have started showing signs of a new way of thinking and operating and are looking to advanced simulation and modeling technologies to rapidly assess the implications of different plans and designs over the long term. For example, mining and metals company, Sibanye-Stillwater, recently engaged simulation specialist, MOSIMTEC, to develop a digital twin of the underground mine, surface logistics

and concentrator at its Nye site in Montana in the United States.⁶

The aim was to create a single intelligent system to predict overall system capacity and schedule delivery of backfill to better match the mine plan. The digital twin integrates with corporate IT systems for data inputs and outputs and can provide the ability to automatically or manually run scenarios to compare risks and surpluses and proactively adjust plans to mitigate bottlenecks. Sibanye-Stillwater estimates that, following implementation of the model, backfill modeling and scheduling now take 20 minutes instead of two to three hours per week, and bottlenecks and sequencing issues can be identified and proactively addressed months in advance.⁷

Another example of the potential that systems thinking creates is in designing mines to be digital first. Rio Tinto did this at its Gudai-Darri iron ore mine in the Pilbara region in Australia. The operation’s autonomous assets are monitored remotely from an operations center 1,500 kilometers away in Perth, and a full digital replica of the processing plant allows teams to monitor and respond to data collected from the plant. The same digital asset data is used to provide an interactive 3D environment for virtual reality training.⁸

Systems modeling can also identify levers as well as potential risks across the value chains and can even be used to rearchitect them completely. OZ Minerals’ Scalable and Adaptable Mining Challenge, the results of which were published in July 2022,⁹ reimagined mine design using flexible and modular solutions. The premise is that new mining and processing methods may unlock access to new deposits, accelerate project development, decrease environmental impact, open alternate ownership models and improve the ability to respond rapidly to volatility.

Inspire Resources teamed up with OZ Minerals and used a systems approach, collaborating with domain experts and equipment suppliers, and applying whole-system models that allowed the complex interactions between elements to be revealed. This allowed the team to prove the hypothesis that an end-to-end simulation of the mining value chain can quantify the value created through flexibility, for example, by simulating management decisions in response to variable renewable power generation and volatile metal prices.

Herman Lombard, partner, Consulting, Deloitte Canada, says: “These examples illustrate how integrated systems thinking, design and modeling are beginning to find their appropriate place in mining. While most applications are currently isolated, the power these tools hold in unlocking larger, more complex challenges and creating new pathways for value means that they will be key in de-risking future technologies, mine designs, and product pathways, and in reducing waste from mining systems.”

Reimagining future mines

Projects like these are a good start, but to make a lasting and impactful change, organizations should also embed systems thinking into their wider work practices, decision-making processes and strategies.

Roland Labuhn, partner, Consulting, Deloitte Canada adds: “This requires visionary leadership as well as support from stakeholders, including educational institutions, investors, Indigenous groups, and suppliers.

“By thinking differently, mining and metals companies have an opportunity to generate new types of value (including social and environmental); to see the full benefit of future technologies and energy sources, such as renewable hydrogen; and to shape a better future for people and the planet.”

Embedding integrated systems design and modeling

- **Think big but start small:** If the organization is new to systems design and modeling, identify process- or operations-level projects that could act as an entry point for applying new thinking and modeling tools. These initiatives will foster valuable skill sets within the organization (for example, soft skills such as the ability to understand complex cause-and-effect relationships and also hard skills in applied mathematics or data science). They will also build confidence in tackling larger, cross-functional or cross-organizational projects at a later date.
- **Curate the tools and knowledge required:** It's rare for a mining and/or metals company to have mature systems design and modeling expertise in-house. If building and maintaining this capacity is prohibitively expensive or impractical, seek out alliances or service providers who can augment and enhance the organization's capabilities. Many software vendors provide off-the-shelf solutions with systems modeling capabilities. Look to these before embarking on costly custom software developments.
- **Involve the ecosystem for holistic transformation:** Digital modeling approaches and tools can speed the transformation process by exploring opportunities at low cost and risk and by making system-level trade-offs visible for decision-makers. But large-scale change also requires changes in the systems that surround and support mining operations. For example, organizations could consider working closely with educational institutions to better align their programs with future industry needs.
- **Strike while the iron is hot:** Even five years ago, large-scale change in mine processes and designs seemed a distant dream. However, today, mounting operational costs and environmental, social, and governance (ESG) requirements make it easier to understand the limitations of current technologies and processes, as well as the need to change how mining organizations develop new solutions. For the first movers, there is an opportunity to capture the greater share of the value-creation potential.
- **Expect resistance to change:** Undertake a risk assessment to identify barriers that could prevent systematic change from reaching its full potential. These could range from resourcing or finance, through to change management. Also consider the implications to your operating model, organizational structure, processes, and key performance indicators (KPIs) to fully unlock the value of each project as most organizations will inherently resist change. Once identified, create a multifaceted plan to help address and overcome these and review it regularly.
- **Create a psychological "safe" space for people to learn:** Learning involves failure and typically, the culture in mining is focused on eliminating failures. While digital approaches and tools don't carry the kinds of physical failures that mining companies want to eliminate, failures in pursuit of learning and developing new practices should be celebrated as praiseworthy rather than blameworthy.

Endnotes

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