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# What "AI for Mining" Actually Means in 2026

**Operations. Projects. Studies.**

*A practical guide for mining professionals navigating the AI landscape*

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## Introduction

If you have been in mining long enough, you have watched buzzwords come and go. "Big data." "Industry 4.0." "Digital twin." Each cycle arrives with grand promises, gets enthusiastically bolted onto the side of an operation, and then quietly fades when the implementation complexity proves greater than the vendor slide deck suggested.

AI is different — not because it is immune to hype, but because the underlying capability is genuinely maturing faster than any previous technology wave. In 2026, the conversation has moved from "should we explore AI?" to "where exactly are we deploying it and what are we getting back?"

But here is the problem with most "AI for mining" conversations: they conflate three fundamentally different categories of work under one umbrella, each with its own maturity levels, risk profile, toolset, and decision-makers. Getting these categories straight is the first step to having a useful conversation about AI strategy.

### AI for Operations

*Physical mine, equipment, processing plant — where AI maturity is highest and ROI is most proven.*

### AI for Projects

*Capital project delivery — procurement, contracts, construction management, and project controls.*

### AI for Studies

*Technical intelligence — feasibility studies, cost benchmarking, report analysis, and investment decisions.*

This article maps all three categories: what is being deployed, where the evidence is strongest, and where the next wave of value creation is still forming. The goal is to give mining professionals — whether you are a geologist, engineer, project manager, or executive — an honest picture of the landscape in 2026.

## The Market Reality: AI Has Left the Pilot Stage

Before mapping individual categories, it is worth anchoring the conversation in numbers — because the scale of investment tells you something important about the seriousness of the moment.



Sources: Mine-Site Technology Adoption Survey 2025<sup>1</sup>; BCG, "The AI-Powered Mining and Metals Company," 2026<sup>2</sup>

Mining and metals technology financing hit a record \$4.8 billion in 2025 alone, part of roughly \$15 billion deployed across the sector from 2021 to 2025. Software and sensors accounted for approximately 90% of that deal flow — a signal that the industry is buying intelligence, not just iron.

BCG's January 2026 research moved mining and metals from "near the bottom" to "the middle of the pack" for AI application maturity across global industries. That means meaningful progress, but also an honest reminder that significant runway remains — particularly in the Projects and Studies categories, where AI is still arriving rather than established.

## AI for Operations

*Physical mine, equipment fleet, and processing plant — the highest-maturity category*

Mine operations is where AI has the longest track record and the strongest evidence base. The applications are mature, the ROI data is real, and deployment is accelerating. This is the category where the question is no longer "does it work?" but "how fast can we scale it?"

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## Predictive Maintenance

Equipment failure in mining is extraordinarily expensive — not just in repair costs, but in lost production from unplanned downtime. AI-powered predictive maintenance analyses sensor data from haul trucks, drills, conveyors, and processing equipment to flag emerging failures days or weeks before they occur.

Anglo American's Tropicana gold mine in Western Australia processes 4.7 terabytes of operational data per day through Hexagon Mining's digital twin platform, adding approximately A\$47 million to annual revenue from the same physical resource through AI-driven mine planning. Newmont's Ahafo mine in Ghana achieved a 6.1% improvement in overall equipment effectiveness and a 9.4% reduction in energy consumption per tonne milled using Siemens Xcelerator. US Steel's implementation of MineMind's maintenance platform reduced work order completion time by approximately 20%.

## Autonomous Haulage and Fleet Management

The autonomous truck is no longer a future technology — it is the current state of operations at the world's largest mining companies. Rio Tinto's autonomous haulage system has delivered a 15% increase in productivity and 10% reduction in operational costs. Fortescue transitioned 108 haul trucks to full autonomy and reported a 30% increase in productivity compared to previous manned operations.

In mid-2024, Fortescue and Liebherr announced the world's first fully integrated autonomous haulage system for zero-emission vehicles — combining fleet management, onboard autonomy, and high-precision machine guidance for hydrogen-powered trucks. Applied Intuition estimates the current \$1.6 billion vehicle autonomy market for mining could expand eightfold to \$12.8 billion by 2031.

Komatsu's AI fleet management system prevents equipment breakdowns that cost \$20,000–\$50,000 each in lost productivity. Rio Tinto's own data provides important context: only 3% of its processes are currently fully automated, with 21% in tele-operations and 76% still manual or mechanised. The growth runway is enormous.

## Processing Plant Optimisation

BHP's Escondida copper mine in Chile deployed digital twins and AI models to predict how ore characteristics influence performance at the SAG mill — informing blasting and blending decisions before material reaches the processing plant. This delivered approximately a 70% reduction in production losses linked to granulometry in targeted applications. Metso Geminex provides metallurgical digital twins for real-time process optimisation, while Microsoft Azure Machine Learning is deployed at multiple concentrators for real-time recovery rate recommendations.

## Safety Monitoring and Computer Vision

AI safety applications are often the entry point for AI adoption in mining, and for good reason: the business case is clear, the technology is mature, and the human stakes are obvious. Strafer's AI safety platform delivers a 30–40% reduction in OSHA recordable incidents and 5–8% reduction in workers' compensation premiums. Doxel's computer vision platform captures 500+ high-resolution images per drone flight every 24 hours, detecting 95%+ of work sequencing issues automatically.

BHP's Western Australia Iron Ore operations use computer vision along conveyors to identify oversized rocks or foreign objects — addressing disruption events that historically contributed to over 1,000 hours of downtime. The data generated by AI safety systems also creates an audit trail that has increasing regulatory and ESG reporting value.

## Exploration and Geological AI

AI is transforming the front end of the mine lifecycle — from geophysical data interpretation to autonomous drilling. Average time from anomaly detection to drill-ready target has been cut from 4.2 years to 1.8 years at sites with full AI interpretation tools deployed.

KoBold Metals — backed by Bill Gates, Jeff Bezos, and Founders Fund, valued at \$2.96 billion following a \$537 million Series C — uses AI to process multispectral satellite imagery, drone hyperspectral data, and ground-based geochemical samples. Their system flagged the Mingomba copper deposit in Zambia's Copperbelt from legacy data alone; subsequent drilling intersected 1.02% copper over 257 metres, one of the most significant copper discoveries globally in the past decade. Epiroc's SmartROC D65 autonomous drill rigs adjust drilling parameters up to 40 times per second, delivering a 23% faster penetration rate and 31% reduction in drill bit wear at Barrick Gold's operations.

## AI for Projects

*Capital project delivery — procurement, contracts, construction management, and project controls*

AI for capital project delivery is the least discussed and most underestimated category in mining. Yet capital projects are where the industry's financial exposure is greatest: cost overruns on major mining projects routinely reach 40–80% of original estimates, and schedule delays are the norm rather than the exception. AI is beginning to address this systematically, across four distinct domains.

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## Procurement and Supply Chain

Mining procurement is extraordinarily complex — long lead times, single-source suppliers for specialised equipment, volatile commodity prices, and global supply chains that span dozens of jurisdictions. AI is reshaping how procurement teams manage this complexity.

Ironclad's 2025 State of AI in Procurement report rates contracting as "one of procurement's most reliable and mature AI applications," with an impact score of 8.3/10 across use cases. Bridger Supply Chain AI monitors lead times, logistics, port delays, and supply chain data — automatically sourcing alternatives and predicting disruptions 30 days in advance, preventing two-week delays that can cost \$150,000+ in idle crew wages and rentals.

The Hackett Group's research shows that organisations using AI-enabled procurement are achieving 15–20% reductions in procurement cycle time and 3–7% reductions in total cost of ownership across key spend categories. For a major mining capital project with \$500M+ in procurement spend, even a 3% cost reduction represents \$15M+ in direct savings.

## Contract Management and Legal Review

Mining capital projects involve thousands of contracts — EPC agreements, equipment supply contracts, labour agreements, offtake contracts, and hundreds of subcontractor arrangements. AI-powered contract management is addressing the volume, complexity, and risk concentration inherent in this environment.

Large Language Models (LLMs) are now being deployed across the contracting lifecycle: automating document evaluation during tendering, extracting key obligations during commercial handover to operations teams, continuously monitoring contractual compliance during execution, evaluating subcontractor bids, and identifying trends in dispute data to suggest data-driven resolutions.

Cobblestone Software's NLP contract platform and Ironclad's AI contracting suite both operate in the mining and resources sector. The key capability shift: what previously required a senior contracts administrator 30–60 minutes per document now takes seconds, with the human role shifting to review and judgment rather than extraction and classification.

## Construction Management and Project Controls

The construction phase of a mining project is where schedule risk and cost exposure peak. AI is beginning to provide real-time intelligence that was previously unavailable to project teams.

Procore's AI predictive analytics — deployed across more than 4 million projects globally — forecasts completion dates with 85%+ accuracy 60+ days out, and flags material shortages and cost overruns in

advance. Kwant's workforce analytics platform reduces labor bottlenecks by 10–15% per project and has identified 20% improvements in trade hour efficiency on identical floor layouts. Touchplan's AI scheduler reduces schedule conflict resolution from 4–6 hours of manual work to seconds.

Doxel's computer vision platform — automated drone scans every 24 hours comparing site status to BIM — detects 70–80% of construction clashes automatically and reduces rework by 15–25%, saving \$8,000–\$15,000 per single trade clash. SAALG Geomechanics' DAARWIN platform integrates real-time geotechnical sensor data during construction, delivering up to 30% reduction in costs related to unforeseen geotechnical issues.

### **The project cost overrun problem in mining**

McKinsey data shows that large mining capital projects overrun their original cost estimates by an average of 43% and schedule by 25%. AI project controls are beginning to shift this trajectory — not by eliminating complexity, but by making its consequences visible earlier, when corrective action is still possible.

Source: McKinsey Global Institute; Kwant.ai Construction Management Report 2026<sup>3</sup>

## **AI for Studies**

*Technical intelligence — feasibility studies, cost benchmarking, report analysis, and investment decisions*

The Studies category is the most intellectually interesting — and the most underserved by current AI tools. Yet it is also the category where the data problem is most acute and the opportunity for transformational improvement is greatest. Mining studies — from scoping through to definitive feasibility — sit at the intersection of enormous technical complexity, regulatory obligation, and high-stakes investment decisions.

Mining is one of the most data-rich industries on earth. A single advanced-stage project generates thousands of pages of technical reports, drill logs, geochemical assays, metallurgical test results, environmental assessments, and regulatory filings — accumulated over decades, often from multiple predecessor companies. The institutional knowledge embedded in that data largely retires with the geologist who wrote it.

### **Cost Estimation and Benchmarking**

Costmine's AI-powered platform suite — SHERPA and WOODY — represents the most mature AI tooling currently available for mining feasibility cost work. SHERPA applies engineering and geological inputs to generate CAPEX and OPEX estimates across the entire mine life cycle. WOODY integrates Mining Cost

Service data into a benchmarking platform that allows users to filter comparable projects by commodity, stage of development, and geography — generating cost curves and identifying outliers without rebuilding models from scratch.

The shift this enables is significant: from manual data collection, static spreadsheets, and inconsistent results, to centralised databases, reproducible models with traceable inputs, and dynamic estimates that update as new data becomes available. For a Qualified Person preparing an NI 43-101 technical report, this represents a fundamental change in the quality and defensibility of cost assumptions.

## Technical Report Analysis and Knowledge Extraction

NI 43-101, SK-1300, and JORC technical reports represent some of the most structured, high-value technical documents in mining — yet the data within them has historically been largely inaccessible to systematic analysis. Each report is a PDF. Each PDF uses different formatting conventions, terminology, and table structures. The collective intelligence contained in thousands of public filings on SEDAR+, EDGAR, and ASX is effectively invisible without AI.

This is changing rapidly. AI document extraction systems — using techniques pioneered in financial document analysis — are now being applied to technical report corpora. Key capabilities in deployment include: structured data extraction from tables and free-form text, cross-document relationship mapping, automatic flagging of anomalies relative to comparable projects, and conversion of legacy records into searchable datasets.

Sequent's Geological Language Model, unveiled in April 2026, extracts structured geochemical data from 1960s-era hand-typed exploration reports at 97% accuracy. BHP's generative AI tools convert unstructured records — scanned reports, field notes, and fragmented datasets accumulated over 140 years — into usable formats, with work that previously took months now completed in hours.

**Platforms like MineGPT are addressing exactly this gap — transforming NI 43-101, SK-1300, and JORC technical reports and study data into structured, searchable intelligence that enables faster comparative analysis, better investment decision-making, and greater transparency across the mining sector.**

The ability to interrogate a portfolio of technical reports as a connected knowledge base — rather than a collection of PDFs — changes what is possible in due diligence, study benchmarking, and resource confidence assessment.

## Study Review and Due Diligence

Mining M&A, project financing, and streaming transactions all require rapid, rigorous review of technical reports and study packages. A typical NI 43-101 feasibility study runs 500–1,500 pages. A comprehensive due diligence package may span dozens of reports across multiple disciplines.

AI-assisted due diligence is compressing review timelines and improving coverage. AI systems can extract and cross-reference key parameters across reports — production rates, strip ratios, recovery assumptions, cost inputs, capital estimates — flagging where assumptions appear aggressive relative to comparable projects. What previously required 2–3 weeks of senior technical review can now be supported with a structured preliminary screening in hours.

## Study Preparation and Automation

Generative AI is beginning to accelerate the study preparation process itself — automated generation of boilerplate sections from structured data inputs, AI-assisted sensitivity analysis, automated cross-checking of report sections for internal consistency, and AI-driven population of standard technical report templates from underlying data.

BHP's teams report that AI-enabled extraction tools allow geoscientists to compile and interpret data that previously took months to complete — in hours. The implication for study teams is significant: the time that engineers and geologists spend on data gathering, formatting, and reconciliation can be dramatically reduced, redirecting professional capacity toward analysis and judgment.

Domain	Representative Tools (2026)	Maturity Level	Key Outcome
Operations: Predictive Maintenance	Hexagon Mining, Siemens Xcelerator, MineMind	Production	Unplanned downtime reduced; 6-9% OEE improvement
Operations: Autonomous Haulage	Rio Tinto AHS, Komatsu AHS, Fortescue/Liebherr	Production	15-30% productivity uplift; 10% cost reduction
Operations: Processing Optimisation	Metso Geminex, Azure ML, BHP Digital Twin	Production	Up to 70% reduction in granulometry-linked losses
Operations: Safety / Computer Vision	Strafer AI, Doxel, BHP WAIO CV	Production	30-40% fewer incidents; 1,000+ hrs downtime prevented
Operations: Exploration AI	KoBold, GoldSpot, Epiroc SmartROC, Sandvik AutoMine	Scaling	4.2 yrs → 1.8 yrs to drill target; 23% faster penetration
Projects: Procurement	Bridger Supply AI, Hackett AI Procurement Suite	Scaling	15-20% cycle time reduction; 3-7% cost of ownership reduction
Projects: Contracts	Cobblestone, Ironclad AI	Scaling	30-60 min/doc → seconds; 8.3/10 impact score

Domain	Representative Tools (2026)	Maturity Level	Key Outcome
Projects: Construction Mgmt	Procure AI, Kwant, Touchplan, Doxel, Bridgit Bench	Scaling	85% schedule accuracy; 10-15% labour efficiency gain
Projects: Geotech Risk	DAARWIN (SAALG Geomechanics)	Emerging	Up to 30% reduction in unforeseen geotech costs
Studies: Cost Estimation	Costmine SHERPA, WOODY, ML uncertainty models	Scaling	Dynamic CAPEX/OPEX benchmarking; traceable inputs
Studies: Report Extraction	Seequent GLM, BHP GenAI, MineGPT, Snorkel Flow	Emerging	97% extraction accuracy; months of work in hours
Studies: Due Diligence AI	AI technical review platforms, custom LLM pipelines	Emerging	Weeks → hours for preliminary study screening

Sources: BCG 2026<sup>2</sup>, Costmine 2026<sup>4</sup>, Business20Channel.tv 2026<sup>5</sup>, Kwant.ai 2026<sup>3</sup>, SAALG 2025<sup>6</sup>, Ironclad 2025<sup>7</sup>, Seequent 2026, BHP 2026<sup>8</sup>

## Governance and Responsible AI: The Risk That Cannot Be Ignored

Across all three categories, the deployment of AI has outpaced the development of governance frameworks. In 2026, two-thirds of organisations cannot reliably enforce limits on how their AI systems are used, and six in ten lack effective "kill switches" for AI systems running in their operations.

### **This is not a theoretical future risk.**

AI is already embedded in safety-critical systems — collision avoidance, autonomous haulage, blast management, and geotechnical monitoring — where a failure of oversight can have immediate consequences for people and infrastructure. Yet governance frameworks have not kept pace with deployment speed.

Source: Mining.com, "Mining's Top Ten ESG Trends for 2026," January 2026<sup>9</sup>

The EU AI Act, ISO/IEC 42001:2023, and emerging frameworks in Canada and Australia are establishing baseline expectations for transparency, auditability, and accountability in AI systems. GRI 14: Mining Sector 2024, effective 1 January 2026, formalises disclosure requirements for land disturbance, water use, and biodiversity — where AI-generated data is increasingly the most credible and auditable source.

The key governance questions for 2026 — across Operations, Projects, and Studies:

- Can you explain, to a regulator or a court, how your AI system reached a specific operational or commercial decision?
- Do you have audit trails for AI-generated recommendations that affected safety or contract outcomes?
- How are you managing bias in AI systems used for exploration targeting, cost estimation, or study benchmarking?
- Who in your organisation has accountability for AI system performance — not just IT deployment?
- For AI used in technical reports: can the data lineage from input to conclusion be fully traced and independently verified?

## What "Good" Looks Like Across All Three Categories

BCG's research on leading AI adopters in mining identified five consistent traits of organisations generating measurable returns. These apply regardless of whether the deployment is in Operations, Projects, or Studies:

Trait	What It Means in Practice
Business-led strategy	AI programs are tied explicitly to operational, project, or study outcomes — not to technology experimentation. The business case is defined before the technology is selected.
Strong data backbone	Leaders work with imperfect data rather than waiting for perfect data. Interoperable systems are prioritised. Data lineage and governance are treated as foundational infrastructure.
Empowered workforce	AI literacy is built across functions — engineers, geologists, project managers, contracts teams. Professionals are trained to work with AI outputs and to challenge them.
Integrated operating model	Cross-functional teams including technical specialists and AI practitioners work together. AI is embedded in workflows, not bolted on.
Responsible governance	Clear principles govern transparency, explainability, and accountability — especially for autonomous systems and AI used in regulatory reporting.

Source: BCG, "The AI-Powered Mining and Metals Company," 2026<sup>2</sup>

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# The Right Questions — By Category

## For AI in Operations

- What is the current baseline for unplanned downtime, and what would a 20% improvement mean in dollar terms?
- Are sensor data streams from equipment being captured and accessible, or siloed in OEM systems?
- What is the current level of autonomy in haulage and drilling — and what is the roadmap?
- How are AI safety system outputs being integrated into incident reporting and regulatory compliance?

## For AI in Projects

- How are cost overruns and schedule delays currently tracked — and at what point in the project lifecycle is the warning visible?
- What percentage of procurement and contract review time is spent on extraction and classification vs. judgment?
- Is construction progress currently measured in real time (computer vision, IoT) or through manual reporting?
- How is geotechnical risk being modelled during construction — static study assumptions or dynamic sensor integration?

## For AI in Studies

- What is the current process for benchmarking CAPEX/OPEX assumptions against comparable projects?
- How much time do study teams spend finding, cleaning, and reconciling data vs. analysing it?
- Are technical reports being produced in formats that support structured data extraction — or formatted exclusively for human readers?
- For due diligence: how long does preliminary technical screening currently take, and what coverage does it achieve?

# Where This Leaves Us

AI for mining in 2026 is not one technology or one conversation — it is three distinct categories of application, each at a different point on the maturity curve, each with its own evidence base, risk profile, and decision-making context.

In Operations, the tools are proven, the ROI is documented, and the question is about speed of adoption and scale. In Projects, AI is arriving at a moment when the industry's capital allocation problem is acute — and tools in procurement, contracts, and construction management are showing strong early results. In Studies, the opportunity is the most underexplored: the intelligence contained in decades of technical reports remains largely locked away, and the first-movers who unlock it will have a material analytical advantage.

Across all three, the organisations capturing the most value are those investing in the foundations: data infrastructure, cross-functional capability, and governance frameworks. The technology is increasingly available. The differentiator is the organisational readiness to use it well.

Future articles in this series will go deeper into each category — covering specific tools, implementation approaches, and the questions that separate productive AI investments from expensive distractions. The goal, as always, is practical clarity for mining professionals navigating this landscape.

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### **About LOMexcel Inc.**

*LOMexcel Inc. is an AI education and advisory consultancy helping mining professionals and organisations navigate the responsible adoption of artificial intelligence across technical disciplines. Our work spans all three categories described in this article — from operational AI strategy to project delivery automation to technical knowledge intelligence.*

[www.lomexcel.com](http://www.lomexcel.com)

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