



WHITE PAPER

Overcoming market challenges and reaching ESG goals in the mining, metals, and materials industries

Authored by:

Fernanda Martins

Director, Industry Marketing in Energy and Emerging Markets, AVEVA

Executive summary:

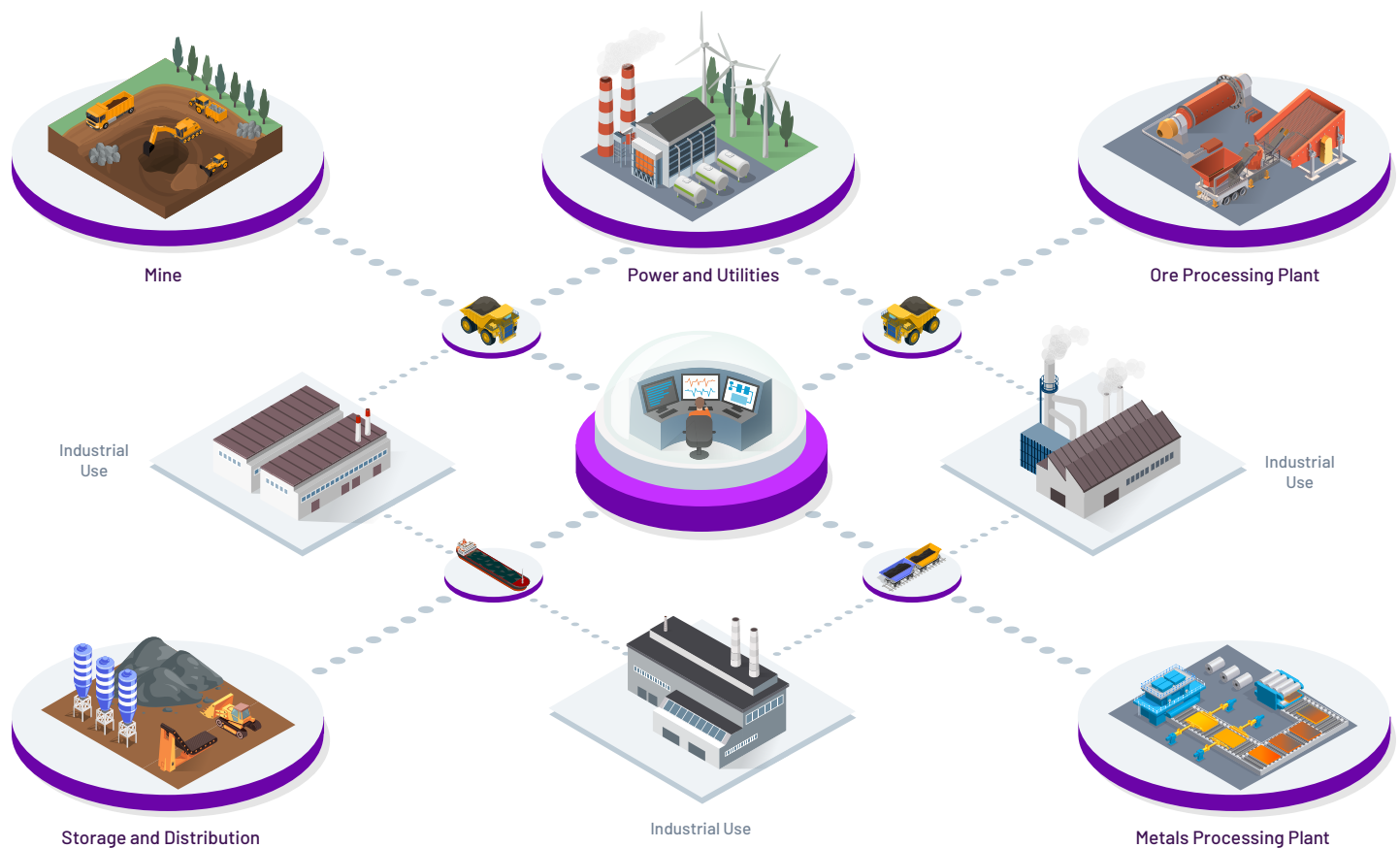
Mining, metals, and materials (MMM) companies face many challenges. Among others, demand shifts and market fluctuations, increased environmental and safety regulations, and a retiring workforce represent significant challenges for the industry. By transforming the way their teams work through the adoption of digital tools that can leverage all available industrial data and turn that information into innovative insights, MMM companies can (1) speed time from concept to full-capacity production, (2) empower the workforce, (3) ensure reliable, safe, and efficient operations, (4) optimize the value chain and increase productivity, and (5) make the best use of precious resources and decarbonize. To accelerate this transformation, MMM companies can undertake one or more of six digital initiatives, powered by the latest advances in cloud, artificial intelligence, big data, and IIoT/edge technologies. Built on open and agnostic industrial software design principles, these digital initiatives can be used by MMM operations today to drive the circular economy and improve the profitability of their businesses.

How digital work transformation unlocks profitability and sustainability

The MMM industry faces a slew of unprecedented challenges. Demand shifts and market fluctuations make it difficult for them to plan and execute accordingly. In the push to mitigate greenhouse gas emissions, minimize waste, and preserve natural resources, governments and industry organizations continue to adopt ever-stricter environmental regulations, which presents MMM companies with a moving target as they strive to stay ahead of new mandates and improve the sustainability of their operations. A retiring workforce invites the real possibility of a shortage of skilled labor, forcing companies to find new ways to transfer institutional knowledge and train new workers.

Aging assets and the pressure to lower costs while investing in substantial capital upgrades continue to shrink already thin margins. In short, the MMM industry will need to surmount many hurdles in the coming decades, and the stakes have never been higher.

Advanced digital solutions represent the best tools MMM operations have to overcome these challenges and improve profitability and sustainability along the way. MMM companies can drastically improve collaboration and efficiency by digitalizing work. Because digital work allows workers to complete tasks from anywhere in the plant, at different sites, or at remote locations, fewer operators can accomplish more, which improves overall efficiency and helps companies build resilience against workforce disruptions.





Not only do digital tools enhance enterprise-wide collaboration, but they can seamlessly unify operations and supply chains, thereby opening new pathways for information flow and breaking down silos. When information is shared via centralized visualization, operators can collaborate on the same information at the same time to identify vulnerabilities in the business and work together to improve efficiency and profitability. Digitalization likewise improves sustainability initiatives and regulatory compliance. Software applications can help operators optimize operations, reduce energy consumption, streamline environmental reporting, and automatically record relevant data in a safe, secure, and non-editable format.

Sharing data also improves the transfer of institutional knowledge and prevents workforce burnout. Even when workers are away from the plant or retire, information is stored in a central digital repository rather than in individual silos or on paper, which means knowledge is retained for new generations of workers to use. By applying analytics to digital data, newer employees can find all the relevant information they need about a given asset. Analytics can alert them about abnormal conditions, which they might have needed to rely on more experienced workers to recognize before.

Digital data augments human insight in new ways. Predictive and prescriptive analytics capabilities can provide early detection of anomalies and recommend the best mitigating action. However, companies can only apply these tools when there is automatic capture of digital data. Artificial intelligence (AI) and machine learning can aid operators in analyzing vast amounts of data to make informed decisions. Despite market disruptions and volatility, MMM companies are finding success by adopting new ways of working collaboratively in digital environments. These new ways of working, based on common data platforms and global visibility, help companies become more profitable and advance the circular economy.

To succeed in the future of the industry, mining, metals, and materials operations must:

1. Speed time from concept to full-capacity production
2. Empower the workforce
3. Ensure asset reliability, efficiency, and safety
4. Optimize the value chain and increase productivity
5. Make the best use of precious resources and decarbonize

Speed time from concept to full-capacity production

Capital expenditures represent a significant risk for MMM companies. Traditionally, capital projects have been delivered late and over budget, eating away at profit margins. However, as the MMM industry moves toward sustainable and net-zero goals, capital projects are unavoidable. Mandates and market demand are putting pressure on companies to build new green facilities, requiring companies to replace or upgrade aging assets. There is little room for cost overruns and delays. To be successful, companies must strategically manage portfolios for better capital employment and ensure capital projects are delivered on time and on budget.

A digital engineering approach increases visibility, awareness, and collaboration, ultimately allowing teams to execute projects faster and deliver new products to meet market demand. With access to a single source of truth for operational data and real-time insights, teams can streamline engineering and capital project execution by evaluating multiple scenarios faster. This approach allows engineers to make the right decisions to optimize KPIs related to profitability, carbon emissions, and overall sustainability of the future facility (or modernized facility). With better visibility, companies can better monitor budgets and schedules, empowering teams to improve project handover to operations and overall engineering efficiency, which reduces CAPEX and OPEX costs.

The K+S Potash mine is located near Saskatchewan and is the first greenfield potash mine in the world. A massive undertaking, the project is valued at more than €3.1Bn and required 11 different EPC firms to work on the mine simultaneously. Traditional handover processes were not enough to make this project successful; the complex and distributed nature required constant information-sharing across all teams and disciplines using a single trusted information management infrastructure. The mine deployed a common platform to easily share all project data, which increased project execution agility while enabling efficient handover to operations.



Learn how K+S Potash improved project consistency and handover with a digital engineering approach

Empower the workforce

Like so many industrial operations, the MMM industry has a labor problem. The workforce is aging and knowledgeable staff are looking to retire soon, while the industry as a whole is experiencing high turnover. Traditionally, MMM companies have taken a conservative approach to digitalization, but low levels of digitalization make it difficult to recruit a new generation of workers. These workforce disruptions as well as a lack of uniform KPIs and visibility can impact both operational safety and productivity.

To succeed in the future, MMM companies must build a connected workforce and allow for remote operations. A connected workforce starts with an industrial information infrastructure to enable full visibility and awareness in the plant and across the enterprise. With the right information at the right time, teams can optimize production and the value chain, increase asset health and performance, streamline engineering and capital project execution, and accelerate process design, innovation, and learning—all from any location. Not only will these digital initiatives allow companies to attract and retain new workers, but by standardizing around digital tools companies can improve training methods, create standard benchmarking, comparisons, and KPIs, and increase workforce efficiency.

Italpress Gauss builds machines and automatic work cells for light alloy casting. The company deployed a custom HMI and remote maintenance solution to create a common vision and strategy, using AR/VR for live remote maintenance and service assistance as well as training. This approach allows operators to have better situational awareness. Now, the company has remote support and maintenance capabilities, which enables teams to collaborate virtually to solve any asset problems wherever they might arise.



Learn how Italpresse Gauss created a custom, first-of-its-kind remote maintenance solution

Ensure asset reliability, efficiency, and safety

The pressure to do more with less

Statistic: 16x more rock and energy are required to produce copper today than in 1900¹

The MMM industry is asset-intensive and, unfortunately, many of those assets are aging and expensive to repair. Unreliable assets not only pose a significant risk, but they can also affect availability, quality, and production results. When combined with increasing regulations, MMM operations must make strategic decisions to improve safety performance, maintenance strategies, and overall asset health and performance.

A successful asset optimization strategy starts with visibility into performance—and that starts with an industrial operational data infrastructure. Using a combination of real-time and historical data and advanced digital tools, teams can quickly identify performance issues, prioritize maintenance needs to maximize reliability and availability, extend the asset lifecycle, and make repair-versus-replacement decisions. From there, operators can identify optimal setpoints to improve efficiency, optimize the value chain, improve compliance with government regulations, and meet environmental, social, and governance goals. By taking a proactive approach to maintenance and repair decisions, MMM operations can enable optimal recovery while ensuring safe, efficient operations.

Votorantim Cimentos wanted to reduce maintenance costs and improve asset reliability to reduce downtime and increase productivity. Accomplishing these goals required Votorantim Cimentos to better understand its asset performance, predict asset behavior, and implement a predictive maintenance program.

To get there, the company deployed an interface that allowed data to be shared across its teams as well as a combination of predictive analytics and machine learning tools. By giving users access to the insights they needed to make informed decisions, the company saved a total of \$88M across all of its sites, boosted asset reliability by 6%, and reduced unplanned maintenance costs by 10%.



Learn how Votorantim Cimentos optimized its asset performance strategy

Optimize the value chain and increase productivity

The demand for digital

Statistic: 82% of metal players see digitalization as the top priority in their strategy²

MMM companies are under pressure from all sides. Pricing volatility, demand shifts, supply chain complexity, and market fluctuations are just some of the hurdles MMM operations face. New market demands surpass current mining production capabilities, putting strain on existing operations. Raw materials and resources, such as lithium, are difficult to access, and the industry is under pressure to move to battery electric vehicles (BEVs), further cutting into already slim margins. Companies must optimize their value chains and find new ways to increase productivity, quality, and capacity while maximizing margins if they are to succeed in the future. With the right digital tools, MMM operations can overcome these challenges and improve their operations in tandem.

¹ <https://www.angloamerican.com/~media/Files/A/Anglo-American-Group/PLC/media/presentations/2020pres/mark-cutifanis-speech-at-mining-indaba-2020.pdf>

² <https://www.mckinsey.com/industries/metals-and-mining/our-insights/how-digital-and-analytics-can-unlock-full-potential-in-steel>

By leveraging data management tools and strategies, MMM operations can implement short-interval control methods across the value chain. With more accurate operational data and a model-driven execution process, companies can improve product quality, reduce waste, increase energy efficiency, and build the agility they need to respond to shifts in supply and demand.

Centralized data management also enables companies to optimize the planning process so they can capitalize on spot market prices and improve ore forecasts from the mine to the processing plants to allow for maximum recoveries. When mines reduce consumable costs and process delays to improve C1 cash costs they can justify lowering cut-off grades. Overall, this results in larger reserves and longer mine life.

Newmont, formerly GoldCorp, deployed an industrial information infrastructure that allowed operators to simulate recovery. **Watch how** Newmont increased zinc recovery by 4% within six months and achieved the equivalent of four-to-five days of additional production.

MMG Limited implemented a production management system to standardize asset utilization across five mines globally. By standardizing around one production management system, MMG aimed to define the maximum sustainable rate for processes, achieve the appropriate level of automated data capture at the instrumentation and data collection layers, standardize the time usage model (TUM), cause codes, and classification matrix, and adopt new work practices.

This initiative helped MMG achieve better equipment utilization, perform root-cause analysis of “less than perfect” utilization of assets, and integrate with other systems to enable single sign-on (SSO). Overall, the global operating platform helped MMG improve productivity and efficiency, simplified root-cause analysis, and increased asset utilization by at least 10% across the sites.



Learn how MMG Limited standardized its global operating platform

Make the best use of precious resources and decarbonize

Sustainability is no longer optional; both regulations and the market demand that MMM companies work towards carbon net-zero and ESG compliance goals. As natural resources and raw materials dwindle, companies must reshape traditional business models to ensure a sustainable future. However, achieving sustainability goals is no small feat. Companies must upgrade old assets and design new facilities that are geared toward green operations and increase both transparency and accountability, all while ensuring license to operate.

Achieving sustainability and ESG goals requires visibility and awareness across the production and value chains. By centralizing data management strategies and enabling remote operations, companies can increase asset health and performance and ensure processes are running as efficiently and sustainably as possible—all while keeping teams safe. With the right tools, MMM operations can democratize insights throughout the value chain, making every team member a key stakeholder in performance and sustainability initiatives. Using the combination of real-time data and advanced tools, teams can accelerate process design, innovation, and learning to build better and more efficient engineering cycles to upgrade facilities and lower emissions and waste. Together, teams can reduce the overall carbon footprint and improve compliance with government regulations and ESG goals.

The Barrick Goldstrike mine has three active air quality operating permits. With strict compliance requirements, the mining operation had to consolidate its data into monthly compliance logs for review by the State of Nevada Bureau of Air Pollution Control. While data was primarily obtained in its centralized information management infrastructure, teams still had to manually record data in the field. To streamline its data collection process, Barrick deployed a data contextualization layer to manage its data through condition-based analytics and notifications. Not only did the solution eliminate complex and time-consuming spreadsheets, but it also created an organized hierarchy that could adapt and scale with the permits and automatically generate compliance logs. Overall, the solution reduced environmental deviations by 45% and fan trips by 61%, ensuring license to operate.



Learn how Barrick Gold transformed air quality compliance

Six digital initiatives that will transform the way your teams work

According to LNS Research's recent "Industrial Transformation in 2021: Getting Real" research spotlight, half of industrial enterprises report they have embarked on a digital transformation journey, and these programs are yielding very real benefits. LNS found that leaders in digital transformation are 72% more likely to have increased revenues by more than 10%. They are 57% more likely to have reduced cost of goods sold (COGS) by more than 10% because of these initiatives.

Many MMM operations wonder where to start their own digital transformation journey and which steps can be quickly taken to catch up with competitors that were early adopters of digital technologies. To successfully transform the way they work and address their business imperatives, MMM companies should incorporate the following six digital initiatives into their digital transformation strategies.



Conclusion

According to the White & Case MMM [2022 report](#), approximately 40% of respondents view ESG and climate-related activism and regulations as the biggest threat to the industry. However, with the right digital strategy, ESG and regulations are also an opportunity to build sustainable business models and find new ways to engage the workforce. To ensure that their strategies are successful, MMM companies must lay the digital groundwork to transform the way their teams work and spark the industrial ingenuity of their staff.

Through the digital initiatives outlined here, powered by the latest technology enablers, MMM companies can build their industrial information infrastructure, upgrade their engineering and operations applications to accelerate value creation, and visualize and share their industrial information to foster collaboration both within their teams and with their value chain partners. By undertaking these initiatives, MMM operations can streamline engineering cycles, empower their workforces, optimize value chains, make the best use of precious resources, and achieve operational excellence to drive the circular economy and ensure profitable and sustainable operations.

About the author

Fernanda Martins is Director of Industry Marketing in Energy and Emerging Markets at AVEVA. She holds a B.Sc. in chemical engineering from the Universidade de São Paulo and a post-graduation degree in business administration. Fernanda started as a process engineer working on big projects for refineries in Brazil. Her career evolved around software and technology. In almost 20 years of experience, she has helped companies adopt and explore various transformational solutions in areas like process simulation, optimization, and workforce enablement for operations and maintenance. Currently, she is responsible for marketing for the entire AVEVA portfolio in the process industries globally. Her main activities include market research and analysis, global marketing campaigns, content creation, and supporting AVEVA and customers to build a sustainable industry.

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