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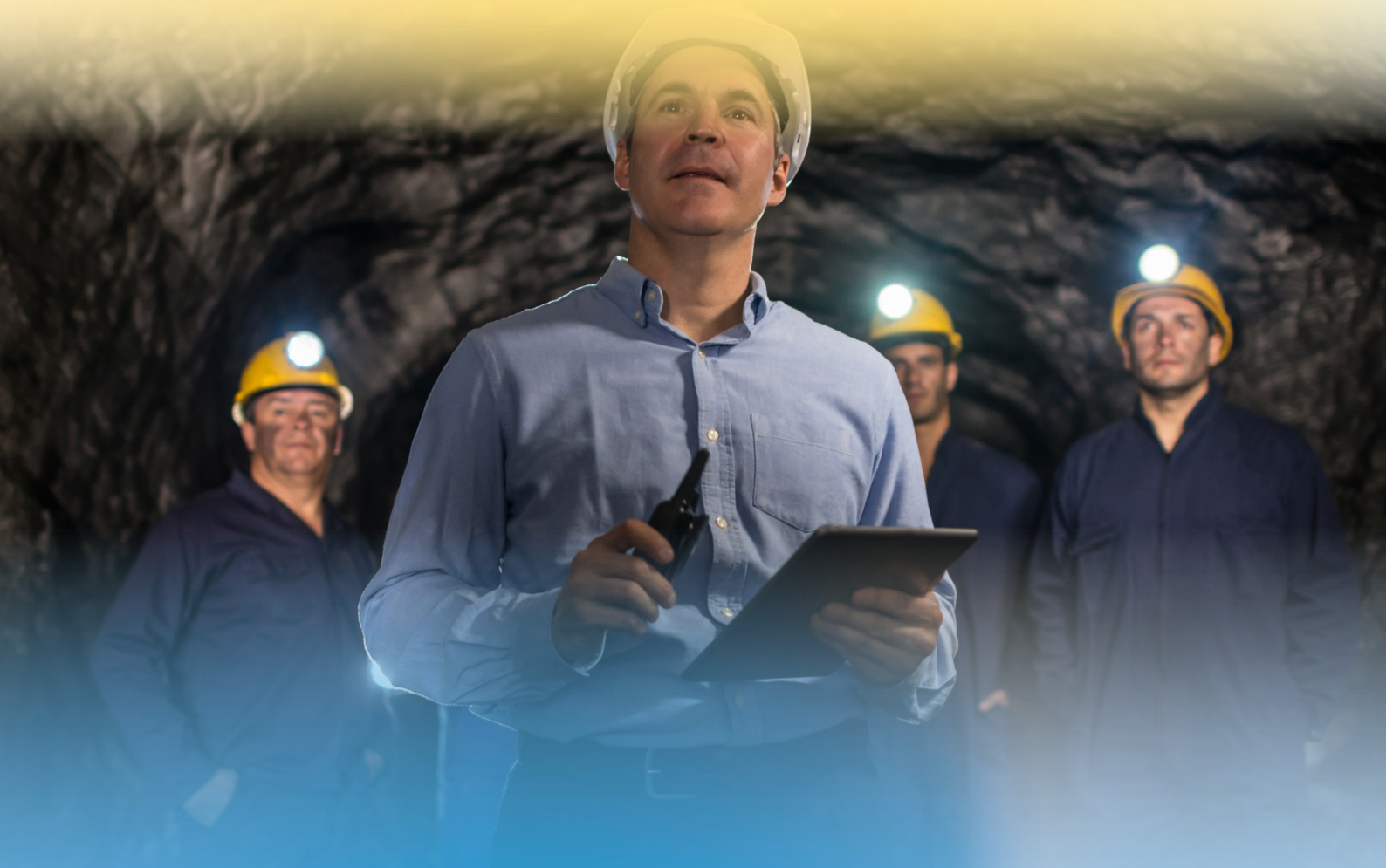


CASE STUDY

Digital transformation is unearthing new potential in **underground mining**

Surface mining has historically been the default worldwide, and for good reason: It's safer, more economical, and less complex than underground mining. Traditionally, underground mining was only considered if reaching the mineral deposits was not possible with surface mining, or if the quality of the mineral deposits was great enough to offset the significant additional costs associated with underground mining.

Current trends are pushing mining underground

Environmental concerns, political pressure, greater scarcity of resources and other factors are steering the trends toward underground mining. The quality of ore deposits accessible through open-pit mines is steadily decreasing. As mines age, it takes greater machine and manpower to derive the same quantity of material.

Surface mining typically has a larger geographic footprint, which can create greater disruption for nearby landowners. And because topsoil is removed, there's greater risk of pollution from surface runoff, which can be highly acidic. That runoff and topsoil removal can also create ecological disruptions for decades to come, even after mining is complete. Given this new reality, the trend toward avoiding underground mining is on a reverse course.

Connected mining systems are helping mitigate traditional reluctance by improving worker safety, simplifying processes—and ultimately making underground mining more profitable.

Barriers for digital transformation

Digital transformation in mining has been thwarted for both technical considerations and stakeholder hesitancies—but underground mining presents a new frontier for IoT and cloud.

Establishing reliable connectivity hundreds of feet below the earth's surface requires special considerations. While 5G technology is quickly evolving to economically enable networks for underground mining, the mines themselves—regardless of whether they're above or below ground—are often located in remote geographic locations that lack 5G coverage or high-speed internet connections.

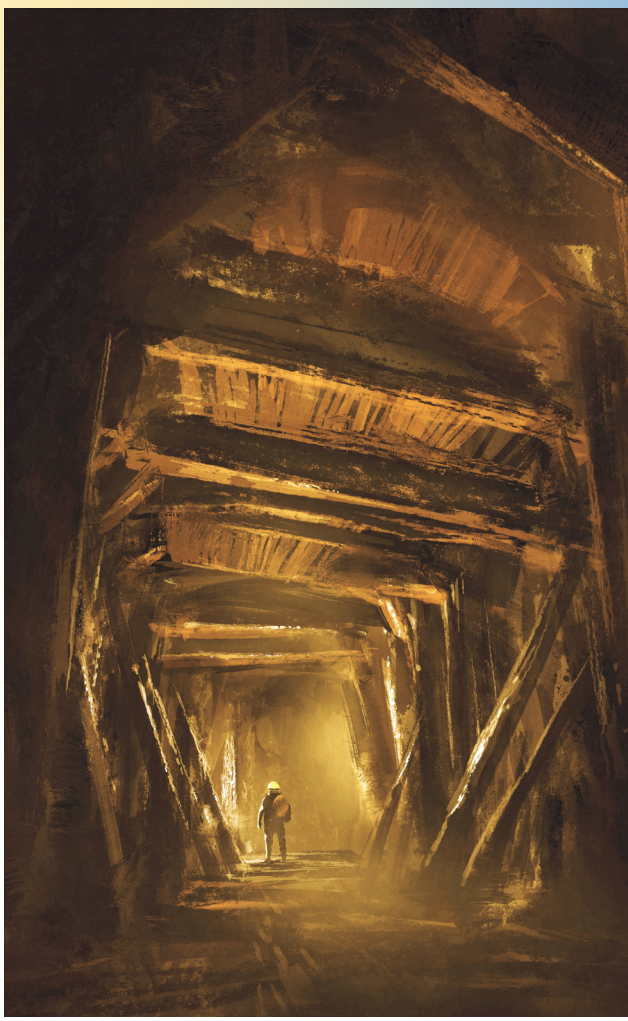
Moreover, workers may be resistant to connected technologies—even though they stand to save upwards of 1,000 workers' lives and prevent 44,000-plus injuries over the next decade.

For widespread connected mining initiatives to be successful, it is imperative that stakeholders communicate how automation can augment workers and enhance their safety in the mine versus replacing their jobs.

A closer look at connected mines

Connected mines can improve worker safety, environmental sustainability, and operational efficiency by interweaving the processes that comprise the mining value chain with IoT sensors, wearables, cloud-based data and more.

Sensors affixed to workers' ventilators can track how much of a potentially harmful chemical they have inhaled, and for how long. This information is vital for long-term worker safety because many illnesses and injuries may not be immediately apparent. Connected mining integrations for worker safety can also include geofencing to track worker location or keep workers from accessing hazardous or prohibited areas.



With Worker NxT from LTIMindtree, data from myriad types of sensors and workers can be aggregated and analyzed in a central platform. This results in a powerful tool to not only track the safety of individual workers but also analyze long-term trends.

IoT-enabled equipment and machinery can help make mining operations more efficient—and ultimately more profitable—which is increasingly important as the quality of pit-mined mineral deposits decreases and other political and environmental factors accelerate the shift to underground mining. With Asset NxT from LTIMindtree, IoT sensors can help stakeholders address issues with complicated and expensive equipment before they cause mining operations to grind to a halt.

Connected and autonomous vehicles can not only make mining haulage safer, but also more efficient. In open-pit mining, haulage can account for upwards up 30% of mining costs, but very few of these vehicles are currently autonomous . Haulage accidents can also account for upwards of 25% of mining deaths. While this figure can differ for underground mining operations, the potential savings—both in safety and currency—are clear.

Asset NxT from LTIMindtree can be used to not only design paths and procedures for autonomous vehicles, but also optimize their effectiveness on an ongoing basis.

GeoSpatial solutions—and advanced AI and ML technologies for analyzing the resultant data—can further increase the efficiency and profitability of mines by assisting stakeholders in pinpointing the locations of high-quality mineral deposits and helping workers sidestep hazards on the way to accessing them.

Solutions like GeoSpatial NxT from LTIMindtree can take digital transformation in mining to a new level. Leveraging comprehensive geological and subterranean data in tandem with AI insights and consulting expertise from LTIMindtree can help mining operations pivot current mining challenges into opportunities for innovation.

United data insights offer perhaps the ultimate value of connected mining initiatives. Implementing these solutions in tandem—and ensuring they're all seamlessly connected—allows leaders to derive deeper insights. If sensors and data must be managed through disparate platforms and dashboards, the advantage of connected mining diminishes significantly. Collected data is only as valuable as what's done with it.

With Insight NxT from LTIMindtree, data from all sensors and sources can be analyzed from a single, streamlined user interface. For example, data from worker wearables can be analyzed alongside efficiency data to communicate to stakeholders that safer practices can be smarter, too.

Going deeper with digital twins

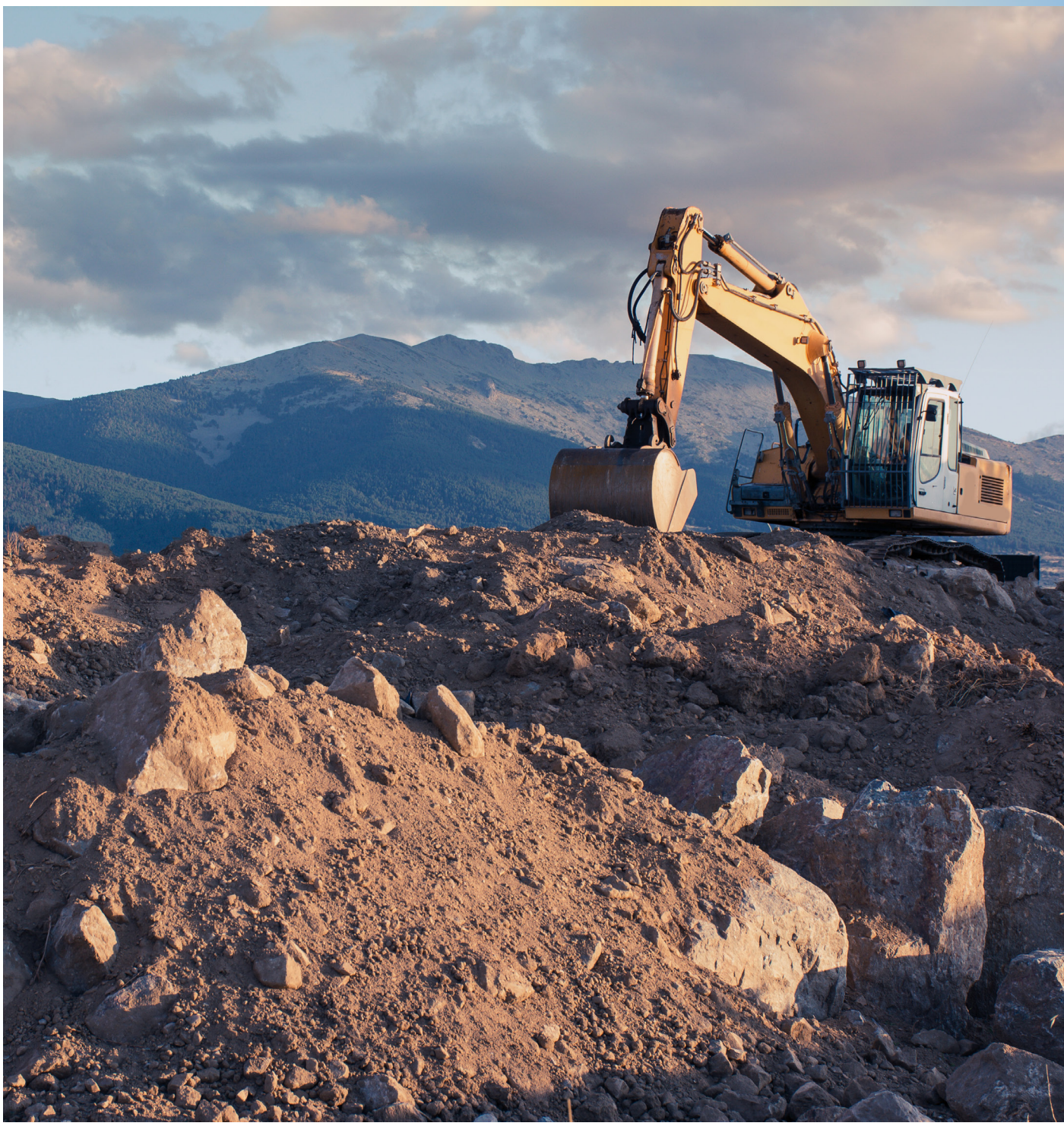
Many mining operations have already joined their peers in embracing digital transformation. The connected mining market is expected to grow from $12.7 billion USD at present to more than $23 billion USD by 2027. Innovative mining operations are taking this industry-wide trend toward connected mining a step further than commonplace applications such as autonomous vehicles and worker wearables.

Digital twins are just one type of opportunity for innovation. At its core, a digital twin is a dynamic, virtual representation of a physical asset, product, system, or in this case, a geographic location. It creates a model of the properties, conditions, and attributes of the real-life counterpart—and gives stakeholders a tangible representation of something that might not be visible to the naked eye.

Digital twins for mining can allow workers to test process parameters—e.g., the speed of mineral output or how vehicles move around a mine—for safety and efficiency in a low-stakes, repeatable manner. Some studies even suggest that digital twin testing for mining processes could achieve a 20x return on investment. Digital twins can be an invaluable tool for identifying bottlenecks, improving safety, and supplementing analytical models to prevent unnecessary capital expenditure. This is important as the shift to underground mining accelerates—where the risks and capital expenditure required are far greater than in traditional open-pit mining.

The future of mining

Digital transformation is the future of underground mining. Is your mining organization ready to explore what it can accomplish by taking the next step in digital transformation? **Let's talk.**



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LTIMindtree is a global technology consulting and digital solutions company that enables enterprises across industries to reimagine business models, accelerate innovation, and maximize growth by harnessing digital technologies. As a digital transformation partner to more than 700+ clients, LTIMindtree brings extensive domain and technology expertise to help drive superior competitive differentiation, customer experiences, and business outcomes in a converging world. Powered by nearly 90,000 talented and entrepreneurial professionals across more than 30 countries, LTIMindtree—a Larsen & Toubro Group company—combines the industry-acclaimed strengths of erstwhile Larsen and Toubro Infotech and Mindtree in solving the most complex business challenges and delivering transformation at scale. For more information, please visit **www.ltimindtree.com.**