Committee: United Nations Commission on Science and Technology for Development (UNCSTD)

Issue: Developing International Cooperation for the Stabilization of the Rare Earth Supply Chain

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Introduction

Rare earth elements (REEs) are essential components in modern technologies and defense systems, making control over their supply a significant source of geopolitical advantage. According to the International Energy Agency (IEA), China currently dominates the REE market, accounting for approximately 60% of global mining and 85% of processing capacity. This dominance has been strategically leveraged, as seen in the 2010 export ban, highlighting the potential use of REEs as a geopolitical tool. Rising tensions between the United States and China have further highlighted the vulnerabilities and risks inherent in the concentrated nature of the rare earth supply chain. These challenges underscore the urgent need for international cooperation to stabilize and diversify the global REE supply network.

Definition of Key Terms

Rare Earth Elements (REEs)

A group of 17 chemically similar elements, including the 15 lanthanides as well as scandium and yttrium, that are critical for high-tech applications such as electronics, renewable energy, and defense technologies.

Geopolitical Leverage

The strategic advantage gained by a country through control of resources or technologies that are essential to the global economy or the national security of other countries.

Made in China 2025

A strategic plan initiated by the Chinese government to upgrade its manufacturing base and achieve global dominance in high-tech industries such as electric vehicles, robotics, and artificial intelligence.

Tech Decoupling

The process of reducing technological interdependence between countries, particularly between

the United States and China, often through trade restrictions, export controls, and domestic investment in strategic sectors.

Export Controls

Government-imposed restrictions on the export of certain goods, technologies, or materials for reasons related to national security, foreign policy, or economic protection.

Critical Minerals

Raw materials deemed essential for the economy or national security, which have supply chains vulnerable to disruption. This includes materials like gallium, germanium, and many REEs.

Environmental Externalities

Negative side effects of industrial processes, such as pollution or ecosystem damage, that are not reflected in the cost of production and are often borne by society or the environment.

Supply Chain Vulnerability

The risk of disruption within the stages of production and delivery of essential goods due to overreliance on a limited number of sources or geopolitical instability.

History

Rise of REEs

Rare earth elements (REEs), despite their name, are not that rare. However, their extraction is complex and often environmentally harmful. Back in the 1980s and 1990s, when REEs were not so highly demanded, the U.S. led global REE production. Yet, as environmental regulations tightened and overseas production costs dropped, the U.S. lost that position.

Meanwhile, China began to recognize the strategic value of rare earths. They increased investment, lessened environmental standards, and set a long-term industrial goal, rapidly expanding their capabilities. By the late 1990s, China became the main supplier, maintaining that status even today.

Global spotlight on the 2010 Export Ban

In 2010, China banned REE exports to Japan during a territorial dispute. This caused Global prices to skyrocket, bringing the spotlight to the vulnerability of the international supply chain. Although the World Trade Organization later ruled the ban a violation of trade rules, the incident revealed how REEs could be used as a political tool.

Following this, countries explored other sources and considered the dangers of overreliance on a single supplier. But China's dominance in the field remained throughout the 2010s.

The Rise of Strategic Competition

In 2015, China introduced its "Made in China 2025" initiative. This targeted global diminance in industries such as electric vehicles, robotics, and artificial intelligence, all highly dependent on REEs. This concerned other countries and the need for independent supply chains

Between 2022 and 2023, the United States imposed export controls on advanced semiconductors and chip-making equipment, aiming to restrict China's access to cutting-edge technologies. In cooperation with Japan and the Netherlands, Washington further limited the export of photolithography tools used in chip manufacturing. In response, China introduced export restrictions on gallium and germanium, both essential to semiconductor production.

Current Landscape and Unresolved Challenges

Despite attempts to diversify the REE supply chain, China still dominates the field. While countries like Australia, Canada, Brazil, and several African nations possess significant reserves, many lack the infrastructure, investment, or political stability required to become major suppliers. Furthermore, even when mining occurs outside of China, much of the global processing still takes place within its borders. The global community faces a challenge to reduce Chinese dependency while ensuring new sources are developed in a sustainable and ethical way. Technological disruptions and geopolitical conflicts will continue without international cooperation,

Key Issues

Global Overconcentration of REEs in China

The current REE landscape resembles a monopoly; a single country, China, controls about 60% of mining and 85% of processing. This means that even minor disruptions or disputes regarding REEs can affect major industries like electric vehicles, semiconductors, and military technologies in a critical way. The semiconductor industry in particular, is the heart of most modern technology, used in everything from computing devices, wireless communication, motors and batteries, factories, energy systems, and defense. China's monodominance suggests that bargaining power and technological independence of other nations and industries are in a fragile state.

Export weaponization

A notable example of rare earth elements (REEs) being used as political leverage was China's (unofficial) 2010 export ban, which sent shockwaves through global markets. This case highlights how easily supply disruptions can destabilize industries worldwide. The concentration of REE production in a

single country makes the global supply chain highly vulnerable, raising the risk that these resources could be weaponized in future geopolitical disputes.

Technological Decoupling

Ongoing tensions between the United States and China illustrate the growing risk of technological decoupling. Washington has imposed export controls on high-tech goods and manufacturing equipment, while Beijing has responded by restricting exports of key elements such as germanium and gallium, both vital for advanced technologies. A similar strategy could extend to REEs, which would further fragment global supply chains, hinder international collaboration, and slow the pace of technological innovation.

Limited Global Processing Capacity

Even when REEs are mined outside of China, the majority are still sent to China for processing. The barriers to establishing processing facilities are considerable: they require significant capital investment, involve environmentally hazardous processes, and demand specialized expertise. While countries such as the United States, Canada, and Australia are investing in alternative refining capacities, progress remains slow due to strict environmental regulations, local opposition, and financial risks. For instance, the Mountain Pass mine in California produces REEs but relies on China for processing, underscoring the global dependency on Chinese refining capabilities.

Ethical Issues

1) Underdevelopment in Resource-Abundant Nations

Many developing countries, including Madagascar, Myanmar, and several African states, possess substantial rare earth reserves but lack the infrastructure, expertise, and political stability necessary to fully benefit from them. As a result, foreign corporations often extract these resources with limited reinvestment in local economies, raising concerns over equitable growth and resource sovereignty. For example, Madagascar's political instability and the dominance of foreign ownership in mining projects have prevented the nation from realizing significant economic gains from its REE reserves.

1) Environmental Consequences

The extraction and processing of REEs are closely linked to environmental degradation, including radioactive waste, soil contamination, and water pollution. In countries with weak regulatory frameworks, the environmental toll can be particularly severe. Myanmar offers a stark example, where unregulated rare earth mining—often controlled by military-backed groups—has caused large-scale ecological destruction, displacement of local communities, and long-term environmental risks. These practices raise serious ethical questions about sustainability and responsibility in the global REE supply chain.

Major Parties Involved and Their Views

Member States

China – The largest producer and processor of rare earth elements. Can use its dominance as a geopolitical tool, including export restrictions.

United States – Seeks to reduce reliance on China by investing in domestic production and forming supply partnerships. But still lacks sufficient processing capacity.

Japan and South Korea – Major importers for the semiconductor and EV industries. Both pursue diversification (Ex. Japan's investment in Lynas, Australia).

European Union – Aims for strategic autonomy through the Critical Raw Materials Act (2023)

Australia and Canada – Politically stable emerging suppliers; investing in refining infrastructure and attracting foreign partnerships.

Brazil – Possesses substantial reserves but faces regulatory and environmental challenges.

Russia and Ukraine – Resource-rich but geopolitically unstable, mostly because of war

Developing Nations (DRC, Madagascar, Malawi) – Hold untapped reserves but lack investment, infrastructure, and environmental governance capacity.

International Organizations and Bodies

United Nations Environment Programme (UNEP) – Addresses environmental sustainability and responsible resource extraction, especially in developing nations.

World Trade Organization (WTO) – Oversees trade disputes, such as China's rare earth export restrictions (Ex. 2012 WTO case filed by the U.S., Japan, and EU).

OECD – Works on supply chain transparency, environmental standards, and responsible mining frameworks.

International Energy Agency (IEA) – Publishes critical mineral outlooks and advocates for resilient clean energy supply chains.

Timeline of Relevant Resolutions, Treaties and Events

March 13, 2012

The United States, the European Union, and Japan formally filed a WTO complaint against China over its rare earth export restrictions.

March 26, 2014

WTO dispute panel rules that China's export restrictions on rare earths violate international trade rules.

December 31, 2014

China officially removes its rare earth export quotas and replaces them with an export licensing system.

January 2015

WTO Appellate Body upholds the ruling against China, finalizing the dispute outcome.

May 19, 2015

China launches the "Made in China 2025" initiative, aiming to dominate strategic tech sectors reliant on REEs.

August 9, 2022

The United States signed the CHIPS and Science Act into law, which includes measures supporting the domestic critical mineral supply.

August 1, 2023

China enforces new export controls on gallium and germanium, materials essential to chip and solar tech production.

Evaluation of Previous Attempts to Resolve the Issue

1. WTO Dispute Resolution (2012–2015)

In 2012, the United States, the European Union, and Japan filed a complaint to the WTO against China's export restrictions on rare earths. The WTO ruled in favor of the complainants in 2014, and the decision was upheld in 2015. Although China formally removed its export quotas, it maintained dominance through domestic subsidies and control over processing capacity. The ruling had a limited long-term impact on market dynamics.

2. Domestic Investment Initiatives (U.S., Australia, EU)

Countries such as the United States and Australia have invested in developing their own REE mining and processing capacity. Notably, the U.S. Department of Defense began funding domestic

processing projects starting in 2020 under the Defense Production Act. Australia's Lynas Corporation has become a key non-Chinese supplier. However, high costs, environmental concerns, and long development timelines have slowed progress.

3. Strategic Policy Responses (CHIPS Act, EU Raw Materials Alliance)

In 2022, the U.S. passed the CHIPS and Science Act, which includes support for domestic critical mineral supply chains. Similarly, the European Union launched the European Raw Materials Alliance (ERMA) in 2020 to diversify sourcing and reduce supply chain vulnerabilities. These policies represent forward-looking efforts, but most are still in early stages or have yet to show measurable impact.

4. Recycling and Circular Economy Efforts

Several countries have encouraged the recycling of rare earths from electronic waste. While promising in theory, rare earth recycling remains limited in scale due to technological and economic barriers.

Possible Solutions

Diversification of Supply Sources

Diversifying supply sources is a crucial step toward reducing the overconcentration of supply in China and thus stabilizing the global rare earth market. One way is to encourage international investment in underdeveloped but resource-rich countries such as Malawi, Madagascar, and the Democratic Republic of Congo. Multilateral partnerships should be established to provide infrastructure, technical expertise, and governance training in these nations. This not only expands global supply but also fosters long-term stability for reserve-potent countries, ultimately leading to a more balanced and secure international supply chain.

- Encouraging international investment in underdeveloped but resource-rich countries.
  - Malawi, Madagascar, DRC, etc
- Establishing multilateral partnerships to provide infrastructure, technical expertise, and governance training in developing nations.
- This can reduce overconcentration in China by expanding global supply and building capacity where reserves already exist.

Strengthening Domestic Processing

Expanding domestic processing in countries such as the United States, Canada, and Australia can also strengthen the international REE supply chain. Governments can play a pivotal role by subsidizing

the establishment of processing plants and offering tax incentives or risk-sharing mechanisms to encourage private companies to enter the rare earth element (REE) processing sector. Currently, even when rare earths are mined outside of China, the majority of global processing takes place within China, giving it a dominant position in the value chain. By investing in domestic sectors, other countries can reduce this dependence, creating a more competitive and resilient market.

Technology transfer and cooperation

Creating international technical cooperation is essential for the responsible and sustainable development of REEs. Many resource-rich countries lack the advanced technology, expertise, or regulatory structures necessary to extract and process REEs efficiently. Establishing multilateral collaborations can accelerate capacity building and promote higher environmental and safety standards across the industry. In the long term, international cooperation can ensure that the benefits of REE development are shared more equitably among participating nations.

International reserves

Establishing multinational strategic reserves of rare earth elements under the guidance of a global organization, such as the IEA, would provide an additional safeguard against supply disruptions. By encouraging member states to maintain coordinated national stockpiles, especially for sectors that rely heavily on rare earths, countries can better manage shortages and reduce vulnerability to market volatility or geopolitical pressures. In addition, by pooling resources and coordinating release mechanisms during crises, such a framework could stabilize prices, ensure access to critical technologies, and reinforce the principle of shared security in an increasingly interconnected global economy.

Trade Agreements and Multilateral Frameworks

Developing trade agreements and multilateral frameworks specifically for REEs can help create a more stable and rule-based global market. With REE-specific trade agreements, similar to international energy treaties, countries can establish clear rules to regulate production, export, and access to these critical resources. Such agreements would reduce the likelihood of export restrictions being used as political leverage, while also ensuring greater predictability and fairness in global trade.

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