

CRITICAL RAW MATERIALS ACT: The challenges of implementation

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Abstract

The European Union (EU) has set itself some very ambitious climate-related targets for the coming years. The first milestone is 2030, when the targets are to reduce net emissions by at least 55% (compared to 1990 levels) and to produce at least 42.5% of energy from renewable sources. These targets cannot be achieved without restructuring our current energy system and shifting massively towards renewables. However, all these clean technologies require large amounts of critical raw materials. For over a decade, the European Commission has been working to ensure the supply of these rare materials. These efforts culminated in the enactment of the Critical Raw Materials Act (CRMA) in 2024, a regulation designed to establish targets and a clear strategy to secure these materials throughout the value chain, ensuring the smooth and complete deployment of the green transition. However, the regulation has blind spots, such as the combination of mineral sourcing with nature protection, the lack of specifically dedicated public investment to support the fulfilment of set targets, and the absence of clear definitions of the contributions of all member states. While the Regulation is well-intentioned and takes a relevant global perspective on prioritising strategic supply for the EU, it fails to specify the necessary measures to achieve this goal. In this paper, we will take an in-depth look at the strengths and weaknesses of the legislation's key provisions.

Introduction

The European Union has set ambitious targets to drive the green transition. These relate to climate change, digital transformation, and the energy transition. To these, we must add the recent focus on security and the need to strengthen the defence and weapons industries in light of the growing geopolitical instability caused by recent armed aggression in Ukraine and the Middle East.

In terms of climate action, the EU aims to become the world's first climate-neutral region by 2050. In terms of digital transformation, the EU intends to digitise all productive sectors and public administration by utilising cloud computing services, big data, artificial intelligence and other technologies. In terms of energy, the EU intends to phase out fossil fuel-based energy in favour of energy from renewable sources.

In terms of defence, there is a global consensus on strengthening the EU's defence capabilities, and NATO demands that all its members (including EU Member States) increase their public defence and weapons industry expenditure to at least 5% of their total national budget.

All of these different needs and aspirations require critical raw materials for their respective manufacturing industries.

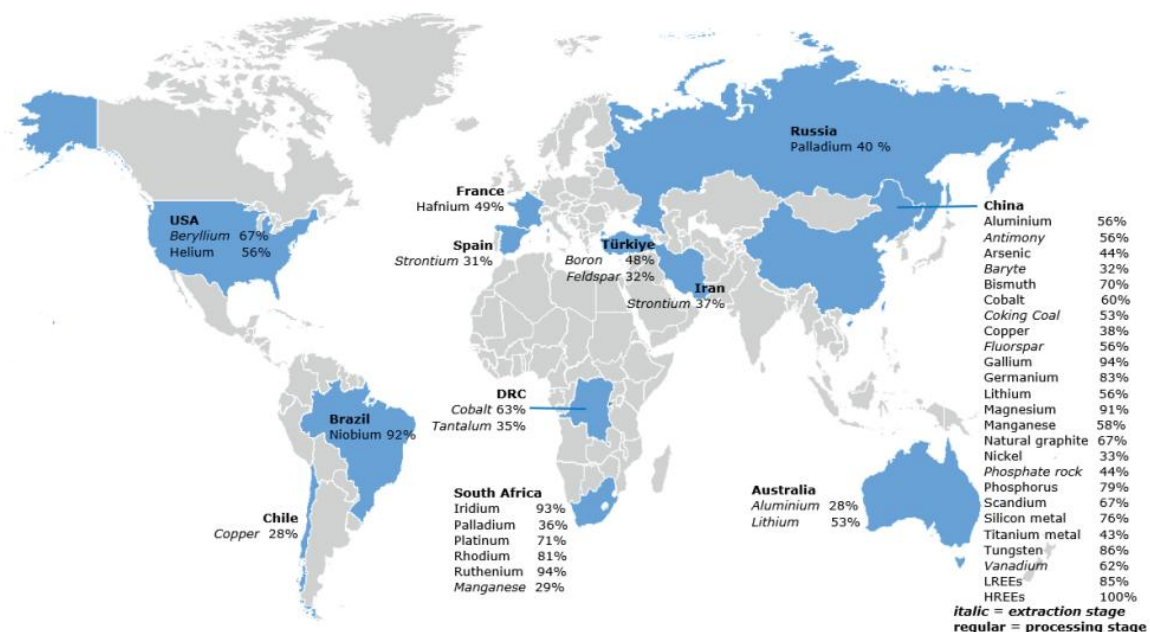
When we talk about *raw materials*, as specified in Article 2 of the Regulation, we are referring to “a substance in processed or unprocessed state used as an input for the manufacturing of

intermediate or final products, excluding substances predominantly used as food, feed or combustion fuel” (CRMA, 2024, p. 17). The CRMA establishes two lists of raw materials on which to focus action. The first list includes 34 materials that are “critical raw materials”, meaning they are of high economic importance to the EU and have a high supply risk. The second list comprises 17 of the materials in the first list that are categorised as “strategic raw materials” meaning they “score among the highest in terms of strategic importance, forecasted demand growth and difficulty of increasing production” (CRMA, 2024, p. 20).

The EU requires significant quantities of critical raw materials for all green transition technologies; these materials are indispensable at the beginning of each value chain. For instance, an offshore wind farm requires nine times more minerals than an equivalent gas facility. Similarly, an electric car requires six times more minerals than a car with a combustion engine. According to the International Energy Agency (IEA, 2021), total mineral demand from clean energy technologies will quadruple by 2040 in the Sustainable Development Scenario (SDS). This scenario includes low-carbon power generation from sources such as solar photovoltaic panels and wind turbines, as well as electricity networks, electric vehicles, battery storage systems, hydrogen electrolyzers and fuel cells. Electric vehicles and battery storage will account for the highest growth in demand. Their mineral demand is expected to increase by over 30 times in the SDS by 2040. Specifically, we expect demand for lithium and nickel to grow around 40-fold for EV production, and demand for nickel and cobalt to grow 140- and 70-fold respectively for storage battery production.

These critical raw materials are sourced and processed mostly outside of Europe. The image below shows the concentration of producers of these materials, both for extraction and processing. These are listed as the main global producers of critical raw materials (CRMs) for the EU in 2023, according to the *Study on the critical raw materials for the EU 2023* (European Commission, 2023).

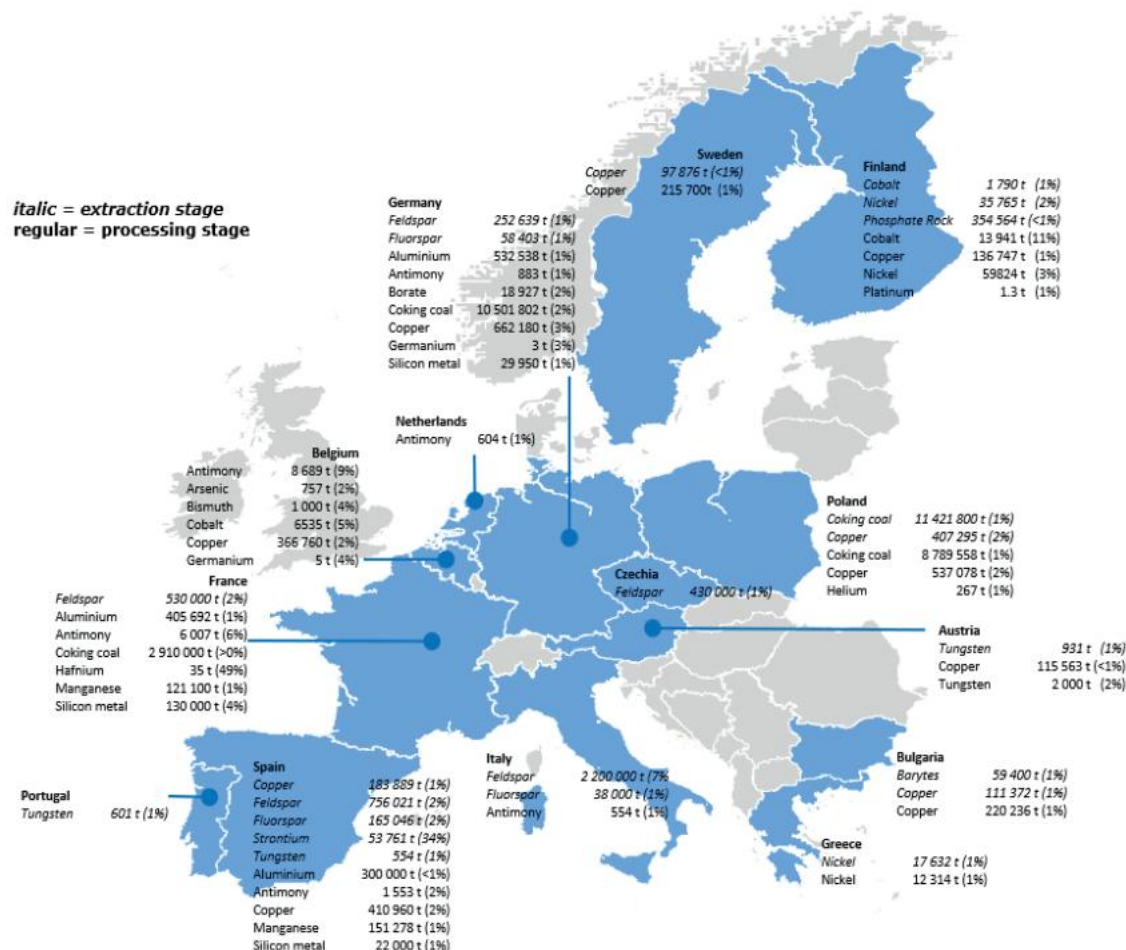
Figure B: Countries accounting for largest share of global supply of CRMs



Source: Study on the critical raw materials for the EU 2023 (<https://op.europa.eu/en/publication-detail/-/publication/57318397-fdd4-11ed-a05c-01aa75ed71a1/language-en>)

In the same document, we also find an overview of the EU producers for the same critical raw materials whose global share exceeds 0,5%:

Figure C: EU producers of CRMs, in brackets shares of global supply, 2016-2020⁷



Source: Study on the critical raw materials for the EU 2023 (<https://op.europa.eu/en/publication-detail/-/publication/57318397-fdd4-11ed-a05c-01aa75ed71a1/language-en>)

The data tells us two key things. First, the EU highly depends on imports of CRMs. Second, these imports are controlled by a few countries. Moreover, some of these countries are associated with geopolitical risks, human rights concerns, or environmental challenges. For example, 63% of the world's cobalt, that is key for batteries production, is extracted in the Democratic Republic of Congo, while 60% is refined in China. 97% of EU's magnesium supply is sourced from China and 100% of the rare earths used for permanent magnets are refined in China. 71% of the EU's needs for platinum group metals comes from South Africa and 98% of the EU's supply of borate are source in Türkiye.

The EU's dependence on critical raw materials has essentially been determined by three KPIs (Carrara et al., 2023):

- *Field of Use*: 15 technologies have been defined in five strategic sectors, including renewables, mobility, industry, digitalisation, defence, and aerospace. The necessary raw materials for each of these strategic technologies have also been defined. These data is

used to compile a list of strategic materials and the expected future demand for each material.

- *Risk Supply*: An analysis has been conducted on the sourcing of each of these raw materials, as well as the processing cycle required to produce the ready-to-use sub-product. The data provides an overview of the countries where these materials are obtained and refined.
- *Forecast* This explores future scenarios based on market trends and existing policies in order to predict future demand and potential bottlenecks throughout the supply chain, as well as assessing potential supply risks in the selected technologies.

These KPIs serve as the basis for setting the benchmarks, instruments and actions in the CRMA regulation.

Context - Before CRMA

Prior to the publication of the CRMA, the European Commission had already introduced other regulations and plans to address the issue of scarcity of critical raw materials.

In 2008, the Commission adopted the Raw Materials Initiative, which aimed to establish a strategy for dealing with the issue of access to raw materials. The initiative had three main points of action:

- Fair and sustainable access to raw materials on global markets:
It focuses in three main areas:
 - supporting SMEs in the critical raw materials supply chain
 - Raw Materials Diplomacy, which aims to establish dialogue and partnerships with EU strategic partners
 - Trade in raw materials, with the aim of facilitating trade and avoiding or reducing tariffs and trade barriers.
- Sustainable supply of raw materials from EU sources: This strategy has evolved over the years and aims to provide the necessary guidelines and tools to promote sustainable access to raw materials. While most of the initiatives are non-binding measures, they indicate the direction in which the EU is heading:
 - *EU principles for sustainable raw materials* (2021): This voluntary, non-binding document sets out best practice for the processing and mining of raw materials from exploration to post-closure and considers their social, environmental, and economic impact.
 - *JRC science for policy report* (2021): Reviews the EU's legal provisions regarding the environmental impact assessment of projects involving the extraction of non-energy minerals.
 - *Guidelines on Extraction: Natura 2000* (2019, 2011): The aim is to reconcile extractive and mining activities carried out in or near Natura 2000 areas with the protection of biodiversity.
 - *Exchange of best practices* (2014, 2011): Sharing expertise on land use and the conditions for exploration and extraction.
 - *Good practice report* (2014)

- *National minerals policy indicators* (2014): The European Commission proposed the creation of indicators to monitor the performance of the extractive sector in line with ad hoc legislation.
- *Knowledge base*: The aim is to increase knowledge of raw materials in Europe by creating a database. This database should also include mineral deposits obtained through national geological surveys or a satellite-based information system.
- *Research and innovation*: This area is essentially driven by two initiatives: the *Horizon 2020* and *Horizon Europe* programmes, which promote and fund research projects on the extraction and processing of raw materials, and the European technology platform, which focuses on innovative techniques that could provide economic and environmental benefits.

All these points are covered in the *Strategic Implementation Plan* (SIP), which sets priorities, encourages the exchange of best practices among EU countries, and promotes public awareness, acceptance and trust.

- *Resource efficiency and recycling*: The aim here is to maximise the potential of recycling to improve resource efficiency.

The CRMA is largely in line with the proposals put forward by these initiatives. The CRMA goes a step further by setting targets and turning some of the voluntary actions in this plan into binding measures.

Apart from launching the Raw Materials Initiative, the European Commission has also set up bodies and institutions to promote knowledge and expertise in the field of raw materials:

- *European Innovation Partnership (EIP) on Raw Materials* This stakeholder platform brings together representatives from public institutions, industry, academia, and non-governmental organisations (NGOs). Its mission is to provide the European Commission, EU countries, and private organisations with high-level guidance on innovative approaches to raw material-related challenges. Project funding is provided by the *R&I funding* tool until 2013 and by the *Horizon 2020* programme thereafter.
- *The European raw materials alliance*: This alliance brings together all relevant stakeholders, including industry, EU countries and regions, civil society, trade unions, research and technology organisations, NGOs and investors. It identifies investment opportunities and barriers in order to develop the raw materials value chain. Initially focused on the rare earths and magnets value chain, its remit could evolve to include other raw materials.
- *EIT RawMaterials*: This consortium in the raw materials sector emerged from the European Institute of Innovation and Technology (EIT) in 2015. Its mission is to secure and sustain the domestic supply of critical raw materials for European industries by creating and accelerating businesses, providing entrepreneurial education and conducting innovation-driven research projects.
- *Strategic partnerships*: they are actions developed under the Critical Raw Materials Action Plan, which was adopted in 2020. This plan presents concrete actions to address vulnerabilities in raw material supply chains.

In addition to these actions, other norms have been adopted that are closely linked to the CRMA's objectives and support the successful implementation of the strategy. Some of these pieces of legislation can be found here:

- *Green Deal*: It was presented in December 2019, with the overarching theme of “Striving to be the first climate-neutral continent”. Based on the European Climate Law, which came into force in 2021, it provided legal legitimacy for the 2050 climate neutrality target. While not a piece of legislation itself, the Green Deal comprises over 50 interconnected legislative acts and policies to be launched over several years. These include the *Climate Target Plan*, the *Carbon Border Adjustment Mechanism (CBAM)* and the *Nature Restoration Law*, among others.
- *Circular Economy Plan*: It was adopted in March 2020. The plan addresses the life cycle of products, from conception to end-of-life and recycling, in line with the principles of the circular economy. A new piece of related legislation is due to be adopted in 2026. *The Circular Economy Act* will impose stricter, more binding circularity targets, complementing other measures already in place under the *Circular Economy Plan* and the *Clean Industrial Deal*.
- *Eco-Design for Sustainable Products Regulation*: The aim of the regulation is to drastically reduce the carbon footprint and environmental impact of products throughout their entire lifecycle. It focuses on the eco-design of products and harmonises standards through eco-design and energy labelling regulations.
- *The Net-Zero Industry Act*: This Act came into force in June 2024, with the aim of strengthening the manufacturing capacity of Europe's essential technologies while decarbonising energy and its components. The goal is to increase clean technology manufacturing in Europe and reduce global imports of key green technologies.
- *Clean Industrial Deal*: This is the most recent legislation mentioned here. Published in February 2025, it focuses on decarbonising the industrial sector, particularly energy-intensive industries. The legislation also drives action to achieve a clean technology sector, which is crucial for future competitiveness. It emphasises circularity, waste reduction and extending the life cycle of materials. The legislation also aims to promote recycling, reuse, and sustainable production.

Critical Raw Materials Act (CRMA)

The Critical Raw Materials Act (CRMA) came into effect in May 2024. It is one of the strategies aimed at achieving the ambition of becoming climate-neutral by 2050. The Act aims to strengthen the resilience and autonomy of the supply of critical raw materials, which are vital for the green and digital transition, as well as for defence purposes.

Critical raw materials are at the beginning of many industrial supply chains. Rare earths are a key component in the production of permanent magnets, which are used in wind turbine motors. Lithium, cobalt and nickel are used in battery production. Silicon is used for semiconductors, which are fundamental building blocks of modern technology. These components are used to produce transistors, diodes and microchips, which act as electronic switches and power controllers. These are needed in a wide range of industries, from communications and medical equipment to renewable energy systems.

The aim of this regulation is to strengthen the EU's capacities throughout the entire value chain.

Some targets have been set to be achieved by 2030. These targets are divided into four main categories:

- *EU Extraction*: The aim is to extract the raw materials needed to produce at least **10%** of the Union's strategic raw material consumption.
- *EU Processing*: The processing capacity of the Union should account for at least **40 %** of its annual consumption of strategic raw materials.
- *EU Recycling*: The Union's recycling capacity should be able to produce at least **25 %** of its annual consumption of strategic raw materials and significantly increase the recycling of each strategic raw material from waste.
- *External Sources*: By 2030, the EU should not depend on a single third country for more than **65 %** of its supply of any strategic raw material, unprocessed and at any stage of processing.

The Regulation sets out strategies to help achieve the set targets:

Building European capacities:

- *Setting priorities*: The regulations provide lists of critical and strategic raw materials. These two lists identify raw materials that are important for the economy and are at high risk of supply disruption. The CRMA identifies 34 critical raw materials, 17 of which are considered strategic.
- *Strategic Projects*: This is the main instrument for achieving the targets set out in the regulation regarding the extraction, processing and recycling of critical raw materials. Once approved by the European Commission, these projects will benefit from accelerated permitting. Member States should also develop national exploration programmes for critical raw materials.

Improve Resilience

- Monitoring critical raw materials and supply chains by pooling the expertise of the EU and its member states.
- Mitigating the risk of supply disruptions by developing national strategic stocks and engaging in joint purchasing.
- Expanding partnerships with third countries.
- Creating a *Critical Raw Materials Club* with countries around the world to strengthen supply chains, investment and trade.
- Enhance Free Trade Agreements.
- Using the *Global Gateway* instruments to lower the risk of investment abroad and ensure fair trade practices.

To lead, monitor and coordinate all these actions, the CRMA relies on the *European Critical Raw Materials Board*. This Board, which is a newly created body, is formed of representatives from the European Commission and the Member States. Participation of other parties and observers will be allowed when appropriate. The Board's mandate is "to support the implementation of tasks pertaining to the development of Strategic Projects and their financing, exploration programmes, monitoring capacities or strategic stocks and to advise the Commission appropriately" (CRMA, 2024, p. 3). The Board began meeting shortly after the CRMA regulation was adopted in May 2024, and meets regularly (on average every three months). The Board has created subgroups to work on specific issues. There are six sub-groups focusing on the following subjects: coordinating the financing of strategic projects; public knowledge and participation; exploring critical raw materials; circularity, resource efficiency and substitution; monitoring the supply chain of critical

raw materials; and strategic stocks of critical raw materials. As they work on specific themes, they hold separate meetings from those of the Board.

As mentioned previously, we can see that the CRMA incorporates many of the points already proposed in previous initiatives. For example, the list of critical materials is simply an updated version of an existing list, and trade agreements for international partnerships have been in place since the early 2020s.

CRMA - The choice of a Regulation and cooperation with Member States

The European Commission opted to enact this legislation in the form of a regulation rather than a directive. A regulation offers several advantages over a directive, making it a particularly suitable choice for CRMs legislation. Firstly, a regulation takes immediate effect upon entry into force and does not require transposition into national law, ensuring uniform application across all member states. However, the disadvantage is that regulations do not allow for flexibility to consider the specifics of each territory. The advantages of a regulation are highly relevant in this case, as the targets are stringent and rapid action is required to meet climate goals. Therefore, the choice of legislation seems logical and appropriate. However, its implementation in the CRMA is not appropriate.

This global approach at a European level appears to be one of the principles of the CRMA. In the opening paragraphs of this regulation, it is clearly stated that the purpose of this legislation is to address the issue of CRM scarcity from a European, global perspective. This is because taking action at the EU level is more efficient than tackling the issue at the level of individual member states. This implicitly applies the principle of subsidiarity under the EU treaties, which states that the EU shall act only if the objective of a proposed action could be better achieved at EU level than at Member State level. However, coordination between the European Commission and Member States is required due to the notion of conferred powers. This concept is rooted in the foundational principles of the Union itself and is defined in the founding EU treaties (EUR-Lex – competences, n.d.). The European Union can only act within the limits of the competences granted by its members. Therefore, Member States have permanently transferred certain powers and rights of sovereignty to the European Union under the principle of conferral. There are three types of conferred powers: exclusive, shared and supporting. The strategies and targets set out in this regulation fall within the remit of the internal market, the environment and industry. They also fall under other domains, such as human health and energy, albeit in a subsidiary way. The only area in which the European Union has exclusive competence is the internal market and trade policy. Therefore, only the final target of establishing new trade partners can be explored and developed exclusively within the European Union and its executive body, the European Commission. For all other measures falling under shared or supporting competencies, collaboration between the EU and its Member States must be established.

While the regulation sets out targets for the European Union as a whole, it does not specify how much each member state should contribute to the global goal. Instead, it leaves it up to each member state to decide on the measures needed to fulfil the objectives. Each member state must ensure that Strategic Projects have the necessary funding and permits. The regulation also requires member states to accelerate permit delivery where possible and to reduce the administrative burden for companies that have submitted a request. Member states must allocate the necessary resources to this process, which, in some cases, may require

modifications to national or local legislation. In any case, this regulation cannot be applied immediately, directly and consistently across the entire European territory.

CRMA Instruments - Strategic Projects

As previously mentioned, Strategic Projects are the main instrument for achieving the ambitions and targets of the CRMA Regulation. Currently, the European Commission has officially approved 60 Strategic Projects. Of these, 47 are in the European territory and 13 are abroad (Strategic Projects Under the CRMA, n.d.).

Strategic projects are divided into four different categories: Extraction, Processing, Recycling and Substitution. They thus follow the categories established for the aforementioned targets.

The distribution of projects by category in European territory is as follows:

- 23 projects in the Extraction category (including 11 projects that integrate Extraction and Processing)
- 23 Projects in the Processing category (including 11 projects that integrate Extraction and Processing)
- 10 Projects for the Recycling category
- 2 Projects for the Substitution category

The distribution of projects by category in non-European territory is as follows:

- 10 Projects in the Extraction category (including 1 project that integrates Extraction and Processing)
- 4 Projects in the Processing category (including 1 project that integrates Extraction and Processing)
- No Projects for the Recycling or Substitution category

Within the EU, France has the most approved strategic projects, with nine in total, one of which is a collaboration with Namibia and Germany. Of the nine projects, just two are in the recycling category; all the rest are in the extraction or processing category. The next countries are Spain and Finland, with seven and six projects respectively. All of these projects are in the extraction or processing category, except for one recycling project in Spain. Italy is the only country with no extraction projects; all four of its projects are in the recycling category. In contrast, Romania has 3 projects, all of which are in the extraction category. Belgium and Germany have proposed the only two projects in the substitution category. This means that, of the 27 member states of the European Union, only 13 have approved strategic projects: Belgium, the Czech Republic, Estonia, Finland, France, Germany, Greece, Italy, Poland, Portugal, Romania, Spain and Sweden. It is clear that the burden of implementing this regulation to meet the targets has not been distributed equally among the member states. It is also evident that the tool adopted by the regulation to achieve its ambitious objectives, Strategic Projects, has not been very successful. Apart from the uneven representation of member states, it has also failed to attract new talent, serving mainly to support established private companies that have been already operating in the market for a long time. The Belgian projects are an example of this. Both are from Umicore, a company founded in 2001 with a clear focus on recycling and innovation. Therefore, the same companies remain in the market and the regulation has so far failed to increase the number of operators in the sector. The current situation will not suffice to achieve the set goals unless more companies enter the CRM market and existing companies diversify.

In terms of scope, most processing projects focus on the battery sector (14 out of 23). The same applies to the recycling category, where six out of ten projects are also devoted to the battery sector.

While the battery sector is important and has many applications, such as in electric vehicles and energy storage, it is not the only significant technology. Clearly, other technologies are underrepresented.

According to recent studies (Barata et al., 2026), strategic projects tackle CRMs with high forecasted demand growth or supply vulnerabilities, but do not address EU dependencies, particularly those relating to China. For example, while a significant number of projects cover graphite, cobalt and rare earths, none cover dependencies for magnesium, germanium, bismuth, barite or vanadium. Estimates suggest that, on average, the existing strategic projects would meet the CRMA's targets for extraction and processing in a low-demand scenario for only five of the CRMs (assuming that the figures provided by companies for production are realistic, as no further verification of these figures has been conducted at an institutional level). However, given the current state of projects, it is clear that recycling objectives will not be met.

Financing CRMA projects

The Regulation proposes that the Strategic Project is the main instrument for achieving the set objectives, even though it does not clearly specify how to fund these projects

The CRMA addresses the subject of financial means in several points, and it relies heavily on private investment. Two articles, 15 and 16, are specifically devoted to this subject. Article 15 states that “The Commission shall carry out activities, where appropriate in cooperation with Member States, to accelerate and crowd-in private investments in Strategic Projects” (CRMA, 2024, p.29). Article 16 broadens the range of financing options to include other existing institutions, such as the *European Investment Bank* and the *European Bank for Reconstruction and Development*. It also refers to other existing funds within the European Commission, such as the *Recovery and Resilience Facility Fund* (part of the wider *Next Generation EU programme*), the *Just Transition Fund*, etc. In these cases, the Commission raises funds to make available to its Member States to implement ambitious reforms and investments. It also refers to specific financial instruments within the Member States, as well as to other funding programmes for overseas countries and territories (OCTs), such as the *Global Gateway Initiative* for strategic projects in third countries.

In all cases, the promoter of these projects should present a business plan demonstrating the project's financial viability and proposing means of funding. If a project depends on public loans or funds, its financial viability may be at risk if all the necessary requirements for public funding are not met. This is why the regulation urges the Member States to facilitate funding. However, the CRMA is very cautious in this regard and remains vague. This lack of detail and secure funding can jeopardise projects requiring significant investment and uncertain funding.

However, as we have seen, no specific programme or budget instrument has been created for the implementation of this Act. Given the strategic importance of this Act, which is seen as a breakthrough for the future of key technologies and climate commitments, it is unusual that the necessary financial resources have not been allocated. There is no estimate of the investment amount needed to fulfil the set targets anywhere in the text. Consequently, this raises legitimate

doubts about the coherence of the implementation of the CRMA's targets. The Act lacks the administrative and fiscal resources to provide credible business cases for projects, and its external dimension remains largely declaratory. It also avoids the issue of meaningful corporate regulation. For example, high-risk projects, particularly those involving extraction, remain accessible only to a limited number of large corporations. Such projects require substantial investment over an extended period, with an uncertain rate of return at the time of investment (Findeisen et al. 2023).

More public-private coordination is needed to make supply chains more resilient, but the CRMA's contributions in this area remain largely descriptive and have demonstrated little effectiveness in terms of specific policy instruments. There is also a risk of overlap: several EU countries have national CRMA initiatives, which could lead to duplication of partnerships with third countries, as well as duplication of efforts and intra-European competition (Barata et al. 2026).

Need for public investment

Most scientists agree that action is urgent. Measures to address climate change cannot be delayed. “Climate inaction creates instability, migration and conflict. Climate action drives growth” (Godfrid, et al., 2026). And because this urgency, action must come hand in hand with public investment, to secure action and research and to secure private project ventures. There is a need for integrated public policy and institutional support that could drive development through private and public investment and innovation creating sustainable, resilient, strong and inclusive growth. Strong investments are necessary specially in key climate areas: energy transition, adaptation and resilience, natural capital and sustainable agriculture and just transition. Clean energy investment will drive development, but it must come with a protection of the natural and a just transition that makes change equitable and possible. In the shorter term, the investment should strengthen demand, supply and efficiency. Innovation and discovery will create new investment opportunities in the medium term and investments in adaptation and resilience will avoid the negative impacts of climate change in the longer term (Godfrid, et al., 2026). To achieve this, public support and leadership are essential, as private initiatives alone cannot fulfil all the necessary requirements and address all the challenges we are facing in the short, medium and long term.

Nevertheless, CRMA's ambition does not come with the proper financial instruments to fulfil it. This Regulation does not provide any new funding from the EU budget. It fails to establish a concrete business case for investments in the value chain and lacks specific resources to foster new projects in third countries.

Other international powers, such as the USA and Japan, take a different approach, placing public support at the heart of their strategy. For example, the US government has recently demonstrated its direct involvement in the deployment of CRMs by implementing the “mine-to-magnet” strategy. This initiative combines tax credits, equity participation, contract guarantees and long-term off-take contracts. These measures provide sufficient security and guarantee for the market and manufacturers to invest and launch new projects. These measures have been complemented by a '100-billion-dollar package' for the direct funding of critical mineral and energy supplies. (Leichthammer, 2025).

CRMA Instruments - Trade Agreements

Of the strategies proposed in the CRMA, trade agreements are the only ones that can be developed and implemented at EU level, because the powers to do so have been completely conferred to the EU by the Member States. In this regard, the EU is developing a network of international partners through bilateral trade agreements, or Free Trade Agreements (FTAs), in order to diversify supply chains and secure the availability of CRMs.

The EU has been developing commercial agreements on CRMs for a long time, even before the CRMA came into effect. Since the early 2010s, the EU has signed numerous bilateral trade agreements, and it has started establishing strategic partnerships since 2021. These efforts have been reinforced since the enactment of the CRMA regulation. Recent FTAs include clauses limiting or banning exports, reducing monopolistic manoeuvres, and imposing more restrictions on state-owned enterprises to increase transparency and regulate prices.

These trade agreements are important and necessary to address market failures. In the case of CRMs, these failures essentially fall into three categories: moral hazard, competitive pressures, and collective action (Barata et al., 2026). Moral hazard refers to companies in the supply chain underinvesting in periods of shortage in expectation of government intervention. Competitive pressure refers to the lack of competitiveness of European manufacturers who do not receive public support, unlike manufacturers in other countries, particularly with regard to sourcing and processing. Collective action will encourage companies to diversify when the limited demand for certain CRMs does not justify investment.

The latest trade agreements already include specific energy and raw materials chapters. The aim of this agreement is mainly to keep CRM costs under control in the long term by fixing prices and thus avoiding the volatility of these commodities, while also securing supply. This is the case for the agreement signed between the EU and Mercosur, where bilateral tariffs are lowered to a minimum. Other trade agreements have also been concluded on a bilateral basis with specific countries :

- Agreement between the EU and Chile: the aim is to ensure preferential access to lithium and copper while incorporating sustainability requirements.
- Agreement between the EU and Australia: to ensure preferential access to lithium and rare earths, and to establish joint action on mining sustainability and research.
- Revision of the agreement between the EU and Mexico: while maintaining tariff-free trade in critical raw materials, the new agreement secures cheaper access and reduced costs for essential materials such as fluorspar, or metals such as iron, steel and aluminium.
- EU-Indonesia: EU is preparing a new trade agreement with Indonesia which is the world's leading producer and processor of nickel. It possesses, as well, massive reserves of copper, bauxite, rare earths and tin. However, concerns regarding human rights and environmental protection at mining sites and in the industry are delaying the signing of the agreement.

Other than concluding trade agreements, EU is also working on establishing Memoranda of Understanding (MoUs). They are non-binding but highly targeted partnership with resource-rich nations. These cooperations initiatives are often framed in the *Global Gateway funding programme*. These cooperation partnerships aim to provide access to CRMs, as well as to build processing capacity and foster research and innovation projects in third countries. The EU has

signed MoUs with specific countries in mostly all continents: with Chile, Argentina, Greenland and US in America, with Namibia, Democratic Republic of Congo, Zambia, Rwanda and South Africa in Africa, with Ukraine, Kazakhstan, Uzbekistan, Norway, and Serbia in Europe and Central Asia and with Australia in Oceania (Countries and regions, 2026).

Even though progress has been made with regard to this subject, there are still major strategic countries with which no trade agreement has yet been established. One of these countries is China. Although geopolitical circumstances may make discussions difficult, China is an essential partner as it is the most influential player in the critical materials market. This concerns the entire value chain: extraction, processing, components, and innovation. For years, there have been attempts to sign a bilateral agreement (EU-China Comprehensive Agreement on Investment: Milestones and Documents, n.d.), but no further progress seems to have been made since 2021. As we will see, innovation is the only way to challenge China's dominance in the critical raw materials sector. However, until innovation and research progress becomes a reality, a trade agreement with China is essential to securing the supply.

Integration of Environmental issues in CRMA

Environmental concerns and social rights should be at the heart of this Regulation, given that the extraction of critical raw materials, whether from mining activities or as secondary materials from recycling and waste treatment, will inevitably have a significant impact on them. Furthermore, the protection of the environment and human rights are founding principles of the EU.

While many strategies and procedures implemented before the CRMA have been compiled and reaffirmed in this Regulation, the same is not happening for environmental and human rights.

In 2021, the EU adopted the *EU Principles for Sustainable Raw Materials*. These principles place environmental issues and social principles on an equal footing with economic and governance principles. There is also a list of goals to be developed in each of these areas, which are not explored in depth in the CRMA. Nor does it seem to have delved deeper into any of the recommendations set out in the *Guidelines on the Extraction of Natura 2000* or the *JRC policy report* on the impact assessment of mineral extraction. Based on this evidence, it could be argued that this regulation could have set out clear, binding clauses to ensure the protection of both the environment and local communities. Instead, the CRMA takes a step back from this complex issue, leaving responsibility for action to the promoter of the Strategic Project (responsible for conducting environmental impact assessments) and the local authorities responsible for granting permits. As the promoter is a private company, environmental and social rights may not necessarily be at the top of their priorities. As for the local authorities, they are subject to various political pressures that could lead to different approaches depending on the member state. The only way to ensure an equitable and fair approach by all member states to public issues such as the environment and human rights is to legislate at EU level.

One striking case of this is the lithium Barroso Mines in Portugal (European Environmental Bureau, 2024). The London-based company, Savannah Lithium Unipessoal, Lda. has been granted the concession to exploit these mines, covering a total area of 593 hectares. They expect to begin exploitation in 2027. However, this same area of the Barroso region is also home to an exceptional natural area that has been awarded Global Important Agricultural Heritage Systems (GIAHS) status by the United Nations. There are only 11 GIAHS sites in Europe, and Barroso is the only one in Portugal. There is also a large local population whose agroforest economy is

dependent on the current state of the ecosystem. The territory is characterised by very rich biodiversity, invaluable cultures and landscapes, and sustainable small-scale farming living in harmony with the surroundings. Despite social protests and public opposition to these mines for years, including complaints filed with local and European judicial authorities, the project has proceeded. Moreover, the Portuguese Environmental Agency had issued several negative opinions on the project: in June 2022, the agency stated that the project would have “very significant and irreversible negative impacts” on the landscape, hydrology and ecosystem. It has even been awarded with the status of Strategic Project under the CRMA despite fierce opposition from locals and environmental organisations. The factsheet for the project on the official EU webpage on Strategic Projects states that the Barroso Lithium Project “will apply conventional production techniques, amplify positive social impact in the region, while minimising environmental impact, visual disturbance and carbon footprint”. (European Commission, 2025).

In fact, CRMs are inevitably intertwined with mining. Extraction from mines is one of the ways of getting critical raw materials, whether they are underground or are open pit. Both options come with a very high environmental cost. According to scientific data, approximately 84% of critical raw materials occurrences are situated inside or within 5.000 m of the nearest protected area and within this 5000 m buffer, around 23% of the area is protected (Ovaskainen et al., 2026). These facts highlight that, EU’s legislation, such as Critical Raw Materials Act and EU biodiversity strategy, are not coordinated and that the application of the first one can undermine the respect of the second one as environmental protection is not guaranteed when CRMs occurrences and projects occurred and overlap with protected areas.

The Regulation has failed to provide any solid arguments to ensure that the environment will not be undamaged by the deployment of the CRM strategy. It actually refers to environmental protection in multiple points and articles of the regulation, indicating that nature protection must be observed when implementing strategic projects within current EU’s legislation. However, it fails to establish concrete guidelines to guarantee this environmental protection. The subject remains vague, leaving all responsibility with Member States to grant permits and approve environmental impact assessments. This approach can result in disparities between countries in the implementation of environmental protection principles, which contradicts the primary rationale for this regulation: the necessity of acting at the EU level due to the transnational nature of the issue. There is room between vagueness and intrusion in Member States affairs, like we see in point (18) (CRMA, 2024, p. 5) of the Regulation where it explicitly bans the possibility of recognition for deep-sea mining projects as Strategic Projects arguing environmental concerns. However, the same determination is not applied when it comes to protected areas. It even states that it is possible to authorise Strategic Projects that have an adverse environmental impact on the basis of a case-by-case assessment, provided that public interest overrides those impacts. The final decision still lies within the Member States, who can have very different approaches.

The CRMA could definitely have been more ambitious with regard to protecting nature, human health and the environment. It could have set red lines, as we have seen in the case of deep-sea mining. According to European Environmental Bureau (European Environmental Bureau, 2024), other measures could have been included in the text of the CRMA such as:

- Reject the Strategic Project status for any the companies involved in human rights violations or with a history of environmental infringements.
- Prohibit the development of projects taking place inside or near recognised valuable natural areas.

- Exclude projects that do not engage local communities' opinion in a meaningful way. EU should guaranty these communities the right to oppose to mining projects that undermine their well-being or irreversibly harm local ecosystems.

This environmental issue is particularly pressing in the mining and extraction industries and all the processing phases that comes along.

Integration of Environmental issues in CRMA - Costs of reopening mines

According to EIT Raw Materials, an EU-funded agency specialising in key minerals, the European Union needs to establish investment funds totalling over 10 billion euros to encourage investment in the exploration, mining, and recycling of critical raw materials. The agency's CEO, Bernd Schäfer, also emphasised the importance of setting up an exploration fund of around €10 billion to determine which minerals the EU could mine. Combined with private investment, these public funds could total around 100 billion euros. The EIT also indicates that around 10% of the total investment should be invested in Research and Development (R&D) to achieve these goals. Additionally, mining techniques must be modernised to meet current standards. (EIT RawMaterials, n.d.).

Apart from the economic issue, mining can have important environmental, social and ecological costs. Mineral developments affects both local and regional environment in different spheres. It can have a direct impact on people, biodiversity and ecosystems. Because of the land use change, it can lead to the displacement of communities and the loss of biodiversity and habitats that could be home to endangered species. Mining normally requires large quantities of water for its industrial processes. It can also provoke water contamination, either through acid mine drainage, wastewater discharge or the disposal of tailings. (The risks of fast-tracking mining projects under the CRMA, n.d.)

Mining is as well a source of enormous waste generation: mines' development produces massive amounts of residues, both during extraction and industrial processing, some of which can be hazardous to human health. To get a sense of magnitude, for example, for lithium material, essential for the battery sector, it has a ratio of 1.634, that means that we need to excavate 1.634 kg of rock to get 1 kg of lithium. (Ritchie, 2024)

Mining can also entail other environmental impacts, such as air pollution, especially mine dust, and other gaseous emissions, or noise pollution due to blasting and transport.

Moreover, European deposits of these materials are quite limited. Europe used to have its own CRM deposits and refining capacities but over the years these activities environmentally dirty and capital-intensive have been outsourced. Mining has been declining for a long time and thus taking back to building domestic capacities will take time as well as large investments.

All these massive investments and all the controversial issues about local communities and environmental damage will lead, in the best-case scenario, to fulfil the targeted goal, 10 % of the Union's consumption of strategic raw materials. The remaining 90% of demand will still need to be fulfilled by other means. This raises the legitimate question of whether investing in researching mining substitutes would be more worthwhile than reopening mines.

CRMA - Lacks and absences

Research and development (R&D) plays a crucial role in the green transition, an area in which Europe is not leading the way. Moreover, it has clearly fallen behind other world powers, such as the United States and, in particular, China.

As we said before, the availability of domestic CRMs is very limited and comes at a very high both economic and environmental costs. Importing of these materials cannot be taken for granted either; geopolitical tensions as well as changes in tariffs, which are currently relatively low, can vary at any time and disrupt trade in these commodities. Therefore, EU must ideally find a way to fulfil their needs for materials to perform the green transition from domestic sources. Extraction and mining are not the way in the long term. Firstly, this is an activity that contradicts other EU priorities, such as the protection of nature. Secondly, these sources are neither sustainable nor renewable, so they are not viable in the long term. The only way to ensure a long-term, sustainable supply of CRMs to the EU is to develop recycling and R&D. By recycling, we will be able to reinject secondary raw materials into the manufacturing cycle to compensate for the increased demand. R&D will help to discover new materials, known as substitutes and to optimise processes that will reduce demand for CRMs.

Innovation

Achieving climate neutrality by 2050 will require a shift in the approach with a significant boost into renewable energy technologies and other key technologies. Considering the present pace and the magnitude of innovation needed, it is not going to be sufficient to meet the emissions neutrality. According to OECD (Innovation and green transitions, 2025), public expenditures on research and development devoted to low-carbon technologies have stagnated (in percentage of GDP) for the last 30 years. Therefore, essential technologies for carbon neutrality are still far from market readiness. It is vital that robust and effective innovation policies become an integral part of climate policy packages if we are to bridge this gap. Besides, we need to make green technologies affordable. For example, the production of green hydrogen costs approximately three times more than grey hydrogen produced from natural gas. It is imperative that innovation and research help make carbon-free technologies competitive with the current fossil-fuel ones, as this is the only way to ensure a sustainable future. Policies and institutional support must cover all key sectors, that is, not only renewable energy but also, other sectors such as electrification of transports and the manufacturing sector, energy storage, carbon capture, hydrogen and bioenergy. For this reason, innovation, research and industrial policies that pursue the development and deployment of low-carbon technologies should be central to achieving both carbon neutrality and energy security.

The CMRA remains very neutral concerning innovation. In fact, there is no article or section explicitly devoted to innovation or research. Innovation is just cited as an important issue, specially to reach the target linked to recyclability: “Innovation plays an important role in reducing the need for critical raw materials, reducing the risks of shortage of supply and for the development of recycling technologies to properly and safely extract critical raw materials from waste. Prompt action addressing the different factors holding back the circularity potential is thus required” (CRMA, 2024, p.12). But does not suggest any measure to foster or implement innovation. Innovation is expected to be development through the main instrument of this regulation, the strategic projects. The CRMA expects that new projects on research and innovation can be streamlined and fund through programmes already existing like the Just

Transition Fund, The *InvestEU* programme, the *Recovery and Resilience Facility*, including the *RePowerEU* or the Innovation Fund. The *Horizon Europe* funding programme is not even mentioned specifically throughout the Regulation, even though it is the programme of reference for research and innovation, funding projects and initiatives related to climate change, the UN Sustainable Development Goals, and the EU's competitiveness and growth.

Member States are responsible for implementing the necessary measures, provisions and incentives to develop expertise in research areas such as waste recovery for secondary critical raw materials. Member States must also assure national research, and innovation programmes equip them with the necessary resources to promote knowledge and technologic advancement on circularity and material efficiency. The European Union remains in the background, just facilitating the exchange of best practices between Member State through the Board.

Similarly to the other strategic projects seen before, innovation projects often originate from private companies or institutions, meaning the development of innovation depends heavily on private initiatives. However, this should not be the case; innovation should be initiated, led and promoted by the public sector. This applies to other countries that benefit from public investment in innovation, which has proven profitable. China is a clear example of that, it has been pursuing for over a decade a sustained plan, placing strategic investments across the entire critical minerals chain value. The launch of the “Made in China 2025” strategic plan was a turning point. This plan was conceived to make China the world leader in ten key technologies, including low-carbon technologies (such as electric vehicles and renewable energy) and digital and AI technologies (such as robotics and biotechnology). These very ambitious objectives have been for most of the cases fulfilled. This was made possible by a combination of suitable research, innovation and quality standards. Moreover, unlike in Europe, China has never abandoned extractive activities and is the world's leading producer of certain minerals, such as rare earths, germanium, silicon and graphite.

However, it also excels in controlling production chains, such as those for batteries and electric vehicles. In the case of batteries, for instance, it has developed the know-how and industrial capacity to process raw materials into ready-to-use minerals, even if the materials are sourced elsewhere. Furthermore, it has developed an entire industry dedicated to producing the essential components required for building batteries, including both anode and cathode electrodes. In fact, China produces 100% of the world's anodes and nearly 90% of its cathodes. Therefore, producers of batteries and electric cars around the world heavily depend on China for the supply of components. (Cabiaux et al, 2025).

Europe therefore has a long way to go to catch up, but it does not have the same quantity of natural resources available as China does. Most of Europe's mines were closed a long time ago. It does not seem reasonable to reopen closed mines given the huge investment required, the time-consuming legal procedures involved, and the ecological impact of such activities. It would be more sensible to invest in research and innovation to find substitutes and secondary materials from recycling to fulfil their needs. This could also give Europe a competitive advantage over its global competitors, who are still very focused on mining and processing means of production.

The success of the Chinese tech industry would never have been possible without the support and leadership of public authorities, as well as political endorsement. We do not see the same level of leadership in the case of Europe. The initiative, means and responsibility for launching projects and activating suitable industries have been diluted among Member States and the

private sector, making targets harder to achieve. Without strong public guidance at a European level with clear and defined actions, it will be difficult to develop the necessary measures.

In this regard, the EU plans to adopt the *European Innovation Act* in 2026. This legislation is intended to enable all initiatives that transform high-quality research into commercial products, and to help start-ups grow across the EU. The legislation will bridge the so-called 'Europe's innovation gap' by providing easier access to finance, streamlining public procurement, promoting collaboration between industry and academia, and creating harmonised testing technology rules. It will also provide a cross-sectoral legal framework to remove barriers to bringing innovative ideas to market in all sectors. It remains to be seen whether the legislation will be underpinned by effective and clearly defined measures that can be easily implemented, and whether critical raw materials will be given special attention.

Circularity

Chapter 5 of this regulation is devoted to sustainability, with circularity being one of its main points. This is also linked to one of the targets set by the regulation: that 25% of the Union's annual consumption of strategic raw materials should come from recycling. Circularity is therefore key to achieving this goal. The norm requests that, within two years, each Member State designs national programmes to implement circularity actions. These programmes must include actions related to technological progress and resource efficiency, as well as waste prevention, increased product reuse and repair, waste sorting and processing, and the promotion of circular design. As is the case with many aspects of this regulation, the implementation of circularity measures is left to the initiative of the Member States. This gives the EU a secondary role based on monitoring, coordination and knowledge sharing. The necessary measures to be proposed will be in harmonisation with other existing legislation very related to the subject. That is all the legislation dealing with waste such as the Directive 2008/98/EC, dealing with waste management, the Directive 2012/19/EU dealing with waste electrical and electronic equipment or the Directive 2006/21/EC dealing with management of waste from extractive industries.

The regulation draws special attention to the recycling of permanent magnets, with specific measures conceived for these elements. All manufacturers producing permanent magnets weighing more than 0.2 kg must declare them. Further legislation will be published to provide detailed information on how to recover critical metals from these magnets. This information must be displayed in accordance with labelling obligations under Decision No 768/2008/EC, which establishes a common framework for the marketing of products. This initiative will facilitate the recovery of rare earth materials, which are currently not sourced in Europe.

The supply of rare materials relies nearly exclusively on China. They are vital components as they are used to build motors and generators used for manufacturing electric vehicle's motors, wind turbines, servo motors in robotics, domestic appliances and also present portable communication technologies. There are known deposits of these materials in Sweden and Norway but they are not yet sourced. This initiative searches also to take advantage of the Processing & Refining premises of Solvay in France which is one of the few plants outside China with capacity for processing all 17 rare earth elements (Solvay, 2025).

As we can see, permanent magnets and the rare elements they contain are the only strategic raw materials to which the regulation refers, establishing more precise conditions and norms. We can easily make a link with innovation as there is a large experience gained over the years by research

projects on this topic. Both through the *European raw materials alliance*, whose mandate have been focused on rare earths and permanent magnets, and research projects. For example, we can cite the case of the company MagREEsource. Founded in 2020, it originated as a spinoff of the CNRS-Institut Néel in Grenoble, building on over 25 years of public research into the recycling of rare earth magnets using hydrogen. Currently, the company is a forerunner in recycling rare earth magnets (MagREEsource, 2025).

Public funding for research projects has led to tangible results in the area of CRMs, recycling and the circular economy, creating a new source of materials that were previously unavailable in EU territory. The regulation now takes advantage of all the knowledge gathered over the years of research and applies the best practices learnt to inform its policy. However, while the regulation highlights this kind of initiative, elevating it to the level of policy guidelines, it unfortunately does not encourage it on the basis of public funding for other research projects with targeted objectives.

On the other hand, another area in which further research has been conducted is the field of batteries. However, the regulation does not take advantage of this knowledge and does not include specific targets or conditions for recycling, unlike for permanent magnets. It merely refers to Regulation (EU) 2023/1542, which covers the entire battery lifecycle, including waste management. However, it does not set any specific goals or binding recycling targets. Regarding batteries, the CRMA only makes declarations of good intentions. For example, in point (51) (CRMA, 2024, p. 12), it exposes the problem of shipping batteries' waste to third countries for treatment, but it does not propose any specific solutions to tackle the problem domestically. The CRMA could have been more ambitious, given the prolific research in this area, as evidenced by the huge number of approved Strategic Projects devoted to the battery sector.

There is a need to accelerate and facilitate the development of a functioning circular economy. Support to large-scale investments in coordination with industrial sector is crucial. But also, the design of advanced materials and products linked to recycling technologies that enable the recovery of critical raw materials (CRMs) all through the full value chain of products. But at the same time, the EU must establish stricter measures on resource use and should rigorously stop the export of feedstock for recycling abroad. That way, the EU will keep valuable materials in circulation, thereby reducing dependency on imports.

RESourceEU Action Plan at rescue

The Commission appears to be well aware of these issues, as it has published a communication announcing its intention to launch the *RESourceEU action plan*. This plan mirrors the *RePowerEU programme*, but focusing specifically on key resources, including critical raw materials. It is not a legislative act, but rather an action plan and policy package that aims to accelerate the critical raw materials strategy, with a planned rollout by mid-2026. The following are the central points of this action plan:

Stock:

- In 2026 the *European Critical Raw Materials Centre* will be created with the mandate of securing access to CRMs for the European industry. And it will be equipped with all necessary legislative instruments by the second quarter of 2026. This Centre will inform European and national actions on investment, joint purchasing and stockpiling. It will

also play a crucial role in steering actions and financial instruments tailored to projects' needs, using both loans and equity options from public and private sources.

Funding:

- This communication outlines the necessary expenditure to at least carry out the 60 Strategic projects already approved, estimated at EUR 2.15 billion. It stresses the fact that this goal cannot be achieved without public investment in order to overcome investors' reluctance to commit to long-term and complex projects and offer de-risk tools.
- EU still relies on private funding, specially through the *Savings and Investments Union* but, at public level, defined budgets will be made available for all existing Strategic Projects. For example, the Innovation fund will support project with a sum of EUR 376 million or the European Investment Bank (EIB) committed to provide up to EUR 2 billion financing per year for CRM-related projects.
- In all, the EU will mobilise EUR 3 billion through EU funds within 2026 in direct support of the CRM value chain.

Coordinating:

- The Commission will create the *CRM financing hub* which will coordinate strategical funding support for projects ahead.
- It will also provide technical assistance both to project promoters and national administrations. It will support projects relevant to the entire value chain, with a particular focus on recycling.
- The *Innovation Fund* will be fed with an important budget in order to incentivise projects related to clean tech manufacturing and CRMs supply chains. Member States will also be invited to contribute to the funding in the form of grants compatible with State aid.

International Partnership:

- The Commission will launch further cooperation actions under the *Horizon Europe 2021–2027* programme. The programme's expected budget is EUR 300 million, which will be used to consolidate partnerships between Member States and third countries, co-financing research and innovation projects along the CRMs value chain. These actions will be supported by existing funds and instruments, such as the financial instruments of the *Global Gateway* and the *EFSD+ Guarantee* instruments.

Circularity and Innovation:

- By the second quarter of 2026, the Commission will propose restrictions on the export of scraps and waste of permanent magnets in order to incentivise recycling of rare earths.
- Similar action will be taken for batteries: waste lithium-ion batteries and black mass will be classified as hazardous, thus prohibiting exports to non-OECD countries. This measure is intended to favour European companies devoted to black mass recovery and recycling.
- It will also foresee specific measures to recover aluminium scrap and regulate the shipment of CRMs and secondary materials waste within the EU.
- It aims to establish labelling to incentivise the recycling of products containing CRMs.

In a nutshell, this action plan come to address some of the issues mentioned earlier in this document: it proposes concretes actions that are framed in time and budget, and Commission acts as leading actor for all measures. There are some merits but also some misses.

Concerning merits we can cite:

- EU is taking its leading role acting as Portfolio Manager and harmonising actions and procedures at a transnational level. Thus, compensating asymmetries between Member States in the deployment of the necessary action to meet the targets sets in the CRMA.
- EU is also acting in his role of supranational authority facilitating the consolidation of a global stockpile of CRMs to assure smooth rolling-out of green transition.
- EU still uses existing generalist funding institutions, such as EIB, but what changes from the CRMA is that there are specific amounts that are mentioned and budgetary lines specially devoted for the deployment of the CRMs strategy.

About the misses:

- Circularity initiatives: There are no real measures in place to promote circularity. The proposed actions are based on restrictions that are intended to trigger a counteraction or adaptation in order to avoid the consequences of the imposed restrictions. The initiatives do not build on actions, but rather on positive reactions to the restrictive measures. This approach is less reliable because reactions are always less controllable and unpredictable. Circularity measures focus on permanent magnets, with some mention of batteries and electrical and electronic devices. As was the case in the CRMA, there is no real global approach to whole possibilities of circularity, but rather a series of clustered proposals.
- Environment: There has been no improvement regarding the weaknesses of the CRMA regulation on environmental protection. In fact, this plan proposes speeding up environmental permits to facilitate the start-up of CRM projects. This could make it even more difficult for local communities and environmental associations to contest inappropriate projects. The Commission is also expected to publish a guidance document for Member States to help them implement EU environmental permitting law more simply and harmoniously, especially with regard to the extraction sector. This should clarify the criteria for compliance with Environmental Quality Standards, which should lead to Member States harmonising their criteria on this topic.

Conclusions

The Critical Raw Materials Act came into force with the aim of addressing the EU's vulnerabilities regarding the supply of critical raw materials. It sets out specific targets to be achieved by 2030, but fails to define a clear path to achieving these objectives. As we saw, there is no direct implication for the EU, which has instead delegated the entire process to Member States. The EU also avoids taking the initiative and showing leadership, as the projects that will make the change, the so-called "strategic projects" are to be proposed by the private sector or other entities. The CRMA regulation should have been drafted so that it is applicable immediately upon enactment and uniformly adopted throughout the EU territory. However, this is not the case, as it is up to the Member States to propose action plans and implement national programmes to incentivise technological progress, increase circularity rates, and boost recycling ambitions. There is no precise indication from the EU or the European Commission on how to achieve this, nor is there any dedicated funding for the CRMA other than the existing generalist funding. This lack of precise guidelines is clearly evident in the asymmetrical responses to the call for projects: only 13 out of 27 countries have had strategic projects approved.

Time is key and EU needs to act promptly and efficiently. This is not only because the timeframe to reach the targets is tight, but also because other foreign powers, such as China and the USA, are taking the lead on critical technology for the green transition and monopolising the supply of critical raw materials.

To address this situation and speed up the process, the EU has announced the launch of the *RESourceEU Action Plan*. This plan addresses issues such as funding needs and availability and centralises some of the intended actions concerning the CRMA, such as joint purchasing and stockpiling, within a newly created centre that will also oversee the granting of funding. However, it does not include any specific actions for targeted research for long-term resilience, nor any new input concerning environmental issues and nature protection.

Further research papers on this topic could focus on the proposed list of critical and strategic materials. It would be useful to analyse the possible alternatives for each material in depth, starting with the possibilities for recycling and substitution. This would provide a clear overview of where research and innovation investments must be made to be most efficient and send a clear message about the need for public investment. Mining should only be pursued as a last resort if no other option is viable, due to the social and environmental impacts already identified.

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