

Adopting smart mining tools and practices will enable organizations to optimize mine sites and their enterprises, resulting in greener, safer, more efficient, and more profitable operations.

Creating Value with Smart Mining Operations

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Introduction

IDC defines smart mining as the practice of capturing and utilizing operational and organizational data from across the mining value chain to deliver insights for operational optimization and value creation. Becoming a smart mining operation is achieved through the development and implementation of digitally transformative initiatives. This paper addresses the following topics:

- » Transitioning to smart mining
- » Delivering environmental, social, and governance (ESG) and safety improvements
- » Optimizing assets and processes
- » Requirements for transformation

According to IDC's 2022 *Worldwide Mining Decision Maker Survey*, only 33.9% of mining organizations identified their maturity level as a data-led organization as either managed (22.2% — organizations that utilize integrated data platforms to collate organizationwide information) or optimized (11.7% — organizations with an intelligent IT/OT core that harnesses AI across the business). Of concern, 5.2% of respondents stated that they are not data-led organizations. With IDC's research showing that digitally mature companies consistently outperform their less digitally mature peers, deploying digital transformation (DX) programs in a scalable manner is critical for organizations to remain profitable and competitive. Data management competency is a fundamental requirement of DX programs and an indicator of digital maturity throughout the industry.

In addition to optimizing business processes and operational performance, smart mining also enables the monitoring and improvement of sustainability/ESG performance. IDC predicts that by 2023, 80% of mining organizations will use sustainability KPIs as part of their primary operational control parameters to help achieve their organizational ESG targets. The KPIs currently assessed by miners vary between different operations and organizations but typically include energy and water consumption, CO2 emissions, and safety and environmental incident rates.

AT A GLANCE

KEY TAKEAWAYS

- » Improving sustainability strategy is the number 1 business driver for mining organizations over the next 18 months.
- » Safety performance improvement is the single most important operational initiative for 2022.
- » Solution deployment, implementation, and integration tools and skills have been identified as the top data priority for 2022.

Transitioning to Smart Mining

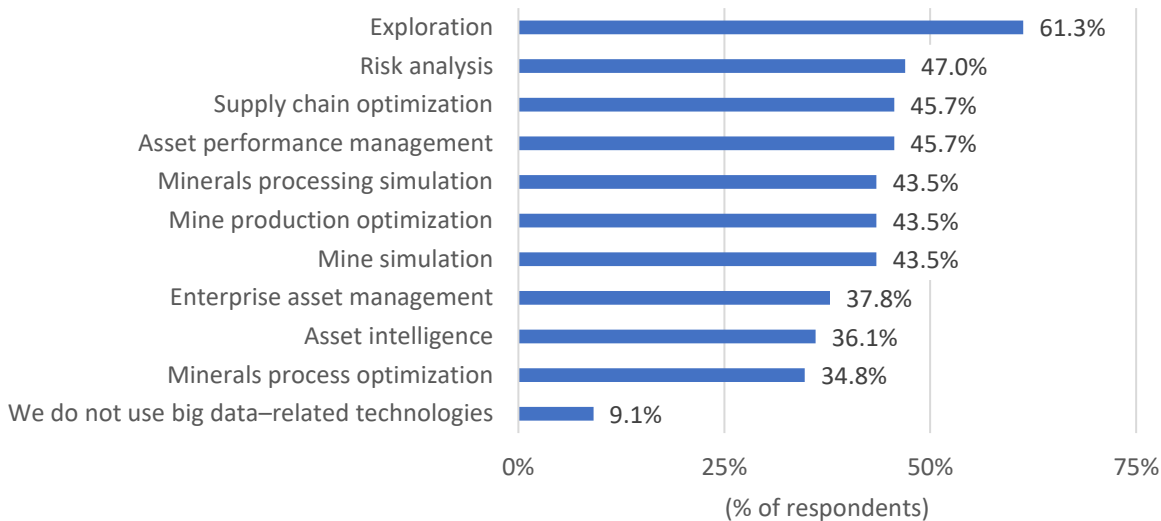
IDC's 2022 *Worldwide Mining Decision Maker Survey* identified declining revenue as the top business concern for miners in 2022. Increasing operational variability, increasing own production, compliance with regulations, and risk of supply chain disruptions rounded out the top 5 concerns. Transitioning to smart mining will enable organizations and their operations to utilize data to address these concerns. The ability to capture, collaborate, and report on data is essential when proving compliance with regulations. Cloud-hosted analytics platforms assisted by wireless communication networks provide the tools for capturing, sharing, and reporting operational and organizational data, dramatically improving regulatory compliance efforts. The use of cloud-based applications also assists in the contextualization of data as it is collected to ensure it is clean and accurate for analysis. By the end of 2023, 59.1% of miners will use cloud-based data analytics platforms.

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Developing databases for optimizing production rates, reducing internal costs, and identifying/rectifying operational bottlenecks is also enhanced through analytics platforms, further quelling business concerns. Figure 1 illustrates the top areas for data analytics platforms usage over the next 18 months. Miners are predominantly targeting operational areas, utilizing these platforms to address major cost contributors, production constraints, asset management, incident prediction/mitigation, and supply chain restrictions.

FIGURE 1: *Top Areas for Data Analytics Platforms*

Q Where will you be using big data/analytics platforms in the next 18 months?



n = 230

Source: IDC's *Worldwide Mining Decision Maker Survey*, 2022

Some major technologies driving the transition to smart mining cover are as follows:

- » Communication infrastructure such as LTE and 5G networks and mesh networks
- » Enterprise systems such as enterprise asset management (EAM) and field service management (FSM) platforms
- » Asset performance management (APM) platforms and other maintenance systems
- » Mine management, planning, and scheduling tools
- » Minerals processing control and management systems

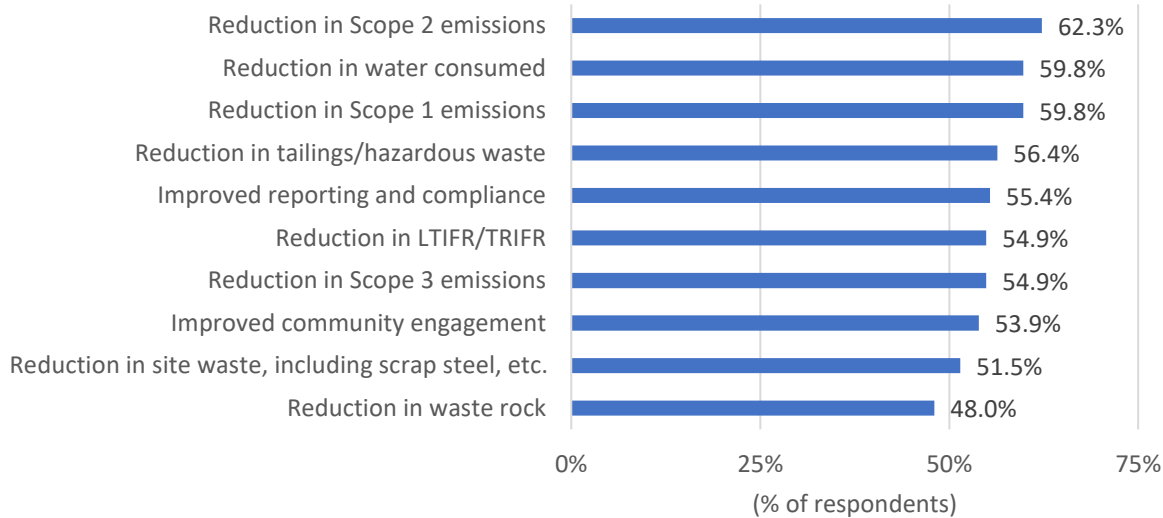
Delivering ESG and Safety Improvements

Enhanced Sustainability

Key stakeholders of the mining industry such as customers, end users, investors, and the communities in which mines operate are demanding mining organizations deliver ESG improvements. As a result of this demand, miners identified improving the sustainability strategy as the number 1 business driver through 2023 and the improvement of safety performance as the top operational initiative for 2022. Similarly, 88.7% of organizations indicated that they had site-specific plans for ESG and sustainability improvements across their business.

Mining organizations are employing many operational technologies across their sites to realize ESG and sustainability improvements as they progress to smart mining operations. For example, many miners are implementing more water-efficient equipment and processes and using connected IoT devices to monitor water consumption. Energy procurement and consumption are also ESG drivers. Obtaining sustainably sourced operational power, transitioning to electrified equipment, and integrating more energy-efficient practices support ESG efforts.

Figure 2 illustrates the ESG and sustainability metrics used across mining operations, with 62.3% of miners relying on a reduction in Scope 2 greenhouse gas (GHG) emissions as a performance metric. Scope 2 emissions are the GHG emissions indirectly produced by a company's consumption of power. As mining operations look to measure this metric, they need to assess where they use power, how much they consume, and the source of their power. Scope 1 emissions are the GHG emissions directly caused by an organization such as through the burning of diesel fuel. Using sensors, digital monitoring platforms, and analytics solutions to assess both Scope 1 and Scope 2 emissions can enable miners to develop plans to reduce the consumption and change energy sources for more sustainable alternatives.

FIGURE 2: *ESG Performance Metrics***Q What metrics do you use to measure ESG/sustainability performance?**

n = 204

Source: IDC's Worldwide Mining Decision Maker Survey, 2022

Improved Safety

More than half of all miners use safety incident rates as an ESG performance indicator. To monitor and maintain personnel safety, mining organizations are deploying connected devices and intelligent workwear supported by FSM platforms. These tools improve communication between workers and enable remote monitoring of worker location and environmental conditions, which helps avoid hazards and reduces incident response times. Monitoring personnel location, especially the precise position of a person in an underground operation, is a crucial factor of mine worker safety and was identified as the top use case when considering wireless communications infrastructure, a critical component for DX improvements. Other leading use cases for wireless networks are the ability to utilize predictive analytics and the ability to connect worker safety devices.

As operations embrace smart mining practices, the adoption of personnel monitoring capabilities is expected to grow from 21.2% currently to 25.8% by the end of 2023, an increase of 21.4%. Over the same period, the number of underground operations that only track if personnel are in the mine or not (as opposed to their precise location underground) is expected to drop from 28.8% to 15.9%. Until operations know the exact location of all personnel underground, workers potentially remain at serious risk in the event of an emergency.

Optimizing Assets and Processes

Optimizing assets and processes across mining operations reduces operational costs through the implementation of improved maintenance cycles, consumables usage, and enhanced labor utilization. The following sections highlight examples of smart mining operational technologies that utilize data from different operational and organizational areas to generate insights that create value for mining companies.

Asset Performance Management

Miners recognize the distinct advantages that APM platforms deliver, and more than 50% of respondents intend to use APM in the next 18 months. The ability to optimize operations with improved data capture and analysis is driving the increased adoption rate of APM platforms and enabling miners to quantify previously hidden expenses, such as the costs associated with unplanned downtimes. IDC expects that 49.6% of mining organizations will have adopted APM platforms by the end of 2023, an increase of 25.2% from 2021 to 2023.

More than 50% of mining organizations intend to use asset performance management platforms within the next 18 months.

Equipment and Process Automation

Automation of equipment and physical processes is set to see an adoption surge: 86.5% of organizations either are currently investing in operational equipment automation or are planning to invest in operational equipment automation within the next 18 months. This will predominantly impact haulage trucks and drill rigs as miners increase their adoption or pilot the use of autonomous mobile machines. Automation of both equipment and physical processes delivers value through greater predictability and consistency of equipment and consumables usage, leading to reduced production and maintenance costs as well as safer operating conditions.

Digital Twins

Smart mining operations are increasingly integrating "digital twins," which are simulations of physical processes and assets created in a digital space. By bringing together many different types of onsite data into digital twins, mining organizations believe that value can be created through the prediction of asset performance (56.5%) and through the prediction of mine process performance (66.1%). For this reason, 18.3% of mining organizations currently use digital twins in various areas of their operations.

Platform Integration

Integrating the different platforms used across mining organizations increases the volume and level of data analysis, which improves each platform's ability to deliver insights. Utilizing platforms to combine data from all of the operations across an organization enables the creation of insights necessary to optimize business processes such as supply chain functions and financial functions.

Requirements for Transformation

Staying abreast of technological developments within the mining industry and deploying smart mining initiatives is critical to ensuring organizations and their operations remain competitive. As the mining industry adapts to long-term changes such as decarbonization and digital transformation, as well as more immediate matters such as supply chain issues, variable commodity cycles, unstable geopolitics, and border movement restrictions, the following actions will play a major part in organizations' ability to remain competitive:

- » **Adopt a holistic analytics platform.** Organizations must ensure that analytics platforms can integrate and utilize insights from other task-specific analytics tools and ensure the insights can be shared across the whole organization.
- » **Identify ways to reduce Scope 1 and 2 emissions.** Sourcing power from renewable assets will require extensive planning and negotiating with existing energy suppliers. Energy use data will play a significant part of those negotiations. Similarly, miners must scope the possibility of running microgrids and improve substation performance.
- » **Improve workforce safety.** Organizations should identify ways in which the workforce and the conditions in which it is operating can be monitored. This can have the added benefit of optimizing workforce time management by pushing updated work schedules to crews in the field.
- » **Develop, recruit, and retain digitally mature talent.** Organizations should utilize external sources to provide digitally mature talent when required to ensure digitally transformative initiatives are successful. Throughout project development, organizations can utilize the third-party talent to organically grow internal talent.

Considering Hitachi Energy

Hitachi Energy serves customers in the mining sector with innovative solutions and services across the value chain. Together with its partners, Hitachi Energy develops technologies and enables the digital transformation required to accelerate the mining industry toward a smart and sustainable future. Its digital tools and energy innovations enable efficient, cleaner electrification in reliable and responsible ways. Hitachi Energy's solutions assist smart mining operations by helping ensure that the power infrastructure is reliable, critical operations run smoothly, workers operate safely and efficiently, and assets run at their peak. Its solutions include Lumada Asset Performance Management, Lumada Enterprise Asset Management, Lumada Field Service Management, LinkOne, e-mesh PowerStore, e-mesh Control, Industrial Communications Networks (TropOS), and Digital Substation.

Lumada Asset Performance Management

Lumada APM provides health and performance insights to prevent critical asset failures while optimizing asset lifecycle costs. The solution enables companies to leverage their online and offline data to drive more intelligent, risk-based approaches to asset management in alignment with industry standards.

Lumada Enterprise Asset Management

Lumada EAM enables peak operational performance and continuous process improvement. Supporting the complete life cycle of complex, critical and costly assets, Lumada EAM includes complete enterprise functionality across asset management and maintenance, scheduling and execution, work planning, supply chain and material planning, multi-entity financial, and people management.

Lumada Field Service Management

Lumada FSM is a scalable and intuitive inspection, maintenance, and repair application. The cloud-based solution equips mobile users to execute work orders in the field safely and efficiently, increasing productivity.

LinkOne

LinkOne is an enterprise graphical parts catalog and content delivery solution for publishing, viewing and finding spare parts for complex equipment and assemblies. LinkOne provides the capability to view and navigate graphical and technical content delivered by publishers.

e-mesh PowerStore

e-mesh PowerStore is a scalable microgrids and energy storage solution which ensures reliable power availability, grid stability, and the highest possible penetration of renewable energy together with an intelligent control system for both grid-connected and off-grid systems.

e-mesh Control

e-mesh Control is a control system for the seamless integration of renewable energy assets with traditional energy assets for maximization of power availability and economic operations. It is designed for grid stabilization, microgrid, and distributed energy resources solutions with application-specific libraries.

Industrial Communications Networks

TropOS provides a mesh network for mining operations to ensure there is robust, reliable connectivity across mine sites. The TropOS portfolio includes software and hardware that are secure and designed to handle the harsh mining environments. TropOS networks provide the communication infrastructure required for transmitting the operational and organizational data needed for digital transformation and smart mining.

Digital Substation

Digital Substation provides customers with control and efficiency. It reduces maintenance requirements and the need for miles of conventional cabling and combines the electrical gear with digital sensors and cloud computing. This combination enables operators to make decisions based on comprehensive, up-to-the-moment information, while predictive algorithms can improve maintenance practices and asset management.

Challenges

The mining industry has traditionally been slower to adopt technology than other industries. This creates challenges when attempting to get buy-in and funding for the digital transformation initiatives that are catalysts to becoming smart mines. The ability for operations to readily adopt new digital initiatives requires some fundamental technologies that many mining operations still do not have, such as robust and reliable communications networks both aboveground and belowground. Despite the slow progress to date, the speed of transformation is increasing throughout the industry, particularly as it continuously looks to create competitive advantages. Globally, mining operations are improving their network infrastructure, greatly increasing the volume of data that can be shared and analyzed, resulting in operational and business improvements across the enterprise.

The increase in operational technology adoption and data analytics also brings the challenge of ensuring organizations have the talent required to operate and maintain operational and analytic applications. Organizations looking to implement business and operational improvements will struggle to compete with other industries when attempting to recruit and retain the digital talent needed to utilize these tools.

Conclusion

IDC believes that mining operations must adopt smart mining tools and practices to remain competitive. With only 33.9% of mining organizations citing their data maturity level as managed or optimized, the remaining 66.1% will struggle to adhere to regulations and remain competitive, particularly the 5.2% of organizations that claim to not be data led at all. Organizations that do not have the digital talent and struggle to identify opportunities should approach third parties for assistance. Forming partnerships and expanding operational ecosystems will enable businesses to operate until they successfully exhaust their ore resources.

About the Analyst



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Ben Kirkwood is a senior research manager for IDC Energy Insights, based in Sydney, Australia. Ben leads research for the worldwide mining practice. His research focuses on the evolution of technology strategies of mining companies and suppliers as they respond to an ever-changing technological landscape. In addition, he supports clients by analyzing maturity, best practices, and technology ecosystem trends.

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