

Task Force 3: Future of the Global Economy



Fueling Clean Energy Transitions: Addressing Value Chain Polarization in Critical Minerals

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Abstract

The global demand for critical minerals required in clean energy transition technologies faces challenges due to supply chain disruptions, geopolitical tensions, and environmental costs. The concentration of mineral processing, refining, and manufacturing capacities within specific geographies poses risks, prompting governance initiatives like the EU's Critical Raw Materials Act and the US's Securing a Made in America Supply Chain for Critical Minerals Act, among others (US Dept Treasury 2024; European Commission 2023a; White House 2022b). However, increasing domestic supply within the G7 advanced economies is costly and time-consuming in

permitting approvals and setting up greenfield processing and refining facilities. This policy brief focuses on the increasing polarization occurring in the critical minerals space as nations compete against each other to secure access to raw materials required to feed their energy transition ambitions. The policy brief argues that the G7 can leverage its existing economic and technological heft to align market forces to address the issue of critical minerals availability better. Ensuring supply chain restructuring through increased commercial collaborations and forging complementary and cooperative arrangements within the existing G7 frameworks would be an added benefit. Moreover, creating a strategic reserve would reduce concerns about supply disruption, allowing nations to leave more room for market forces.

The challenge

Critical minerals occupy a central role in enabling a sustainable, low-carbon future. The International Energy Agency (IEA) estimates that the energy sector's overall need for critical minerals could increase by as much as six times by the middle of this century (IEA 2022). The escalating demand for critical minerals has resulted in significant impediments within supply chains, causing raw material shortages across various sectors. Supply chains are already under stress, from automotive microchips and solar panels to fuel cells and specialized batteries, because of regional conflicts, sanctions on countries, and post-Covid-19 aftershocks. In 2023, the IEA highlighted that an insufficient mineral supply could lead to a more expensive, delayed, or less efficient energy transition (IEA 2023). The geographical concentration of critical mineral production, processing, and refining, often situated in politically unstable regions, coupled with extended supply lead times to markets and the substantial environmental and social costs of extraction, refining, and processing, contribute to heightened risks and add to expenses related to resiliency and security in supply and value chains.

Naturally, nations that bear the environmental and social costs of often highly polluting mineral extraction, processing, and refining seek to ascend economically in these value chains to extract additional value and create economic growth opportunities for their economies. Furthermore, some nations have occasionally used their command over critical minerals to gain geopolitical leverage in international crises. As a consequence, the increasing economic and geopolitical risks associated with potential critical minerals supply disruptions have prompted many countries (primarily developed) to embark on domestic prospecting, extraction, and processing, contributing to onshoring/nearshoring practices that seek to polarize value chains and challenge current global trade governance principles centered on accessibility and equity. The disruptions in critical minerals supply sat at the forefront of the worldwide supply chain problems, a prominent feature of the post-Covid-19 recovery of the global economy. These immediate problems caused the most developed economies to onshore/nearshore to produce and process critical minerals, often invoking national security discourse in tandem as illustrated by the Securing a Made in America Supply Chain for Critical Minerals Act from the US and the EU's Critical Raw

Materials Act. This polarization exacts a toll on global welfare, particularly affecting developing and less developed countries. The main challenge in this reactionary environment is that these on/nearshoring efforts will likely occur at the expense of global welfare. In other words, such immediate protectionist responses may evolve into long-term rigidities in critical mineral supply chains and polarized markets. Such undue pressure can make the energy transition for other countries costlier, diluting global efforts and collective progress towards Net Zero Emissions goals. Hence, it becomes inherent for the G7 member countries to focus on addressing the issues of geographical concentration of mineral supply and value chains, focus on resolving the problems of increasing geopolitical and energy security risks associated with such concentrations, and work collectively to ensure that economic and political rent-seeking doesn't negatively impact the collective progress on free trade globally and the progress towards an equitable and sustainable future.

The role of the G7

It is important to note that the current reliance on non-OECD critical mineral extraction and processing is not due to scarcity of resources; deposits of many critical minerals are widespread on the Earth's crust. Instead, economics has brought about the geographical concentration of critical minerals production. For example, the Chinese dominance in rare earth element markets has been chiefly due to its "operational cost competitiveness" (Mancheri et al. 2019).

Against this backdrop, nearshoring/onshoring has regained popularity worldwide after the Covid-19 pandemic as a policy response to supply chain breakdowns. The politicization of nearshoring/onshoring threatens the gains that the G7, the G20 and the global community have eked out through tenuous trade negotiations over the last several decades. Furthermore, a polarization of value chains can have negative geopolitical externalities, partially costing the global community the dividends of peace in trade, investment, and human capital flows. Undoubtedly, nearshoring/onshoring policies provide a short-term solution to these potential crises and soothe the markets by mitigating worst-case scenarios. However, a "metamorphosis" of near/onshoring into trade protectionism in the longer term will impose significant costs for global welfare. Policy mechanisms for enhancing existing global trade governance mechanisms to prevent "cornering" markets for political or economic purposes by resource-rich countries will help ensure stability in global commodity markets that have faced volatility in terms of price and volume. These mechanisms also aim to avoid protectionist reactions by end-user countries that could invalidate existing global value chains. G7's institutional framework offers a unique opportunity to underpin efforts towards sustaining a global critical mineral value chain (Serebrin 2022). Its ministerial meetings platform facilitates regular business-to-business engagements within its member nations to formulate a bottom-up based on trade, commerce, and enterprise to establish a resilient, globally dispersed critical mineral value chain. In doing so, G7 support towards establishing resilient global critical mineral supply chains will also ensure subscription

to all the SDG aspirations (Natural Resources Canada 2022; Franks et al. 2023; UNECE 2022).

Recommendations to the G7

We focus on establishing a fungible and equitable global market for critical minerals by enhancing business-to-business (B2B) relations within a collaborative global supply chain. This approach can serve as a vital facilitator for increased funding, consequently mitigating the risk of supply shortages, mainly through the introduction of transparency in pricing. We propose that technology transfers driven by foreign direct investment (FDI) will create innovative critical mineral clusters connecting producers, refiners, and consumers. Extending fiscal incentives for essential mineral investments from the G7 to developing countries through G20 mechanisms can help enhance critical minerals supply chain resilience while optimizing global production factors. G20's various platforms constitute good springboards to initiate related B2B and government-to-business (G2B) discussions. Additionally, including the African Union as a member of the G20 helps provide a formalized mechanism to ensure greater coordination between the member states of the G7 and the G20 (African Business 2023; Acharya and Chaganti Singh 2023).

Our proposals offer the following action points towards enabling an equitable distribution of critical mineral extraction, processing, and research and development efforts to sustain future energy transitions.

A time to revisit/leverage tools of global trade: The supply-security concerns are legitimate; critical minerals producer nations have already weaponized their market power several times to gain geopolitical advantage (Home 2024; Rachman 2023; Tabeta 2023). Existing monitoring, dialogue, and dispute resolution mechanisms can be finetuned to bestow trust in global critical mineral supply chains. Democratize international trade governance to a holistic/supply-chain-oriented one by involving the global trade bodies to further strengthen the value chains' building blocks. Our specific recommendations rest on the idea of devolving the focus of the global trade framework from regulating commodity exchange to managing supply chains. In doing so, we especially recommend (i) business- and society-driven priorities to provide evidence-based inputs for the global governance of trade, (ii) prioritize countermeasures for either the initial or end-users to corner their respective markets, but in doing so, (iii) ensure equitable, incentive-compatible means for the businesses of resource-rich countries to move up in the global value chains. Technology sharing and reforming global IPR regimes are vital enablers of these recommendations.

Creation of a strategic reserve of critical raw materials: The European members of G7 could create a 'coalition of the willing' and pool resources to build strategic reserves of the most important critical materials, such as rare earth elements, Germanium, and Gallium. A strategic reserve based on the commonly identified critical minerals should be formed. The G7 can work

together to determine a standard list amongst its member states, and then the reserve would be under joint EU and G7 management, and part of its stock would be released to its members in case of supply disruptions. Other members of the G7 would be invited to join or create their reserves. The G7 should then work towards an agreement between these national reserves to coordinate accumulation policies and release stockpiles into the market when necessary based on commonly identified threat perceptions. The stockpile and its withdrawal operations should be isolated from seasonal variations and utilized predominantly for strategic actions (e.g., supply disruptions because of wilful acts by states controlling such mineral value chains with an impact on the energy security of the G7 member states and their partners). This should strengthen the confidence in supply availability and thus reinforce the other recommendations.

A firm-level critical minerals ecosystem with solid global connections: We suggest a market-driven approach where businesses and local initiatives take the driver's seat. We argue that such a "distributed" global critical minerals market will bolster innovation and underpin global efforts towards a low-carbon future with an agile structure. Adding non-governmental platforms as additional leverage in strengthening global value chains: We also argue that the best way for countries with critical natural resources to move up the value chain is to promote indigenous innovation rather than disrupting global value chains as a means of populist response. In doing so, the G20's engagement groups, like Business 20 (B20), Urban 20 (U20), Science 20 (S20), and Think 20 (T20), provide a platform to communicate, coordinate and formulate such agile non-governmental (and preferably market-based) responses (G20 Italy 2021). Technology transfer and cooperative mechanisms for sharing knowledge and expertise within national and international collaborative ecosystems can also accelerate Indigenous innovation. Such ecosystem development can also help incubate technology development, especially in regions currently outside of global value chains, which are focused primarily on exports of raw materials without any significant value addition.

Use existing business clusters: The energy transition opens up business opportunities in critical minerals beyond extraction and processing. These opportunities constitute a chance for a more equitable share of the benefits of the energy transition for developing countries. Much knowledge can be transposed from cutting-edge expertise in product development, B2B services, etc., towards creating a genuinely global critical mineral value chain. Existing business clusters across the globe may constitute a significant springboard in these efforts. Additionally, the G7 can seek to leverage the opportunities represented by infrastructure and mining projects in which the Partnership for Global Infrastructure and Investment and Global Gateway initiative are investing, e.g., economic corridors and infrastructure projects in Asia and Africa (White House 2022a; European Commission 2023b; Gupta 2024). Through such investments, the G7 would be able to address the issue of setting up diversified supply chains for both minerals and metals. This would also enable the dilution of the current geographical concentration of minerals and metals processing within specific geographies, which often allow geopolitical rent-seeking and increase associated risks of supply disruptions. Such actions would also enable the development

of supportive mechanisms (e.g., non-governmental bodies to monitor and address environmental and social costs associated with producing rare earths and processing critical minerals). These locally developed and evolved mechanisms would be much more suitable to address local contextual issues, helping resolve potential conflict in mineral extraction.

Implementing design requisites for critical mineral recycling and circularity: As per the Circularity Gap Report, only 8.6 per cent of the over 100 billion tonnes of raw materials in oil, metals, and gas consumed in 2021 were reused (Berger 2024). The potential for recycling from creating a circular economy would be immense. While making “spare capacity” for critical mineral extraction and processing to smooth out volatility may be costly, creating an equivalent capacity through recycling, optimal, and circular use of critical minerals may be feasible. Since many products, including recyclable critical minerals (e.g., lithium in batteries), will be recycled towards the end of this decade, the G7 has enough time to implement an encompassing governance mechanism to promote a circular economy approach for critical minerals. It is, however, essential to note that critical mineral recycling is an energy-intensive process and should go hand-in-hand with using low-carbon energy vectors such as clean hydrogen and renewable energy. To progress towards a circular economy, it would be critical to identify and map the recycling opportunities across the G7 member countries and create a database for the overall size of the recycled minerals that can be brought into circulation. This would also enable policymakers to develop policies that could allow recycling.

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