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DIGITAL IN MINING:
PROGRESS... AND OPPORTUNITY

INTRODUCTION

The mining industry has gotten some good news lately, with a lift in commodity prices and China's infrastructure growth plans. But challenges remain, ranging from weak global demand and excess capacity, to increasingly restricted access to resources.

These difficult conditions could be considered the "new normal," according to a recent report from the World Economic Forum (WEF). However, the report continues, digital technology has the potential to help mining companies contend with these conditions—and it could help the industry generate a benefit of $190 billion over the next decade.[1]

The WEF report found a typical digital "first mover" mining company would have average EBITDA differences in the final year (2025) of the analysis that were at least 70 percent higher than the digital "laggards" who simply continued business as usual. According to the report, "For those organizations that can move from being digital laggards to digital-first movers, the value is real."

Accenture recently completed additional research into how the mining industry is using, and not using, digital technology to improve decision making, increase efficiency and productivity, and succeed in a challenging environment.[2] The research indicates that mining companies are indeed looking to digital technology to help them move forward—82 percent of executives said they expect to increase investments in

digital technology over the next three years, and 28 percent expect those increases to be significant. For those that embrace digital technology sooner rather than later, the results are likely to be well worth the effort.
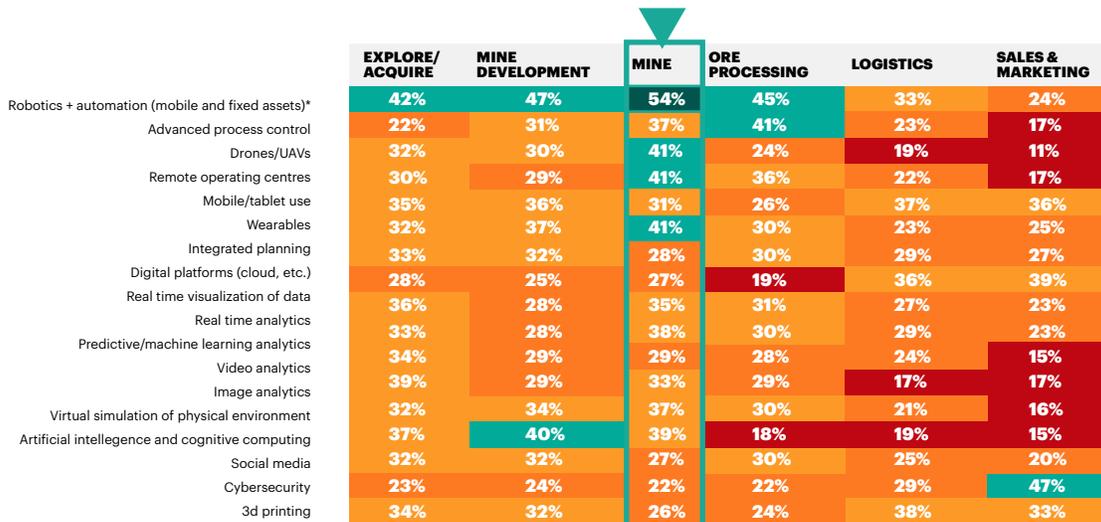
▶ **82%**

expect to increase investments in digital technology over the next three years

▶ **28%**

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DIGITAL ABOVE AND
BELOW GROUND

Mining companies are applying digital technology across the organization, but they are embracing it most heavily in mine operations, as opposed to areas such as exploration, mine development or marketing. When asked about the specific technologies they are using or plan to use at the mine over the next three to five years, executives cited a wide range—from the cloud and other digital platforms, to video analytics and mobile/tablet devices.

Digital technologies are being employed most in mine operations

LEGEND

Color	Range		Range
	10-19%		40-49%
	20-29%		50-59%
	30-39%		

	EXPLORE/ ACQUIRE	MINE DEVELOPMENT	MINE	ORE PROCESSING	LOGISTICS	SALES & MARKETING
Robotics + automation (mobile and fixed assets)*	42%	47%	54%	45%	33%	24%
Advanced process control	22%	31%	37%	41%	23%	17%
Drones/UAVs	32%	30%	41%	24%	19%	11%
Remote operating centres	30%	29%	41%	36%	22%	17%
Mobile/tablet use	35%	36%	31%	26%	37%	36%
Wearables	32%	37%	41%	30%	23%	25%
Integrated planning	33%	32%	28%	30%	29%	27%
Digital platforms (cloud, etc.)	28%	25%	27%	19%	36%	39%
Real time visualization of data	36%	28%	35%	31%	27%	23%
Real time analytics	33%	28%	38%	30%	29%	23%
Predictive/machine learning analytics	34%	29%	29%	28%	24%	15%
Video analytics	39%	29%	33%	29%	17%	17%
Image analytics	32%	34%	37%	30%	21%	16%
Virtual simulation of physical environment	37%	40%	39%	18%	19%	15%
Artificial intelligence and cognitive computing	32%	32%	27%	30%	25%	20%
Social media	23%	24%	22%	22%	29%	47%
Cybersecurity	23%	24%	22%	22%	29%	47%
3d printing	34%	32%	26%	24%	38%	33%

* Robotics + Automation (mobile and fixed assets): refer to those instances where respondents have/plan to employ Robotics and/or Automation in each respective mining activity.

Miners appear to be especially interested in getting the right data in the right timeframe to help people to take the right actions and react quickly to changing situations. This is enabled by the four technologies at the top of the list—robotics/automation, drones, remote operating centers and wearable technology. Taken together, those four technologies paint a coherent picture in which miners are developing more timely operational data through digital visibility, automated processes and drones; using remote operating centers to make collaborative decisions with that data; and then using wearables to share data with individuals.

Although the industry's sales and marketing groups in general are not making significant use of digital technologies, there are important exceptions. Some companies are applying digital technology in those areas in an effort to create connections across the value chain and link the mine to the market. Such integration can help mine operations be better informed about market needs and, conversely, help sales and marketing better understand what mine products are in the pipeline and available for customers.
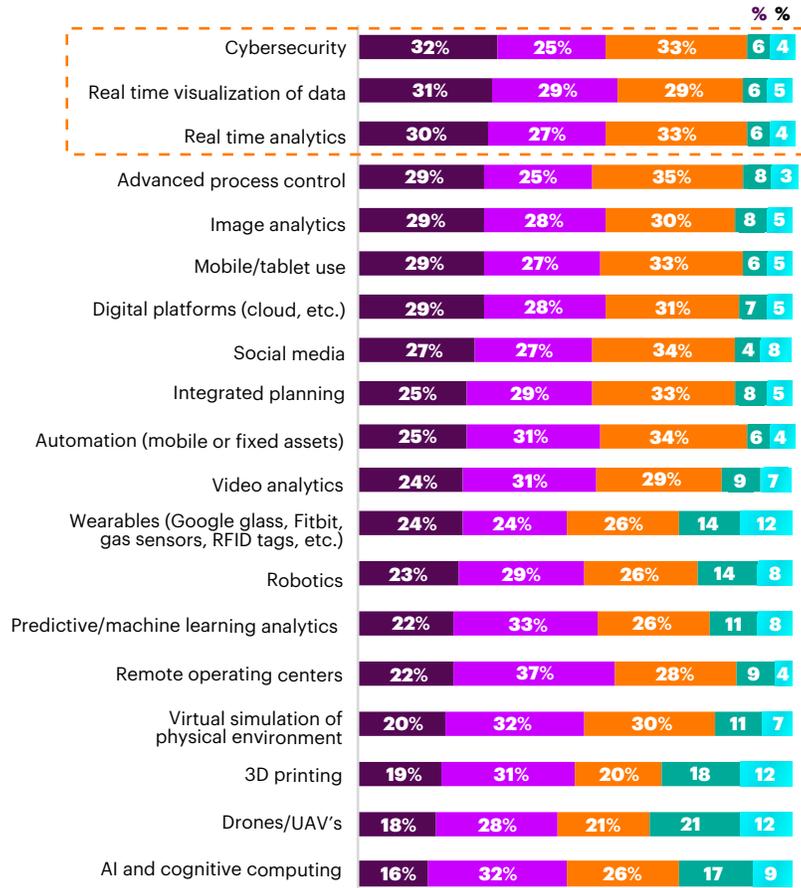
Meanwhile, cybersecurity ranks near the bottom of the list of investments being made at mine sites. This points to an area of real risk: As mines become more connected, and processes increasingly digitized, mining companies will face increased network-borne security threats. Interestingly, the industry's focus on cybersecurity is fairly strong at the enterprise-wide level (see below), but that focus does not seem to extend to the mine itself. It may be that the digitally-enabled mine is still a relatively new concept, and awareness of those risks is still low. In any case, miners need to be aware of their growing exposure in operations.

TOP-TO-BOTTOM
DIGITAL INVESTMENTS

LEGEND

- ■ Widespread adoption within organization
- ■ Technology strategy has been defined/being developed
- ■ Not applicable/relevant to our business
- ■ Have begun pilot programs in part of the organization
- ■ Currently no plan to employ within next 3-5 years

	Widespread adoption	Pilot programs	Strategy defined	No plan	Not applicable
	%			%	
Cybersecurity	32%	25%	33%	6	4
Real time visualization of data	31%	29%	29%	6	5
Real time analytics	30%	27%	33%	6	4
Advanced process control	29%	25%	35%	8	3
Image analytics	29%	28%	30%	8	5
Mobile/tablet use	29%	27%	33%	6	5
Digital platforms (cloud, etc.)	29%	28%	31%	7	5
Social media	27%	27%	34%	4	8
Integrated planning	25%	29%	33%	8	5
Automation (mobile or fixed assets)	25%	31%	34%	6	4
Video analytics	24%	31%	29%	9	7
Wearables (Google glass, Fitbit, gas sensors, RFID tags, etc.)	24%	24%	26%	14	12
Robotics	23%	29%	26%	14	8
Predictive/machine learning analytics	22%	33%	26%	11	8
Remote operating centers	22%	37%	28%	9	4
Virtual simulation of physical environment	20%	32%	30%	11	7
3D printing	19%	31%	20%	18	12
Drones/UAV's	18%	28%	21%	21	12
AI and cognitive computing	16%	32%	26%	17	9

Digital technologies with the most widespread adoption across the organization are cybersecurity, real-time visualization of data and real-time analytics.

The awareness of cybersecurity is not surprising, since there have been major breaches at 22 mining companies since 2010.[3] In addition, the use of cybersecurity technology is likely to keep growing, with 25 percent of respondents saying they are piloting cybersecurity technologies, and 33 percent saying they have defined or are developing cybersecurity technology strategies. The responses for real-time data visualization and analytics pilots/technology strategies were similar.

Mining companies' greater interest in enterprise-level security compared to mine-level security is a reflection of their traditional approach to security. The mining industry, like many others, has essentially focused on building strong barriers around centralized technologies, such as corporate servers. However, mine

operations are becoming more and more connected, and miners are increasingly likely to be sharing data with a variety of partners. This means miners not only need to invest in centralized security, but they also need to move beyond traditional approaches to secure data that is used collaboratively by a number of parties.

Looking ahead, miners' priorities shift somewhat. For example, when executives were asked what technologies they were piloting, remote operating centers (whether physical or digital centers) topped the list. For many, these centers are designed to act as focal points for digital-enabled processes and decision making, and collaboration across facilities. They also enhance safety because fewer employees are exposed to potential hazards at the mine site.

And by reducing the need for "fly-in, fly-out" programs, they help reduce costs while contributing to a better work-life balance—an increasingly important factor for workers today.

The research also asked about miners' forward-looking technology strategies, which provides a glimpse of the next wave of digital technology coming to the industry. Here, miners are most often focused on advanced process control, followed closely by automation of both fixed and mobile assets.

While advanced process control is not a new concept, it takes on new meaning in the digital age. Traditionally, it has been used within a given processing plant. But in a digital, automated and integrated environment, advanced process control systems can communicate with upstream and downstream processes beyond the plant. That is, they can draw on data from the mine and crusher on the one hand, and supply chain partners, logistics, ports and other downstream users—including customers—on the other. These process control systems can also create horizontal connections across the entire supply chain from mine to market. The system can then automatically balance processes so that each is working in harmony with the next. As bottlenecks appear, processes can be quickly realigned to work around them, helping to reduce waste and delays. Advancements in digital technologies such as Robotic Process Automation (RPA) will accelerate how technology can enable this change.

With traditional company information technology (IT) and operational technology (OT) becoming more integrated, the research looked at how mining companies plan to manage these converging areas. Results show the IT-OT integration is well underway, with 46 percent of respondents saying business data is managed by a combination of groups including IT and operations, and 33 percent saying operational data is managed in a similar fashion. More than half of the respondents (56 percent) said that they are considering merging their IT and OT groups within the next 12 months.

The integration of these groups under a single governance umbrella is key to getting the most out of IT-OT convergence. For example, it opens the door to practices such as real-time monitoring of the full range of operations, and the cloud-based, as-a-service delivery of operational activities such as alarm management and production accounting. It also allows miners to bring together the combined, complementary strengths of both groups to focus on innovations that bring greater efficiency and effectiveness to operations.

TAKING ANALYTICS AND CYBERSECURITY TO THE
NEXT LEVEL

As we consider all these findings, some themes emerge. For one thing, it is clear that miners are looking to sophisticated analytics to help them improve operations and make data-driven decisions. For example, one third or more of the respondents said that the most widely used digital technologies in mine operations involved some type of analytics. When looking at organization-wide digital technologies, 31 percent of respondents said that they are making significant investments in real-time data visualization, and 58 percent are piloting or in the strategy stage with that technology. About one third said that they are conducting pilots with predictive/machine learning analytics; artificial intelligence and cognitive computing; virtual simulation of physical environments; or video analytics.

Altogether, these statistics show that miners are interested in leveraging leading-edge technologies to take analytics to the next level, moving to more real-time and dynamic analyses, developing simulations, and tying in artificial and machine intelligence. Ultimately, the focus is on using these tools to improve decision-making around the fundamentals of mining, and taking a data-driven approach to determining how to best process the right material to realize the greatest value.

Cybersecurity is also top-of-mind for industry executives. As mentioned earlier, it is the most widely adopted digital technology across the organization.

33%
said future technology strategies focus on cybersecurity

37%
said cybersecurity concerns were a barrier to getting more out of digital technology

Overall, this interest in security probably stems from the fact that miners are still in the early stages of using digital technology. Many are changing their technology infrastructure to handle growing volumes of data and to take advantage of "as-a-service" digital offerings. Thus, miners are paying attention to setting up the appropriate tools and policies needed in a world of connected systems, IT and OT convergence, and the cloud. Some of their concern may also come from a lack of understanding that digital technologies, when used correctly, can actually provide better security than the traditional business server. Again, however, miners will need to rethink their traditional approaches to security if they are to get the most out of their new technology.

WHAT'S THE
PAYOFF?
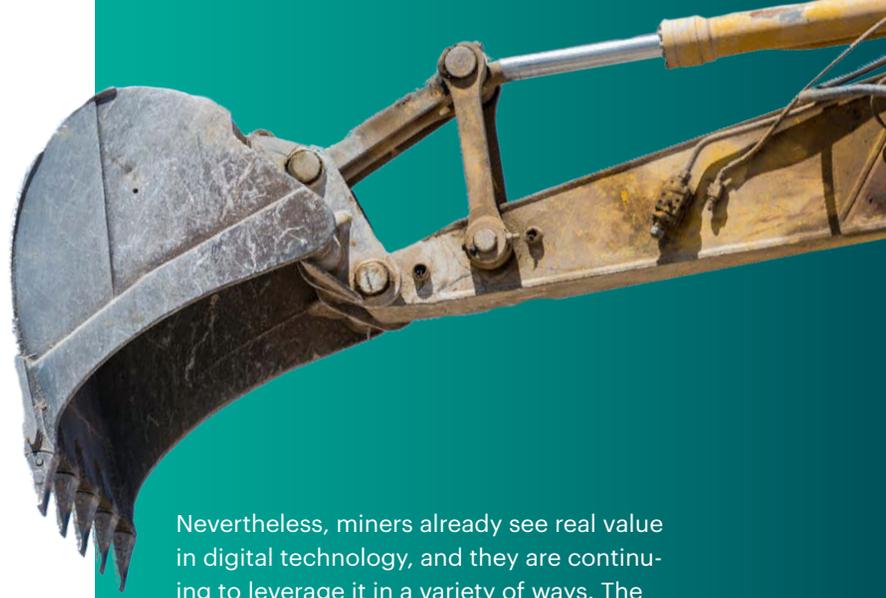
One question, of course, is what benefits are miners seeing from digital technology? On an operational level, executives most often cited better equipment performance (47 percent), operational/administrative cost savings (42 percent) and better decision making (40 percent) as top benefits. Looking ahead, they expect those benefits to continue. However, they also have growing expectations for consolidated planning across all horizons, as well as the ability to send more dynamic work orders to operators.

When asked about overall business benefits across the organization, executives most often cited improved workforce productivity, especially from mobile/tablet devices, automation, visualization and the ability to simulate physical environments. That's not surprising because productivity is an area with considerable room for improvement in the industry—and it is fairly easy to identify the productivity improvements from digital technology.

The finding also raises an important point. Digital technology is still relatively new, and miners often struggle to determine the monetary impact of benefits such as improved collaboration and decision-making, or to quantify precisely how digital-enabled improvements affect the bottom line. As the industry and business in general develop a better understanding of how to calculate the financial impact of the technology, we may see mining executives pointing to a broader set of benefits.

Nevertheless, miners already see real value in digital technology, and they are continuing to leverage it in a variety of ways. The vast majority of executives told researchers they were satisfied with their digital investments over the last 12 months;

▶ **64%**

were "relatively satisfied"

▶ **33%**

were "extremely satisfied"

These numbers are important because the effective use of digital technology is becoming less of a technical challenge and more of an organizational issue involving people and processes.

Technology is the enabler, but achieving real value depends on how the business leverages the technology. If companies are satisfied with the value they are seeing from their investments, it boosts buy-in and interest—and that, in turn, can help drive success and sustained results from the growing use of digital technology.

RESEARCH METHODOLOGY

Accenture conducted an online survey of 201 C-level and top management executives and functional leaders in the mining and metals industry. The survey was fielded in mid-October through mid-November 2016 and included respondents from Australia, Brazil, Canada, Chile, China/Hong Kong, Indonesia, India, Singapore, South Africa, United States and United Kingdom. The companies represented have total annual revenue ranging from US$500 million to more than US$20 billion.

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1 "Digital Transformation Initiative: Mining and Metals Industry," World Economic Forum, January 2017, http://reports.weforum.org/digital-transformation/mining-and-metals/.

2 Accenture Digital Technology in Mining Survey 2016.

3 "Blockchain Technology in the Mining Industry," Accenture, 2016, https://www.accenture.com/us-en/insight-highlights-natural-resources-blockchain-technology (accessed April 1, 2017).