

November 2026

# Smarter operations. Safer people. Sustainable progress.

Mining sector

Get started

# Transform mining with connected operations and intelligent technologies that improve productivity, safety, resilience and sustainability

## Market dynamic for sector growth in 2026

**Drivers:** Strong demand for critical minerals (energy transition, AI, infrastructure), tech-driven productivity gains, policy support and western supply-chain security push

**Challenges:** Regulatory, cost and ESG pressures alongside skills gaps, market volatility, weaker prices, community opposition, supply disruptions and capital discipline

**Key trends:** Critical minerals surge, tech-led automation driving productivity and a strong low-carbon shift are impacting mining, with a focus on brownfield expansions and selective exploration



**Global mining** is undergoing major changes: The mining industry is moving from traditional, fossil-fuel-heavy methods to digital, AI-driven and more autonomous systems, focusing on decarbonization and supporting the global energy transition and net-zero goals.

The mining and resources sector is facing a **compound operating challenge**. It must **supply the minerals and materials** needed for **electrification, infrastructure, technology** and **grid buildouts**, while also operating in tougher physical, economic, geopolitical and regulatory conditions. This is creating a fundamental shift in what mining transformation needs to achieve.



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# Full-stack digital integration and execution for mining value chains

NTT DATA helps you connect fragmented operations, data, systems and ecosystems into intelligent, secure and scalable operating environments. We combine advisory, infrastructure, connectivity, cloud, cyber, applications, data, AI and global execution capability to help you move from isolated  digital initiatives to coordinated transformation across exploration, extraction, processing, logistics, trading, workforce safety and sustainability.



## Upstream intelligent exploration and extraction:

Combining resource intelligence, planning, geology, field operations and remote environments into a more intelligent resource development model



## Midstream connected operations and asset performance:

Bringing mine, plant, workforce, assets and enterprise systems together into secure, resilient and scalable operations



## Downstream resilient, sustainable and traceable resources:

Connecting processing, logistics, trading, ESG, compliance and ecosystem partners into a more transparent and responsive resources value chain

**Enabling safer, smarter mining through real-time orchestration, generative AI (GenAI)-powered workforces, operational ESG intelligence and autonomous safety**



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# Key initiatives we're driving with clients to solve their challenges

## Programs

**Autonomous operations**
Real-time orchestration with an ICC "neutral hub" and exception-based control

**Workforce transformation**
Connecting every mining worker with safety, efficiency and the digital intelligence of the future

**ESG-driven operations**
Decisions that weigh production, safety and ESG in real time

**Safety by design**
No one in the line of fire — prevention and response become autonomous

## Key enablers

### Organizational readiness

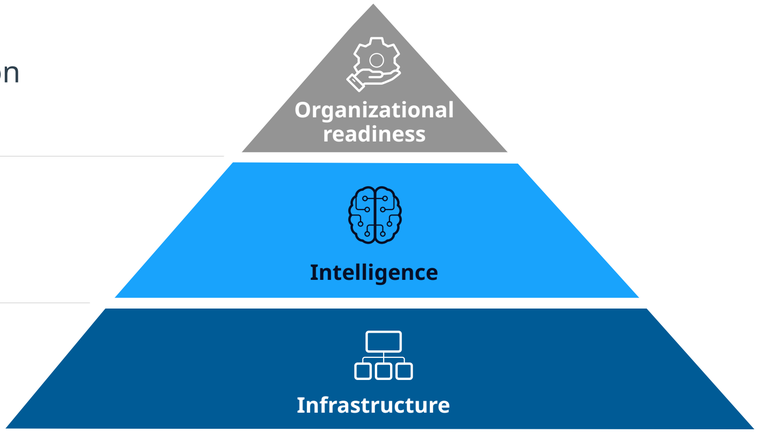
- Decision governance, value PMO, management by exception, talent transformation

### Intelligence

- Reusable twins, optimization, computer vision, GenAI copilots
- A common "brain" consumed by ICC, digital collaborator, safety and ESG

### Infrastructure

- Private 5G/IOWN, edge, IT–OT convergence, data fabric that powers all four programs consistently




**NTT DATA autonomy tower**



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# Infrastructure (the foundation layer)

“No data, no autonomy.”

### IOWN photonic

**If autonomy is the brain, IOWN is the nervous system.**

Developed by NTT Group, IOWN delivers near-zero latency, ultra-high-bandwidth, ultra-low-power data transmission. It enables real-time AI, edge computing, robotics and digital twins in large-scale industrial environments. Already tested in mining, it’s the backbone for autonomous operations at scale.

### Edge computing

**In autonomy, edge computing is the first responder.**

We deploy industrial edge architectures to process critical data at the source — close to sensors, machines and operational events. This allows low-latency AI inference, autonomy continuity in disconnected environments and a scalable, secure bridge to hybrid cloud.

### Private 5G

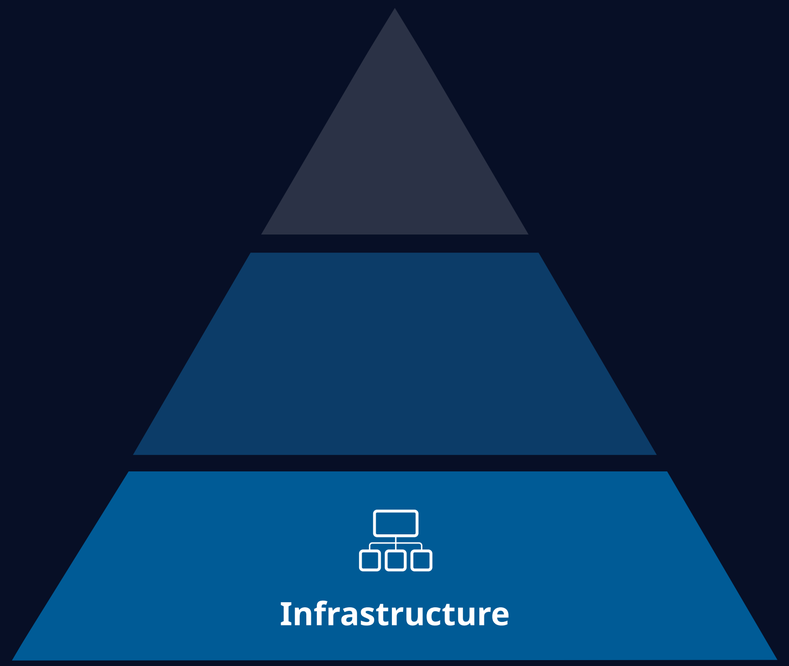
**Linking machines, sensors and workers in motion, in real time.**

We deploy true private 5G — no telco, no shared spectrum. The mining company owns the network, controls the devices and connects people and machines without relying on external infrastructure. That’s true operational sovereignty.

### Satellite data (C89)

**Satellite + data is the eye in the sky — capturing the big picture in real time.**

Our satellite services provide continuous, high-resolution monitoring across vast, inaccessible areas. Whether it’s evaporation ponds, tailings, haul roads, critical infrastructure, natural capital or remote camps — we bring live operational visibility from orbit, enriched with AI analytics.




**NTT DATA autonomy tower**



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# Intelligence (the decision layer)

Autonomy happens when machines can decide safely and efficiently

### GenAI copilots

**Translating complexity into action, one conversation at a time.**

NTT DATA designs, builds and scales GenAI copilots that transform complex industrial systems into natural, conversational experiences, enabling frontline workers, supervisors and executives to interact with operational intelligence in real time, make better decisions faster and reduce friction across the value chain.

### Smart robotics

**Robots are not here to replace the workforce; they're here to protect it.**

NTT DATA designs and integrates AI-powered smart robotics to automate high-risk, high-precision tasks, combining simulation, control and perception to deploy robots that operate safely, independently and in coordination with people and systems. We co-design robots with our partners in simulated environments, using platforms like NVIDIA Omniverse and digital twins.

### Digital twins

**Replicating reality so the system can learn, predict and act with foresight.**

NTT DATA designs and deploys digital twins that replicate complex mining systems — from equipment and infrastructure to entire processes — fed by real-time OT and IT data. These living models enable simulation, prediction and optimization at scale, serving as the decision backbone of autonomous operations.

### Predictive analytics

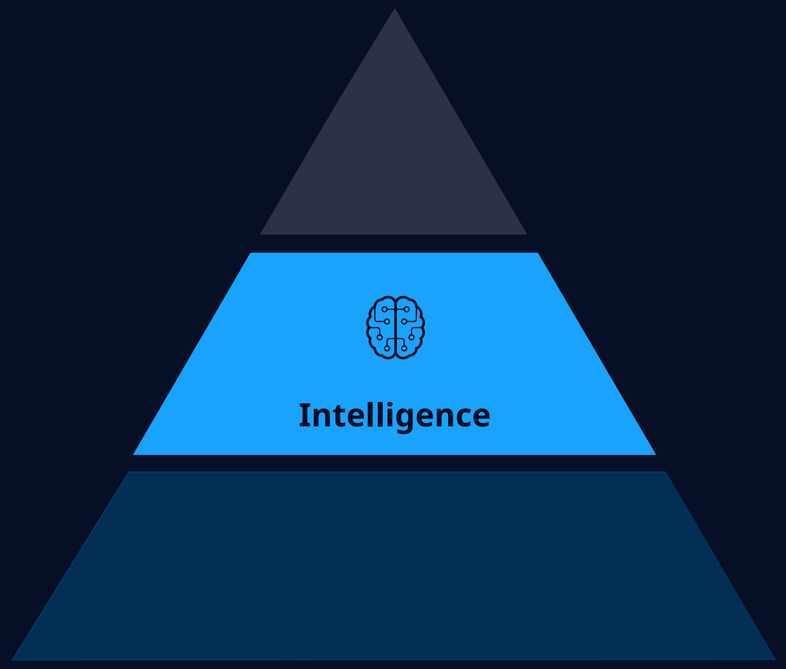
**Allowing the system to anticipate what's next before it happens.**

NTT DATA implements predictive analytics across operational systems to transform data into foresight, from anticipating asset failures to forecasting demand, delays or quality issues. By combining statistical modeling, machine learning and real-time data flows, we help mining operations make proactive decisions that improve safety, performance and business outcomes.

### Quantum computing

**Solving what traditional systems can't, at the speed the operation demands.**

NTT DATA applies quantum computing to solve industrial problems that are too complex or too slow for classical systems, optimizing supply chains, scheduling, maintenance and operational trade-offs in real time. We help mining operations process millions of variables simultaneously, unlocking new frontiers in decision-making and AI performance.




**NTT DATA autonomy tower**



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# Organizational readiness (the execution layer)

Without people, process and governance, autonomy remains a prototype

## Execution and governance

**Turning strategic intent into real outcomes.**

NTT DATA integrates governance, PMO and value capture into a single execution engine, helping organizations turn pilot projects into scaled programs, with clear priorities, sponsorship and measurable impact across the autonomy journey.

## Workforce transformation and enablement

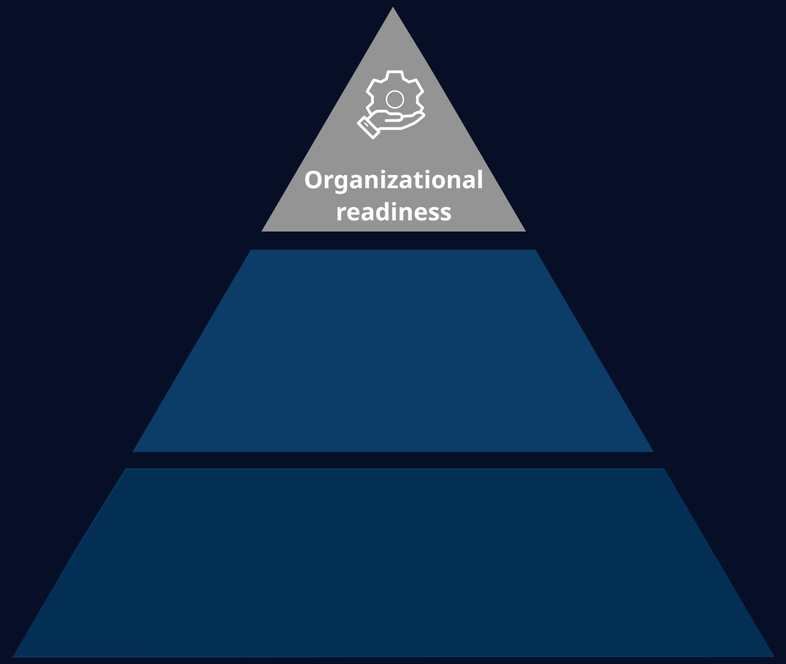
**If autonomy is the brain, the digital workforce is the body — trained, enabled and ready to operate it.**

We empower the digital workforce by transforming talent from the ground up, redesigning roles, equipping them with GenAI and predictive tools and enabling every worker to interact naturally with autonomous systems.

## IT-OT convergence

**An integrated IT–OT architecture, operated by one cross-functional team, enables fast delivery of business-critical use cases.**

NTT DATA drives IT–OT convergence as both a technological and organizational transformation, where IT and OT teams no longer operate in silos. Instead, they become a unified digital industrial organization, supported by a secure, interoperable architecture that enables agile responses to business challenges and opportunities.




NTT DATA autonomy tower



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# Autonomous mining operations

**The mines of the future will run smarter, safer and faster as autonomous operations redefine productivity and unlock zero-harm performance, with four foundational areas enabling autonomy.**

## 4 domains of value in mining

### 01 Autonomous things

Equipment that moves and operates autonomously in the physical world: Trucks, drills, loaders, drones and inspection robots

### 02 Smart operations

The intelligence, infrastructure and organizational layer that enables concentrators, smelters and processing plants to operate with minimal human intervention

### 03 Operations anywhere

Intelligent control centers serve as the “neural hub” for pit-to-port orchestration, enabling remote, exception-based operations

### 04 Intelligent supply chain

Automated decision-making across the supply and logistics network, enabling real-time visibility, planning and optimization of flows from mine to customer

## Use cases

- Autonomous haul trucks, drills, drones, robotic inspection and maintenance
- Advanced process control, digital twins of plant circuits, self-optimizing concentrators and robotics in labs
- Integrated control centers, remote operations, immersive interfaces and exception-based management
- Real-time logistics orchestration, pit-to-port integration and automated demand-supply balancing

## Our capabilities

| | Autonomous things | Smart operations | Operations anywhere | Intelligent supply chain |
|---|---|---|---|---|
| **Operational readiness** | Autonomy PMO, digital academy for operators | Governance for AI decision rights, change management | Intelligent governance, organizational redesign, capability academies | Value tracking, ESG-by-design supply chain governance |
| **Intelligence** | Computer vision, agentic platforms, predictive/ optimization models | Digital twins, MLOps, AI for process control | Conversational copilots, optimization engines | Agent-based decision platforms, GenAI for scenario planning |
| **Infrastructure** | IOWN private 5G, satellite connectivity, edge computing | Interoperable digital architectures, cyber-resilient OT, quantum-ready compute | Edge-to-cloud platforms, interoperable IT–OT, IOWN and private 5G | Data platforms, IOWN connectivity, IoT-enabled assets. |



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# Workforce transformation

**Empower frontline workers with digital copilots, real-time information and collaborative tools so they can perform their tasks more safely, efficiently and consistently. This is the first step toward autonomous operations, reducing reliance on manual, high-risk work.**

## 3 domains of value in mining

### 01 Digital collaboration and AR/VR

Wearables, mobile devices, AR glasses, step-by-step workflows, remote assistance, immersive training

### 02 AI-assisted copilots

Conversational copilots guide inspections, maintenance and decision-making. **Exception management:** AI identifies anomalies; workers act only where needed

### 03 Digital mindset

The shift equips mining workers to operate in a fully digital, **autonomous environment**. It focuses on **continuous upskilling** and a **new way of managing digital talent**, fostering adaptability, collaboration and data-driven decision-making beyond traditional mining roles

## Use cases

| | | |
|---|---|---|
| Remote expert support, immersive training, work instruction overlays | Predictive maintenance copilot, inspection assistant, operation decision support | Digital academies in mining |

## Our capabilities

| | |
|---|---|
| **Operational readiness** | Digital academies, change management, hybrid digital–operational roles, upskilling programs, cultural change management |
| **Intelligence** | GenAI copilots, predictive analytics, computer vision |
| **Infrastructure** | Private 5G/IOWN networks, edge computing, IoT platforms, AR/VR simulators |



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# ESG-driven operations

**ESG-driven operations enable mining companies to align productivity with sustainability, embedding environmental, social and governance principles at the core of every decision. By leveraging data, automation and transparency, operations become safer, cleaner and more resilient. This future-ready model builds stakeholder trust while ensuring long-term value creation for people, planet and business.**

## 3 domains of value in mining

### 01 ESG in real-time

Leverage technology and data to enable real-time ESG-driven decisions

### 02 People and community engagement

Create a shared value with employees, communities and society

### 03 Governance and transparency

Strengthen trust and social license to operate through integrity and transparency

## Use cases

Production vs. sustainability trade-offs: Real-time simulation of production scenarios integrating energy, water and emissions footprint → enabling balanced and efficient decisions

Community digital twin: Platform modeling the impact of mining on jobs, health, environment and local development → creating shared value initiatives and strengthening social license

Automated ESG audit and reporting: “Auto-evidence” platform that generates auditable reports in real time for regulators and investors → building trust and reducing audit cycle times

## Our capabilities

| | |
|---|---|
| **Operational readiness** | ESG compliance, governance frameworks, risk management |
| **Intelligence** | GenAI for audits, compliance analytics |
| **Infrastructure** | Integrated data platforms, blockchain for traceability |



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# Safety by design

**Our goal is to redefine mining safety by removing people from hazardous work zones, ensuring that high-risk activities are handled by automation, robotics and AI. The program shifts safety from compliance reporting to a design principle embedded in every operation.**

## 4 domains of value in mining

### 01 Intelligent safety infrastructure

Next-gen networks (private 5G/IOWN), edge computing, IoT sensors and computer vision work together to create a **real-time safety shield**. This includes geofencing, wearables and predictive safety digital twins to anticipate hazards before they occur

### 02 Robotics and autonomous hazard removal

Autonomous trucks, drills, drones and robots take over hazardous tasks in pits, plants and logistics. This component **removes humans from the line of fire** by default, ensuring “zero exposure” in confined spaces, high walls, blasting zones and critical inspections

### 03 Digital safety governance

Digital permit-to-work systems, embedded SOPs, automated interlocks and compliance workflows enforce safety protocols end to end. Unsafe work cannot start unless conditions are validated, ensuring **procedural integrity and traceability** aligned with global standards

### 04 Immersive safety training and simulation

VR/AR simulations, haptic training and safety digital twins prepare the workforce for emergency scenarios and new autonomous environments. This **builds muscle memory and a safety-first culture**, ensuring readiness as autonomy scales

## Use cases

- Autonomous geofencing in open pit mines
- Underground robotic inspection
- Smart permit-to-work for confined spaces
- Virtual blast training

## Our capabilities

| | |
|---|---|
| **Operational readiness** | Digital permit-to-work platforms, safety governance models, immersive VR/AR training,digital academies, change management, SOPs embedded in workflows |
| **Intelligence** | Computer vision, predictive safety analytics, safety digital twins, AI and machine learning Quantum-ready simulation → high-complexity safety scenarios and optimization |
| **Infrastructure** | Private 5G/IOWN, edge computing, IoT wearables and sensors, OT cyber resilience, Autonomous drills and trucks, inspection robots, drones, tele-remote operations, robotics |



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# Proof

| | Chile-based copper mining group | World's largest mining company | Sustainability control tower PoC |
|---|---|---|---|
| | **Gen-AI recommenders for plant control** | **Building the digital backbone for autonomous operations** | **From fragmented ESG reporting to live KPI visibility** |
| | NTT DATA developed AI-based recommenders powered by GenAI agents to support concentrator plant operators with real-time decision-making, helping them understand complex recommendations and identify better control options | NTT DATA supported an infrastructure modernization roadmap spanning network and hosting upgrades, cloud adoption, connectivity, secure access networks, OT modernization and autonomy enablement for autonomous drilling and truck operations | NTT DATA supported a leading mining company in evaluating a sustainability control tower approach, moving from fragmented legacy systems, manual data entry and limited visibility toward a prioritized roadmap for integrated sustainability KPI management |
| **Outcomes** | Frontline GenAI, workforce enablement and AI-assisted operational decision-making | Secure IT–OT, cloud, network and operational foundations for connected and autonomous mining | Downstream sustainability, traceability, ESG data integration and operational KPI visibility |
| **Context** | GenAI across the value chain and the future workforce | Midstream connected operations and asset performance | Downstream resilient, sustainable and traceable resources |

## Expected impact from NTT DATA mining transformation programs

### Productivity

5%–10% production enhancement

### Cost and uptime

10% maintenance cost reduction and +5% asset uptime

### Safety

20%–30% TRIFR reduction

### Workforce efficiency

>50% reduction in time to expertise and human error

### Sustainability

3%–5% reduced GHG emissions



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# Connect the mine. Orchestrate the future.

NTT DATA brings the digital backbone, operational intelligence and execution discipline to help mining organizations improve productivity, safety and sustainability together, from mine site to cloud.

## Start with value

Prioritize use cases around uptime, cost/ton, exposure reduction, ESG visibility and cyber risk

## Scale with confidence

Industrialize with shared architecture, IT/OT convergence, governance, PMO and adoption

## Co-innovate the future

Use NTT DATA R&D, ecosystem partnerships and mining-specific innovation to optimize autonomous operations

Visit nttdata.com to learn more.

NTT DATA is a $30+ billion business and technology services leader in AI and digital infrastructure. We accelerate client success and positively impact society through responsible innovation. As a Global Top Employer, we have experts in more than 70 countries.



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