



DIGIECOQUARRY
INNOVATIVE DIGITAL SUSTAINABLE
AGGREGATES SYSTEMS

The Smart Side of Quarrying

**Digital and AI solutions to
power your site's performance**

digiecoquarry.eu



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003750.

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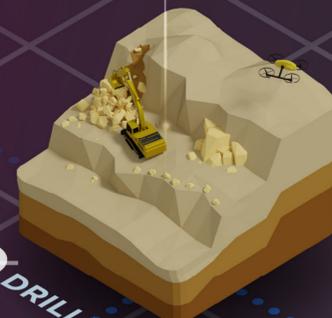
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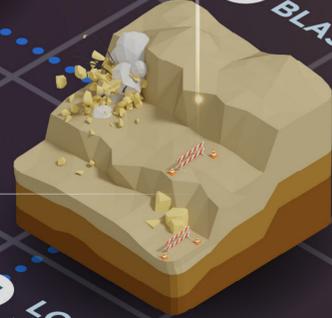
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BIM



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01

VIRTUAL CORING WHILE DRILLING

Map the geology
while you drill

Why it matters

In quarries with complex geology, poor knowledge of local rock conditions can lead to inefficient blasting, excessive fly rock, and suboptimal fragmentation. VCWD assesses rock mass characteristics during drilling, giving operators valuable data to optimise blast design with minimal extra effort.

How it works

VCWD consists of a robust sensor mounted on the drill rig and software that captures, stitches, and analyses borehole images in real time—all integrated into the drilling process.

Impact and benefits

By improving rock characterisation, VCWD enables better fragmentation control and reduces fly rock risk, enhancing safety and blast efficiency with minimal operational disruption.

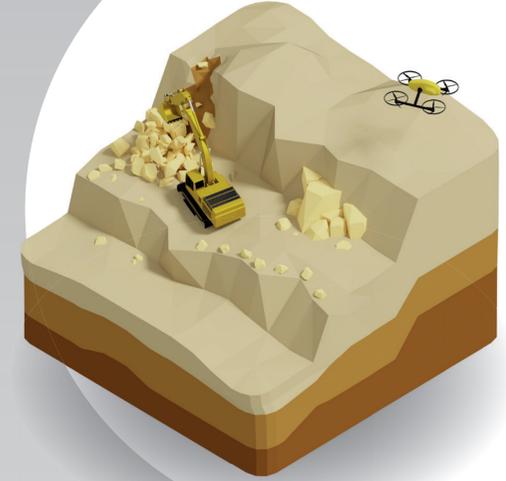
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Drilling



Drilling



AUTOMATION Operate drilling rigs remotely and safely

Why it matters

Quarry drill operations often expose operators to noise, dust, vibration, and hazardous areas near high walls. While automation is common in mining, quarries still lack tailored solutions. Sandvik's remote and autonomous drilling system improves safety and productivity by enabling operators to control multiple rigs from a safe, centralised location.

How it works

Operators manage drill rigs remotely from a control room, trailer, or van, using a fleet interface with multiple camera views and audio. The system allows safe, continuous drilling, even during shift changes or in dangerous environments.

Automation functions reduce equipment wear, enable consistent output, and integrate with obstacle detection for safer, more accurate operations.

Impact and benefits

The solution boosts productivity, enhances safety, and lowers maintenance costs. Designed specifically for quarries, it brings automation capabilities previously limited to mining into the quarrying sector.



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DATA HANDLING

Log and process drill data efficiently

Why it matters

Drilling operations often suffer from incomplete or inaccurate data capture, limiting the ability to optimise performance and address bottlenecks. Manual logging is time-consuming and error-prone, while isolated systems make data integration difficult.

This innovation enables accurate, real-time data logging and analysis directly from the drill rig, improving productivity and operational insight without the need for extra hardware.

How it works

The system integrates automated and manual data logging into the rig's control system. It records key metrics like drilling time, cycles, and downtime causes, with seamless data transfer via Bluetooth, cellular, Wi-Fi, or REST API. Connectivity and standardised interfaces allow easy integration with third-party platforms and local server solutions for near real-time monitoring and reporting.

Impact and benefits

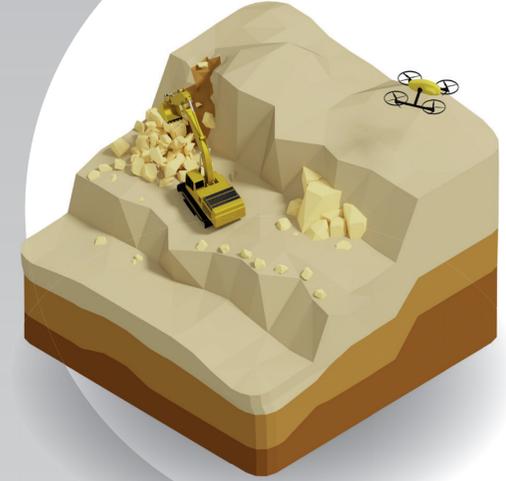
Operators gain reliable, comprehensive data to optimise drilling, reduce costs, and streamline reporting. Fully replicable across sites, the solution boosts efficiency and simplifies data handling while minimising setup complexity.

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Drilling

 SANDVIK



DRILLING DATA ANALYSIS

Analyse drill data to optimise performance

Why it matters

Drilling operations often lack precise insight into time use and performance, leading to undetected inefficiencies and production losses. Manual logging is limited and error-prone, and many systems lack integration with existing equipment.

This innovation enables detailed, real-time analysis of drilling performance using both automated and manual data inputs—helping identify bottlenecks, optimise processes, and improve productivity.

How it works

The system applies Time Usage and Net Productivity Models to assess drilling efficiency, combining control-system data with operator input via a tailored interface. It logs operational time, drill cycles, and downtime causes, integrating this data into offboard visualisation tools.

The solution connects seamlessly with existing equipment, reducing hardware costs and enabling real-time insights across various drilling environments.

Impact and benefits

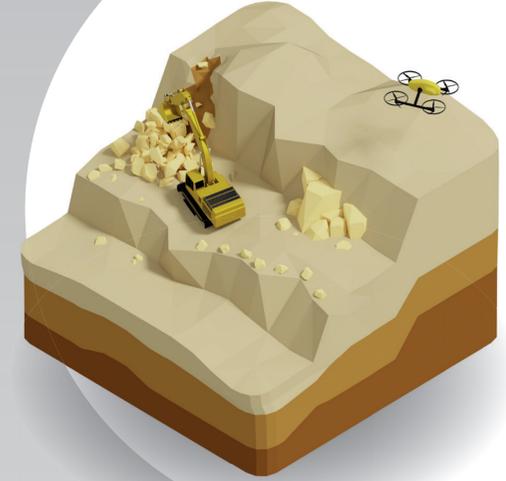
Operators gain a comprehensive view of time losses and drill performance, supporting faster decisions and reduced downtime. The system is cost-effective, fully replicable, and provides verified accuracy, offering a practical path to smarter, more efficient drilling.

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Drilling

 **SANDVIK**



TOPHAMMER TECHNOLOGY

Drill faster and more
efficiently

Why it matters

Quarrying operations with medium to large hole sizes have traditionally relied on Down-The-Hole (DTH) drilling, which is energy-intensive, costly, and prone to tool wear. There was no efficient top hammer alternative for holes below 165 mm.

Sandvik's Tophammer XL bridges this gap, enabling efficient, precise, and lower-cost drilling in hole sizes down to 140 mm, transforming both productivity and energy use in quarrying.

How it works

Tophammer XL combines a long-piston rock drill with optimised tools to deliver higher impact energy and straighter holes. The design minimises deviation, reduces cyclical tool stress, and removes the need for compressed air, cutting energy consumption.

The technology adapts to a wide range of hole diameters (140–178 mm), making it suitable for both large-scale mining and smaller quarrying operations.

Impact and benefits

The system improves drilling speed, tool life, and hole quality while significantly reducing operating costs and emissions. Its adaptability and precision offer a reliable, fuel-efficient alternative to DTH systems in demanding environments.

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Drilling

 **SANDVIK**



MEASUREMENT WHILE DRILLING (MWD)

Why it matters

Understanding structural and geomechanical characteristics of the rock mass to guide mining and quarrying operations using a dense dataset collected while drilling. Traditional methods are time-consuming and provide off-line data, which slows decision-making and complicates changes in the blast design.

MWD enables real-time rock mass characterisation during drilling, allowing a fast rock mass description.

How it works

The system uses data from MWD-equipped drills. It provides real-time rock mass descriptions from online operational parameters of the drilling rigs. The rock mass model is calibrated for each site using accompanying measurements and AI techniques. It does not rely on proprietary commercial systems and can be plugged into commercial software packages and drilling equipment.

Adapt blasting to real-time rock data

The technology generates a high-resolution dataset, enabling on-site structural and geomechanical characterisation that can be used to adapt explosive characteristics to local site conditions, improving safety, efficiency, and sustainability.

Impact and benefits

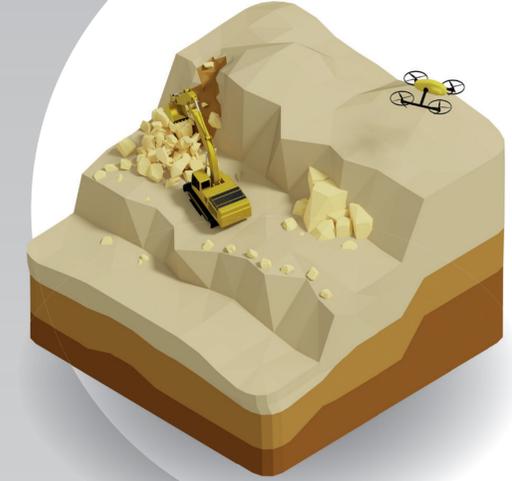
The system enables tracing and digitising the deposit characteristics in an automatic way. It supports smarter and flexible explosive charging, replacing generic rock mass parameters by high resolution site-specific data. It reduces dependency on external software, improves the quality of downstream operations, and supports safer and more sustainable resource extraction.

While still at a research-focused stage, the system is fully replicable on any site with MWD-enabled drills and shows strong potential for integration into operational blasting strategies.

Drilling



POLITÉCNICA



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ROCK DAMAGE PREDICTION BASED ON NEAR FIELD SEISMIC MEASUREMENTS

Why it matters

Controlling blast-induced damage in the surrounding rock is essential to maintain slope stability and preserve the integrity of the pit. Traditional models often oversimplify the seismic field and fail to predict damage zones accurately. The use of a physically sound model of the radiation pattern from blasting enables better control over damage and improved design of blasting operations.

How it works

The method adapts the full-field solution (FFS) to simulate seismic radiation from a blasthole, incorporating shock physics at the detonation-rock interface and accounting for the free face effect. It delivers a refined prediction of rock damage extent, adaptable to different geological conditions. Key elements, such as the detonation source model and seismic integration, are replicable across sites, while site-specific calibration is required to describe vibration attenuation laws.

Impact and benefits

This approach allows for the prediction and management of blast-induced damage more accurately, supporting safer highwall faces. It offers strong potential for use in consultancy-based services.

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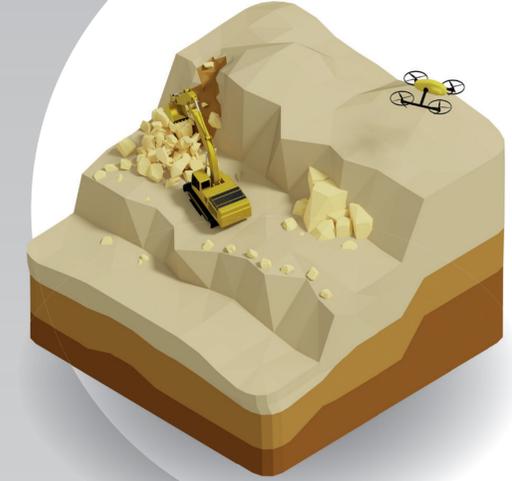
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Drilling

Predict rock damage with seismic models



POLITÉCNICA



DRILL-TO-MILL Link blasting to plant performance

Why it matters

Conventional blasting practices often fail to optimise fragmentation and downstream processes, leading to higher energy use, increased CO₂ emissions, and unnecessary operational costs. Many sites lack the digital tools and adaptive technologies needed to improve performance holistically. Drill-to-Mill tackles this by integrating advanced explosives, automation, and blast design software to optimise operations from drilling through to crushing. It enhances efficiency, reduces environmental impact, and delivers significant cost savings across the entire value chain.

How it works

Drill-to-Mill combines three elements: high-energy explosives with instant density variability, automated loading systems, and advanced blast modelling software. Explosives are tailored in real time to match rock properties, improving fragmentation and diggability.

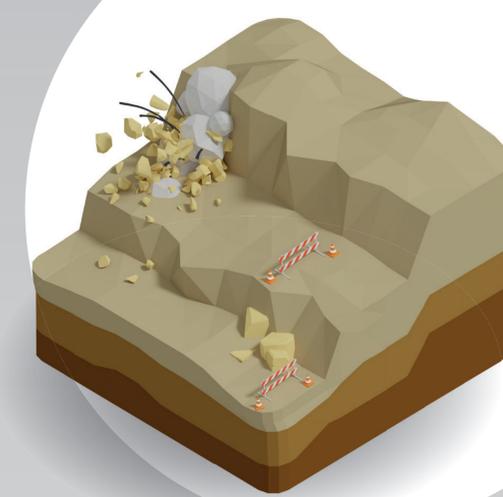
The software enables accurate blast design, scenario analysis, and predictive modelling. Combined with automated placement, the system creates a seamless digital workflow that links blasting to downstream processes such as hauling and comminution, driving continuous improvement and sustainability.

Impact and benefits

This integrated solution reduces total operational cost by improving efficiency and enabling smarter resource use. Better fragmentation leads to lower energy consumption in crushing and grinding, cutting both fuel use and CO₂ emissions. Drill-to-Mill is fully replicable and gives quarry operators a decisive competitive advantage by combining precise execution, digital control, and measurable performance gains, supporting both operational and environmental objectives.

Blasting

MAXAM



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BLAST VIBRATIONS

Control and reduce vibration impacts

Why it matters

Mining blasts can create tensions with nearby communities due to vibrations. Traditional tools like geophones are technical and harder to communicate to the public.

This solution uses cameras to monitor blast vibrations—an intuitive, visual method that helps improve social acceptance.

How it works

The system uses a camera and a dedicated algorithm to analyse the movement of vibrating subjects during blasting. It replaces conventional sensors with a visual, non-contact approach that is easier to operate and deploy. Its simplicity makes it an accessible solution for sites aiming to monitor and demonstrate vibration control without specialist training or high investment.

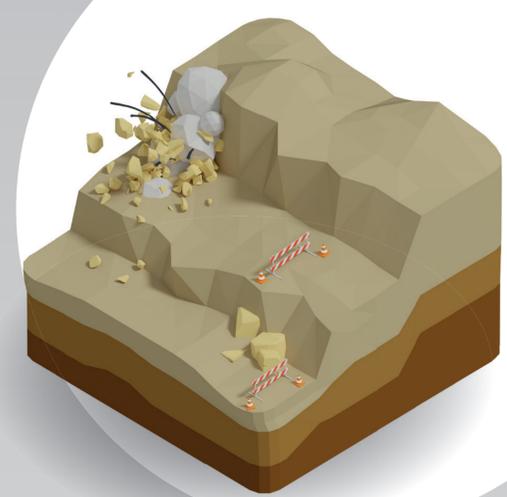
Impact and benefits

Easier to deploy and explain than geophones, this approach supports transparency, reduces community friction, and enhances environmental monitoring.

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Blasting



FRACTURE NETWORK MODELLING

Model rock fractures to improve blasting

Why it matters

Accurate modelling of rock fractures is critical for safe and efficient blasting and assists mine design. However, traditional tools rely on complex pre-processing steps, predefined fracture families, and expensive commercial software, slowing down workflows and reducing flexibility. This innovation introduces a faster, more flexible way to model fracture networks without relying on rigid statistical assumptions or third-party software.

How it works

The code developed applies non-parametric and directional-linear statistics to implement a Discrete Fracture Network (DFN) model for rock mass characterisation. The code uses trace maps derived from photogrammetric models of exposed rock surfaces (benches in open pits or stopes in underground). It eliminates the need to cluster fractures into families and avoids predefined distribution models.

Validated in two quarry environments, this code produces discrete fracture network models suitable for rock blasting and geotechnical analysis, while significantly reducing data preparation time. The results demonstrate excellent agreement with observed data.

Impact and benefits

This approach simplifies the modelling process, offering a quicker, cost-effective alternative to conventional software. It delivers high-fidelity fracture characterisation and supports better-informed engineering decisions.

Although currently at pilot stage (TRL 6), the code is replicable and shows strong potential for integration into practical workflows for consultants, geotechnical engineers, and mine planners.

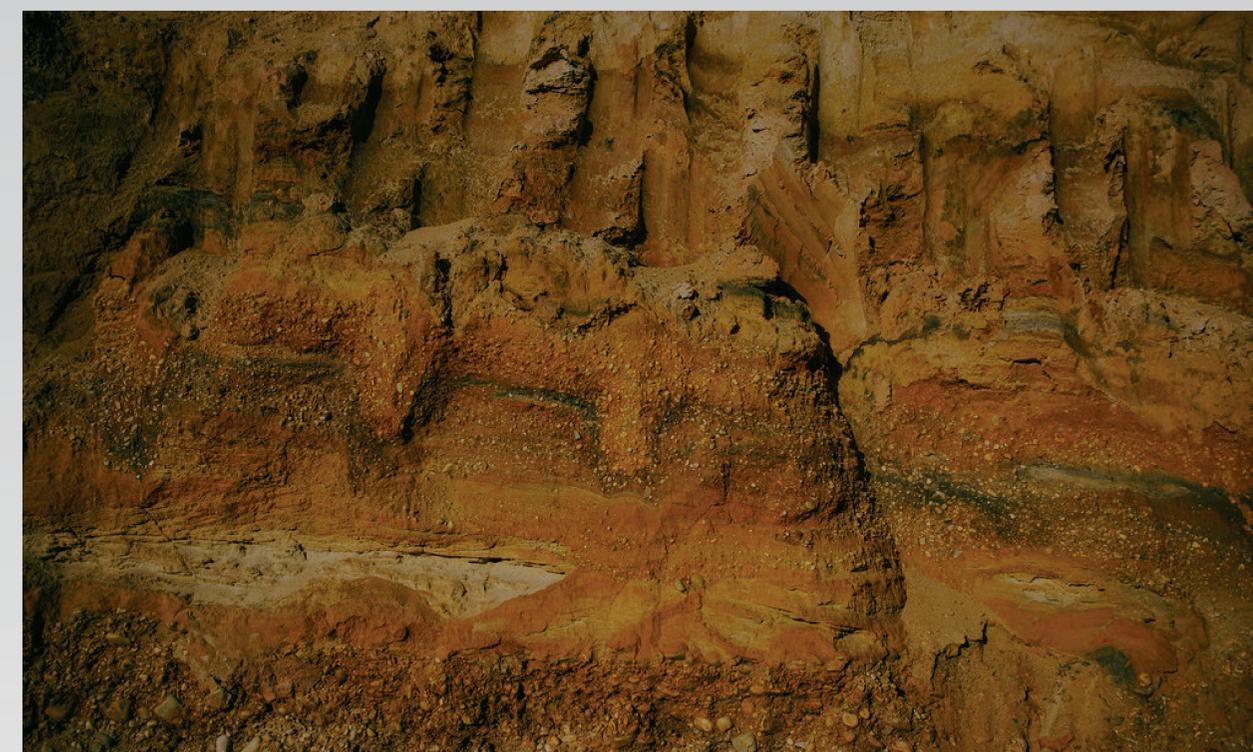
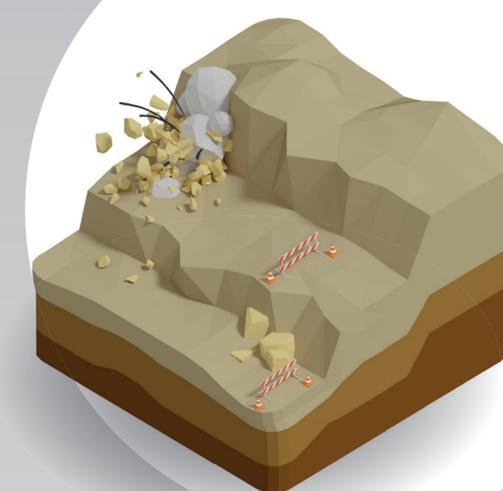
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Blasting



POLITÉCNICA



D2M ALGORITHMS

Analyse blast geometry and outcomes

Why it matters

An accurate knowledge of the blast geometry, including the volume of excavated rock, is a basis for operational optimisation and digital traceability. The drill-to-mill approach also requires a quantitative assessment of muckpile characteristics, including fragmentation, swell and geometry. Among them, fragmentation is a complicated measurement and often inaccurate, limiting the overall improvement of quarrying operations.

How it works

D2M algorithms provide a data-driven method to assess blast outcomes through 3D photogrammetry, linking blasting with downstream operations. Measurements from different measuring systems and suppliers, such as drones or surveying blasthole probes, are incorporated into a realistic and detailed model of the block to be blasted.

Tools based on drone surveys before and after the blast offer a quantitative insight into the muckpile geometry. A procedure to rebuild fragmentation in the muckpile surface from automatic analysis of 3D models with commercial software and online mass-based measurements is developed.

These tools support pre- and post-blast evaluation, enabling traceability and operational optimisation without the need for proprietary systems.

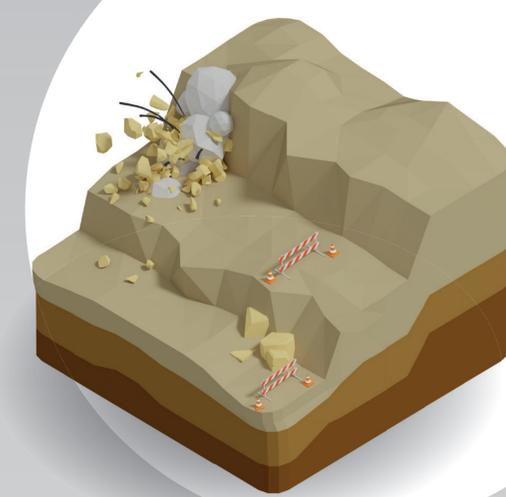
Impact and benefits

The solutions are modular and flexible and allow explosive suppliers, quarry operators and consultants to control the impact of blasting on the plant performance, and achieve a more sustainable, efficient and safer resources exploitation. While not available for direct leasing, it is well-suited for consultancy-based applications and technology transfer.

Blasting



POLITÉCNICA



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Loading and internal transport



MEMT Monitor machine activity

Why it matters

Open-pit mines often rely on fragmented or OEM-dependent monitoring systems, making it difficult to access timely, consistent data for decision-making. This limits operational efficiency and visibility across the production chain.

MEMT solves this by unifying and automating data collection and analysis, delivering real-time insights tailored to mining processes. It supports faster, more objective decisions that enhance productivity and mine planning.

How it works

MEMT is an AI-driven monitoring tool offered as SaaS + HaaS, using plug & play hardware installed in mobile machinery. It gathers sensor and image data (GNSS, IMU, camera, etc.), processes it with AI classifiers, and delivers real-time operational insights.

Designed for mining-specific scenarios, MEMT detects machine activities, transport conditions, and material flow. It operates independently of OEMs and integrates easily with third-party systems.

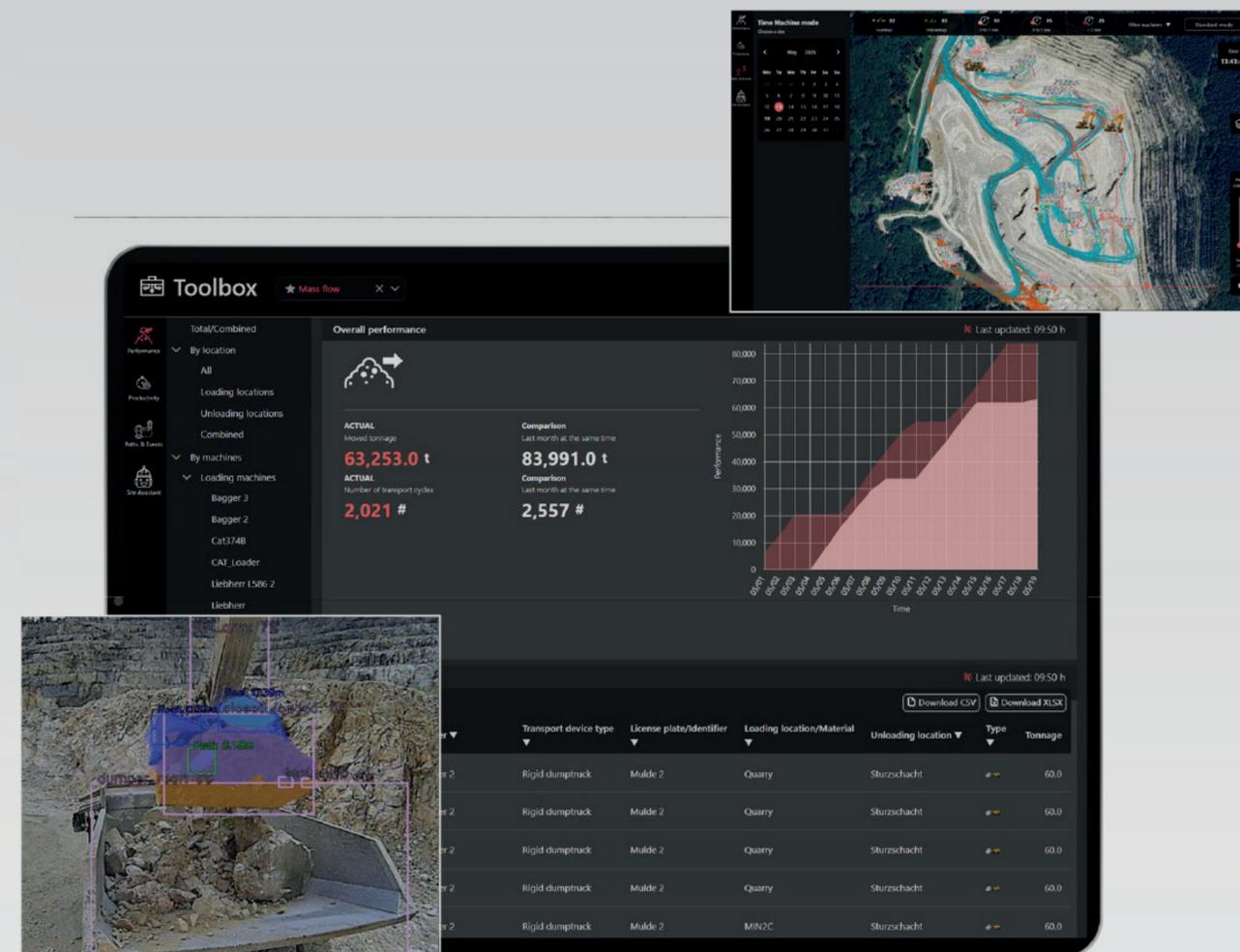
Impact and benefits

MEMT provides actionable data without operator input, helping optimise transport cycles, monitor machine use, and track production in near real time. Its intuitive dashboards support better decisions at both the site and group levels.

With full control over data quality and frequency, MEMT improves operational transparency, equipment health, and overall mine efficiency.

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DATA LOGGER FOR MOBILE MINING EQUIPMENT

Record equipment
performance from any vehicle

Why it matters

Mobile mining equipment often operates with limited data visibility, especially in mixed fleets or older machines. OEM-specific systems only capture partial information, are rarely interoperable, and are usually designed for civil construction, not mining environments.

This data logger addresses the need for comprehensive, OEM-independent performance monitoring, enabling mining operators to digitise and evaluate mobile asset activity across their entire fleet, regardless of brand or machine age.

How it works

The solution comprises a robust data logger with CAN bus integration, specifically designed for quarrying and mining environments. It easily connects with retrofit sensors and enables reliable data acquisition from mobile machinery, including older assets.

Designed for flexibility, the system enables near real-time data capture and modelling across mixed fleets, and provides integration interfaces with existing tools such as weighing systems, fuel management, or mine modelling software.

Impact and benefits

By implementing this hardware, operators gain accurate, real-time insights into machine performance across brands and vintages, supporting improved utilisation, maintenance planning, and operational efficiency.

It reduces dependence on OEM platforms and lays the foundation for full digital integration of mobile equipment within broader open mining data platforms, key for modern, data-driven quarry operations.

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Loading and internal transport

Design your mine
DOHMEN, HERZOG & Partner GmbH
engineering & software for mining



Loading and internal transport



AutoPLAN smartQuarry Visualise all quarry equipment in one platform

Design your mine
DOHMEN, HERZOG & Partner GmbH
engineering & software for mining

Why it matters

Mobile equipment performance in mining is often recorded manually or not at all, especially in operations with mixed fleets or older assets. This results in limited visibility over processes, missed optimisation opportunities, and inefficient cost control.

AutoPLAN smartQuarry addresses this by providing a digital platform to automatically capture, mining processes, and visualise OEM-independent data from mobile assets. It supports detailed analysis of equipment activity to enhance operational oversight, uncover cost-saving potential and quality control.

How it works

AutoPLAN smartQuarry is a web and CAD-based software solution tailored to quarrying and raw material extraction sites. It records and analyses sensors, position, and operational data from mobile, semi-mobile, and stationary equipment, using data loggers such as the DSA VCG-2.

The platform supports integration with retrofit sensors and GPS hardware, enabling near real-time 3D positioning and performance tracking. Interfaces can be adapted to suit site-specific requirements, ensuring flexibility and full compatibility with existing infrastructure.

Impact and benefits

By adopting smartQuarry, operators gain real-time visibility over mixed fleets, improving equipment utilisation and enabling proactive decision-making. It supports digitalisation across quarry operations while reducing dependency on several individual OEM systems. The system is fully replicable across sites and adaptable to diverse machine types. It empowers small and mid-sized companies to modernise without overhauling existing equipment, making data-driven operations accessible and cost-effective.



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Loading and internal transport



3D GEOFENCES Use geofences to improve safety and control

Why it matters

Many quarry operations still rely on manual or 2D tracking of mobile equipment, limiting visibility and hindering optimisation. These methods often ignore site topography, are disconnected from real survey data and 3D deposit information.

This 3D geofencing solution enables real-time tracking of mobile assets across site-specific zones, offering a clearer, more accurate picture of drilling, loading and hauling operations, independent of equipment brand or age.

How it works

The system defines 3D operational zones using CAD models, current survey data and 3D deposit models. GPS- and DGPS-equipped data loggers capture precise 3D-equipment location and activity, feeding into the smartQuarry platform for visualisation and detail analysis.

It supports all typical quarry operations (e.g. loading, hauling, dumping) and integrates seamlessly with existing infrastructure, provided survey data is available.

Impact and benefits

Operators gain precise insight into fleet behaviour, enabling better planning, asset use, and cost control. It's fully replicable at sites with CAD and survey data, and sets the groundwork for broader digital integration.

Design your mine
DOHMEN, HERZOG & Partner GmbH
engineering & software for mining



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MINERAL PLATINUM Automate and manage your plant

Why it matters

Quarries and aggregate plants often operate without a centralised system to monitor and control their machinery, limiting their ability to act preventively and optimise performance. Operators lack real-time visibility over plant processes, which can lead to inefficiencies and unplanned downtime.

Mineral Platinum addresses this gap by offering a digital control solution that provides a global view of plant operations and the status of each machine, directly from a PC. This enables more informed decision-making and paves the way for predictive maintenance strategies.

How it works

Arco Mineral Platinum is a control software designed specifically for aggregate plants. It enables full visualisation and independent control of each plant process, and allows users to monitor machine status and export performance reports.

The software runs on any Windows OS and supports Siemens PLCs. Key features include alarm systems, user-configurable access, multi-station support via local network, and integration with weighing systems and external data platforms such as Excel or Access.

Impact and benefits

With Mineral Platinum, users gain centralised control over their entire operation, enhancing oversight and reducing operational blind spots. The ability to monitor machine status supports predictive maintenance, helping to prevent breakdowns and costly interruptions. By digitalising plant control, operators align with current technological standards, achieving improved performance, streamlined reporting, and long-term operational reliability.

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Treatment



WEIGHING SYSTEM

Measure material flow to optimise treatment

Why it matters

Quarries and aggregate plants often lack precise, real-time control over material flow at key points in the production process. Without this data, managing throughput, optimising production, or ensuring accurate loading becomes difficult and reactive.

The Weighing System solves this by enabling continuous, automated measurement of material as it moves along conveyor belts. It offers production visibility at strategic points, helping operators monitor and control flow with greater accuracy and efficiency.

How it works

This solution is a precision weighing system installed directly on conveyor belts, capable of measuring material flow from 25 to 2,000 tonnes per hour. It includes a robust, adaptable structure and uses encoder-based weighing methods to ensure high accuracy, with a margin of error as low as 2.25%.

The system integrates with Arco Monitor Software to visualise data in real time from a PC, whether at the foot of the belt or in the control room. It supports applications like truck loading, dosage control, and RFID-based identification.

Impact and benefits

The Weighing System enables operators to monitor production continuously and in real time, improving process control and enabling more precise reporting and planning. When multiple systems are installed, data can be aggregated and exported for broader operational insights. Its digital interface supports the shift towards modernisation and automation in quarrying, while its replicability in sectors like recycling or agri-food adds long-term versatility and value.

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Treatment



Q-PORTAL AND Q-PILOT

Control your plant with a web-based platform

Why it matters

Many quarry and aggregate operations struggle to monitor their production processes efficiently or automate them effectively. A lack of real-time data and skilled personnel often leads to inefficiencies, inconsistent performance, and missed opportunities for optimisation.

Q-Portal and Q-Pilot address these challenges by offering digital tools that monitor and automate material handling, crushing, screening, and washing. Together, they help operators gain control, reduce costs, and improve safety and environmental performance.

How it works

Q-Portal is a cloud-based system that collects field data—automatically or manually—and presents it through customised dashboards. It highlights key performance indicators (KPIs) such as energy use, cost, and CO₂ emissions, and identifies inefficiencies in real time.

Q-Pilot is a PLC-based automation system capable of managing plant operations autonomously. It interprets machine workload via sensors and adjusts parameters accordingly. Both solutions are fully replicable, with Q-Portal adaptable to non-automated systems and Q-Pilot deployable with a tailored Go-Live setup.

Impact and benefits

By using Q-Portal and Q-Pilot, quarries can achieve significant gains in process efficiency (between 5% and 30%) and improve the occupational health and safety of their operators. The configurability of the system makes it accessible without the need for developers or other specialised personnel.

These technologies not only reduce operational costs but also enhance the sector's digital appeal, helping attract new talent and secure long-term competitiveness in an evolving industry.

Treatment

maestro
Process Optimization
AGGREGATES.MINING.RECYCLING.



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MOBILE IMPACT CRUSHER

Crush more efficiently and sustainably

Why it matters

Conventional mobile crushers often suffer from high fuel use, noise, and dust emissions—challenges that raise costs and hinder compliance with environmental standards, especially in sensitive or urban settings.

Metso's innovation improves energy efficiency and reduces environmental impact through a redesigned powertrain, advanced dust suppression, and targeted noise control.

How it works

Built on the Lokotrack LT1213SE platform, this mobile impact crusher features a new powertrain combining a variable-speed generator, high-voltage battery, and liquid-cooled power electronics. The system allows the diesel engine to run more efficiently, especially under partial loads, while battery storage smooths load variations during crushing. New powertrain brings additional performance, and thus crusher's capacity can be increased in applications where

the diesel engine has been a bottleneck.

The dust suppression system uses high-pressure water spray with optimised nozzles across key areas, binding particulate matter effectively. Noise reduction measures include encapsulation of noisy components and rubber linings, significantly lowering sound emissions from the feeder, crusher, and discharge sections.

Impact and benefits

This crusher delivers lower CO₂, NO_x, dust, and noise emissions, meeting the increasing demand for sustainable equipment in both rock and recycling applications. Its dual power mode (electric or diesel) also provides flexibility and further environmental gains.

With improved performance and reduced operating costs, Metso's solution sets a new standard in mobile crushing, aligning operational efficiency with sustainability goals and backed by the brand's global support and expertise.

Treatment Metso



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DIGITAL TWIN Simulate and optimise your process digitally

Why it matters

Crushing and screening plants often lack tools to analyse, optimise, and predict performance using real operational data. Manual assessments limit opportunities for cost reduction, efficiency gains, and digital transformation across processing circuits.

Mintek's digital twin addresses this by enabling engineers and operators to simulate, calibrate, and optimise their crushing circuits virtually, helping meet economic, environmental, and operational goals before applying changes on site.

How it works

The solution combines three components: an Excel-based calibration interface, a simulation module powered by a flowsheet software, and a cloud infrastructure with APIs for data ingestion, storage, and digital twin simulation and optimisation scheduling.

Users can simulate plant performance, adjust operating parameters, and assess outcomes against custom objectives. While the system is site-specific, individual components are replicable and designed to scale to broader mineral processing applications.

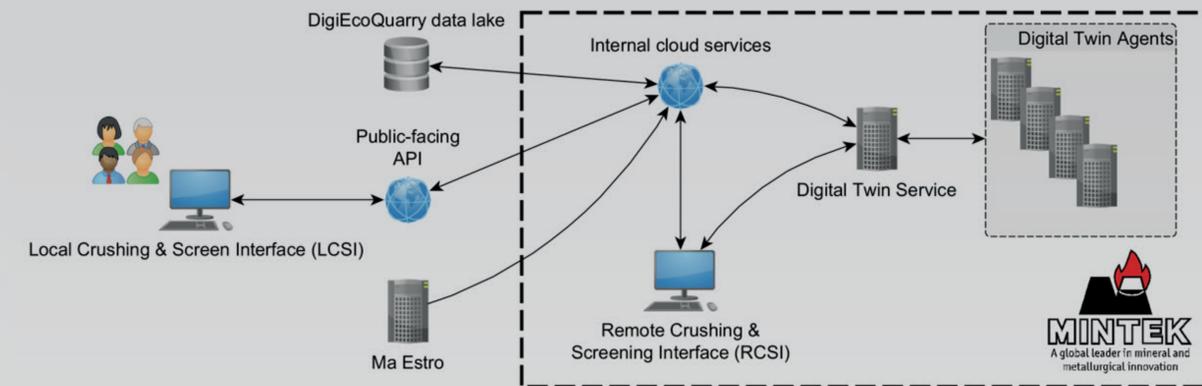
Impact and benefits

This innovation enables better decision-making, lowering production costs while improving revenue. It consolidates multiple data streams into a single platform for real-time optimisation. Backed by Mintek's extensive experience in metallurgical modelling and process control, the system offers a uniquely tailored digital twin for the minerals industry.

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Treatment



Online Plant Data from Quarry Site

Initiation of Digital Twin Simulation on LCSI

| Simulation Parameters | | | |
|-----------------------|---------------------|------|--------|
| Name | Description | Unit | Action |
| CSB | Closed Side Setting | mm | ✓ ✕ |
| LELN | Line Length | mm | ✓ ✕ |
| LLEN | Line Length | mm | ✓ ✕ |
| LW | Line Age | s | ✓ ✕ |
| WOT | Screening Time | mm | ✓ ✕ |
| TPH | Feed Throughput | th | ✓ ✕ |

| Simulation Outputs | | | |
|------------------------|-----------------------------------|------|--------|
| Name | Description | Unit | Action |
| ProductionRate | Product Stream Mass Flow | th | ✓ ✕ |
| ProductionPulpFraction | Product Stream Mass Flow Fraction | | ✓ ✕ |

Analysis of Simulation Results for Effective Decision Making

GRAIN SIZE

Monitor particle size instantly

Why it matters

Monitoring the size distribution of aggregate products is essential for ensuring quality and process efficiency. However, traditional methods—such as manual sampling and sieving—require production to stop, increasing downtime and operational costs.

The Grain Size service provides a continuous, non-intrusive solution to this challenge by using computer vision to measure particle size distribution directly on the conveyor belt, without interrupting production.

How it works

The system uses a single camera, mounted above the conveyor, alongside a lighting unit and a processing computer. It analyses the material in real time to estimate grain size and identify irregularities, issuing alerts if deviations from expected distribution are detected.

The setup is fully independent of existing site infrastructure and communicates via mobile connectivity. Once calibrated using sample data, it provides reliable ongoing measurements.

Impact and benefits

This solution enables continuous quality monitoring and early detection of screening issues, helping reduce downtime and improve plant performance. It also supports predictive maintenance and operational analysis by building a historical record of material characteristics.

Cost-effective and easy to replicate, the system offers a practical path to automation in quality control for quarry operators focused on efficiency and reliability.

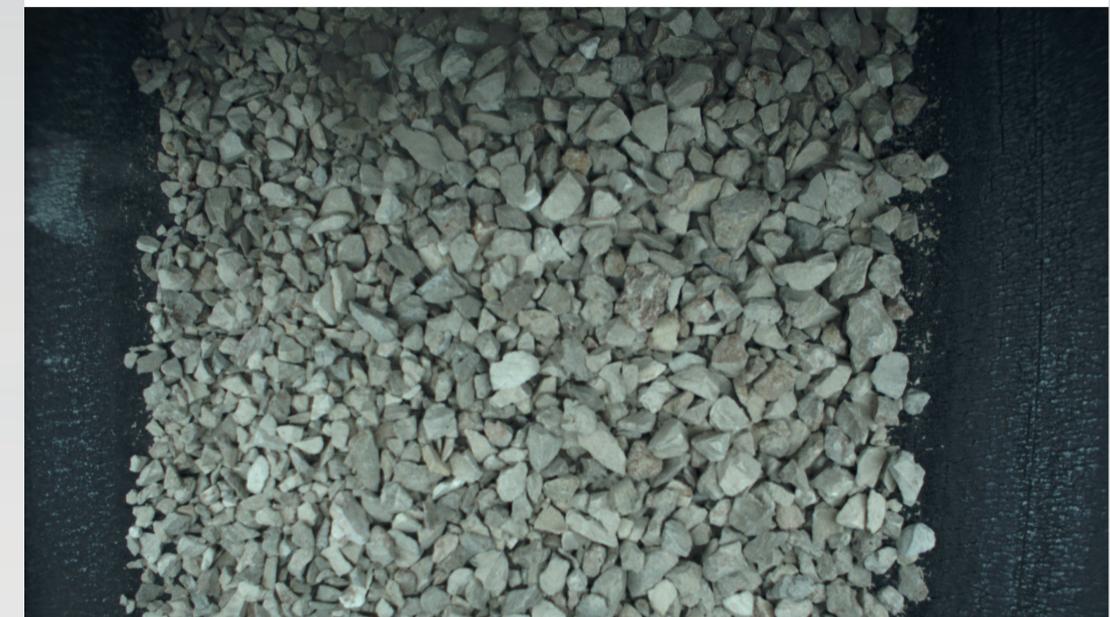
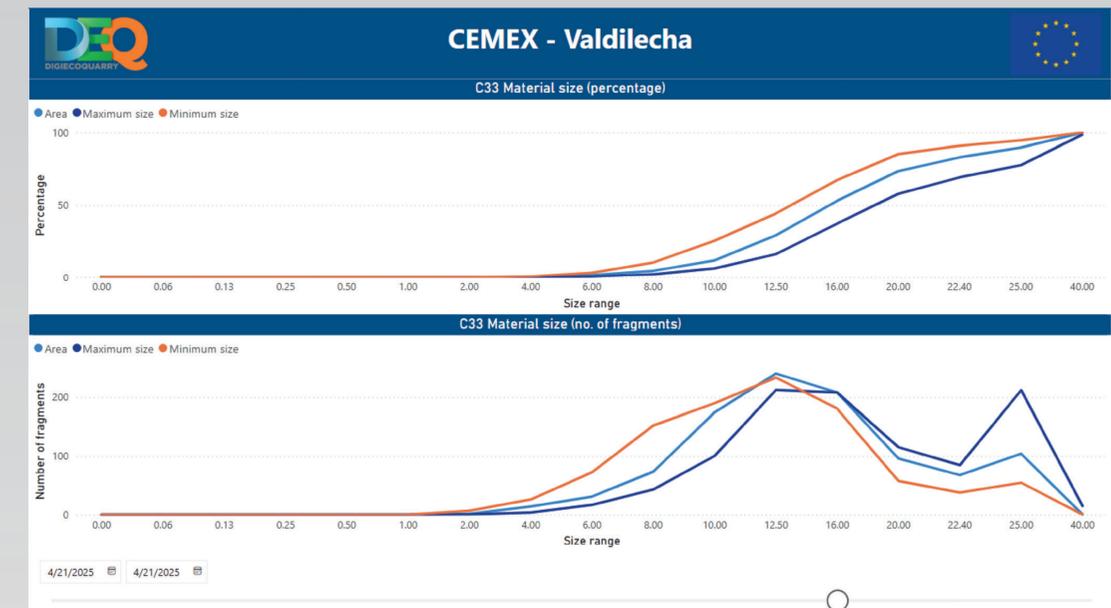
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Treatment



S I G M A
ARTIFICIAL INTELLIGENCE



QUALITY DETERMINATION Track aggregate quality in real time

Why it matters

In many quarries, the assessment of incoming material quality is still based largely on the operator's experience. This makes it difficult to react quickly to variations in material composition and size, increasing the risk of blockages and suboptimal processing.

Quality Determination provides a systematic and continuous overview of the material entering the crusher, helping to prevent operational issues and enabling more responsive and efficient plant management.

How it works

Using image-based analysis, the system evaluates the size and composition of the incoming material, specifically its clay and limestone content, without interrupting production. It can detect oversized fragments, issue blockage warnings, and suggest adjustments to plant speed.

While designed for limestone quarries where clay is the primary waste material, the service can be adapted to other contexts with tailored calibration.

Impact and benefits

The system supports safer, more autonomous operation by allowing the plant to speed up when input quality is high and slow down, or stop, if problematic material is detected. It also builds a historical record of material quality for long-term analysis and optimisation.

By reducing unplanned stoppages and relying less on manual judgment, the service enhances operational reliability, efficiency, and overall production control.

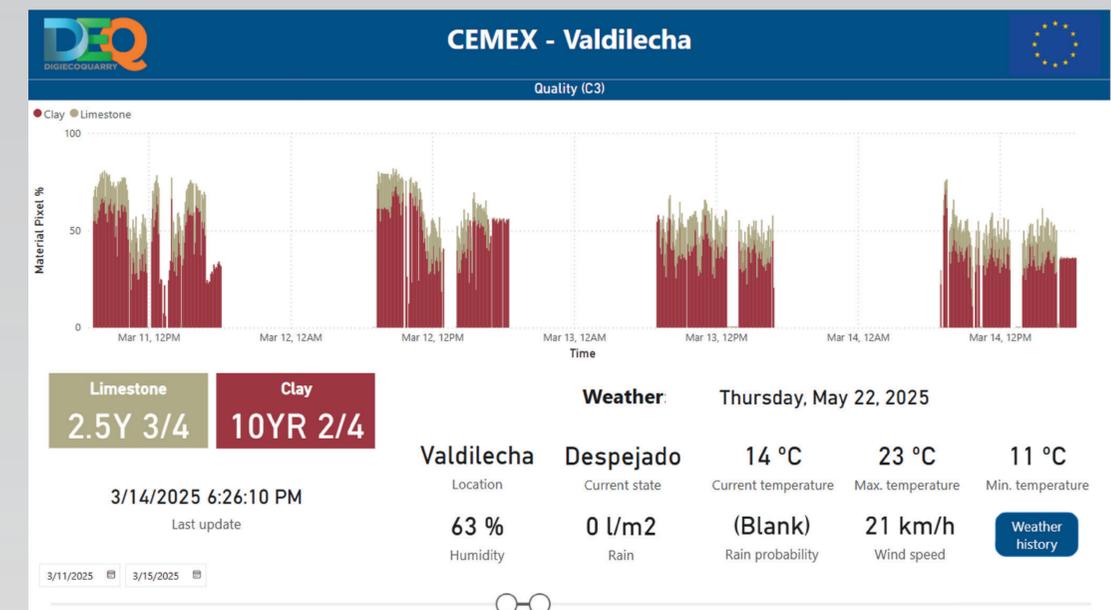
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Treatment



S I G M A
ARTIFICIAL INTELLIGENCE



ACOPIA **Measure your stockpiles using your phone**

Why it matters

Knowing how much material is stored on site is essential for managing production, planning deliveries and avoiding unexpected shortages. However, measuring stockpiles is still a challenge in many quarries. Drone flights take time to organise, and the tools currently available often require external help or expensive equipment.

ACOPIA changes that. It allows quarry teams to measure stockpiles quickly and accurately using just a smartphone – no drones, no special training, and no delays.

How it works

Using a simple mobile app, quarry staff can record short videos of the stockpiles from the ground. These videos are then uploaded to a secure online platform, where powerful algorithms convert them into a 3D model and calculate the volume of material stored.

The process is fast, fully digital and has been tested in real quarry conditions. Results are typically ready in under five minutes, and accuracy is within 1%. ACOPIA works with any standard smartphone and can be used anytime and anywhere.

Impact and benefits

ACOPIA makes it easy to check stock levels as often as needed without hiring external contractors or interrupting operations. This helps avoid supply issues, improves planning and ensures reliable reporting.

Because it's simple to use and works on any phone, teams can start using it immediately. All measurements are stored in one place, making it easy to track changes over time and share information with colleagues or clients. It's a modern, low-cost way to bring stock management into the digital age.

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Treatment



POLITÉCNICA



OIDO Detect anomalies and prevent failures automatically

Why it matters

In quarry operations, equipment and installations can extend over large areas, often covering several kilometres. With so many machines operating at once, keeping track of everything can be a real challenge. Noise, distance, and complex systems make it difficult to spot when something starts to go wrong.

Relying solely on people to monitor it all isn't always possible, especially when teams are stretched. OIDO helps by offering an easy and automatic way to keep an eye on the plant, without the need for extra staff or specialised equipment.

How it works

OIDO uses small devices placed in key parts of the quarry to "listen" to sounds and "feel" vibrations. If the system notices something unusual, for example, a strange noise or movement, it raises a warning.

It learns from the normal working patterns of your equipment, so it can tell when something

is not right. All this information is sent to a secure platform that can be accessed remotely, giving quarry managers a clear view of what is happening at any time. The system does not depend on any specific brand or type of machinery and only needs a power supply and an internet connection to run.

Impact and benefits

OIDO gives quarry teams a simple and reliable way to monitor the condition of their equipment without needing to be everywhere at once. By detecting unusual sounds or vibrations, it helps identify problems early, often before they cause serious damage or stoppages.

Because the system learns how each machine normally behaves, it can quickly adapt to the specific conditions of any site. This reduces the need for constant checks by operators and allows teams to focus on where they are really needed

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Treatment



POLITÉCNICA



Intelligent Quarrying System Manage your site from one screen

Why it matters

Quarry operators face the challenge of managing highly fragmented data across multiple systems, limiting their ability to optimise operations, control costs, and meet growing demands for sustainability and regulations compliance. Manual or siloed data management often results in difficulties for digital tools maintenance (relevance and evolutions), inefficient processes and reactive decision-making. The Intelligent Quarry System (IQS) addresses these issues by gathering data from across the quarry lifecycle and its processes—from blasting to delivery—enabling a complete, real-time overview of operations. This supports better planning, compliance, and continuous performance improvement

How it works

IQS is a modular and scalable service in the cloud, built around a Central Data Management Platform (CDMP). It integrates IoT, AI, BIM, automation, and process control modules to collect, structure and analyse data across all quarrying processes. Data is received in a common format from expert systems and made accessible for monitoring, reporting, and optimisation.

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Designed for flexibility, IQS can adapt to any quarrying environment and scale to multi-site operations. It includes connectors to interface with SCADA, third-party tools, and legacy systems, providing a unified and customisable digital ecosystem for the quarry.

Impact and benefits

IQS gives operators a 360° real-time view of their operations, allowing them to monitor production, optimise transport cycles, track environmental impact, and improve worker safety. Its data-driven architecture enables collection, storage, accessibility and sharing of data, facilitates informed decision-making and unlocks efficiencies at every level. By transforming raw data into strategic insights, IQS helps quarries reduce costs, stay compliant with regulations, and gain a competitive edge through digital transformation. It turns operational data into a long-term asset for innovation and continuous improvement.

Cross-cutting

AKKODIS



BIM Platform

Apply BIM to optimise your operations

Why it matters

Quarrying operations often face challenges with fragmented planning tools, limited site visualisation, and disconnected data flows. These issues lead to inefficiencies in scheduling, resource management, and communication among stakeholders.

The BIM Digital Platform addresses these problems by providing an integrated environment for planning and data management. It enables operators to visualise, simulate, and coordinate site operations across both time and space—supporting smarter planning and reducing operational friction.

How it works

This solution combines a BIM Common Data Environment with 3D modelling, 4D planning, time-location planning, risk analysis, forensic schedule analysis and data lake integration. It supports lean planning, task coordination, haulage simulation, and comprehensive reporting through tailored dashboards and KPIs. Sensor data, environmental metric, and operational in-

puts are all consolidated within the platform, creating a unified digital twin of the site. The system is scalable and purpose-built for quarrying and mining operations, developed in close collaboration with experienced operators.

Impact and benefits

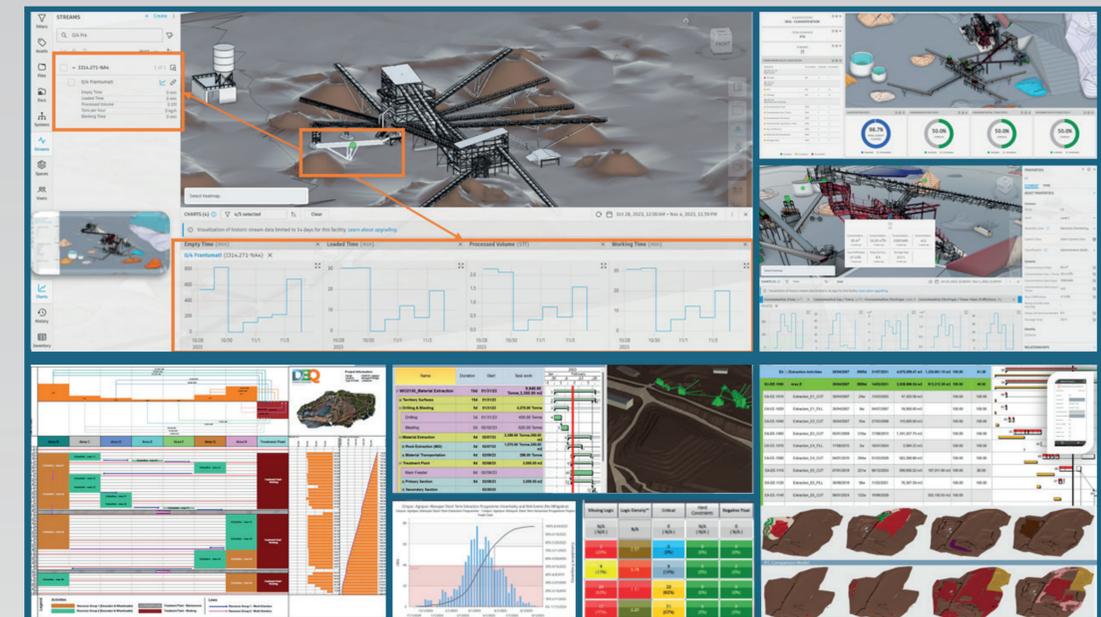
By centralising planning, data, and visualisation, the platform helps optimise operational schedules, streamline reporting, enhance collaboration across teams, and reduce unnecessary delays or confusion. It enables better resource utilisation, reduces inefficiencies, and improves alignment between design and operations.

The result is a more transparent, data-driven workflow that delivers cost savings throughout the mining lifecycle and offers deeper insights into site performance across both space and time.

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Cross-cutting



PLANTSMITH

Track and improve sustainability metrics

Why it matters

As environmental transparency becomes a market expectation, aggregate producers increasingly need to generate Environmental Product Declarations (EPDs). However, many, especially SMEs, lack the internal resources or budget to produce these reports independently, often relying on expensive external consultants.

Plantsmith addresses this challenge by enabling producers to simulate plant operations and automatically generate Environmental Product Declaration (EPD) documentation, thereby simplifying compliance and making sustainability reporting accessible to all producers.

How it works

Plantsmith is a standalone, cloud-based platform designed for the aggregates industry. Built using HTML, JavaScript, and Python, it allows users to simulate crushing plant operations, assess environmental impacts, and generate EPD and LCA reports in line with EN15804 and associated standards.

The platform includes a flowsheet generator, a modular LCA environmental database, and report templates. Results are generated centrally and can be exported in Word or with a Rest-API in a JSON format, enabling seamless integration with external tools such as the IQS.

Impact and benefits

With Plantsmith, aggregate producers, particularly SMEs, can independently create industry-compliant EPDs without specialist staff or consultants. This supports regulatory readiness, cost savings, and a stronger environmental position in the market.

As the demand for EPDs grows, Plantsmith offers a tailored, accessible solution that improves both process understanding and environmental performance documentation across the production chain.

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Cross-cutting



PERSON DETECTION

Detect pedestrians and improve safety

Why it matters

Increasing the level of safety within quarries and ready-mix concrete plants is, despite an already existing high level of safety, an ongoing topic within the industry. Heavy machines, rough environmental conditions (e.g. dust) and workers (and visitors) being exposed to these conditions make it a necessity to continuously strive for an improvement of safety.

ITK's AI-powered person recognition system addresses this by using real-time detection and gives either a warning of people and vehicles near operations or, in case an object is too close to a machine, stops the machine, significantly reducing the likelihood of accidents and downtime.

How it works

The system uses a stereo camera that can be mounted in different positions, depending, which use case makes most sense. Advanced AI algorithms process these images from, for instance, a top-view perspective, minimising

occlusions and reliably identifying people and vehicles within the hazard zone.

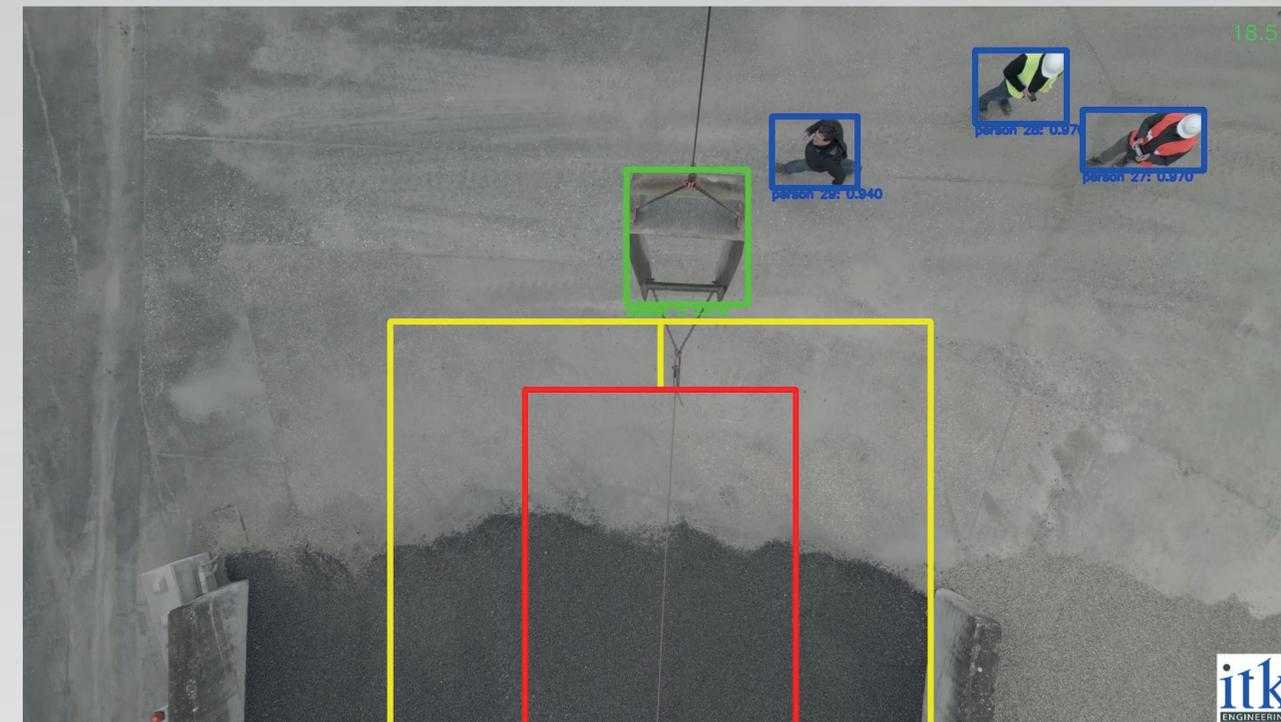
It is robust under varying environmental conditions, easily retrofittable to existing scraper systems, and designed for seamless integration with quarry infrastructure. The solution is suitable for OEMs and site operators seeking enhanced safety functionality.

Impact and benefits

By proactively detecting hazardous situations, the system enables timely warnings and preventative action, significantly improving worker safety and reducing accident-related downtime. This directly supports operational continuity and regulatory compliance. Its adaptability, integration ease, and high accuracy make it a future-ready safety enhancement for quarry operators and equipment manufacturers alike, aligning with the industry's increasing focus on digital safety solutions.

Cross-cutting

itk
ENGINEERING



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FORECAST

Forecast production costs in advance

Why it matters

Quarry operators often lack visibility over key environmental and operational variables such as water usage, dust levels, or weather impact. In many cases, valuable data remains unused, limiting the site's ability to plan proactively and optimise resources.

The Forecast service enables quarry managers to make informed, forward-looking decisions by generating reliable predictions based on existing operational data and additional environmental inputs without disrupting daily activities.

How it works

The service combines production data with external information, such as weather forecasts, water consumption and air quality, using a network of simple, non-invasive sensors. This data is analysed using advanced models to generate practical, site-specific forecasts.

Typical outputs include anticipating water demand for dust suppression, identifying periods when electricity is likely to be renewable-sourced, and assessing the weather's effect on production.

Impact and benefits

Forecast helps quarries improve efficiency, reduce costs, and strengthen environmental management by transforming raw data into actionable insight. The system is affordable, easy to deploy, and highly adaptable to different quarry conditions.

Its predictive capabilities allow managers to act in advance rather than reactively, enhancing operational control and supporting more sustainable site management.

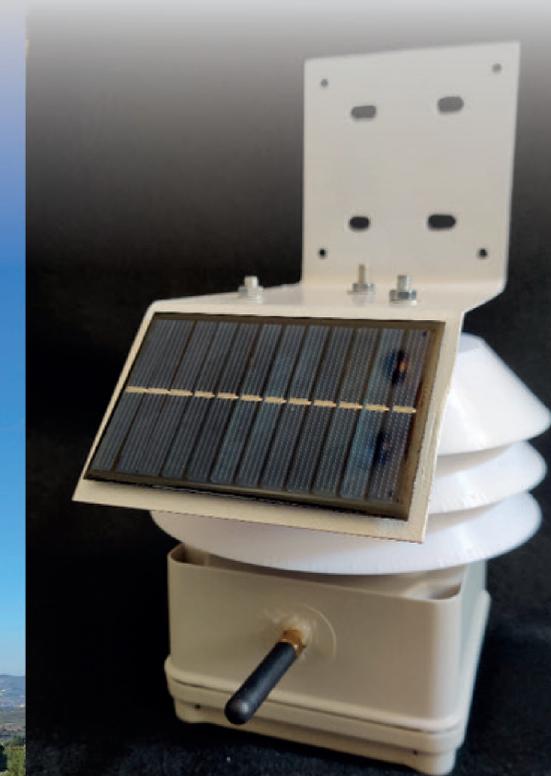
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Cross-cutting



S I G M A
ARTIFICIAL INTELLIGENCE



METAQUARRY Organise and access your information easily

Why it matters

Organisations increasingly generate large volumes of unstructured information—documents, videos, audio files—that remain underutilised due to their dispersion and lack of structure. This creates inefficiencies when searching for or reusing valuable internal knowledge.

Metaquarry addresses this by converting multimedia content into searchable text, enabling intuitive, intelligent access to corporate information using natural language rather than rigid keywords or filters.

How it works

Metaquarry processes content from various formats—documents, recordings, videos—into a standardised text base. It applies advanced natural language processing (NLP) to allow semantic searches, automatic answers to explicit questions, and content summarisation.

The platform integrates seamlessly with widely used tools like Microsoft Teams, Google Drive or OwnCloud, making it easy to deploy across existing corporate environments.

Impact and benefits

Metaquarry allows teams to locate relevant information quickly, even when specific terms are not used, and to extract insights from vast content libraries. It improves knowledge management, decision-making, and operational agility.

Adaptable across sectors, it offers a Google-like search experience for internal content, enhancing access to organisational intelligence in a modern, scalable way.

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The screenshots show the MetaQuarry user interface. The top-left panel displays the 'DIGIECOQUARRY' logo and a navigation menu with options: Questions, Testing, Documents, and Configuration (highlighted in red). Below the menu is a small European Union flag and the text 'Logged as Holcim'. The top-right panel is titled 'Configuration' and lists integration platforms: Google Drive, SharePoint, and OwnCloud. It includes a section for 'Instructions' with a 4-step process for creating a service account and adding a JSON key. A text input field is provided for pasting the key. The bottom-left panel shows the 'Questions' section with a search bar containing 'Where is Holcim located?'. Below the search bar is a 'Filters' dropdown menu. The 'Answer:' section shows a green box with the text: 'Holcim is located at Corso Magenta N° 55, 1-20123 Milano (MI), Italia.' Below this, it states '1640 relevant documents found' and lists a document titled 'Tonon_Stazione+pre-vagliatura+inerti.pdf' with a 'Download' button. The document's last modified date is '2022-07-26T08:38:37Z'. The 'Show more text' button is visible at the bottom.

NEUTRAL AGGREGATES 2050

Start your decarbonisation journey

Cross-cutting



Why it matters

The aggregates industry is under increasing pressure to reduce greenhouse gas emissions and align with EU climate targets. Without a coordinated roadmap, companies risk falling behind regulatory demands, market expectations, and social acceptance.

The Climate Neutral Aggregates Roadmap 2050 offers a clear sector-wide strategy to reach net-zero emissions, ensuring continued competitiveness, regulatory alignment, and sustainability.

How it works

This is a strategic framework guiding the transition to climate neutrality. It sets out phased goals to 2050 and focuses on eight key areas, including energy efficiency, low-carbon fuels, circularity, digitalisation, and biodiversity restoration.

Rather than prescribing one-size-fits-all technologies, the roadmap proposes a flexible framework that can be tailored to the size and context of each operator. It also includes key performance indicators to measure progress and supports collaboration between industry, policy-makers, and the value chain to achieve shared environmental goals.

Impact and benefits

This strategy enables operators to anticipate future regulations, reduce emissions, and enhance their social and environmental credibility. It also supports access to green financing and public procurement opportunities.

By adopting this roadmap, the aggregates sector positions itself as a proactive and responsible player in Europe's transition to a climate-neutral economy.



[Download it for free >](#)

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COMMUNITY ENGAGEMENT STRATEGY

Strengthen community relations

Why it matters

Quarry operations are increasingly affected by social and regulatory pressures. Failing to engage proactively with stakeholders, particularly local communities, can result in opposition, delays, or disruption of activities, ultimately putting the viability of projects at risk.

The Community Engagement Strategy (CES) provides a structured approach to identify key stakeholders, understand their expectations, and build trust through transparent and consistent communication.

How it works

CES is a transversal solution designed to integrate community and stakeholder engagement into quarry operations. It focuses on participation, openness, and mutual understanding by promoting information sharing and dialogue with both internal and external audiences, including employees, clients, and the general public.

The strategy helps operators anticipate concerns and strengthen their social understanding through structured engagement practices.

Impact and benefits

By adopting the CES, quarries can reduce the risk of conflict, improve operational continuity, and build long-term acceptance of their activities. It supports transparency, enhances credibility, and aligns operations with the expectations of an increasingly aware and demanding public.

This approach is not just a communication tool—it is a strategic asset for sustainable and responsible quarry management.

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Cross-cutting



COMMUNITY GUIDE

Connect with your community through dialogue

Why it matters

Mining and quarrying operations frequently encounter tensions with local communities due to environmental impacts, a lack of transparency, or insufficient stakeholder involvement. Poor community relations can delay projects, damage reputations, and reduce operational continuity. The Community Relations Strategy provides a structured and proactive approach for quarry operators to build trust, prevent conflict, and strengthen their social licence to operate.

How it works

This guide includes methodologies for stakeholder mapping, participatory processes, alliance-building, internal and external communication, conflict prevention, and crisis management. The strategy is grounded in practical tools: from SWOT analyses and feedback loops to inclusive decision-making processes and communication plans. It also offers guidance on how to integrate social and environmental values into the core of operational planning.

Impact and benefits

By adopting this strategy, quarry operators foster stronger ties with local communities and public authorities. This improves public perception, reduces the risk of opposition or disruption, and enables a more stable and predictable business environment. It also supports long-term sustainability by embedding community engagement as a core component of responsible mining practice, aligned with EU expectations and evolving societal demands.

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GENDER EQUALITY GUIDE

Promote gender equality on site

Why it matters

The mining sector continues to face structural gender inequalities that limit women's participation and progression. Without a clear and strategic approach, companies risk reputational damage, legal challenges, and internal inefficiencies.

The Gender Equality Strategy offers quarry and mining operators a structured framework to address these challenges by promoting inclusion, improving internal processes, and aligning with current legal and societal expectations.

How it works

This guide is built around best practices in gender equality, workplace inclusion, and employee wellbeing. It includes the development of equality plans, inclusive language guidelines, training programmes, fair recruitment strategies, and clear internal protocols to address bias and harassment.

The strategy also provides templates and self-assessment tools to help companies track progress and comply with legal obligations in equality and diversity management.

Impact and benefits

Implementing this strategy improves company culture, enhances employee engagement, and strengthens the social licence to operate. It also supports public procurement eligibility and helps attract and retain diverse talent, positioning the company as a modern, responsible, and competitive actor in the mining sector.

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