

POLICY BRIEF - NOVEMBER 2023

INTRODUCTION

The H2020 Resilient Bio-inspired Modular Robotic Miners (ROBOMINERS) project, which started in June 2019 and is set to conclude in November 2023, is creating a prototype of a bio-inspired, modular, and reconfigurable robot-miner. This robotic miner was designed to exploit small and hard-to-reach mineral deposits that are not economically feasible to extract using conventional mining methods.

The ROBOMINERS prototype will operate, navigate, and selectively mine in underground environments. To complement the development of the physical prototype, the ROBOMINERS project is also establishing a mining ecosystem through simulations, modelling, and virtual prototyping. The prototype is being subjected to rigorous testing under various scenarios to evaluate its mining capabilities and resilience, and to demonstrate the potential of this new technology to exploit mineral resources effectively. The key functions of the robot-miner are being validated to a Technology Readiness Level (TRL) of 4, indicating that they have been demonstrated in a laboratory environment.

THE CRITICAL RAW MATERIALS ACT

In March this year the European Commission presented the draft for a Critical Raw Materials Act (CRMA). This legislative initiative aims to strengthen EU's critical raw materials capacities along all stages of the value chain. It also aims to increase the European resilience by reducing dependencies, increasing preparedness and promoting supply chain sustainability and circularity. The CRMA establishes a set of strategic actions to achieve this (EC, 2023):

- Setting clear priorities for action.** The CRMA identifies a list of 30 critical raw materials and a list of strategic raw materials crucial for technologies for the green and digital transition, as well as for defence and space. It also sets benchmarks for domestic capacities along the strategic raw material supply chain to be reached by 2030: 10% of the EU's annual needs for extraction; 40% for processing and 15% for recycling. No more than 65% of EU's annual needs of each strategic raw material at any relevant stage of processing should come from a single third country.
- Building European capacities.** The CRMA defines a path to strengthening the EU raw materials value chain, from mining to refining to processing and recycling. This requires development of national exploration, more streamlined and predictable approach to permitting procedures, as well as improved access to finance.
- Improving resilience.** This pillar focuses on improving the EU's ability to withstand disruptions in the supply chain. It will do so by increasing the monitoring capacity through stress tests, ensuring coordinated efforts for the build-up of strategic stockpiles and fostering sustainable investment and trade.
- Investing in research, innovation and skills.** The EU will strengthen the uptake and deployment of breakthrough technologies in critical raw materials. The establishment of a large-scale skills partnership on critical raw materials and of a Raw Materials Academy will promote skills relevant to the workforce in critical raw materials supply chains.
- Promoting a more sustainable and circular critical raw materials economy.** The recycling of raw materials must be promoted and a strong secondary market enabled. This will be achieved by encouraging the recovery of critical raw materials from extrac-

tive waste facilities and increasing efforts to mitigate adverse impacts with respect to labour rights, human rights and environmental protection. Certification schemes to increase the sustainability of critical raw materials on the EU market must also be recognised.

Supply of critical raw materials to the EU is often very concentrated

Selected countries by share of total EU mineral supply (%)

Country	Mineral (key use)	Share of EU market
 China	Rare earths (offshore turbines)	98%
 Turkey	Borate (chemicals industry)	98%
 Chile	Lithium (batteries)	78%
 South Africa	Platinum (electrical equipment)	71%
 DR Congo	Cobalt (batteries)	68%
 Guinea	Bauxite (aluminium production)	64%

Source: <https://www.energymonitor.ai/policy/eu-to-launch-quest-for-raw-materials-critical-for-cleantech/>

CHALLENGES OF IMPLEMENTING THE CRITICAL RAW MATERIALS ACT

The implementation of the Critical Raw Materials Act (CRMA) is likely to encounter several challenges, ranging from cooperation between EU Member States to public opposition, industry concerns, and the exploitation of developing countries.

Cooperation between Member States

The CRMA emphasises the need for cooperation among EU Member States. It requires Member States to establish a streamlined and efficient permitting process for critical raw materials projects, exchange information on strategic raw material stocks, and coordinate the implementation of the measures outlined in the act. However, achieving effective cooperation among Member States may prove challenging. Balancing the expectations of the European Commission with domestic implementation obstacles and varying national interests could pose significant hurdles.

Public opposition

As the EU pursues its green energy transition, the demand for critical raw materials is set to increase substantially (IEA, 2021). This heightened demand necessitates the extraction of raw materials through mining, which often faces opposition from the public due to environmental concerns. The CRMA aims to streamline the permitting process to address the lengthy delays currently associated with opening new mines in Europe. However, environmental groups remain wary of the potential trade-off between curbing CO2 emissions and the impact on local ecosystems and biodiversity.

Industry concerns

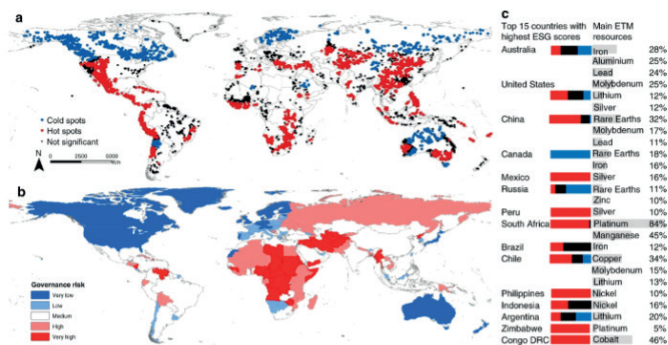
Certain sectors within the extractive industry argue that the CRMA does not cover a broad enough range of raw materials. The act focuses on critical and strategic raw materials, but ignores essential resources which are crucial in sectors like wind power: for example, iron and aggregates together account for 90% of the total mass of most wind turbines (Keating, 2023). Industry stakeholders fear that the CRMA's narrow scope could fail to effectively reduce the EU's dependence on foreign mineral imports.



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Exploitation of developing countries

Many critical minerals' resources are concentrated in undeveloped and developing countries that often face governance risks and have low environmental and social performance standards. The surge in demand for these minerals driven by the energy transition could have negative impacts on these countries. The CRMA acknowledges the need to work with trade partner countries to move up the value chain and align their interests with EU interests. It also pledges to promote the addition of local value to extracted ores by supporting processing and smelting within producing countries. However, implementing these measures may pose significant challenges due to complexities related to governance, infrastructure, and local capacity.



a Global map of social and environmental hot spots and cold spots. Clusters of significantly low environmental and social scores (i.e., cold spots) and clusters of significantly high environmental and social scores (i.e., hot spots) are determined according to the sum of the six environmental and social dimensions. Mining projects outside hot spots and cold spots appear as black dots. **b** Global governance map. Source: Worldwide Governance Indicators, World Bank. **c** Top 15 countries according to the sum of individual mining projects' risk scores and the percentage of main energy transition metal resources in each country. Coloured bars indicate the dominance of hot spots or cold spots in the country.

Source: <https://www.nature.com/articles/s41467-020-18661-9/figures/2>

WHAT IS THE CONTRIBUTION OF ROBOMINERS TO THE CRMA

The successful implementation of the CRMA relies on four pillars that aim to strengthen the European Union's raw materials capacities and ensure a resilient and sustainable supply chain:

- **Boosting domestic production.** The CRMA encourages the development and expansion of domestic raw materials production within the EU. This includes supporting exploration activities, streamlining permitting procedures, and providing access to finance for mining projects. The introduction of technologies like ROBOMINERS plays a pivotal role in boosting domestic production by enabling efficient, low impact and cost-effective mineral extraction from previously inaccessible or economically unviable deposits.
- **Ramping up recycling.** Recycling plays a crucial role in reducing the dependence on primary raw materials and minimising waste generation. The CRMA emphasises the importance of increasing the recycling rates of critical raw materials, promoting the recovery of these materials from products and waste streams. By adopting innovative technologies and practices, such as advanced sorting and processing methods, the recycling sector can contribute to the circular economy and ensure a more sustainable and efficient use of raw materials.

- **Diversifying the supply chain of raw materials.** The CRMA recognises the need to diversify the sources of raw materials to reduce dependency on a single country or region. By encouraging the exploration and development of new deposits within the EU and fostering partnerships with resource-rich countries, the CRMA aims to establish a more diverse and resilient supply chain. The utilisation of advanced mining technologies like ROBOMINERS can enable the extraction of raw materials from unconventional sources and contribute to diversification efforts.
- **Reinforcing international engagement.** The CRMA acknowledges the importance of international cooperation and engagement to ensure a secure and sustainable supply of raw materials. By forging partnerships with third countries, the EU can collaborate on responsible mining practices, knowledge sharing, and technology transfer. These mutually beneficial partnerships can contribute to the development of sustainable supply chains and support the transition towards a more resource-efficient global economy.

The introduction of transformative technologies like ROBOMINERS aligns with the objectives of the CRMA. By offering improved efficiency, reduced environmental impact, and access to previously untapped mineral resources, ROBOMINERS paves the way for a more sustainable and resource-efficient future in the mining industry. Embracing such innovations will play a vital role in achieving the goals set forth by the CRMA and ensuring the long-term availability of critical raw materials for the EU and its industries.

SOURCES

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