

NOKIA

Digitalization in Lithium Mining: A New Era of Efficiency and Sustainability



Introduction

Lithium has emerged as a metal of paramount importance in the 21st century, driving the global transition to clean energy and electrified transportation. Rechargeable lithium-ion batteries are at the heart of electric vehicles (EVs), renewable energy storage systems, and various portable electronics. As the world moves further and transitions from fossil fuels to combat climate change, demand for lithium is rising to unprecedented levels.

In response, the lithium mining industry is experiencing rapid growth and change. Global lithium production has more than doubled in the last decade, with new mining projects planned and existing operations being expanded to keep pace with rising demand. However, conventional lithium mining faces significant challenges, including high water consumption, a large carbon footprint, waste generation, and social license risks. Mining companies leverage digital technologies to overcome challenges and sustain lithium supply.

Industrial digitalization is revolutionizing the lithium mining sector and introducing a new era of optimized, connected, intelligent operations. Advanced sensors, industrial IoT, big data analytics, automation, and artificial intelligence (AI) are being used to transform every value chain stage. These technologies enable real-time monitoring, predictive maintenance, precision extraction, process optimization, and improved safety and environmental performance. Consequently, digitally enabled lithium mines are becoming safer, more efficient, and more sustainable.

This eBook explores the profound impact of digitalization on the lithium mining industry. It overviews the key digital technologies currently in use, examines their application across the mining lifecycle, and presents real-world case studies. It also looks at the future of lithium mining. It discusses how digital transformation will ensure a steady and sustainable lithium supply for a clean energy transition in the wake of the battery metal boom.



Overview of Lithium Mining

The lightest metal, lithium, is an essential component of the rechargeable batteries that power electric vehicles, renewable energy storage, and consumer electronics. Although lithium is relatively abundant on Earth due to its high reactivity, it is not found in pure elemental form. Instead, it must be extracted from mineral deposits and brines.

The world’s lithium deposits are geographically concentrated, with the largest reserves in Australia, Chile, Argentina, Bolivia, China, and the United States. Australia is the world’s largest lithium producer from hard rock mineral deposits. At the same time, Chile and Argentina are the largest producers of lithium from the brine deposits in their vast salt marshes.

Lithium is primarily extracted using conventional hard rock mining and brine evaporation. In hard rock mining, lithium is extracted from open-pit mines, where the ore is crushed, roasted, and processed with various chemicals to produce lithium carbonate or lithium hydroxide. The most important lithium-containing mineral is spodumene, found in pegmatite deposits.

During the brine evaporation process, lithium-rich brine is pumped from underground aquifers into a series of evaporation ponds. Over 12 to 18 months, the sun and winds evaporate the water and concentrate the lithium chloride solution. This concentrated solution is then pumped to a recovery plant and treated with sodium carbonate to precipitate lithium carbonate.

Because of the methods used, the lithium industry faces several challenges in meeting the projected growth in demand. First, hard rock mining for lithium results in significant amounts of waste rock and overburden, which can lead to environmental degradation if not appropriately managed. Secondly, the carbon

footprint of lithium production can be significant due to the energy-intensive extraction and processing methods. Thirdly, the mining and processing of lithium is very water-intensive, requiring approximately 500,000 gallons of water per ton of lithium to evaporate the brine. While brine evaporation does have a lower carbon footprint than conventional hard rock mining, it can strain resources in water-scarce regions such as the “lithium triangle” of Chile, Argentina, and Bolivia.

The lithium industry is implementing more sustainable mining practices, circular economy principles, and digital technologies to overcome these challenges, from connectivity to monitoring and analytics. Recycling lithium-ion batteries can reduce pressure on primary lithium supplies. Direct lithium extraction methods that selectively filter lithium from brine can reduce water consumption and shorten production times. Digital technologies offer immense potential for optimizing processes and minimizing the social and environmental costs of lithium mining. The responsible and efficient production of lithium will enable the global energy transition.



Digital Technologies in Mining

The mining industry is undergoing a profound digital transformation. Advanced digital technologies are used to optimize operations, increase safety, reduce environmental impact, and improve decision-making. This eBook summarizes those used in the mining sector and discusses how they can be applied specifically to lithium mining.

Sensors and Industrial Internet of Things (IIoT)

Sensors are the eyes and ears of digital mining. They are used in mining equipment, processing plants, and mine sites to collect real-time data on various parameters, such as equipment performance, ore grades, geotechnical conditions, and environmental metrics. The Industrial Internet of Things (IIoT) enables these sensors to communicate and share data via wireless networks, creating an interconnected ecosystem of smart devices.

IIoT platforms aggregate and analyze vast amounts of sensor data, providing real-time insights into mining operations. This allows operators to monitor the condition of equipment, track key performance indicators, and make data-driven decisions to optimize processes. Predictive maintenance algorithms can analyze data collected from these sensors to anticipate equipment failures, identify anomalies before they impact operations, and reduce unplanned downtime and associated costs.

Big Data Analytics

Mining generates vast amounts of data from many sources, including sensors, equipment logs, geological models, and market data. Big data analytics tools can be applied to process and analyze this data on a grand scale. Using Machine learning (ML) algorithms, mining companies can uncover hidden patterns and insights from that data to make better decisions.

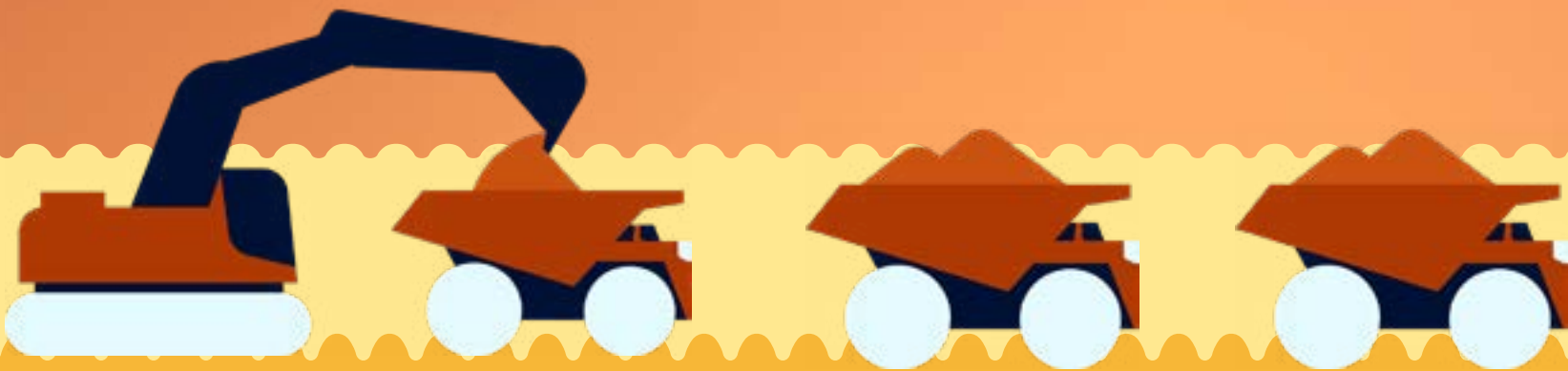
Big data analytics can be applied to optimize various aspects of mining, including resource modeling, process optimization, and supply chain management. It can also enable predictive analytics, using equipment data to predict failures and trigger proactive maintenance. By applying ML, blasting plans and fragmentation can be optimized to improve lithium extraction processes. Data-driven insights can also improve safety by identifying high-risk activities and conditions.

Automation and Remote Operation

Automation is changing how mines operate and can be applied at every stage of the mining process, from exploration to extraction. Autonomous drones with cameras and sensors can survey mine sites and exploration targets and create high-resolution maps and 3D models. This data can be used to optimize mine planning and design.

Remote control allows operators to control mining equipment at a distance from operations centers, reducing the need for on-site personnel. Consequently, autonomous trucks, drills, and trains are becoming commonplace at mines. These vehicles and equipment use sensors, GPS, and onboard computers that allow them to navigate a site and operate without human intervention to increase safety and efficiency. The use of autonomous drills, for example, can improve drilling accuracy.

In underground mining, autonomous systems can be used for rock bolting, shotcrete construction, and excavation in hazardous or inaccessible areas. This increases safety and allows mining to continue under challenging conditions. In mineral processing plants, advanced process control systems optimize real-time variables such as reagent dosing, particle size, and flotation conditions. This improves recovery rates, reduces energy and water consumption, and improves product quality.



Digital Technologies in Mining

Digital Twins

A digital twin is a virtual image of a physical plant or process created using real-time sensor data and information from other sources. It allows operators to monitor, simulate, and optimize mining operations in a virtual environment before making changes in the real world. Digital twins can be used for plant management, process optimization, and scenario modeling.

For example, a digital twin of a processing plant can be used to test various operating scenarios and determine the optimal configuration for maximum throughput and recovery. A digital twin of a mine site can be used to plan and optimize the placement of infrastructure, such as roads and power lines, to minimize the environmental impact of operations.

Artificial Intelligence and Machine Learning

AI and ML are powerful tools for analyzing the vast amounts of data generated by mining operations. ML algorithms can generate predictions and process optimizations by learning from historical information. AI can be applied to achieve many benefits, from generating exploration targets to enabling autonomous plant operations.

For example, by applying ML to analyze borehole data and geological models, companies can more accurately predict the location and grade of ore bodies. AI can also optimize the use of trucks and loaders in open-cast mining to minimize queues and maximize productivity. Computer vision and AI can also separate waste rock from valuable minerals.

Virtual and Augmented Reality

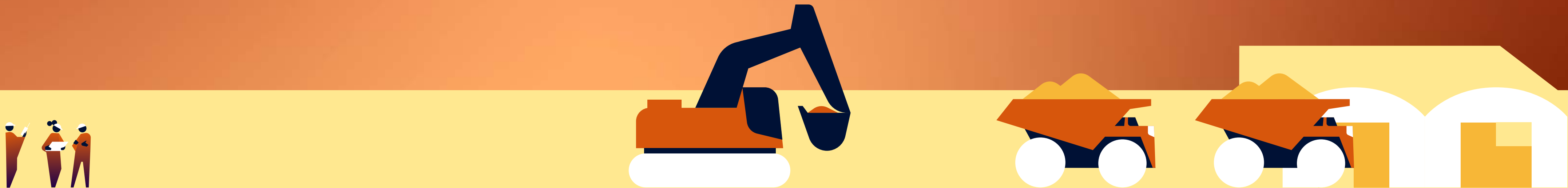
Virtual reality (VR) and augmented reality (AR) are used in mining for training, visualization, and remote collaboration. Using VR, companies can create immersive simulations of mining environments and equipment to train personnel to train in a safe, controlled environment. Using AR to overlay the real world with digital information, workers can benefit from real-time data and guidance.

VR can, for example, be used to safely train drivers to operate trucks in different weather conditions or over different terrains and road conditions. Maintenance personnel can leverage AI to visualize diagrams superimposed on complex equipment and step-by-step instructions to resolve issues more rapidly and safely.

4G and 5G Private Wireless Networks

Both 4G/LTE and 5G private wireless deliver high speeds, low latency, and the capacity to connect sensors, support real-time control of autonomous devices, and perform data analysis and processing at the network's edge.

Private wireless networks can support the Industrial Internet of Things on a large scale by connecting thousands of sensors and devices on a mine site. Remote device operation is enabled with minimal delay to improve safety and efficiency. This is supported through industrial edge computing, which allows data to be processed and analyzed close to the source rather than at the public cloud.



Applications in Lithium Mining

Private wireless networks are transforming the mining industry, creating safer, more efficient, and more sustainable “mines of the future.” This section will explore how lithium mines can leverage new digital technologies to overcome challenges and benefit from new opportunities, from exploration to processing and waste management, using these networks.

Exploration

Lithium mining companies can benefit, even at the exploration phase, through accelerated discovery, reduced costs, and improved resource modeling by applying digital technologies. Some critical applications include:

AI-powered geological modeling: ML algorithms can analyze vast amounts of geological data, including drill logs, geophysical surveys, and satellite imagery, to identify patterns and predict the location of lithium deposits. This can help exploration teams prioritize targets and reduce unnecessary drilling activity.

Autonomous drones with high-resolution cameras and sensors can quickly and cost-effectively survey large areas and create detailed maps and 3D terrain models. This data can be used to identify geological structures, plan access roads and infrastructure, and monitor environmental impacts.

By applying predictive analytics capabilities to combined geological, geochemical, and geophysical data, companies can benefit from prospectivity maps highlighting the areas with the highest probability of lithium resources. This can guide exploration drilling and reduce the number of wells required to delineate a resource.

Extraction

Digital technologies are changing how lithium is extracted (hard rock mining and brine extraction). Some critical applications are:

Autonomous drilling and extraction: Autonomous drills can work around the clock, drilling blast holes at the optimal depth and pattern. Autonomous haulage vehicles can transport ore and overburden safely and efficiently by optimizing routes and reducing fuel consumption. This improves productivity and safety while reducing costs.

Remote operations: Operators can monitor and control brine pumps, drill rigs, excavators, and other mining equipment from remote operations centers, sometimes hundreds of miles from a mine. This reduces the need for on-site personnel, increases safety, and enables operations in rugged or remote areas.

Predictive maintenance: sensors on mining equipment can monitor critical parameters such as vibration, temperature, and pressure. ML algorithms can analyze this data to predict when equipment will likely fail, enabling proactive maintenance. This reduces unplanned downtime and extends the life of equipment.

Processing

Lithium processing can be optimized using advanced process control and data analysis from hard rock or brines. Some critical applications are:

Advanced process control: Real-time sensors can monitor critical process variables such as reagent dosing, pH, and temperature. Advanced process control systems can automatically adjust these variables to optimize lithium recovery, product quality, and cost. ML can continuously improve control models based on process data.

Digital twins: A digital twin of a lithium processing plant can simulate the entire process, from crushing and grinding to flotation and roasting. This allows engineers to test different scenarios and optimize the plant configuration without jeopardizing production. Real-time data from the physical plant can update the digital twin, enabling real-time predictive maintenance and optimization.

Predictable quality: Machine learning models can predict the quality of the lithium product based on upstream process variables. This allows operators to proactively adjust the process to ensure consistent product quality and reduce waste and rework.

Tailings and Waste Management

Lithium mining, managed through hard rock mining, generates significant amounts of waste rock and overburden. Digital technologies can help monitor and manage this waste to reduce the environmental impact. Some critical applications include:

Intelligent monitoring of waste rock piles: Sensors built into tailings piles can monitor structural integrity, water levels, and pore pressure in real time. This data can be analyzed to detect early signs of instability and trigger alerts to prevent catastrophic failures.

Waste rock optimization: ML can optimize waste rock placement to minimize landfill footprint and environmental impact. Predictive models can also forecast the geochemical evolution of waste rock over time, enabling proactive management of acid rock drainage.

Waste upgrading: Data analytics can identify opportunities for adding value to waste streams, such as recovering valuable by-products or using waste rock for construction materials. In this way, waste can be converted into resources, and disposal costs and the environmental impact can be reduced.

Applications in Lithium Mining

Water Management

Lithium mining, mainly from brine sources, can be water-intensive and significantly impact local resources. Digital technologies can help to monitor and optimize water consumption. Some critical applications are:

Intelligent water sensors: IoT sensors can monitor and analyze water levels, flow, and quality across mining operations in real time, from groundwater extraction to processing and wastewater discharge. This data can be used to optimize water usage, detect leaks, and ensure compliance with water permits.

AI-optimized water treatment: ML can optimize the performance of water treatment plants by adjusting treatment parameters based on water quality and flow rates in real-time. This can minimize chemicals, energy consumption, and waste generation.

Modeling the water balance: Digital water balance models can simulate the entire water cycle across mine operations, from rainfall and runoff to evaporation and infiltration. This can help predict water scarcity, optimize water storage and reuse, and minimize the impact on local resources.

Energy Management

The mining and processing of lithium can be energy-intensive and contribute to greenhouse gas emissions. Digital technologies can help optimize energy use and enable the integration of renewable energy. Some critical applications are:

Microgrids: Smart microgrids can combine renewable energy sources such as solar and wind power with conventional diesel generators. Intelligent controls can optimize the mix of energy sources based on real-time supply and demand to reduce costs and emissions.

Energy analytics: Data analytics can identify ways mining companies can reduce energy consumption and costs across their operations. ML can be used to optimize the energy efficiency of equipment such as pumps, compressors, and conveyor belts using real-time operational data.

Renewable energy integration: Predictive analytics can forecast the performance of solar and wind energy based on climate data, enabling better integration into the mining energy supply. Energy storage systems can be optimized to store excess renewable energy for use during peak demand periods.

Safety and Environment

Ensuring worker safety and minimizing environmental impact are top priorities in lithium mining. Digital technologies can help monitor and mitigate risks. Some critical applications are:

Wearables for safety: Smart wearables and PPE (Personal Protective Equipment), such as helmets and safety vests, leverage sensors that monitor worker health and safety in real time. These sensors can detect falls, collisions, and exposure to hazardous gases and trigger alerts and emergency responses. Fatigue monitoring can detect tired employees and trigger alerts to prevent accidents.

Environmental monitoring: IoT sensors can monitor air quality, noise levels, vibrations, and other ecological parameters throughout the mine in real time. This data can be used to ensure compliance with environmental regulations and identify opportunities to reduce the environmental impact of lithium mining. Drones can also be used for environmental monitoring and remediation planning.

Predictive safety: ML can be applied to analyze safety incident data and identify high-risk activities, conditions, and behaviors. This allows companies to implement targeted safety training and measures and prevent accidents before they can occur.

Supply Chain

Lithium supply chains are complex and global and are coming under increasing scrutiny regarding sustainability and traceability. Digital technologies can be implemented to manage and optimize these supply chains. Some critical applications include:

Digital twins for logistics: Digital twins can simulate the entire lithium supply chain, from the mine to the refinery, the battery manufacturer, and the recycler. This allows bottlenecks to be identified, stock levels to be optimized, and interruptions to be tested in scenarios. Tracking shipments in real-time can enable dynamic route planning and just-in-time delivery.

Predictive demand forecasting: ML can analyze market data, customer orders, and other data and indicators to predict demand for lithium products. This can help mining companies optimize their production plans, inventory levels, and sales strategies.

These are just some of the many applications of digital technologies in lithium mining. As the technology landscape continues to evolve, new opportunities for optimization and innovation will emerge. Companies will benefit most from integrating these digital solutions into a holistic, strategic approach to transformation rather than pursuing isolated pilot projects.

The Digital Future of Lithium Mining

While this eBook has already described the potential for digital technologies in lithium mining today, what does the future hold? This section explores the emerging trends, opportunities, and challenges that will shape the industry's digital future. It provides some real-life case studies of lithium mining companies leading digital transformation.

Accelerating the Adoption of Digital Technologies

- Digitalization in the lithium mining industry is expected to accelerate in the coming years. The confluence of several factors will drive this:
- Rising demand for lithium: The global shift towards EVs and renewable energy storage will continue to drive strong demand for lithium. This will pressure lithium mine operators to increase production efficiently and sustainably, leveraging digital solutions.
- Mature technologies: Many digital technologies discussed in this eBook, such as industrial IoT, AI, and automation, are maturing rapidly. They are becoming more reliable, scalable, and affordable, lowering the barriers to adoption.
- Proven value: Success stories from pioneers in digital mining technology demonstrate the tangible value of digital transformation. These successes will encourage more lithium mining companies to embark on their digital journey.
- Competitive pressure: As more mining companies digitalize operations, those that delay will face increasing competitive pressure. Digital capabilities will become a key differentiator in the industry.
- Investor and stakeholder expectations: External pressures from investors, customers, and other stakeholders to improve efficiency, sustainability, and transparency in lithium mining will further drive digital transformations.



The Digital Future of Lithium Mining

Integration and Interoperability

A key challenge in the current digital landscape of lithium mining is the fragmentation of systems and data. Many mines have implemented digital solutions in a piecemeal approach, which has led to data silos and a lack of interoperability between systems.

Greater integration and interoperability will become the standard in the future. Mining companies will seek to build holistic, end-to-end digital architectures that seamlessly connect data and processes across the value chain. This will enable proper optimization and real-time decision-making.

- Interoperability standards will become increasingly important. These standards will enable plug-and-play compatibility between systems from different providers, reducing integration costs and complexity.
- Cloud platforms will play a key role in enabling integration and interoperability. By moving data and applications to the cloud, mining companies can break down silos and enable seamless data sharing and collaboration across sites and functions. Mining in remote areas is always a challenge regarding cloud services; nevertheless, Nokia Solutions can define how data remains on-site and what data will get into the cloud, optimizing this need.



The Digital Future of Lithium Mining

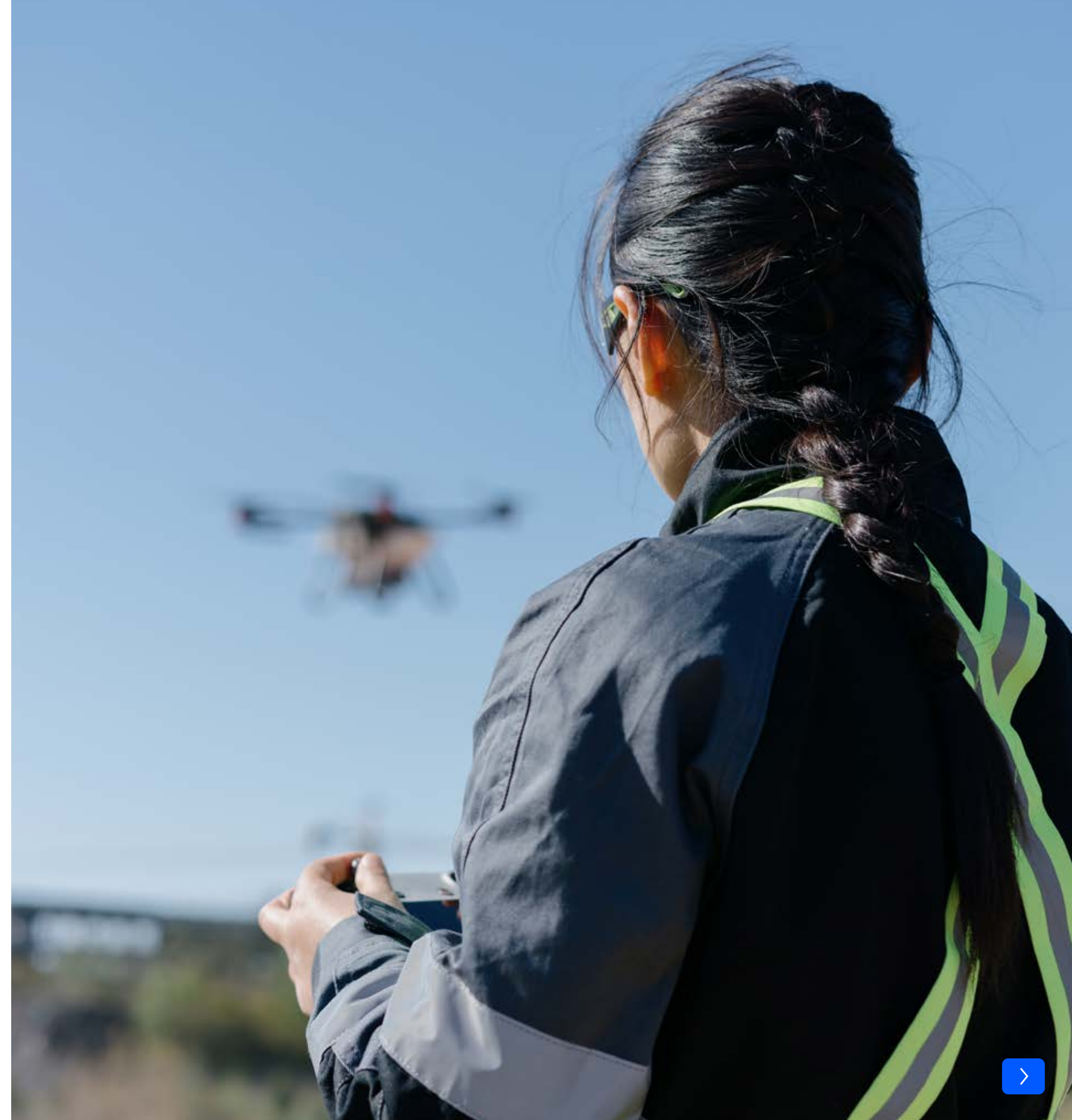
AI and Automation

AI and automation will become increasingly crucial in lithium mining. With growing data volumes and greater computing power, the potential to use AI for optimization and decision-making will multiply.

Some key areas where AI and automation are expected to advance are:

- **Autonomous mining:** fully autonomous mines, where AI controls all equipment without human intervention, will become a reality, improving safety, productivity, and consistency.
- **Predictive maintenance:** AI will enable increasingly sophisticated predictive maintenance, moving from simple threshold-based alerts to complex multivariate models that can predict failures weeks in advance.
- **Process optimization:** AI will enable real-time, self-optimizing processing plants that can continuously adapt to changes in output characteristics, input costs, and market demand.
- **Exploration and resource modeling:** AI will accelerate the discovery of new lithium resources by identifying subtle patterns in vast geological datasets. It will also enable more accurate and dynamic resource models.

Automation will also move beyond physical equipment, including robotic automation of back-office functions such as invoice processing and supply chain management. This will improve efficiency and free up workers to tackle higher-value tasks.



The Digital Future of Lithium Mining

Sustainable and Circular Solutions

Digital technologies will drive sustainability and circularity in the lithium industry. Some key opportunities are:

- **Renewable energy integration and optimization:** Digital solutions will enable the seamless integration of renewable energy into mining operations and optimize the balance between intermittent supply and variable demand, reducing the carbon footprint of lithium production.
- **Water management:** Advanced sensors and analytics will optimize water usage, treatment, and recycling to reduce the impact of lithium mining on local resources.
- **Waste valorization:** Digital solutions will help identify opportunities to valorize waste streams, e.g., recovering valuable by-products from overburden or using waste rock for construction materials. This will reduce waste and create new sources of revenue.
- **Circular economy:** Digital technologies such as blockchain will enable the tracking of lithium throughout its life cycle, from mining to battery production and recycling. This will support the development of a circular economy for lithium, where old batteries are recycled into new batteries, reducing the need for primary mining.



Challenges and Risks

While the opportunities for digitalization are immense, some challenges and risks must be tackled. Some of the most significant challenges are:

Cybersecurity

Mining operations become more digitally connected and vulnerable to cyber threats. Cybersecurity must be a top priority, and companies must implement robust defense and incident response plans.

Data governance

The explosion of data generated by digital mines raises questions about data ownership, access, and control. Clear data governance frameworks are needed to ensure ethical and secure data use.

Changing workforce

The increasing automation of mining operations will result in changes in the workforce. Some roles will become redundant, while new roles requiring digital skills will emerge. Managing this transition through retraining and upskilling will be critical, and this process can be accelerated by leveraging some of the digital technologies previously mentioned.

Social acceptance

If digital transformation is not managed correctly, it risks widening the gap between mining companies and local communities. Transparent communication and benefit sharing are vital to maintaining companies’ social acceptance.

Despite these challenges, the future of digital transformation in the lithium mining industry is bright. Companies that successfully manage digital transformation will be well-positioned to thrive in the new energy economy. They will be able to produce lithium more efficiently, sustainably, and responsibly and drive the transition to a cleaner future.



Case Studies: Sigma Lithium

In July 2024, Sigma Lithium Corporation, a leading producer of high-purity lithium concentrate, Nokia Corporation, and mission-critical integration partner Alcon announced a strategic partnership to drive sustainable lithium mining and processing practices.

The collaboration will leverage Sigma Lithium's expertise in responsible lithium production and Nokia's advanced digital solutions to optimize operations, boost energy efficiency, and minimize the environmental impact of lithium extraction activities.

Key elements of the partnership include:

- Deploy Nokia industrial-grade LTE/5G, IoT, and data analytics solutions across Sigma Lithium's mining and processing facilities to enable real-time monitoring, predictive maintenance, and process optimization.
- The private wireless network will support 200 Sigma workers and mine equipment, increasing operational efficiency, productivity, and worker safety.
- Connecting workers with certified ruggedized devices, industrial edge computing, and a catalog of ecosystem-neutral applications contributes to the creation of a safer working environment and enhances productivity and operational efficiency with crucial mining apps such as dispatch, push-to-talk and push-to-video, and innovative badge systems.

This collaboration will serve as a model for the lithium industry, demonstrating how advanced technologies can be leveraged to enable an environmentally and socially responsible lithium supply that will meet the growing demand from electric vehicle and battery manufacturers worldwide.

For more information, please visit



Conclusion

The lithium mining industry is at a critical juncture. As the world transitions to a low-carbon future, demand for lithium, the metal powering the EV and renewable energy storage revolution, is set to skyrocket. At the same time, the industry is under growing pressure to increase production efficiency, reduce its environmental impact, and enable responsible and sustainable supply chains.

Digital transformation is critical to overcome these challenges. As outlined in this eBook, digital technologies such as the Internet of Things, AI, automation, and blockchain are changing how lithium is explored, mined, and processed. These technologies enable lithium mine operators to optimize operations, reduce costs, improve safety, and minimize their environmental footprint.

But the lithium mining industry’s digital journey is only just beginning. Several trends and opportunities are becoming apparent as we look to the future.

First, the pace of digital adoption will accelerate. As technologies mature and competitive pressures increase, more lithium mining companies will embrace their digital transformation. Those that delay risk being left behind.

Secondly, we will see a move towards more integrated and interoperable digital architectures. The current patchwork of individual solutions will give way to holistic, end-to-end platforms that seamlessly connect data and processes across the entire value chain. Cloud, edge computing, and 4G and 5G private wireless networks will create the most essential prerequisites for this.

Thirdly, AI and automation will be omnipresent. From autonomous mining to self-optimizing processing plants and predictive maintenance, AI will significantly improve productivity and decision-making. The interface between man and machine will be redefined.

Fourthly, digitalization will drive the sustainability agenda. Digital solutions will support renewable energy integration, water optimization, waste recovery, and end-of-life recycling. Digitalization will be vital in creating a lithium circular economy.

The lithium mining industry is critical in enabling the global energy transition, but it will face challenges and risks. Cybersecurity, data management, workforce transition, and social acceptance are all critical issues that must be addressed. Success will require companies to embrace digital transformation and exhibit technological innovation, leadership, change management, and stakeholder engagement.

With the right vision, strategy, and execution, the industry can achieve a more intelligent, better-connected, and sustainable future, creating value for all stakeholders—shareholders, employees, communities, and the environment. This will result in a future where the lithium mining industry is not just a source of raw materials but a source of innovation and inspiration for the global energy transition. Lithium, the metal of tomorrow, will be produced with the technologies of tomorrow.

The stakes could not be higher, and the winners will be those who can harness the power of data, algorithms, and machines to create value in new ways. Those who can combine the best of human ingenuity with the best of digital technology. Those who cannot only adapt to change but drive it.

Nokia has created a roadmap for lithium mining companies’ digital journeys in this eBook. We have highlighted opportunities, challenges, pioneers, and best practices, and we hope we have inspired and informed you about your digital transformation.

The final chapter will be written by the visionaries, innovators, and change-makers in the lithium mining industry – by those who dare to imagine a different future and have the courage and ability to make it a reality.

Learn more about our solutions

Nokia OYJ
Karakaari 7
02610 Espoo
Finland

Tel. +358 (0) 10 44 88 000

CID: 214366 (Nov)

nokia.com

NOKIA

About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.

Nokia is a registered trademark of Nokia Corporation. Other product and company names mentioned herein may be trademarks or trade names of their respective owners.

© 2024 Nokia

