



MINE.IO

A Holistic Digital Mine 4.0 Ecosystem

MINE.IO Final Event Workshop

*Sustainable Mining Practices in the Future
From Demonstration to Market Perspectives*

*MINE.IO Final Event Workshop
07th May 2026*

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Technology, Sweden



Co-funded by
the European Union



MINE.IO

Mine.io aims to provide solutions that will build a novel mining digital ecosystem and a systemic structure for the implementation of Industry 4.0 in mining industrial environments.

25 partners

7 pilot use cases

€14M budget

42 months



Increase of
energy efficiency
and production



Digitization of all
mine procedures



Waste
reduction and reuse



Workload
optimization

Application
marketplace

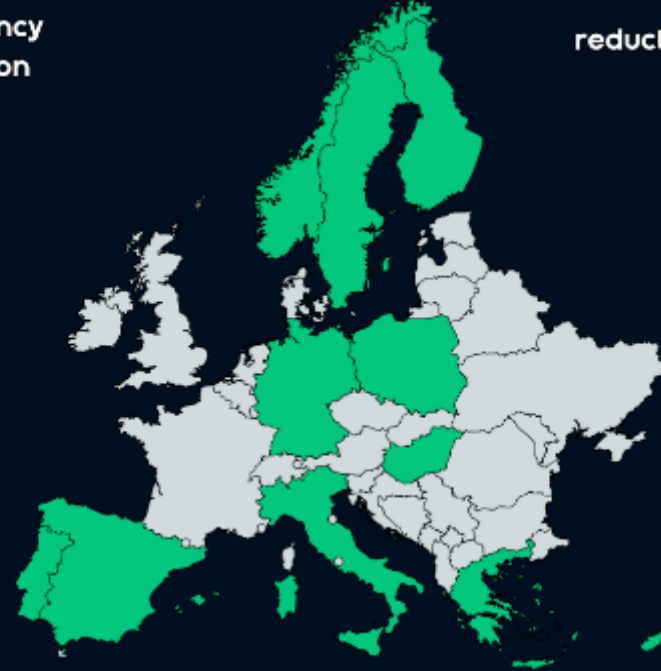


Environmental
footprint reduction



Workflow
automation

Electification of
underground trucks



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Mine.io vision

-  **Mine.io - A Holistic Digital Mine 4.0 Ecosystem** is a project focused on industrialization, informatization and sustainable development of the mining sector.
-  We aim to provide solutions that will build a novel mining digital ecosystem and a systemic structure for the implementation of Industry 4.0 in mining industrial environments.
-  Mine.io solution will embrace the whole mining system value chain from resources' exploration, extraction, and processing to waste management and post mining activity.



Strategic Objectives: Technology, Society & Environment

Technological Objectives

- **Transformation:** Deploying advanced digital and smart sustainable technologies.
- **Connectivity:** Creating an interoperable digital platform across mining operations and sites.
- **Performance:** Using data-driven solutions to increase efficiency, optimize processes and reduce costs.



Societal & Environmental Objectives

- **Climate Neutrality:** Minimizing the CO₂ footprint by eliminating fossil fuels through the electrification of underground vehicles.
- **Safety:** Removing workers from hazardous zones through autonomous systems.
- **Circular Economy:** Supporting Europe's transition to a digitally enabled circular economy.

Mine.io Approach

- Holistic value chain integration, connecting Exploration, Extraction, Mineral processing, and Waste management
- Ecosystem-driven collaboration, aligning industry, research, and societal stakeholders
- Pilot-based validation, translating innovation into scalable, real-world solutions

One Integrated Digital Ecosystem - From Exploration to Sustainable Digital Mining



Cloud services: Cloud-based analytics enabling predictive maintenance and automated workflows



Cyber Security: A framework for secure access control across users, machines, and applications.



ISO 10303: PLM module for seamless data exchange, enabling interoperability and collaboration across users.



Mine.IO platform: A centralized cloud-based core platform that enables seamless data sharing and collaboration across the entire mining value chain from exploration to waste management



Exploration

- **Muon-based imaging** – Non-invasive subsurface exploration
- **Autonomous underwater exploration** – Safe 3D mapping in flooded mines



Ore Extraction

- **Measurement While Drilling & Predictive Maintenance** – Near real-time operator feedback
- **Smart Scheduling & Planning** – Improved resource allocation and production efficiency
- **Wireless Dynamic Charging for Heavy Vehicles** – In-motion charging, higher productivity
- **X-ray for drill core analysis**



Mineral Processing and Smelting

- **AI-enhanced flotation control** – Real-time optimization of flotation
- **Digital Twin for smelter** – Real-time simulation and decision support for smelting process
- **Smart sorting with X-ray**



Waste management

- **Autonomous drone-based exploration** – 3D mapping and environmental risk assessment of new and abandoned mining sites
- **Real-time tailings monitoring** – Instability detection for safer and compliant operations



Community

- **Socio-economic impact** – Social impacts associated with digitalization in mining
- **Standardization activities** – Contributing to ISO and emerging standards in cosmic-ray muography and wireless power transfer

What You Will See Today

- **09:20 – 09:40 – Mine.io Architecture & Digital Framework for the Digital Mine – Mine.io platform**
- 09:40 – 10:25 – Pilot Demonstrators I – Smart & Automated Operations
- 10:25 – 10:45 – Coffee break
- 10:45 – 11:20 – Pilot Demonstrators II – Autonomous & Electrified Operations
- 11:20 – 12:00 – Pilot Demonstrators III – Environment & Waste Management
- 12:00 – 12:50 – Lunch break
- 12:50 – 13:10 – Scaling Digital Mining – Social Sustainability of digital transformation in mining
- 13:10 – 13:30 – Scaling Digital Mining – Standardisation perspective
- 13:30 – 13:50 – Scaling Digital Mining – Market Analysis & Exploitation
- 13:50 – 14:15 – Collaboration with sister projects within the Smart EcoMine Hub
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Mine.io platform

The digital foundation and reference architecture to support seamless interoperability throughout the mining supply chain.

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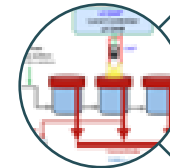
Digitalization of drill operations

Predictive maintenance and Measurement while drilling: Real-time sensor data and ML-models to early detect wear and faster feedback to drilling operator.



X-ray technologies in mining operations

Smart sorting of ore and drill core analysis using X-Ray technologies



AI-enhanced flotation froth control

Closed-loop optimisation of flotation parameters using real-time froth image analysis, delivering higher recovery and more stable plant operation

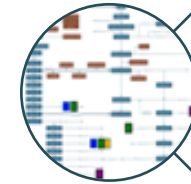


Digital Twin for smelter

Real-time simulation and decision support for stable smelter operation and improved recovery

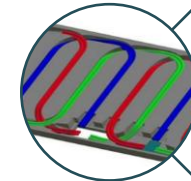
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Workload scheduling and planning

Better resource allocation and optimized production



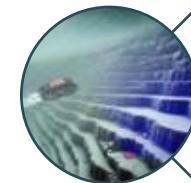
Electrification of mines through dynamic wireless charging

Allows vehicles to recharge while moving, cutting CO₂ emissions and boosting overall productivity.



Autonomous navigation in mines

Improve safety and efficiency by navigating hazardous mine routes without human operators.



Robotics in flooded mines (water)

Explore flooded mine enabling remote 3D data collection without risking human divers. In parallel, non-invasive measurements based on muon technology to enhance the efficiency of mineral exploration.

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UAV & electromagnetic sensing (Air)

Utilizing autonomous drones and EM sensors for environmental risk assessment in abandoned mines



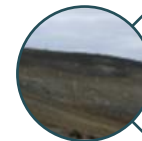
Real-time tailings monitoring

Early detection of geotechnical and structural instability, ensuring regulatory compliance, early risk detection, and safe facility operation.



WebGIS Viewer Development

Multi-source data integration – Combine satellite, UAV, sensor, and survey data



Workflow automation

Supporting the digitalisation and automation of business processes across the mining value chain.

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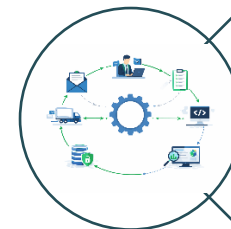
Social Life Cycle Assessment (S-LCA) framework

Social impacts associated with digitalization in mining



Standardisation activities

Contribution to ISO 10303, as well as emerging standards in cosmic-ray muography and J2954/2 for wireless power transfer in heavy-duty electric vehicles.



Market Analysis & Exploitation

Framework for cost-benefit and cost-effectiveness analysis to evaluate Mine.io services, exploitable results, and their socio-economic impact.

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DINAMINE
Digital and innovative mine of the future

DINAMINE transforms the mining value chain through smart, data-driven integration, automation, and sustainable practices.

Find out more about Mine.io on our website



Mineio-horizon.eu



info@mineio-horizon.eu



and on social media



About The Project

A Holistic Digital Mine 4.0 Ecosystem is a project focused on industrialization, informatization and sustainable development of the mining sector. We aim to provide solutions that will build a novel mining digital ecosystem and a systemic structure for the implementation of Industry 4.0 in mining industrial environments. MINE.IO solution will embrace the whole mining system value chain from resources' exploration, extraction, and processing to waste management and post mining activity.

