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**Article**

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# Europe's Critical Raw Materials: Balancing Strategic Needs with Environmental Protection

The European Union faces an unprecedented dilemma in securing its mineral raw materials supply while protecting the environment. The 2024 Critical Raw Materials Act of the European Commission represents a turning point, marking a fundamental shift from market-oriented approaches towards strategic intervention in response to growing supply chain vulnerabilities. This paper examines the complex challenges facing Europe's critical raw materials strategy, particularly the tension between strategic resource security and environmental protection objectives. Drawing on recent implementation experiences, a three-pronged strategy is proposed that addresses public acceptance, financing barriers and international cooperation in order to strengthen the Critical Raw Materials Act framework while maintaining democratic values and environmental standards.

The European Union's approach to mineral raw materials has evolved significantly since 2008, culminating in the Critical Raw Materials Act (CRMA) in April 2024 (European Union, 2024). This shift to a more strategic stance reflects growing recognition among policy stakeholders and economic operators of the criticality of secure and responsible access to materials underlying Europe's security, competitiveness and green and digital transitions. However, CRMA implementation barriers span institutional, techno-economic and social-environmental dimensions, with public acceptance emerging as particularly critical for operations, policy and financing.

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## From market reliance to strategic intervention

Europe's mineral raw materials journey began in the 1970s with growing opposition to domestic mining and subsequent disinvestment in European mines (Bridge, 2004). Driven by heightening environmental standards, mining activities relocated to developing countries, facilitated by liberal trade policies. This arrangement initially appeared beneficial: European industry secured cheaper raw materials, developing countries gained economic opportunities, and European politicians claimed credit for domestic environmental achievements (Humphreys, 2015). This came, however, at the price of displacing environmental and societal impacts to potentially more vulnerable communities outside Europe.

China's accession to the World Trade Organization in 2001 fundamentally disrupted this equilibrium. Within a decade, China transformed into an industrial powerhouse and the world's largest raw materials importer, creating new competition with Europe, Japan and the USA (UNCTAD, 2009; World Bank, 2019). This shift exposed Europe's vulnerability, with the European Commission's 2010 working group highlighting significant supply chain risks (European Commission, 2010). Yet it took 14 years to implement comprehensive legislation through the CRMA, reflecting the EU's traditional preference for market-based solutions over regulatory intervention (Egenhofer et al., 2020).

The current strategic approach recognises that access to mineral raw materials on global markets requires integrated industrial, trade and foreign policy, framing foreign relations as both geoeconomic and geopolitical tools. This

necessitates moving beyond traditional market mechanisms to address structural vulnerabilities in European supply chains.

### Implementation barriers

#### The environmental paradox

The CRMA's ambitious objectives face formidable implementation challenges. Research from the Horizon Europe project CIRAN (Ovaskainen et al., 2024) reveals that 85% of Europe's critical mineral raw material occurrences are located either beneath environmentally protected areas or within a 5 km radius of them.<sup>1</sup> This spatial constraint creates an unprecedented governance challenge, particularly when combined with the Nature Restoration Law's requirement to restore at least 20% of EU land and sea areas by 2030 (European Commission, 2024).

This paradox lies at the heart of Europe's mineral raw materials challenge: the fundamental tension between EU-level strategic objectives and local community interests (Correia et al., 2024a; Dunlap & Riquito, 2023; Poelzer, 2023). The CRMA's non-binding benchmarks – 10% domestic extraction, 40% processing and 25% recycling by 2030 – appear increasingly ambitious given these environmental constraints and coordinated opposition from environmental groups and local communities.

Civil society organisations are already mobilising against strategic projects under the CRMA (Business & Human Rights Resource Centre, 2023), highlighting the urgency of addressing social acceptance challenges before implementation barriers become insurmountable.

#### The societal acceptance challenge

Public acceptance, rather than technical or economic feasibility, has emerged as the decisive factor determining mining project success in Europe (Lesser et al., 2023; Tost et al., 2021). Opposition to mineral and industrial projects in the EU typically stems from a sense of disconnect between EU-level policy priorities and local interests, aligning with broader Eurosceptic sentiment, distrust in institutions and perceptions of inequality. Communities often resist projects, fearing permanent damage to their ecosystems and ways of life. This resistance reflects deeper concerns about procedural fairness, institutional trust and the disconnect between global material consumption and local environmental consequences (Stewart & Lewis, 2017).

The concept of social licence to operate requires fundamental adaptation to European contexts characterised by higher institutional trust, comprehensive regulatory frameworks and strong environmental consciousness (Boutilier & Thomson, 2011). Traditional approaches relying on technical assessments and expert consensus have proven insufficient to address value-based opposition rooted in place attachment and environmental protection priorities (O'Faircheallaigh, 2015).

Recent experiences across EU member states illustrate these challenges. In Portugal, despite long-standing lithium production, societal opposition is putting new, responsible operations at risk (Dunlap & Riquito, 2023). In France, similar movements are delaying redevelopment of existing kaolin operations for underground lithium mining (Verrax, 2024). These cases demonstrate that even technically sound and environmentally compliant projects face significant societal barriers.

#### Financing and market challenges

Fragmentation and low risk appetite in European capital markets impede large-scale reallocation of capital – including European private savings – towards EU priorities of mineral development, reindustrialisation and global competitiveness. This challenge is particularly acute for mining and minerals, constrained by an insular and specialised financing universe that has shrunk dramatically in OECD markets over the last decade (BDO, 2025).

In critical minerals markets, opacity, low volumes and ore concentration further amplify risks to current operations and projects, affecting entire value chains. These structural market failures require urgent attention to unlock European financial capacity for responsible mineral development aligned with CRMA objectives.

### Solutions: A comprehensive strategy for CRMA implementation

#### Technological innovation and new business models

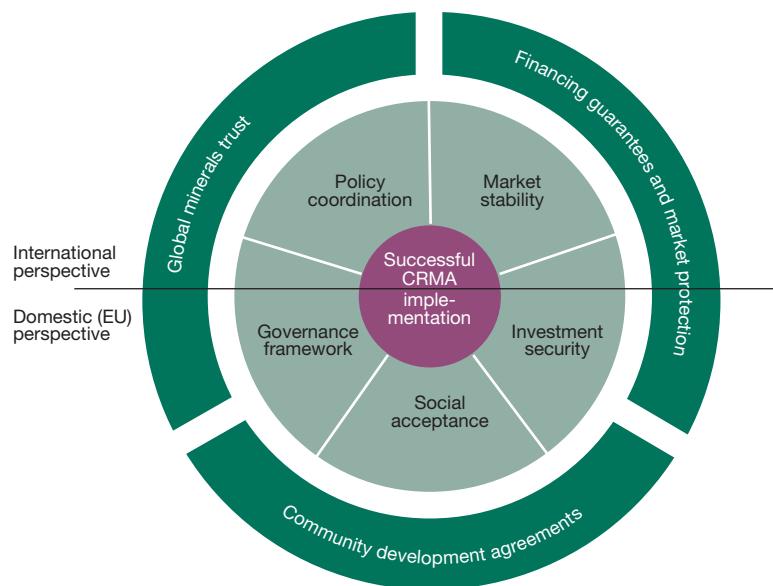
The development of “invisible mining” technologies offers promising pathways to reconcile resource security with environmental protection (Correia et al., 2024b). These technologies, characterised by robotics, miniaturisation and low-impact extraction methods, could address many concerns associated with traditional mining practices.

However, technological innovation alone cannot resolve fundamental governance challenges. The transition to a

<sup>1</sup> See also Correia et al. (2024b).

Figure 1

## Critical Raw Materials Act implementation: Three-pronged strategy



Note: The strategy highlights the interconnected relationships between social acceptance mechanisms, financial instruments and international cooperation frameworks.

Source: Authors' elaboration.

new mining paradigm requires comprehensive and integrated resource recovery principles and materials-as-a-service business models (Lüdeke-Freund et al., 2019). These innovative approaches must be coupled with new forms of social contracts that recognise local values while providing genuine opportunities for community influence over project development and management (see Arnstein, 1969).

#### A three-pronged strategy for implementation

Based on analysis of current challenges and international best practices, we propose a comprehensive strategy addressing the interconnected barriers to CRMA implementation (Figure 1).

#### Community development agreements

Formal arrangements between government, mineral companies and communities, focused on long-term regional development, can bridge the permitting trust gap and allow equitable allocation of burden and benefits. Community development agreements (CDAs) offer promising approaches to social equity and delivery of sustainable benefits to affected communities (O'Faircheallaigh, 2015; Sternberg et al., 2019).

A CDA establishes a formal, legally binding three-way contract between government (at both central and local levels), the mining company and affected communities represented through a recognised legal association supported by a majority of inhabitants. This contract explicitly defines each party's commitments, establishes penalties for non-compliance and provides clear dispute resolution procedures (World Bank, 2012). By bringing decision-making authority closer to those directly affected, CDAs address many community concerns about nearby mining operations while ensuring that all voices are heard in the development process.

Successful CDA implementation can reduce non-technical risk, increase societal acceptance, mitigate conflict and promote cooperative development by combining: a negotiated tripartite agreement formalising rights and obligations of stakeholders; a representative monitoring body, adequately resourced and empowered; and an effective dispute resolution mechanism including arbitration.

Such arrangements move beyond administrative processes and consultation to design a shared vision for the future and define clear accountability lines for all stakeholders. Drawing on World Bank guidance (Otto, 2010;

World Bank, 2012) and successful international examples, CDAs represent a paradigm shift from consultation towards genuine participatory governance.

#### *Financing guarantees and market protection*

To effectively mobilise European financial institutions, increase their risk-bearing capacity and reduce the cost of financing for responsible mineral operators aligning with European sourcing priorities, the EU must urgently implement two complementary measures.

First, it should back public and private-sector lenders supporting development of responsible operators through enhanced guarantee schemes. This aligns with calls under the Clean Industrial Deal for the European Investment Bank (EIB) to launch new financing instruments, including guarantees and other de-risking support.

Second, it must protect operations and projects from price volatility that puts financial viability of current and new supply at risk, particularly in opaque, small-volume and highly controlled markets. This approach would leverage private sector experience and coordinate European and member state initiatives to rapidly establish a leading position in mineral finance.

These initiatives would be led by private sector actors with deep industry expertise, contrary to debatable demand aggregation and joint purchasing approaches. Both guarantee schemes and market protection initiatives could be optimised through collaboration with partners and allies successfully implementing their own strategies.

#### *Global mineral trust*

Drawing inspiration from the early days of European construction with the Coal and Steel Community, a voluntary governance mechanism federating mineral producer and consumer regions around shared goals could address fragmentation in multilateral approaches. Unlike buyer-side initiatives to date, this would foster collaborative solutions operating on foundational principles of gradualism, voluntary membership and open access to all nations willing to align (Ali, 2024).

This initiative could be co-organised with pioneering nations including partners and allies such as Japan, Chile, Kazakhstan, Indonesia and Norway, aligning with priorities of G7 countries and leveraging existing member state initiatives. Success would hinge on clearly defining the organisation's scope and assembling committed founding members ready to embrace this open framework.

#### *Complementary policy measures*

##### *Governance architecture reform*

The CRMA's implementation requires coordinated action across multiple governance levels, addressing current fragmentation of responsibilities (Hámör-Vidó et al., 2021). Enhanced coordination mechanisms must balance EU strategic objectives with member state autonomy and local democratic participation. The Critical Raw Materials Board foreseen in the CRMA provides a platform for this coordination but requires strengthening to address complex implementation challenges.

##### *Financial innovation*

Traditional feasibility assessments must evolve to incorporate comprehensive resource recovery principles and circular economy approaches (Centobelli et al., 2020). Price floor mechanisms for European-extracted critical raw materials could provide investment certainty necessary to compete with subsidised operations elsewhere, addressing structural disadvantages in global markets.

##### *Technological investment*

Systematic investment in robotics and automation research, coupled with comprehensive workforce retraining programmes, can position Europe as a global leader in sustainable mining technologies (Köllner et al., 2023). The creation of invisible mines will shift workforce competencies towards more advanced cognitive domains while addressing environmental concerns.

##### *Circular economy integration*

The convergence of mining and recycling operations through materials-as-a-service business models can transform time-limited extractive operations into long-term commitments to regional development (Geissdoerfer et al., 2018; Lüdeke-Freund et al., 2019). This approach addresses both resource efficiency and societal acceptance challenges.

##### *International cooperation and partnership*

Raw materials diplomacy through strategic partnerships, policy dialogues and integration of critical raw materials provisions in trade negotiations requires a redesign to better leverage European strengths. Current initiatives have yet to yield tangible results, highlighting the need for a more purposeful mobilisation of European industry and improved investment protection conditions.

Successful partnerships must recognise European comparative advantages in infrastructure, governance and technology while addressing partner country priorities for employment, skills transfer and economic development. The EU's approach through the Global Gateway initiative offers opportunities for sustainable development partnerships that contrast with purely extractive transactional relationships.

### The path forward for Europe's critical raw materials strategy

The current EU Council trio (2025-2026) has a unique opportunity to reshape the conversation around critical raw materials, with a focus on de-risking investment, addressing market failures and enhancing Europe's credibility among international partners and stakeholders. This moment calls for EU unity, a readiness to collaborate with allies who share European values, and a steadfast commitment to defending those values.

Implementation requires wide and constructive engagement with European institutions, capital allocators, sector actors and relevant stakeholders. Working from European strengths also entails leveraging opportunities with experienced allies, particularly through established partnerships with Canada, Australia and other like-minded nations committed to responsible resource development.

The mining and minerals sector – both European and non-European, aligning with EU priorities of resilient and responsible critical raw materials supply – has a key role to play in the design and implementation of the various pillars of the strategy. Neutral convening platforms such as the International Raw Materials Observatory (INTRAW) or the European Raw Materials Alliance (ERMA) can facilitate such convenings, offering impartial expertise and fostering dialogue among governments, industry and civil society.

### Conclusion

Europe's critical raw materials challenge reflects broader tensions in contemporary governance between global imperatives and local democratic participation. Success in implementing the CRMA will depend not only on technological innovation and policy coherence, but also on fundamental changes in how society conceptualises the relationship between resource extraction and environmental stewardship.

The comprehensive strategy proposed in this article – addressing social acceptance through CDAs, financing through guarantees and market protection, international

cooperation through a global mineral trust, and complementary policy measures – offers practical pathways to strengthen the CRMA framework while maintaining European values. Staged implementation over 2026-2027 would address critical gaps while positioning Europe as a leader in responsible raw materials development.

Ultimately, Europe's response to its critical raw materials challenge will shape not only its industrial competitiveness and environmental sustainability but also its capacity to demonstrate that democratic governance can effectively address complex, multi-scale challenges in an interconnected world. The CRMA represents an important first step, but its success will depend on the courage to embrace systemic change and the wisdom to build solutions that honour both strategic necessities and democratic values.

The proposed strategy mirrors Jean Monnet's transformative vision for Europe in 1950, adapted to the challenges of the 21st century. By pioneering innovative approaches to social acceptance, financing and international cooperation, Europe can establish global leadership in responsible raw materials governance while securing its strategic autonomy and environmental objectives.

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