ODI Europe

The Centre for Geopolitics of Global Change

Briefing Paper

Building resilient and mutually beneficial Critical Raw Material supply chains

Olena Borodyna

September 2025

Key messages

Diversification in minerals production and processing remains limited, with supply chains, particularly in processing, still highly concentrated. Jurisdictions aiming to diversify supply chains to support the energy transition, defence manufacturing and digital production must take stronger measures to enable it.

The EU's policy approach and cooperation frameworks for critical raw material (CRM) supply chains are evolving. The introduction of the Critical Raw Materials Act is a significant milestone that sets production benchmarks for minerals production and processing. New cooperation tools and frameworks, such as Clean Trade and Investment Partnerships (CTIPs), are being created. The recent selection of 60 strategic projects in and outside the EU is an important step, but supporting their implementation is now essential.

There is strong interest among resource-rich emerging economies in cooperation with the EU on research and innovation, financing, industrialisation and environmental and social standards. Policy interventions are needed to reward projects that meet higher

environmental standards, which are not currently reflected through green premiums.

Resource-rich emerging economies such as Chile, Kazakhstan and South Africa are adopting measures to move up mineral value chains. Success will depend on domestic actions, such as identifying priority segments of the value chain, and support from partners including the EU.

How to cite: Borodyna, O. (2025) Building resilient and mutually beneficial Critical Raw Material supply chains. ODI Europe Briefing Paper. Brussels: ODI Europe

Acknowledgements

About this publication

This briefing paper has been prepared in the context of the Second International Climate, Trade and Industrial Policy Dialogue, held in Brussels on 9 July 2025. This series of events, co-hosted by ODI Europe and the European Climate Foundation (ECF), aims to deliberate potential policy solutions that address challenges posed by EU climate, trade and industrial policy and identify opportunities that can be harnessed through collaborative approaches. Opinions and any errors or omissions remain the responsibility of the author.

ODI Europe and ECF thank all participants of the second dialogue for their invaluable contributions. Thanks also go to Dora Meredith, David Kleimann and Claire Kumar for their helpful review and comments.

About the author

Olena Borodyna is a Senior Geopolitical Risks Advisor in the Global Risks and Resilience team at ODI Global and leads the work on critical mineral supply chains at the Centre for the Geopolitics of Global Change. Her expertise spans the geopolitics of critical minerals, energy security and the cascading impacts of climate and geopolitical risks on global supply chains.

Contents

Abbreviations and acronyms

CRM	Critical Raw Materials
CRMA	Critical Raw Materials Act
CTIPs	Clean Trade and Investment Partnerships
EU	European Union
EV	Electric vehicle
ERM	Energy Raw Materials
ESG	Environmental social governance
FTA	Free Trade Agreement
IEA	International Energy Agency
MoU	Memorandum of Understanding
REEs	Rare earth elements

1 Introduction

This briefing paper was developed in the context of ODI Europe's Second International Climate Trade and Industrial Policy Dialogue (ODI Europe, 2025). It provides background on the role of critical raw material (CRM) supply chains in the green transition and across other applications, highlighting key trends in the sector. It includes a brief overview of the multiple objectives underpinning European Union (EU) policies, cooperation frameworks and trade tools to diversify and secure CRM supply chains. It also includes examples of CRM and industrial policies in resource-rich emerging economies, highlighting opportunities for EU cooperation.

This briefing paper also presents the reflections shared by the stakeholders who attended the second policy dialogue. This group included representatives from EU institutions, international agencies, think tanks and academia, as well as participation from the private sector involved in the CRM supply chains (including both multinational and smaller, specialist firms). Key points raised by participants are included in boxes at the end of the relevant sections.

1.1 The role of critical raw materials in the green transition and defence applications

The EU, and the world more broadly, is undergoing multiple transitions in the energy and digital sectors, as well as scaling up defence supply chains in response to geopolitical volatility. These transitions are material-intensive and require a range of metals and minerals. Economically important minerals with application across a range of industries and at high supply risk are often referred to as CRMs (European Council, 2025).[1]

In the energy transition, CRMs such as copper, lithium and manganese are essential not only for the technologies themselves, but also for the supporting infrastructure. Copper is used across

[1] Mining refers to the extraction of minerals and metals, while processing and refining refer to stages of enhancing the value of raw ores and their use towards final product. Minerals processing refers to 'separat[ing] valuable minerals from the surrounding rock and other undesired materials. Crushing, grinding, and sorting techniques are employed to achieve this and maximize the yield of beneficial elements'. Refining steps 'follow to purify and enhance their quality. The refining process varies depending .on the mineral and its intended use'. The EU's CRMA (2024) defines both minerals processing and refining as 'processing'.

various clean energy technologies, including wind turbines, electric vehicles (EVs) and grid battery storage. Likewise, the mineral is crucial to the expansion of the electricity grid, which provides the backbone to the energy and digital transition. Lithium is key to battery storage and EVs; manganese is used in EVs, grid storage and wind energy systems. Other minerals, such as vanadium, have more niche application, but nonetheless play a crucial role in the future of grid storage (Colthorpe, 2025; Fraunhofer Institute for Chemical Technology, 2025). In addition to their widespread use in energy transition technologies, CRMs such as graphite, copper and cobalt are essential for defence applications (Girardi et al., 2023).

1.2 Key trends in the sector

Global demand and investment

Global minerals demand is projected to rise sharply between now and 2040 (IEA, 2025). Lithium demand is expected to grow five-fold; graphite and nickel will double; and cobalt will increase by 50–60%. Copper demand is projected to rise by 30%, largely due to demand for EVs and grid storage (IEA, 2025). Much of this demand has been driven by the energy sector, particularly in China.

Economic uncertainty and increased supply mean that strong demand growth for minerals has not translated into increased investment. Although markets may appear adequately supplied in the short term, medium-term supply constraints, especially for copper and lithium, are projected to emerge by the 2030s, when demand is expected to accelerate further (IEA, 2025).

EU demand

EU demand for a range of minerals is projected to increase, driven by applications in clean technology manufacturing and digitalisation (European Commission, 2020). Under a high-demand scenario aligned with the EU's climate and energy goals, lithium demand is expected to grow 12 times between 2020 and 2030, and 21 times by 2050. Similarly, demand is expected to grow for various forms of graphite. For platinum group metals, EU demand is projected to increase 30-fold by 2030 and 200-fold by 2050. Although growth in demand for neodymium and dysprosium (both rare earth elements (REEs)) is more modest, it is still significant – 5–6 times by 2030 and 6–7 times by 2050 (European Commission, 2020).

EU production and processing capacity

EU countries are producers and processors of several CRMs, though few are major global players. Belgium and France processed 9% and 6% of global antimony supply on average, respectively, between 2016 and 2020. France accounted for 49% of global hafnium processing during the same period. Spain is a significant source of

strontium, representing around a third of global production (European Commission: Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Grohol and Veeh, 2023).

Although domestic production goes some way to meeting demand, the EU remains largely dependent on imports from third countries, in particular China, the world's largest supplier of baryte, bismuth, gallium, germanium, magnesium, natural graphite, heavy and light REEs, tungsten and vanadium. Other key third-country suppliers include Chile (lithium), Guinea (bauxite), Kazakhstan (titanium, phosphorus), Mexico (fluorspar), Norway (silicon metal) and Türkiye (antimony, boron, feldspar) (European Commission: Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Grohol and Veeh, 2023).

EU dependence on imports of gallium and germanium from China has risen owing to decline in domestic production and mine closures in Finland and Germany. At the same time, the bloc's supply base for other minerals is shifting. Finland has scaled up nickel production to account for 38% of EU consumption, while Qatar has become the main supplier of helium (35%) (European Commission: Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs et al., 2023).

Recycled materials are playing a larger role. Recycled iron, zinc and platinum, for instance, now account for a quarter of EU consumption (European Commission: Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs et al., 2023).

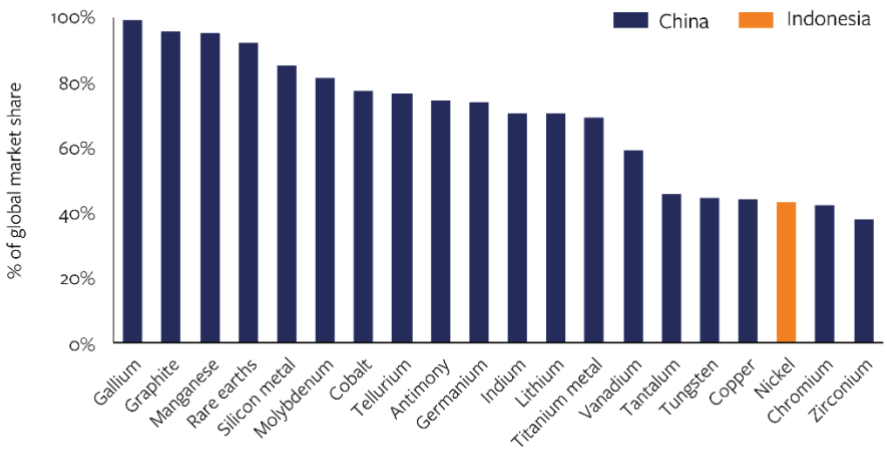
Extraction and processing diversification trends

Geopolitical volatility, trade tensions and natural and structural supply chain disruptions and bottlenecks have underscored the risks of overreliance on single suppliers and highly concentrated supply chains, prompting accelerated efforts to diversify energy and natural resource supply networks. Japan, which faced retaliatory trade measures in the early 2010s, responded by investing in supply chain diversification. Several countries are now seeking to de-risk supply, including Australia, South Korea, the United Kingdom, the United States and the EU, while also engaging with resource-rich emerging economies on joint approaches. Simultaneously, CRM-rich nations are aiming to move up the value chain, expanding their roles in processing and downstream activities (see Section 3).

At the same time, major suppliers are driving increases in mining output: the Democratic Republic of the Congo (DRC) leads in cobalt, Indonesia in nickel, and China in graphite and REEs. As a result, their global market shares grew between 2020 and 2024. Some diversification in mining is anticipated in lithium, graphite and REEs.

China, meanwhile, has expanded its dominance in refining capacity for key energy minerals, including lithium, cobalt, graphite, REEs and copper (IEA, 2025; Figure 1).

Figure 1 Share of top refining country for 20 energy-related minerals



Source: Author's elaboration based on IEA (2025a)

Tools from other commodity markets, such as price floors and ceilings, contracts for difference, stockpiling and group purchasing, could be applied to enhance diversification and reduce risk. On the supply side, innovation may involve support for exploring new types of deposits and for developing synthetic minerals such as graphite. On the demand side, changes in material use, for example through alternative battery chemistries, also present opportunities, although the impact of such shifts remains uncertain.[2]

[2] Source: Participants' inputs from the Second International Climate, Trade and Industrial Policy dialogue

2 EU priorities and cooperation frameworks in critical raw material supply chains

The EU's policy and legislative frameworks for monitoring the strategic security of CRM supply chains have evolved, with considerable activity particularly over the past five years. In 2020, the EU adopted the Action Plan on Critical Raw Materials, as part of which the bloc aims to engage in strategic partnerships with resource-rich countries to manage supply chain vulnerabilities. The bloc has been assessing strategic minerals supply chains since 2008, and in its most recent criticality assessment in 2023 identified 34 minerals as critical raw materials, 16 of which are designated as strategic.[3] These 16 minerals, along with bauxite/alumina/aluminium, have been classified as strategic under the CRMA (Official Journal of the European Union, 2024).[4]

These CRMs are critical to supporting the EU's ambitions across sectors, where it has introduced a range of policy and legislative measures to increase manufacturing of clean, digital, defence and aerospace technologies. In relation to the green transition, the Net Zero Industry Act sets out the EU's aim to scale up manufacturing capacity to meet at least 40% of deployment needs by 2030 across a range of clean technologies (European Commission, 2023). These include solar PV and thermal technologies, onshore and offshore renewable technologies, battery/storage technologies, heat pumps and geothermal and hydrogen energy technologies (European Commission, 2023).

[3] The following raw materials shall be considered critical: antimony; arsenic; bauxite; baryte; beryllium; bismuth; boron; cobalt; coking coal; copper; feldspar; fluorspar; gallium; germanium; hafnium; helium; heavy rare earth elements; light rare earth elements; lithium; magnesium; manganese; natural graphite; nickel – battery grade; niobium; phosphate rock; phosphorus; platinum group metals; scandium; silicon metal; strontium; tantalum; titanium metal; tungsten and vanadium.

[4] The following 17 raw materials are considered strategic under the CRMA (2024): bauxite/alumina/aluminium; bismuth; boron (metallurgy grade); cobalt; copper; gallium; germanium; lithium (battery grade); magnesium metal; manganese (battery grade); graphite (battery grade); nickel (battery grade); platinum group metals; rare earth elements for permanent magnets (Nd, Pr, Tb, Dy, Gd, Sm, and Ce); silicon metal; titanium metal; tungsten.

Under the Defence Industrial Strategy, the EU aims to source at least 50% of its defence procurement budget within the bloc by 2030, increasing to 60% by 2035 (European Commission, 2024). The White Paper on European Defence – Readiness 2030 proposes the creation of strategic stockpiles and defence industrial readiness pools (European Commission and the High Representative, 2025). The Niinistö report, which focused on enhancing European civilian and military preparedness and readiness, also recommends the development of an EU-wide stockpiling strategy (Niinistö, 2024). As defence budgets rise across many EU Member States, particularly NATO members, defence is expected to become a key driver of demand for CRMs, alongside the energy and digital sectors.

2.1 **Critical Raw Materials Act 2024**

The CRMA adopted in 2024 responds to calls for secure and diversified CRM supply chains through a range of domestic measures and international partnerships (Official Journal of the European Union, 2024). The CRMA establishes a legislative framework to mitigate risks and reduce dependencies, support the EU's economic resilience and enhance the circularity and sustainability of supply chains.

The CRMA sets non-binding benchmark targets for 2030, aligned with the EU's climate, energy and digital goals:

- Domestic extraction to cover at least 10% of annual consumption.
- Processing capacity to reach 40%.
- Recycling to provide at least 25% of strategic raw materials.
- Dependency on any single third-country supplier to be limited to 65%, with exemptions for countries that have established strategic partnerships, free trade agreements or other forms of cooperation.

The Act also outlines criteria for recognising strategic projects that support supply chain diversification. To qualify, projects must contribute meaningfully to EU supply security, be technically feasible and meet sustainability criteria. Projects within the EU must also generate cross-border benefits. Projects in third countries, particularly in emerging markets and developing economies (EMDEs), must demonstrate mutual value creation (Official Journal of the European Union, 2024). In March 2025, as part of CRMA implementation, the EU identified 47 strategic projects across 13 Member States, covering 14 of the 17 strategic raw materials (European Commission, 2025b). These projects, which require €22.5 billion in capital investment, will receive support from the Commission, Member States and financial institutions to facilitate

access to financing and offtake agreements (European Commission, 2025b).

Response to the CRMA

The CRMA has been welcomed as a step towards diversification of EU supply chains. Enrico Letta's report on the EU Single Market, commissioned by the European Council, recognises the CRMA as a key measure to address dependencies linked to concentrated supply chains and to ensure EU economic resilience (Letta, 2024). Highlighting the 'assertive' strategies of countries such as China, Letta recommends leveraging the EU's purchasing power through a joint procurement mechanism to secure critical materials. The report also argues that the EU should 'move away from a logic of imposing regulations that harm partners and our ability to negotiate strategic partnerships' (Letta, 2024).

The Draghi Report on EU Competitiveness supports the CRMA and calls for additional measures in the sector (Draghi, 2024). It highlights specific minerals (e.g. lithium, rare earths) where the EU can reduce dependencies through domestic production and recycling, particularly in cost-competitive regions such as the Nordic countries. It outlines four priority actions for CRMA implementation, including:

1. Enhance domestic production, processing and recycling in the EU along the CRM value chain.
2. Support the diversification of supply chains: international strategic partnerships and strategic projects.
3. Simplify permitting procedures: shorten timeframes and develop national programmes.
4. Advance the strategic projects.

Additionally, the Draghi report proposes 11 action points, including strengthening global CRM diplomacy, aligning the Global Gateway more directly with EU industrial and strategic interests and forming coalitions (e.g. G7/OECD) with countries such as Japan to avoid internal competition and promote a 'Club Approach' to secure and diversify global CRM value chains. This could include joint R&D and technology transfer initiatives (Draghi, 2024).

2.2 Key EU cooperation frameworks and trade instruments for CRMs

The EU has used a range of tools to diversify supply, including Strategic Partnerships, dedicated chapters on Energy and Raw Materials (ERM) in recent Free Trade Agreements (FTAs) and Clean Trade and Investment Partnerships (CTIPs).

Strategic partnerships and projects

Since the 2020 Action Plan, the EU has developed CRM partnerships with 14 countries and territories: Serbia, Australia, Uzbekistan, Norway, Rwanda, Greenland, the Democratic Republic of Congo (DRC), Zambia, Chile, Argentina, Namibia, Kazakhstan, Ukraine and Canada (European Commission, n.d.). Exploratory talks have taken place with Brazil, Japan, Mexico, Peru, the US, Uruguay, the EuroMed countries and the African Union (European Commission, n.d.). Meanwhile, Member States such as Germany, France and Italy have pursued bilateral Memorandums of Understanding (MoU) with resource-rich countries across Africa, Central Asia and Latin America, often focusing on full supply chain development.

The CRMA encourages the EU to continue pursuing strategic partnerships as outlined in the 2020 Action Plan on CRMs. Reporting on the objectives, progress content and prioritisation of these partnerships is now an obligation under the newly established European Critical Raw Materials Board. The EU is to pursue mutually beneficial partnerships with EMDEs, aligned with the Global Gateway, in a manner that supports both diversification of supply chains and value addition in partner countries. Article 37 further defines reporting requirements to the Board (Official Journal of the European Union, 2024).

In June 2025 the Commission identified 13 strategic CRM projects outside the EU (European Commission, 2025d). Seven are in partner countries with signed CRM agreements: Canada, Greenland, Kazakhstan, Norway, Serbia, Ukraine and Zambia. The other six are in Brazil, Madagascar, Malawi, New Caledonia, South Africa and the UK. These projects focus on diversifying EU supply chains for minerals including graphite, nickel, cobalt, lithium and rare earths. While most are extraction-based, several, such as the SMP Nickel and Cobalt Refinery Restart Project (Brazil), CaledoNi (New Caledonia) and Kobaloni Energy (Zambia), focus on minerals processing. To be selected as strategic, these projects had to demonstrate contribution to EU supply security. Like projects internally across the EU, these projects will receive support with accessing finance and contacts with off-takers (European Commission, 2025a).

Energy and Raw Materials chapters in Free Trade Agreements

Another mechanism used to support EU goals on CRM supply chains has been the introduction of ERM chapters in FTAs. In their analysis of ERM provisions in the EU's recently concluded FTAs with third countries and blocs, including Vietnam, Mexico, Chile, Mercosur and India, Van der Ven et al. (2024) find that, while provisions ensuring EU access to raw materials and energy supply chains are often framed in binding and enforceable terms, they are less effective in promoting green industrialisation or sustainability in resource-rich

partner countries (Van der Ven et al., 2024). Nevertheless, certain carve-outs and exceptions represent steps in the right direction. The dual pricing exception in the EU–Chile Advanced Framework Agreement, for example, allows Chile to further develop its domestic processing capacity, particularly in lithium. Future FTAs could include sui generis carve-outs on dual pricing that reflect the specific circumstances of each partner country, rather than strictly replicating the model used in the EU–Chile agreement (van der Ven et al., 2024).

Clean and Trade Investment Partnerships

CTIPs aim to diversify trade instruments used to secure material access. They complement but do not replace FTAs; they are faster, more targeted, more flexible and provide scope to better align with EU and partner country business interests (European Commission, 2025b). Sometimes referred to as trade-related agreements or 'mini-trade deals', they offer alternatives to time-consuming multilateral and bilateral FTA negotiations (Jutten, 2025). They aim to combine regulatory cooperation, investment and rules to develop strategic clean value chains. CRM access is a key focus of CTIPs, aligning with CRMA objectives to secure and diversify EU supply chains while supporting the clean energy transition in third countries.

In March 2025, the EU agreed to commence CTIP negotiations with South Africa which, if agreed, will be the first in this generation of new deals (European Commission, 2025c). While focused on investment and clean energy, the partnership would look to extend to raw material supply chains given South Africa's role as a major producer of manganese, vanadium, titanium and platinum group metals.

Box 1 Stakeholder exchange regarding EU's evolving approach to CRM supply chains

During the dialogue, stakeholders presented EU efforts to strengthen the resilience of CRM supply chains. This included, for the first time in EU legislation, benchmarks and objectives for CRM production capacity.

EU activities across three cross-cutting areas were highlighted. In exploration, Member States are developing national exploration programmes. A first round has been submitted to Brussels and is currently under review. In innovation, the EU has allocated almost €1 billion under the current budget to support research and innovation in raw materials, including partnerships with third countries. Multiple proposals have been submitted and are being analysed. Finally, strategic projects in Europe and beyond are a key feature of the approach.

The Commission highlighted strong interest from market actors in investing across EU supply chains. The CRM Act seeks to provide an enabling environment by working with Member States on permitting procedures; improving access to finance; and facilitating the signing of contracts and agreements.

Domestic production and processing targets were highlighted as part of a growing market, with partnerships playing a central role in the EU's approach. The Commission emphasised that its approach focuses on working strategically with partner countries to diversify supply chains and grow the market. In terms of cooperation frameworks, FTAs remain a feature, but strategic partnerships are regarded as essential as they allow cooperation to go beyond FTAs. Examples of partnerships were highlighted, ranging from research cooperation in Kazakhstan to industrial collaboration with Canada (the EU's oldest strategic partnership in this field) and progress with the DRC in supporting industrial partnerships between Congolese and European operators.

The Commission underlined that adherence to high environmental and social standards is a cornerstone of the EU's approach. The aim is not to replicate existing frameworks, but to promote and raise standards wherever possible. As part of the CRMA, the Commission is working towards a certification scheme that would recognise projects and enable companies to demonstrate that imports to Europe meet high environmental and social standards. Circularity was also stressed as a key dimension, ensuring that materials within the EU can be reused.

Source: Participants' inputs from the Second International Climate, Trade and Industrial Policy dialogue

3 Critical raw materials and industrial policies in resource-rich emerging economies

Against a backdrop of geopolitical volatility, prompting the pursuit of de-risking, diversification and resilience of supply chains, coupled with mineral-intensive transitions in the energy and digital sectors and increased defence spending, a growing number of resource-rich emerging economies are ramping up efforts to move up value chains.

Many of these countries, including ones the EU seeks to engage through strategic partnerships, such as Indonesia, Zambia, Kazakhstan and Chile, are reassessing their position in CRM supply chains and resulting leverage in negotiations with demand-side jurisdictions. The primary aim is to shift from being raw material exporters to engaging in higher-value activities in refining and upstream value chains, stimulating economic growth and generating growth in higher-skilled labour domestically. For example, in recent years Indonesia has moved from being primarily an exporter of raw nickel ore to becoming a key player in downstream processing and refining.[5]

This section outlines the strategic approaches to CRMs adopted by resource-rich partner countries with which the European Union seeks to deepen engagement – Chile, Kazakhstan, and South Africa. It further synthesises stakeholder perspectives on advancing mineral value chain development in emerging economies, while identifying key challenges, and outlining the EU's potential role in promoting responsible and mutually beneficial mineral value chains.

[5] See Kumar (2025) for a further discussion on Indonesia's efforts to move up value chains, including the role of joint ventures.

3.1 Country strategies to strengthen CRM value chains – Chile, Kazakhstan, South Africa

Chile

Since the late 1990s, Chile's development agency CORFO has worked to integrate the country's raw materials sector into global supply chains by supporting local suppliers and encouraging innovation. A central pillar of the 2023 National Lithium Strategy is the strong role of the state through public–private partnerships (PPPs), where lithium reserves are developed in a context of majority state ownership (Carry, 2025).

CORFO provides incentives for local value addition, including subsidies for technology transfer, training and R&D in sustainable extraction and battery recycling. Efforts are under way to boost downstream industries such as refining and processing. Chile's approach incorporates environmental and social safeguards, aiming to protect 30% of its salt flats from extraction by 2030 and integrating community concerns into planning (Carry, 2025).

The country is looking to invest heavily in renewable energy to power mining operations and produce green hydrogen, targeting 80% renewable electricity by 2030 (Carry, 2025). However, challenges remain, including limited refining capacity, an underdeveloped automotive industry and bureaucratic delays. The government recognises the need to improve the investment climate and regulatory stability to retain foreign partners and support long-term growth in the critical raw materials sector (ibid.).

Kazakhstan

Central Asia recently hosted its first summit with the EU, where CRMs featured prominently on the agenda. Countries such as Kazakhstan and Uzbekistan are seeking to capitalise on their natural resources and expand critical raw materials production (Borodyna, 2025). Aside from the EU, Kazakhstan has actively engaged with, and been courted by, a range of partners, including China and Russia. Both are investors in, and export destinations for, Kazakhstan's minerals, with just over 90% of its copper and 30% of its zinc exported to China (Observatory of Economic Complexity, n.d.).

Kazakhstan has developed a Comprehensive Plan for the Development of the Rare and Rare Earth Metals Industry for 2024–2028, aiming to boost investment in exploration and processing of minerals including lithium, titanium, zirconium, tantalum, niobium and beryllium (Astana Times, 2025). According to the Plan, the country aims to boost domestic and foreign investment in exploration and extraction by 40%, increase the attractiveness of domestic

processing, increase REE production by at least 40%, develop pricing rules and facilitate technology transfer to domestic facilities (Government of Kazakhstan, 2024).

As a key part of its investment pitch, the country aims to improve the business environment as well as raw material processing and high-tech production (Kazakh Invest, 2025). Already a miner of manganese, the country has begun manganese sulphate processing and wants to capture 10% of the global market. It also aims to scale up production of battery-grade metals for lithium iron phosphate (LFP) batteries (Auyezov and Onstad, 2024).

To boost processing capacity, KAZ Minerals Smelting has signed an agreement with China Nonferrous Metal Industry's Foreign Engineering and Construction company, commissioning construction of a 300,000-tonne copper smelter, due to be operational by the end of 2028 and expected to create 1,000 jobs (Official Information Source of the Prime Minister and of the Republic of Kazakhstan, 2024).

South Africa

South Africa, with which the EU is pursuing a Memorandum of Understanding on a CTIP agreement, launched a Critical Minerals Strategy in May 2025. The country ranks fifth globally in terms of the contribution of mining to GDP and is a major global producer of platinum group metals (PGMs) (59%), vanadium (25%), zirconium (32%) and manganese ore (17%). Under the Strategy, the country aims to leverage its mineral wealth for industrialisation, improve competitiveness and enhance its role in global value chains for the green transition. South Africa has introduced its own criticality list, ranking minerals including platinum, manganese, iron ore, coal and chrome ore as high criticality, whilst gold, palladium, rhodium and rare earths rank as medium-high (Department of Mineral and Petroleum Resources, 2025).

The country aims to reform mining laws and empower governments to impose export restrictions to ensure that minerals are retained for domestic processing. In this way, South Africa is positioning itself as the premier destination for refined metals, high-tech alloys and advanced components. The Strategy emphasises retaining select CRMs for local processing whilst permitting targeted exports to address immediate market demands (Department of Mineral and Petroleum Resources, 2025).

South Africa has also published a Draft Mineral Resources Development Amendment Bill to support efforts to assert greater control over mineral resource value chains (Felthun et al., 2025). The proposal seeks to revive previous attempts to secure greater control over the development of the country's mineral resources, and includes proposals for control over processing and export of critical minerals and over transfer of ownership of mineral resources.

However, the Bill contains vague wording and a broad scope of powers that may attract criticism from the industry, with earlier iterations criticised as a ‘draconian interference in the marketplace’ (Felthun et al., 2025).

The strategy and bill have drawn attention from markets regarding their impact on global supply chains, including exports to China (Tong et al., 2025). There has been reported scepticism with regard to implementation; key concerns include limited smelter capacity, power shortages and the need to stimulate domestic consumption (Tong et al., 2025).

Box 2 Stakeholder exchange on enabling mineral value chain addition in resource-rich emerging economies

Stakeholders shared several recommendations to support the development of mineral value chains in resource-rich emerging economies. To incentivise sustainable CRM supply chains, participants from Brazil suggested offering targeted incentives such as tax benefits, fast-track permitting and infrastructure support, but stressed these should only be offered to companies that meet strong ESG benchmarks and deliver local value addition. Other recommendations include designing trade measures that enable domestic processing and the development of mid-stream capacity, while still allowing participation in global trade. Aligning national industrial goals with clean technology value chains was also highlighted, including co-locating refining and production, training local workforces and ensuring CRM development contributes not only to revenue creation, but also shared prosperity.

Chile was presented as a useful case study, with the country targeting value addition in specific segments of the mineral value chain. Given the concentration of refining capacity, Chile has focused particularly on the copper smelting stage of the processing chain. Stakeholders emphasised that supporting such approaches from demand-side jurisdictions is as much a matter of geostrategy as of economics.

Source: Participants’ inputs from the Second International Climate, Trade and Industrial Policy dialogue

3.2 Challenges to enhanced value retention

Overall, across resource-rich countries, similar challenges persist with regard to advancing further along critical raw materials and low-carbon value chains. Common obstacles include energy and

infrastructure bottlenecks, gaps in technological capacity and human capital, as well as broader regulatory and policy uncertainty. Governance issues and weaknesses in environmental and social standards further compound the risks, making the investment climate in many jurisdictions complex and unpredictable. Market-related challenges also play a role. These include the cost competitiveness of value-added products and return on investment, limited scale and the shortage of skilled personnel required to establish globally viable downstream industries.

The EU can play a constructive role in building responsible and mutually beneficial mineral value chains, particularly through capacity-building, investment and industrial development, and supporting projects and products that meet high standards of environmental and social responsibility. A relatively late entrant into this geoeconomic space, the EU will need to demonstrate sustained commitment and credibility in its pursuit of partnerships if it is to play a meaningful role in shaping future value chains in the spirit of pursuing mutual prosperity (see Box 3).

Box 3 Stakeholder exchange on the EU's role in building responsible and mutually beneficial mineral value chains

During the dialogue, stakeholders highlighted significant scope for engagement with the EU on jointly building resilient and responsible mineral value chains.

Direct investment and support for industrialisation in countries such as South Africa were identified as key opportunities. Stakeholders stressed the importance of cooperation frameworks such as CTIPs, not only for securing minerals for the EU, but also for supporting the broader industrial ecosystem. Commitments to local beneficiation, as well as the development of green infrastructure and industry, were emphasised as critical to this approach.

In Ukraine, home to significant CRM reserves and a signatory of an MoU with the EU, progress has been hampered by the ongoing war. In this context, joint work on improving the regulatory environment, modernising extraction and processing technologies, promoting circular economy principles and supporting the decarbonisation of the CRM sector will be critical in the 2025–2026 implementation phase of the MoU. The selection of strategic CRM projects is also a positive step towards supporting Ukrainian industry, despite ongoing geopolitical risks.

Stakeholders also highlighted opportunities for research and innovation with the EU and beyond. This includes research on context-specific mining practices, such as nickel exploration from

different types of deposit, where knowledge remains limited, for instance in Indonesia. Japan's Kizuna programme, implemented through JICA, was presented as an example of capacity-building through education at both university and postgraduate levels. Participants explained that trainees are expected to strengthen the mining sector in home countries by improving quality, attracting finance and modernising practices. Some noted that trilateral cooperation between Japan, the EU and South Africa could build on this model.

Finally, stakeholders underlined the role of the EU in promoting responsible mineral supply chains with high levels of environmental and social integrity. EU regulations such as the Carbon Border Adjustment Mechanism and Corporate Sustainability Due Diligence Directive were seen as having significant impacts, not only on mining producers but also on other countries such as China, as they move towards meeting the necessary compliance criteria. However, several participants noted challenges, including a lack of clarity on how the regulations will be implemented, which creates uncertainty for market players.

It was further observed that current markets do not reward sustainable production through green premiums. For example, sustainable lithium and copper production in countries such as Brazil and Chile respectively with stronger social performance and lower carbon footprints is not financially rewarded. Stakeholders therefore recommended that demand-side jurisdictions such as the EU take additional steps to support high environmental standards of production. These included linking eligibility for subsidies or preferential treatment to verified sustainability performance, embedding ESG conditionality into trade and procurement frameworks, and recognising that ESG-aligned projects face higher costs and risks. Responding with appropriate financing, including blended finance, concessional loans and guarantees for producers investing in responsible mining and refining, was also recommended.

Source: Participants' inputs from the Second International Climate, Trade and Industrial Policy dialogue

4 Outlook and implications for the EU

Despite ongoing efforts to diversify critical mineral supply chains, production and processing remain highly concentrated. Securing access to these minerals and achieving meaningful diversification for EU countries will require stronger measures, including drawing lessons from tools and strategies that have proven effective in other commodity categories.

The EU and its Member States are actively pursuing supply chain diversification, with policy and cooperation frameworks evolving significantly over the past five years. The CRMA marked a major milestone, establishing benchmarks for mineral production and processing for the first time. The recent selection of 60 strategic projects within and outside the EU represents another important step.

However, the critical challenge now lies in supporting the implementation of these strategic projects, particularly by facilitating access to finance and streamlining permitting processes. While there is considerable market interest in these projects, the EU must also build confidence that it can deliver on its commitments. Successfully delivering on these objectives will be essential for the EU to secure its own supply chains.

Resource-rich emerging economies are also showing strong interest in cooperating with the EU and EU Member States. Here, the EU will need to strike a balance between securing domestic production and supporting these countries in moving up the minerals value chain. Financing projects, developing innovative trade models and policies that reward green premiums, and fostering cooperation in research and development, are opportunities both to secure critical raw materials and to sustain the EU’s broader geostrategic influence.

References

Astana Times (2025) '"New Oil Market": Assessing Kazakhstan's Rare Earth Potential', 17 February (https://astanatimes.com/2025/02/new-oil-market-assessing-kazakhstans-rare-earth-potential/).

Auyezov, O. and Onstad, E. (2024) 'Metals-rich Kazakhstan seeks niche in battery supply chain', *Reuters*, 16 September (www.reuters.com/markets/commodities/metals-rich-kazakhstan-seeks-niche-battery-supply-chain-2024-09-13/).

Borodyna, O. (2025) 'Central Asia in focus: What to watch as the EU scales up engagement', ODI Global, 16 April (https://odi.org/en/insights/central-asia-in-focus-what-to-watch-as-the-eu-scales-up-engagement/).

Carry, I. (2025) *Raw Materials Partner Chile: More Than Just a Supplier*. SWP Comment No. 26 (www.swp-berlin.org/publications/products/comments/2025C26_RawMaterialsPartnerChile.pdf).

Colthorpe, A. (2025) 'Sumitomo Electric deploys first vanadium flow battery for a community microgrid in Japan', *Energy Storage News*, 30 May (www.energy-storage.news/sumitomo-electric-deploys-first-vanadium-flow-battery-for-a-community-microgrid-in-japan/).

Department of Mineral and Petroleum Resources (2025) *Critical minerals and metals strategy South Africa*. Republic of South Africa (www.gov.za/sites/default/files/gcis_document/202505/critical-minerals-and-metals-strategy-south-africa-2025.pdf).

Draghi, M. (2024) *The Draghi report: In-depth analysis and recommendations (Part B)*. European Commission (https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en).

European Commission (2020) *Critical materials for strategic technologies and sectors in the EU – a foresight study, 2020*. European Commission, Joint Research Centre (https://ec.europa.eu/docsroom/documents/42882).

European Commission (2023) 'Net-Zero Industry Act' (https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/green-deal-industrial-plan/net-zero-industry-act_en).

European Commission (2024) 'First ever defence industrial strategy and a new defence industry programme to enhance Europe's readiness and security', 5 March (https://ec.europa.eu/commission/presscorner/detail/en/ip_24_1321).

European Commission (2025a) ‘Commission selects 47 Strategic Projects to secure and diversify access to raw materials in the EU’, 25 March (https://ec.europa.eu/commission/presscorner/detail/en/ip_25_864).

European Commission (2025b) *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee of the Regions: The Clean Industrial Deal: A joint roadmap for competitiveness and decarbonisation* (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52025DC0085).

European Commission (2025c) ‘President von der Leyen in South Africa: launches talks on a new trade and investment deal, unveils €4.7 billion Global Gateway package’, 13 March (https://ec.europa.eu/commission/presscorner/detail/en/ip_25_774).

European Commission (2025d) ‘Selected strategic projects’. Webpage (https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials/strategic-projects-under-crma/selected-projects_en).

European Commission (n.d.) ‘Raw materials diplomacy’. Webpage (https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/raw-materials-diplomacy_en).

European Commission: Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Grohol, M. and Veeh, C. (2023) *Study on the critical raw materials for the EU 2023 – Final report*. Publications Office of the European Union (https://data.europa.eu/doi/10.2873/725585).

European Commission and the High Representative (2025) *White Paper for European Defence – Readiness 2030*. Brussels (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52025JC0120).

European Council (2025) *An EU critical raw materials act for the future of EU supply chains (Explainers)*. Webpage (www.consilium.europa.eu/en/infographics/critical-raw-materials/#:~:text=Metals%2C%20minerals%20and%20natural%20materials,wide%20range%20of%20industrial%20ecosystems).

Felthun, G., Christie, L. and Campbell, R. (2025) ‘Proposed overhaul of South African mining law regime’, *White&Case*, 13 June (www.whitecase.com/insight-alert/proposed-overhaul-south-african-mining-law-regime).

Fraunhofer Institute for Chemical Technology (2025) ‘Successful start to test operation at Fraunhofer ICT: renewable energy stored in a large-scale battery is introduced into the power grid on demand’, 24 June (www.ict.fraunhofer.de/en/press_media/press_releases/2025/large-scale-battery-introduced-into-the-power-grid-on-demand.html).

Girardi, B. et al. (2023) *Strategic raw materials for defence. Mapping European industry needs*. The Hague Centre for Strategic Studies (https://hcss.nl/wp-content/uploads/2023/01/Strategic-Raw-Materials-for-Defence-HCSS-2023-V2.pdf).

Government of Kazakhstan (2024) *Comprehensive plan for the development of the rare and rare earth metals industry for 2024–2028* (www.gov.kz/memleket/entities/geology-ekn/documents/details/608740?lang=ru).

IEA (2025) *Global Critical Minerals Outlook 2025*. Paris: IEA (www.iea.org/reports/global-critical-minerals-outlook-2025).

IEA (2025a) 'Share of top refining country for 20 energy-related minerals'. Paris: IEA (www.iea.org/data-and-statistics/charts/share-of-top-refining-country-for-20-energy-related-minerals).

Jutten, M. (2025) *Clean trade and investment partnerships: A new instrument in the EU's trade policy toolbox*. European Parliamentary Research Service (www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2025)769576).

Kazakh Invest (2025) 'Kazakhstan Showcases Investment Opportunities in the Mining Sector at PDAC-2025'. Kazakh Invest, 3 March (https://invest.gov.kz/media-center/press-releases/kazakhstan-showcases-investment-opportunities-in-the-mining-sector-at-pdac-2025/).

Kumar, C. (2025) Building sustainable critical raw materials supply chains: the use of joint ventures. ODI Europe Briefing Paper. Brussels: ODI Europe.

Letta, E. (2024) *Much more than a market: Speed, Security, Solidarity. Empowering the Single Market to deliver a sustainable future and prosperity for all EU citizens*. European Council (www.consilium.europa.eu/media/ny3j24sm/much-more-than-a-market-report-by-enrico-letta.pdf).

Niinistö, S. (2024) *Safer Together: Strengthening Europe's Civilian and Military Preparedness and Readiness*. European Commission (https://commission.europa.eu/document/5bb2881f-9e29-42f2-8b77-8739b19d047c_en).

ODI Europe (2025) 'Second international climate, trade and industrial policy dialogue: building resilient and mutually beneficial critical raw materials supply chains'. ODI Europe Event (https://odi.org/en/events/second-international-climate-trade-and-industrial-policy-dialogue-building-resilient-and-mutually-beneficial-critical-raw-materials-supply-chains/).

Observatory of Economic Complexity (n.d.) *Kazakhstan's Export Destinations*. Webpage (https://oec.world/en/profile/country/kaz).

Official Information Source of the Prime Minister and of the Republic of Kazakhstan (2024) 'Agreement for construction of $1.5bn copper smelter signed in Kazakhstan Government', 3 June (https://primeminister.kz/en/news/agreement-for-construction-of-a-15bn-copper-smelter-signed-in-kazakhstan-government-28564).

Official Journal of the European Union (2024) *Regulation (EU) 2024/1252 of the European Parliament and of the Council of 11 April 2024 establishing a framework for ensuring a secure and sustainable supply of critical raw materials and amending Regulations (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1724 and (EU) 2019/1020 (Text with EEA relevance)*. Available at: http://data.europa.eu/eli/reg/2024/1252/oj.

Tong, T. et al. (2025) *South Africa's new critical minerals policy draw critical eye of buyers, miners*. Fastmarkets (www.fastmarkets.com/insights/south-africas-new-critical-minerals-policy-draw-critical-eye-of-buyers-miners/).

van der Ven, C., Sasmal, S. and Alcántara Torres, G. (2024) *Towards a Better Balance: Leveraging EU Free Trade Agreements to advance responsible and resilient raw materials trade*. Geneva: TULIP (www.transportenvironment.org/uploads/files/2024_06_26_Tulip_study_Towards_a_better_balance_2024-06-26-105606_pwip.pdf).