PERÚMIN Comunidad de Innovadores hub

INNOVACIONES 2025 QUE DESPEGAN

Guidelines 2025
Scaling Innovations

PERUMIN Hub

PERUMIN Hub is an open innovation program in the Peruvian mining sector, seeking collaborative solutions to major industry challenges. It is an initiative by the Institute of Mining Engineers of Peru (IIMP) and the Mining Innovation Hub of Peru. The program consists of three phases:

A. **Challenges:** Through a collaborative and reflective process that begins with the work of company executives—and is strengthened by an internal organizational culture of innovation within mining companies—the main challenges have been identified and characterized. These challenges are then made available to various innovation communities to collectively seek solutions.

B. **Matchmaking:** In this stage, collaboration is actively promoted through connection spaces between innovators, as well as between innovators and mining companies. This process is supported by two complementary spaces to the contest:

- **Matchmaking 1 (MM1):** Through virtual sessions, we promote connections among participants so they can submit more robust proposals during the contest stage—proposals that are the result of collaborative or partnered work. The objective of this space is to foster synergies that extend beyond the contest itself.

  During the evaluation process of the contest stage, collaborative or partnered proposals—whether emerging from MM1 or other processes coordinated by the innovators—will be positively valued.

- **Matchmaking 2 (MM2):** Through an online platform, potential solution providers can optionally submit a profile of their proposals prior to the contest in order to receive feedback from the internal teams of mining companies. The goal is to connect them with potential end users so they can refine their proposals based on the feedback received.

  In the event of a tie during the evaluation process of the contest stage, preference will be given to those proposals that generated greater interest among the internal teams of the mining companies through the Matchmaking platform.

C. **Contest:** In this stage, innovators present their solutions in response to the challenges posed by mining companies. These guidelines outline the most relevant aspects to ensure the objectives of this stage are met.

For more information about the PERUMIN Hub program and its stages, visit our website: https://perumin.com/perumin37/public/en/hub

PERUMIN Hub: Contest

1. What are the objectives of the contest?

- Promote the development of innovative solutions that address specific challenges in the mining industry.
- Facilitate the consolidation of innovations through collaboration.
- Recognize successful innovations and support their commercial takeoff within the sector.

2. What are the challenges of the mining industry?

The main challenges are grouped into 3 thematic areas and 10 specific problems:

2.1 **Circular and Regenerative Mining**

- How can water consumption be reduced, its reuse maximized, and mining systems designed to regenerate water sources?
- How can waste and tailings be reduced or transformed into valuable inputs for other industries?
- How can mining operations become carbon-neutral through renewable energy, carbon capture, and ecosystem regeneration?
- How can the environment be restored during the mine closure process?

2.2 **Smart Mining**

- How can operational efficiency and productivity be improved using emerging technologies, while facilitating their adoption by the workforce?
- How can risks be minimized and mining safety improved through new technologies?
- How can mineral exploration and extraction be optimized using advanced technologies?
- How can emerging technologies be leveraged to prevent, detect, and mitigate illegal mining?

2.3 **New Horizons in Mining**

- How can mining develop new products and business models aligned with global trends?
- How can we optimize and reduce operational costs in the logistics value chain through technologies and synergies with stakeholders?

The technical details of the 10 challenges can be found in Annex 1.

3. What type of solutions is the contest looking for?

We are looking for innovations with a certain level of development/maturity, according to the following categories:

3.1 **Category 1: Innovations to Validate**

This category is aimed at innovative solutions that have already passed the conceptual validation phase and have a prototype ready to be tested, along with a validation plan that can be carried out for the first time within a mining company. The solutions submitted in this category must specifically address one or more of the prioritized challenges in this 4th edition.

3.2 **Category 2: Successful Innovations**

This category is intended for innovative solutions that have already been tested and validated in the field (either in mining companies or centers that simulate real conditions), whether developed in Peru or abroad, with satisfactory results obtained in recent years (2022–2025). Innovations submitted in this category must fall within one of the previously mentioned thematic areas: i) Circular and Regenerative Mining, ii) Smart Mining, or iii) New Horizons in Mining.

4. Who can apply?

4.1 **Category 1: Innovations to Validate**

Participation in Category 1 is divided into 3 subcategories:

- **National companies:** Companies with headquarters in Peru[1].
- **International or multinational companies:** Companies with headquarters outside of Peru.
- **R&D entities:** Universities, research centers, or institutes based in Peru, represented by a recognized unit within their organizational structure such as a School, Faculty, Laboratory, Research Office, Research Group, Incubator, among others.

In all three cases, applications may be submitted individually or in collaboration with national or international companies and/or R&D entities.

4.2 **Category 2: Successful Innovations**

Participation in Category 2 is divided into 2 subcategories:

[1] This includes companies established under Decree Law No. 21621, the Law on Sole Proprietorships with Limited Liability (E.I.R.L.), as well as the corporate forms outlined in Law No. 26887, the General Law of Corporations, such as S.A. (Corporation), S.A.A. (Public Corporation), S.A.C. (Closed Corporation), S.R.L. (Limited Liability Company), Civil Society, Ordinary Civil Society, and Civil Society with Limited Liability.

- **National companies:** Companies with headquarters in Peru.[3].
- **International or multinational companies:** Companies with headquarters outside of Peru.

In both cases, applications may be submitted individually or in collaboration with national or international companies and/or R&D entities.

5. How to apply to the contest?

To apply, the proposal must be submitted through the following link: https://peruminhub.vform.pe/ by completing all items in the provided form, according to the timeline detailed in Section 8.

6. What are the contest requirements?

6.1 **Cover Letter (Annex 2):** This document must be signed by an authorized representative of the organization submitting the proposal. It is mandatory for both categories.

6.2 **Collaboration Letter (Annex 3):** If your proposal involves more than one organization, you must attach this letter signed by an authorized representative of each partner entity. This applies only when multiple organizations are participating and is required for both categories.

6.3 **Field Validation Document (free format):** This document confirms that the solution has already been tested in a real-world environment. It must be signed by an authorized representative of the company or organization where the validation was carried out. It is only required for Category 2: Successful Innovations, meaning if your model has already been validated.

The document must be in free format but must explicitly include the following information:

- Name of the organization or company where the field validation took place
- Name of the applicant entity/company
- Name of the project and/or technology to be validated
- Positive validation results
- Completion date of the validation (month and year)

6.4 **Considerations/Restrictions**

- Participation with previous solutions: Companies that were finalists or winners in PERUMIN Hub 2021, 2022, or 2023 with the same solution they were previously selected for are not eligible to apply in this edition. However, they may participate if they present a different solution or if they apply with the same solution under a different category (for example, if it was previously in the "to validate" stage and has now been validated in the field).
- Collaboratively developed proposals: If the proposal has been developed by more than one organization, the entity leading the application

must be the one that developed the core technology.

- Single recognition per category: To select the best solution in each category, in addition to the technical evaluation, it will be verified that the proposal has not already won in another PERUMIN 37 program, such as the TIS Forum or PERUMIN Inspira. If the same solution is selected in more than one program, only one recognition will be granted, with priority given to one of them.

7. How will the evaluation and selection be carried out?

The evaluation process will take place in the following stages:

7.1 **Eligibility Review:** In this stage, all application requirements will be reviewed according to the applicable category. This process will be carried out by the PERUMIN Hub team.

7.2 **Technical Evaluation:** In this stage, all solutions will be assessed by experts in the relevant technologies or subject areas, through PERUMIN Hub's partner organizations. This evaluation will result in a shortlist of innovations that will move on to the next stage: user-level evaluation.

7.3 **User-Level Evaluation:** Innovative solutions must address the specific needs of mining companies. Therefore, company representatives will be responsible for selecting the finalists. To that end, solution providers who pass the technical evaluation will be required to clearly, precisely, and dynamically present their solutions during the scheduled Demo Days.

During these Demo Days, mining companies will have the opportunity to learn firsthand about the solutions developed by the innovation community. They will then select 15 finalists who will be invited to present their proposals at the PERUMIN 37 Mining Convention. Finalist selection will be subject to approval by the evaluators, but will follow the distribution guideline below:

	Circular and Regenerative Mining	Smart Mining	New Horizons in Mining	Total
Category 1: Innovations to Validate	9 finalists will be selected, distributed as follows: 3 national companies, 3 international companies, 3 R&D entities			9
Category 2: Successful Innovations	6 finalists will be selected, distributed as follows: 3 national companies, 3 international companies			6
Total				15

In both categories, efforts will be made to ensure a balanced distribution across the thematic areas.

7.4 Final Evaluation

The exhibition of finalist solutions, their final evaluation, and the announcement of the best innovations will take place during the PERUMIN 37 Mining Convention, from September 22 to 26, 2025.

All evaluation stages will consider the following criteria, according to category:

Category 1: Innovations to Validate

Criterion	Description	Weight
Relevance	The solution is appropriate, relevant, and clearly beneficial in addressing the specific challenge.	25%
Novelty	The solution is new and innovative compared to the local and/or international market. Having registered intellectual property will be positively considered.	25%
Feasibility	The proposed implementation plan is viable and consistent with the expected outcomes.	35%
Sustainable Development	The solution has a social and/or developmental impact linked to the Sustainable Development Goals (SDGs).	10%
Collaboration	The solution is the result of a collaborative strategy between two or more entities.	5%

Category 2: Successful Innovations

Criterion	Description	Weight
Relevance	The presented innovation is relevant and clearly beneficial in relation to the thematic area and the Peruvian mining industry.	30%
Novelty	The solution is new and innovative compared to the local and/or international market. Having registered intellectual property will be positively considered.	25%
Scalability	The innovation has strong potential for market adaptation and expansion.	35%
Sustainable Development	The solution has a social and/or developmental impact aligned with the Sustainable Development Goals (SDGs).	10%

7.3.1. Tie-Breaking Criterion: Expectation

In the event of a tie between two or more solutions, an additional criterion will be applied based on the level of interest generated among potential users. As a reference, the number of times the proposal was rated as "The solution is innovative" in the feedback provided by mining companies during the Matchmaking 2 process will be used, reflecting the sector's valuation.

8. Timeline

Activity	Date
Matchmaking 1	April 14 to June 15, 2025
Matchmaking 2	April 14 to May 5, 2025
Start of Contest Submissions	Thursday, May 15, 2025
Deadline for Contest Submissions	Monday, June 23, 2025 at 11:59 PM (UTC-5)
Announcement of Preselected Proposals and Presentation Schedule	Wednesday, July 30, 2025
Demo Days	August 12 to 21, 2025
Finalists Announcement	August 25 to 29, 2025
PERUMIN 37 Mining Convention	September 22 to 26, 2025

9. Benefits and Awards

9.1. Participation in PERUMIN 37

The 15 finalists will have the opportunity to participate in the PERUMIN 37 Mining Convention and present their solutions to the sector. PERUMIN Hub will cover[2] the following expenses for the finalist entities[3]:

- Round-trip transportation within Peru to the city of Arequipa for one representative per entity.
- Accommodation and meals for one representative per entity, based on the presentation dates.
- Admission tickets to PERUMIN 37 for two representatives[4] per finalist entity.

10. Inquiries

If you have additional questions, feel free to contact us via email at peruminhub@iimp.org.pe or visit our website https://perumin.com/perumin37/public/en/hub

11. General Provisions

11.1 PERUMIN Hub reserves the right to disqualify participants if proposals are found to contain false information, violate intellectual property rights, or fail to meet the requirements and/or provisions at any stage of the program.

[2] Flight schedules and lodging arrangements will be determined by PERUMIN Hub; any modifications or changes will be the responsibility of the participants. Additionally, lodging may be assigned in shared double rooms.
[3] All purchases will be made by the organizing team; no reimbursements will be issued for expenses incurred in advance by the finalists.
[4] For the second representative, travel and accommodation expenses are not included.

11.2 PERUMIN Hub holds exclusive authority to interpret the scope of the provisions outlined in these guidelines.

11.3 PERUMIN Hub commits to not disclosing or sharing sensitive information regarding the project without the prior knowledge and consent of the applicant. In the case of evaluators, confidentiality agreements will be used.

11.4 PERUMIN Hub will not take part in or be responsible for any agreements made between participating entities during collaboration, partnership, or other processes. Any actions taken in the potential implementation of proposed solutions will be at the discretion of the involved parties and are beyond the scope of this Contest.

11.5 To participate, solutions must have been developed and tested in formal mining environments, in compliance with current legal regulations. PERUMIN Hub reserves the right to reject those that do not meet this criterion.

Annex 1. Characterization of Thematic Areas and Challenges

The challenges are grouped into 3 thematic areas and 10 specific challenges[5]:

A. Circular and Regenerative Mining

The circular economy has become a key trend to address today's environmental and economic challenges. Rather than following a linear model of production and consumption, circularity proposes closing the lifecycle of materials and resources—keeping them in use for as long as possible while minimizing waste and pollution.

Implementing circular practices in the mining sector offers significant environmental, social, and economic benefits. This restorative and regenerative approach aims to reduce dependence on energy and raw materials, promoting a more efficient and sustainable use of resources within the economic system. Circular mining represents an opportunity to advance climate change mitigation and adaptation, improve sector competitiveness, lower costs, and strengthen relationships with communities and authorities, aligned with new market demands (CESCO and MinSus, 2022).

Challenge 1: How can we reduce water consumption, maximize its reuse, and design mining systems that regenerate water sources?

Peru is one of the countries with the largest amount of freshwater in the world. In the face of a global water scarcity scenario, we have the responsibility to promote management models and technologies that optimize its use, enable reuse, and regenerate water sources.

In the mining sector, water scarcity and lack of coordination in water use have led to low economic productivity and social conflicts. This is both a challenge and an opportunity to find solutions that promote resource exchange, efficient coordination, access to new water sources, and collaborative management (CESCO and MinSus, 2022).

Opportunities and/or Value Elements:

- Solutions that include a watershed-based water balance diagnosis and climate change projections.

[5] The prioritization and characterization of the challenges were made possible thanks to the contributions of the following mining companies: Alpayana, Anglo American Quellaveco, Antamina, Antapaccay, Bateas, Buenaventura, Chinalco, Eramet, Gold Fields, Hudbay, MMG - Las Bambas, Nexa, Pan American Silver, Newmont, Poderosa, Quilla Resources, and Southern Peaks Mining.

- Solutions that diagnose/measure natural sources (natural water quality surpluses) to validate initial conditions and ease regulatory exceptions.
- Solutions that enable collaboration with the National Water Authority and align with national regulations.
- Solutions for regenerating water sources with a multisectoral approach (mining, agriculture, energy, and territory) and that promote community involvement.
- Solutions focused on reducing consumption and losses (evaporation/leakage).
- Real-time monitoring solutions for:
  i) water use;
  ii) evaporation, leakage, and tailings entrapment losses;
  iii) water quantity and quality based on supply watersheds.
- Solutions with rainwater harvesting and storage systems integrated into watershed management models.
- Solutions to maximize water recirculation and reuse, including other types such as groundwater.
- Solutions that avoid perpetual water treatment.
- Solutions that ensure sustainable discharge quality during and after operations.
- Solutions that leverage undervalued water sources.
- Solutions for sulfate and acid water treatment.
- Solutions for reusing wastewater in the surrounding area.
- Use of non-contact water (e.g., rainwater not involved in mining processes).
- Solutions for treating and revalorizing brine and highly saline wastewater.
- Nature-based solutions to restore watersheds and water sources.
- Solutions that optimize aquifer recharge and infiltration technologies.
- Solutions that reduce water footprint in tailings management.
- Solutions using biofilters, microorganisms, and nanotechnology to improve reused water quality.
- Models that include the productive use of wastewater in nearby industrial or agricultural sectors.

Challenge 2: How can we reduce waste and tailings or transform them into valuable inputs for other industries?

As a driving industry, mining plays a fundamental role in the economy, not only through direct contributions but also by influencing the entire value chain. As a major purchaser of goods and services, mining stimulates demand and economic activity across sectors. However, it also has a significant impact in terms of waste generation and environmental footprint. This gives mining a key role in implementing circular economy practices—reducing, reusing, and recycling waste to minimize environmental harm.

Circular economy approaches are relevant not only downstream (e.g., pallets, plastics, tires, electronics) but also upstream (e.g., overburden, effluents,

tailings, acid water). It is crucial to apply circular economy principles at every stage—from extraction and processing to final disposal—generating valuable inputs for other industries like construction, manufacturing, or even new advanced materials.

Opportunities and/or Value Elements:

- Solutions focused on tailings dam safety, aligned with current standards.
- Solutions to extend the lifespan of critical inputs (mill balls, tires, equipment oils, etc.).
- Solutions to revalorize tailings with non-metallic minerals (pyrite, carbonates, silicates, etc.).
- Solutions to revalorize organic waste for energy generation or agricultural use.
- Solutions to revalorize sludge from acid water treatment.
- Solutions to recover remaining valuable minerals or elements from tailings.
- Solutions to stabilize contaminants and desulfurize tailings for further use.
- Solutions to revalorize tailings for construction materials, composites, soil improvement, etc.
- Industrial symbiosis models for comprehensive waste reuse.
- Solutions for tailings compaction and dewatering (filtered tailings).
- Solutions addressing characterization, reduction, and remediation of legacy environmental liabilities with valorization potential. As of February 19, 2025, Peru's Ministry of Energy and Mines has identified 6,026 mining environmental liabilities (Ministerial Resolution No. 290-2006-MEM/DM).

Challenge 3: How can we achieve carbon-neutral mining operations through renewable energy, carbon capture, and ecosystem regeneration?

Mining plays a crucial role in the global sustainable development and climate agenda—not only as a provider of minerals essential to clean technologies, but also as an agent of change capable of adopting innovations to reduce or reverse its carbon footprint and become a carbon-neutral activity.

To achieve this, mining must innovate in strategies to reduce fossil fuel use and carbon emissions across its value chain. This includes Scope 1 (direct emissions), Scope 2 (from energy generation), and Scope 3 (indirect, supply chain-related). Alternatives like solar, wind, biodiesel, and green hydrogen are being explored for an effective energy transition. However, economically viable carbon footprint reduction strategies are still needed.

Opportunities and/or Value Elements:

- Solutions that utilize available surfaces for energy generation (solar, wind, etc.).
- Solutions that prioritize clean energy sources and reduce carbon footprint.
- Cost-efficient solutions tailored to sector conditions such as energy storage, mine site access, environmental factors, etc.
- Solutions that integrate renewable energy into mining operations.
- Solutions to improve the energy efficiency of mining equipment, focusing on pumping systems.
- Long-term solutions including post-closure site use and energy cost reduction.
- Solutions incorporating best practices in energy efficiency and carbon reduction (e.g., ISO 50001 standards).
- Solutions that integrate carbon footprint monitoring as a key indicator of progress and reputational impact.
- Solutions promoting cross-sector or inter-project synergies, considering the full value chain (Scope 3 emissions).
- Solutions that offer financial value (carbon credits, green bonds, etc.).
- Solutions focused on reducing energy use in mining operations.
- Solutions to convert or adapt fixed and mobile equipment for non-fossil fuels, supporting decarbonization of mining transport.
- Solutions for energy storage in mining operations.
- Solutions for carbon capture using nature-based approaches.

Challenge 4: How can we restore the environment during the mine closure process?

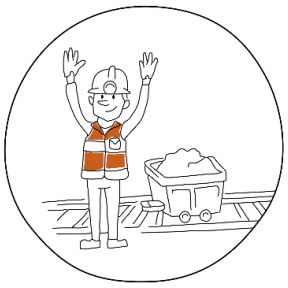
Mining is not permanent—it has a defined life cycle. Therefore, companies must establish a plan to ensure that once operations end, conditions are the same or better than before. Mine closure is a complex challenge requiring solutions tailored to the specific context of each operation. Peru's diverse geography, climate, ecology, and social realities demand differentiated strategies and technologies for environmentally sustainable, economically viable, and socially responsible closure.

Mine closure is a progressive process that begins in the conceptual design phase and ends only when specific closure goals are permanently achieved. There are four closure scenarios:
i) **Temporary closure**, requiring a detailed care and maintenance plan considering possible future use;
ii) **Progressive closure**, occurring during mining when a component is no longer useful, involving dismantling, demolition, land reshaping, revegetation, etc.;
iii) **Final closure**, after resource depletion, requiring complete dismantling, studies, final disposal, physical/geochemical/hydrological stabilization, and revegetation;
iv) **Post-closure**, where the operator remains responsible for a minimum of five years (MINEM, 2006).

Opportunities and/or Value Elements:

- Solutions that promote community involvement (communal enterprises/local actors) in land planning and sustainable post-closure economic activities.
- Solutions that reduce visual impacts and improve environmental integration.
- Solutions tailored to each closure type: temporary, progressive, final, and post-closure.
- Solutions for managing and remediating already-closed mines (as of 2024).
- Solutions that create a net positive legacy—environmental, economic, and social.
- Solutions that consider carbon emissions reduction and compensation during mine closure.
- Innovative solutions for land recovery and reuse with equal or higher economic value, considering risks and limitations.
- Solutions to improve soil chemical stability and speed up revegetation, based on soil type and climate.
- Real-time environmental monitoring solutions for water, soil, biodiversity, etc., during closure stages.
- Nature-based solutions.

B. Smart Mining



Digital transformation is a global trend that is redefining the mining industry. The introduction of emerging technologies such as artificial intelligence, real-time data analytics, and automation has improved operational efficiency and reduced risks. The use of technology can reduce workers' exposure to operational hazards and minimize environmental impact through better resource management. However, Peruvian mining still faces challenges in effectively adopting and integrating these technologies, due to a lack of digital infrastructure, resistance to change, and the need for more training in advanced tools.

Challenge 1: How can we improve operational efficiency and productivity using emerging technologies, while facilitating their adoption by the workforce?

In Peru, the mining sector faces the challenge of improving operational efficiency in a context of rising costs and stricter regulations. The implementation of technologies such as digital twins, automation, and advanced analytics can optimize processes, reduce input consumption, and enhance real-time decision-making. However, adoption remains difficult due to technological fragmentation, a shortage of data-literate talent (such as data scientists), lack of knowledge about mining processes, resistance to

change, and conservative attitudes toward the benefits of adopting new technologies.

Opportunities and/or Value Elements:

- Solutions that integrate emerging technologies with existing ones to maximize value and reduce infrastructure/hardware needs.
- Solutions that consolidate automation processes (Industry 3.0) as a foundation to progress toward Mining 4.0.
- Cost-efficient solutions for data capture, transmission, and usage, with a focus on interoperability.
- Solutions that prioritize ease of use, adapting to various levels of digital literacy among personnel. Inclusion of digital literacy components related to Industry 4.0 technologies is valued to reduce knowledge gaps.
- Solutions that offer long-term support for technology adoption (continuous training, monitoring of tech advances).
- Solutions with a change management approach: training, digital mindset, empowerment, and organizational culture.
- Solutions that integrate performance indicators and reports to demonstrate benefits.
- Solutions with a focus on prevention, prediction, and prescription through data utilization.
- Solutions that promote autonomy in plant operations.
- Solutions adapted to Peru's mining conditions (geography, climate, value chain, etc.), connectivity infrastructure limitations, and enabling instrumentation (tools, sensors that withstand corrosive environments, high temperatures, and areas with poor real-time transmission).
- Solutions that include virtual instrumentation (no physical equipment).
- Solutions that incorporate cybersecurity measures and comply with the user companies' policies.
- Solutions that integrate Industry 4.0 technologies across the entire value chain: mine production, plant, ports, etc., increasing process efficiency. Involvement of suppliers is also valued.
- Solutions that promote collaboration with academia and the use of mining royalties for technology development.
- Solutions that promote energy efficiency in plants and greater resource recovery.
- Solutions for applying AI in metallurgical processes, such as flotation, to improve efficiency.

Challenge 2: How can we minimize risks and improve mining safety with new technologies?

Mining activity demands continuous and thorough protection of workers to minimize accident risk and ensure a safe and healthy work environment. Occupational safety and health are fundamental at all operational stages, beginning with shift changes and extending through every process—from task planning and execution to equipment and facilities maintenance and

supervision. This requires a comprehensive safety culture that prioritizes risk prevention, continuous training, and the use of technology as a key ally. From smart sensors to AI for risk prediction, technological solutions can help reduce incidents, enhance safety, and move toward zero-accident operations.

Opportunities and/or Value Elements:

- Solutions with smart sensors (physical and virtual) for remote monitoring of operating conditions.
- Technological solutions for predicting fatigue, sleep, and behavioral patterns to prevent accidents (e.g., biometric monitoring).
- Solutions that maximize training impact and reduce digital literacy gaps (tech literacy).
- Solutions that ensure cybersecurity and align with company policies.
- Solutions adapted to Peruvian operational conditions (altitude, climate, connectivity, corrosion, etc.).
- Virtual instrumentation solutions that reduce costs and speed up adoption.
- Solutions that integrate technologies for early accident detection and alert.
- Solutions that automate, digitalize, or remotely control high-risk procedures.
- Solutions for fast alert and reporting of workplace incidents.
- Tech solutions that reduce vehicle-to-vehicle contact.
- Solutions with advanced analytics models that process large volumes of operational and safety data for decision-making.
- Solutions that consider the employment impacts of tech use and propose mitigation actions.
- Tech solutions that reduce personnel exposure in hazardous zones (e.g., advanced geophysical methods, drones for inspection).
- Solutions that include suppliers in design and implementation.
- Solutions to reduce injuries and improve occupational safety (e.g., use of body support devices like exoskeletons).

Challenge 3: How can we optimize mineral exploration and extraction using advanced technologies?

In Peru, it can take around four years from identifying an area of interest to deploying drilling equipment, compared to just eight months to a year in other countries (IIMP, 2025). The exploration stage involves significant investment, which is only recovered if a technically and economically viable mineral deposit is discovered.

Exploration and extraction are complex and costly processes that require constant innovation. In the Peruvian context, mining requires technologies that enable the identification of new deposits with greater precision and efficiency, reducing costs and minimizing environmental impact. Solutions such as machine learning, remote sensing, and automated drilling can

significantly contribute to making these processes more sustainable and profitable by improving efficiency and reducing risks.

Opportunities and/or Value Elements:

- Tech solutions that minimize personnel interaction with drilling equipment to improve safety and costs.
- Solutions that reduce risks from handling pipes during drilling.
- Real-time geotechnical monitoring solutions to improve safety and efficiency in drilling.
- Solutions that reduce exposure in high-altitude tasks.
- Innovative solutions that revisit the basic principles of the mining cycle and unit operations, facilitating adoption and optimization.
- Tech solutions to improve safety and efficiency in field sampling during prospecting.
- Machine learning-based solutions to improve accuracy in deposit identification.
- Tech solutions for automated drilling with minimal environmental impact.
- Solutions that promote precision mining to optimize resources and minimize impacts.
- Technological solutions to optimize real-time geological modeling.
- Practical application solutions using remote sensors and advanced geophysics for fast, cost-efficient exploration.

Challenge 4: How can we leverage emerging technologies to prevent, detect, and mitigate illegal mining?

Illegal mining is a critical issue in Peru, with severe environmental damage, loss of human lives, and various negative economic, social, and psychosocial impacts across regions. To tackle this challenge comprehensively, regulatory and governance efforts must be complemented by the use of advanced technologies that enable real-time monitoring and control of illicit activities.

Tools such as artificial intelligence, blockchain for traceability, and surveillance drones can play a crucial role in strengthening oversight and governance of the mining sector. The implementation of such technological solutions can significantly contribute to reducing informal and illegal mining.

Opportunities and/or Value Elements:

- Tech solutions integrating artificial intelligence for early identification of illegal activities.
- Solutions to improve traceability and control of mineral trade, including the supply chain and inputs like explosives, fuel, and chemicals (e.g., blockchain).
- Solutions for constant surveillance in critical areas (e.g., satellite and drone monitoring, image and geospatial data analysis).

- Solutions that strengthen governance and oversight in vulnerable territories through accessible and scalable technologies.
- Multi-stakeholder approach solutions.
- Tech solutions from other industries adapted to the mining sector for oversight, monitoring, and control.

C. New Horizons in Mining

The future of mining not only depends on the efficient extraction of minerals but also on its ability to adapt to new market demands. Globally, the shift toward a more sustainable economy is driving the use of strategic minerals for the production of fertilizers, batteries, clean energy, and other applications. This presents a major opportunity for Peruvian mining to diversify its portfolio and explore new business models.

Likewise, integration across the entire value chain offers opportunities to capture value, from emissions control to the creation of premium, cleaner products. Mining and metals companies are exploring local partnerships that can generate long-term organizational and social value.

Challenge 1: How can mining develop new products and business models aligned with global trends?

Peruvian mining has historically focused on extracting metals like copper, gold, and zinc. However, there are opportunities to expand into the production of minerals used in fertilizers, water treatment, animal nutrition, and clean technologies. Diversification would not only increase the industry's value but also enable greater resilience in the face of price fluctuations for traditional metals.

Value Elements:

- Solutions related to the production of minerals for agricultural and livestock activities (fertilizers, nutrients, pesticides, animal nutrition).
- Solutions that include new business models aligned with the circular economy.
- Solutions that bring communities and companies closer together, considering current and future local capacities.
- Multi-stakeholder approach solutions.
- Solutions that promote the development of local supplier clusters and networks for diversification and innovation.
- Technological solutions and business models for the commercial valorization of mining by-products.
- Solutions with new business models that leverage the production of strategic mineral inputs for emerging sectors (electronics, nanotechnology, electromobility).

- Solutions for the mining sector that incorporate new business models related to urban mining and electronic waste recovery.
- Solutions that integrate regenerative mining as a competitive advantage.
- Solutions that include local suppliers, accessible technologies, and self-sustainable business models.

Challenge 2: How can we optimize and reduce operational costs in the logistics value chain through technologies and synergies with stakeholders?

Transport and logistics represent a significant portion of operational costs in mining, especially in Peru, where complex geography and reliance on fossil fuels increase supply chain challenges. Addressing this challenge requires optimizing and reducing operational costs by integrating the entire value chain, creating synergies with suppliers, and leveraging innovative technologies. This will not only improve efficiency and sustainability but also generate organizational and social value for the sector, contributing to more responsible and competitive mining.

Value Elements:

- Solutions that integrate Industry 4.0 technologies across the entire value chain (mine, plant, port), including suppliers.
- Solutions for supply shortages or logistical cost overruns caused by external variables (e.g., conflicts).
- Social logistics solutions to improve agreements with communities by including them in the value chain.
- Solutions to strengthen supplier networks using blockchain (transparency, contracts, traceability).
- Route and time optimization solutions to enhance supplier relations.
- Solutions that simplify the supplier certification process.
- Strategic solutions to integrate Peruvian mining into global sustainable and circular value chains.
- Solutions for logistical risk management and operational resilience using AI and/or advanced analytics tools.

Annex 2. Cover Letter

Cover Letter[6]

PERUMIN Hub

I, *(insert full name)* ……, in my capacity as *(position within the institution being represented: legal representative, director, or other as applicable)* …… of *(insert the name of the company/entity/department or as applicable)* ……, am pleased to express my intention to participate in the PERUMIN Hub 2025 Open Innovation Program Contest: Innovations that Take Off, with the proposal *(insert the name of the project being submitted to the contest)* …….

I declare that I am aware of the provisions of the present guidelines, and that all information presented in the proposal submitted by the institution/entity I represent is truthful and accurate.

Signature

Name and Surname
ID/Passport
Email
Phone Number

[6] The letter may be signed either digitally or physically. In the case of companies/NGOs/associations, it must be signed by the legal representative. For R&D entities, it must be signed by the highest authority of the unit/area/department submitting the proposal.

Annex 3. Collaboration Letter

Collaboration Letter[7]

(This annex applies only if your proposal is submitted by more than one organization. In such case, you must attach this letter signed by an authorized representative from each partner entity. This requirement is mandatory for both categories when multiple entities are participating jointly. "Authorized representative" is defined as the legal representative or a person in a senior management role with decision-making power within the applying entity.)

PERUMIN Hub

I, *(insert full name)* ……, in my capacity as *(position within the institution being represented: legal representative, director, or other as applicable)* …… of *((insert the name of the company/entity/department or as applicable)* ……, am pleased to express my commitment to collaborate as a strategic partner in the proposal *(insert name of the project being submitted to the contest)* ……, submitted by *(insert name of the applicant company/institution)* …… within the framework of the PERUMIN Hub 2025 Open Innovation Program Contest.

I declare that I am aware of the provisions of the present guidelines, and that all the information submitted in the proposal, of which I am a part, is accurate and truthful.

Signature

Name and Surname
ID/Passport
Email
Phone Number

[7] The letter may be signed either digitally or physically. In the case of companies, NGOs, or associations, it must be signed by the legal representative. For R&D entities, it must be signed by the highest authority of the unit/area/department submitting the proposal.