Engaging employees to use analytics: How mining companies solve the adoption challenge

Advanced analytics can drive value only if employees use them to make decisions. But adoption is often the biggest stumbling block in analytics initiatives. Here's how to get it right.

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In a capital-intensive industry like mining, productivity improvements can have a major bottom-line impact. For that reason, advanced analytics can generate immense value, helping leaders optimize processes, reduce downtime, and inform on-site decision making.

But the mining industry is highly complex. Plants operate like small cities, with hundreds of people and thousands of pieces of equipment. Nearly every process requires specialized expertise and careful choreography. Metallurgists have to adjust procedures for site conditions. Dispatchers have to keep trucks moving in just the right sequence. Mine engineers must continually tailor mine plans. Knowing what measures to dial up or pull back on to keep the operation humming is both an art and a science.

These complexities have slowed the adoption of analytics. For an artificial-intelligence (AI) or other advanced-analytics program to succeed in a mining context, metallurgists, operators, planners, and other stakeholders need to buy into the effort. But many don't—at least not initially—because they assume their expertise is too specialized to be codified as an analytics tool or that the initiatives will be managed by others with no operational context.

However, some large mining operations have bucked this trend. They are deploying analytics at scale and building widespread adoption. For example, real-time data on location and road conditions helped an open-pit mining operation increase material-movement efficiency by 5 percent. Superior modeling helped a copper mine increase throughput and recovery by 10 to 15 percent. And sensors on dump trucks and other equipment helped a coal-mining company lower fuel-consumption costs by 15 percent within the first two months of implementation.

What are these businesses doing right? We looked at 140 analytics implementations across multiple mining operations to understand the conditions that create success. What we learned is that engaging experts and frontline users, fostering ongoing collaboration, and maintaining a zealous focus on impact are keys to driving adoption and value. If an industry as complex as mining can find a successful

way to build and scale analytics, other industries can do the same.

Here are six ways that analytics leaders drive adoption.

1. Build analytics products with domain experts and influencers

Adoption requires users to trust the analytics. That can be hard to do in mining, where any deviation from the OEM manual, the mine plan, or the "rules of metallurgy" is viewed as suspect. One of the most effective ways to engender trust is to get metallurgists, process leaders, and other subject experts directly involved in the development effort. Doing so allows experts to kick the tires of the emerging models and gain confidence in the analytics. Engaging them also enables higher-quality output, which helps to make sure the right data and variables are factored into the design in formats that users can understand and apply. At one mine, for example, process-control experts were key participants in creating a tool for a semi-autogenous (SAG) mill. Their hands-on involvement resulted in a nimble tool capable of calibrating how much water the mill should use for different grinding speeds and the right bearing pressure to apply for different types of ore.

Expert engagement should continue in the field. The process experts in the previous example transitioned the model for use in the mill. Having learned to parlay business needs into analytical terms and vice versa from the development team's "translators" (individuals with a blend of technical and business skills who serve as a critical interface between the analytics experts and the operators and domain experts), the mine's experts could now provide similar translation on site. Their close involvement helped to continually inform and improve the analytical model, ensuring the underlying logic is sound and the outputs actionable.

Including these influential leaders had another benefit. As they became invested in the success of the project, they helped operators and others at the mill gain trust in it as well. Their buy-in served as an organic form of internal marketing. As organizations evolve their analytics capabilities, such internal

marketing can become more ingrained, led by marketing experts and supported by a clear go-to-market framework to spread a clear understanding of the new solution across all levels of the company.

2. Establish a shared understanding at all levels

Analytics can mean different things to different people. At one mining company, for example, the senior decision maker who sponsored the analytics initiative had one set of objectives. But middle managers tasked with overseeing the implementation had their own ideas for how the program should run. Meanwhile, business-line leaders—whose people and processes would be affected by the analytics—had only an arm's-length understanding of the program details. As confusion swirled, delays mounted and team members moved on to other projects, with the result that the program never advanced beyond the pilot.

Organizations can avoid disconnects like these by creating a shared understanding of the program's top-line objectives and appointing a product owner with the leadership clout and managerial skills to drive the initiative. The product owner and her or his team should strive to make the inner workings transparent and explainable. Data governance also is crucial. Data must be well organized and accessible, with core dictionaries, terms, and formulas standardized. Leaders, designers, and users need to know the major sources of data being used and the way the algorithm's recommendations are generated; this knowledge drives trust and acceptance of the model at the frontline level.

Communication is essential to the success of analytics initiatives. A clear messaging and awareness-building campaign establishes support, and tailored training programs equip employees to succeed. Before leaders at one mining company embarked on an initiative to improve haul-equipment productivity, they invited the site's general manager and the mine's general manager and hauling manager to an alignment meeting. Together, the meeting participants outlined the business objectives. Once the project was under way, project leaders scheduled monthly showcase meetings to walk business executives, mine dispatch operators, field-mine operations supervisors, and haul-truck operators through their progress, soliciting input and answering questions. Biweekly reviews with the mine manager and hauling manager went deeper, delving into the analytics development and logic to ensure that performance tracked with the overall business objectives. They complemented these conversations with on-the-ground training for end users, a process that allowed team members to acquire new certifications and equipped project leads to provide upward feedback on how the design team could further refine the models. The communications discipline created a positive atmosphere: key voices felt heard, negative surprises were eliminated, and interest in the program grew.

Communicating success stories is equally important. Organizations that see the greatest returns on their analytics investment share the results company-wide. In forums, newsletters, and other formats, these leaders demonstrate not only what the new models do but also how they make the company better. Wrapping the analytics effort within the context of a company's larger transformation can make the initiative feel more relevant and more engaging.

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3. Integrate analytics into existing workflow processes

The more familiar and intuitive a model is, the more likely it is to gain acceptance. Tailoring the interface to the specific user context, configuring steps to mirror the ones users would normally take to complete a particular task, and integrating the analytics into core processes can make new systems feel like a natural extension of existing ones, rather than an abrupt change.

For example, a mining company developed a predictive model that would trigger an alarm whenever an especially large queue of haul trucks threatened to jam traffic at one of the primary crushers. Testing showed the system to be relatively accurate. However, dispatchers and operators rarely paid attention to the alarms, relying instead on their usual system of waiting until backlogs built up before responding. To improve adoption, the implementation team redesigned the model, embedding the alert mechanism directly into the monitoring system. The changes not only reduced traffic queues but also created goodwill on the front line.

Similarly, at an SAG mill, a new analytics model suggested that increasing feed levels by 5 percent would deliver significant uplift. But that level was far higher than the current belts could accommodate, which made the operator distrustful. "What's the point of analytics," he asked, "if the recommendations are unusable?" Designers reconfigured the algorithm and user interface, creating a "current state" optimization view that provides recommendations to maximize throughput under existing systems and a "target state" window with specific recommendations for capital expenditures and operations (for example, to increase the percentage of solids), along with metrics that show the benefits of following the recommendations.

Analytics teams also need to make sure that any new system is designed to integrate smoothly with the mine's back-end technology stack. Otherwise, companies can end up with stand-alone models that eventually fall out of use because they cannot

be updated or scaled. We find it can help to build a dedicated data-storage replica to support the model and to include quality-control checks for data integrity in the ingestion code.

4. Employ agile techniques to foster ownership and empowerment

Many mines have traditionally operated with a "buy not make" mindset when it comes to technology. Decision makers far removed from the field invest in prebuilt tools with a specific set of goals in mind, and they pass along instructions for local teams to use in prescribed ways. This approach can work well for enterprise resource planning (ERP) and other applications that handle routine back-office processes, but analytics initiatives typically involve frontline workers and managers. When field- and plant-based employees get directions from afar, they often feel that management devalues their expertise.

One of the most effective ways to increase adoption is to engage users directly in the development process by employing agile techniques that give users more agency. Agile ways of working democratize ownership. Instead of directing teams, leaders lay out the core problem to be solved and leave it up to the design team on the ground (itself a mix of users, developers, and product leaders) to determine the most effective ways to address the issue and meet the desired objectives. This open, nonhierarchical approach creates a healthy problem-solving dynamic in which individuals can more easily and freely contribute insights to the solution, regardless of their seniority and experience. The result is greater innovation and agility. As the leader of a precious-metals company explained, "The how of doing analytics is as important as the what."

For example, an open-pit mine implemented an analytics model to help dispatchers improve productivity. But dispatchers resisted using it because they felt the initiative would duplicate other systems already in place and would automate an important part of their role. When

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the analytics team brought fleet managers and dispatch operators into the development team, things changed. Through a series of field tests, the joint team improved the algorithmic logic and created a system that could automatically adjust the haul truck's dump locations when a spike in the primary crusher queue was anticipated. When operators realized they could help shape the model and that the tool was meant to enhance their role, not replace it, they were more open to using the system and collaborate in its development. The program feature was ultimately deployed at scale in other plant locations. Over time, the approach of "make not buy" created new capabilities and helped encourage new and more productive ways of working in different areas of the mine.

5. Unlock value through holistic performance management

For analytics initiatives to gain traction, mining leaders need to connect the dots between the overall business objectives for the analytics program and the specific milestones and criteria that define success at different stages. Otherwise, maintenance may have one set of measures, plant and mine managers another, and executive sponsors still others, resulting in divergent expectations.

Without a cohesive understanding of value, clear accountability, and concrete prioritization of tasks, adoption and impact can suffer. Teams can have a hard time maintaining enthusiasm for an initiative, and leaders can have a hard time justifying continued investment. To create a clear line of

sight to value, project leaders need to create a management infrastructure that eliminates silos, aligns performance metrics across teams, and assigns ownership for delivering on them. Working backward from top-line goals, project leads within the design team should define individualized performance measures for each role and work stream and ensure team members understand what is expected of them. Individuals and teams tasked with meeting specific goals can then prioritize workflow more effectively.

For example, a copper plant invested in analytics to optimize processing. To ensure the model delivered on that goal, the product owner agreed to be held accountable for increasing copper production by a defined percentage by using the model's recommendations—a target that then informed how he prioritized the development backlog. Developers, in turn, were accountable for testing and iterating the recommendations in the field until they met predefined performance thresholds. Digital cells within the agile team were responsible for more detailed metrics, such as prediction accuracy. Regular check-ins between site leadership and the development team kept all parties updated on progress. Where maintenance and other teams might have had different—and sometimes conflicting—incentives in the past, now all pulled together toward the same end goal. Leaders also made a point of celebrating teams for the value they created. By driving greater alignment, accountability, and transparency in these ways, mining companies can boost the returns on their analytics investment and make value easier to see.

6. Anticipate the skills needed to scale and sustain

For mining organizations that are just beginning their analytics journeys, it can be easy to focus on the use cases, tools, and algorithms, since the learning curve for each can be steep. However, transitioning from pilot to production requires planning for scale from the start and building an in-house skill base capable of supporting the analytics portfolio over the long term.

In our experience, having the right expertise to maintain and train systems is one of the most important success factors with analytics. Model accuracy naturally drifts over time as operating conditions change. To account for that, businesses need to retrain the system continually—that is, roughly every three to six months. Otherwise, the quality of recommendations will drop, leading to fewer users and declining impact.

For example, when studying why a promising pilot in its concentrator plant had sputtered after weeks of trying to get it off the ground, leaders at one mine determined that the issue wasn't the analytics model but rather the lack of skills to interpret its outcomes and optimize its logic. These leaders didn't have the software-engineering capabilities to manage the infrastructure or the data-science know-how to maintain or improve the model. Every time a change order came in to tweak the analytics, the skeleton design team had to reach out to their third-party provider for support.

To address this, the leaders decided to ramp up their in-house capabilities. They created an internship program to train interested employees, designed new certification programs to advance digital skills that greatly appealed to internal IT and business talent, and coupled this training initiative with a targeted recruiting strategy to bring in experienced hires. The results helped the mine create an analytics hub within its organization to design, support, and enhance a portfolio of AI and analytics initiatives. To monitor system accuracy, analysts embedded into their models code that tracked concept drift and sent automatic alerts when retraining was needed. They also built a model-performance scorecard to track stability and relevance. These measures provided a helpful way to monitor system health and add value.

Other companies can do the same. Most will need to add software developers, data scientists, data engineers, and other digital talent. They will also need translators who can use their blend of technical and business skills to ensure that the operators and domain experts understand the analytics team and vice versa. Acquiring this talent takes time, especially since digital skill sets are in high demand. Starting early can allow companies to get a jump on recruiting and training, so that they have the in-house resources in place to create a smooth handoff at the end of the pilot stage and sustain their analytics program.

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Mining companies have a huge untapped opportunity when it comes to analytics. Relatively low rates of adoption industry-wide create openings for committed leaders to gain competitive advantage. Businesses that lay the right groundwork for analytics success—by building engagement and alignment and by making the analytics easy to use and the value easy to track—can create the mindset and process shifts needed to sustain double-digit returns on their analytics investments.