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Rare-Earth Elements and Geopolitical Supply Chain Dynamics: How can the EU Successfully Navigate between Cooperation and Competition with China and the United States?

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Quando pensi che c'è una scorciatoia per arrivare dove vuoi arrivare, hai già fallito. Non devi puntare al successo, devi puntare al lavoro.

Se pensi che puoi saltare quel lavoro per arrivare al successo, il successo non arriva se è effimero.

Il cammino è il bello, non è la meta, è il cammino che ti forma e se tu non fai quel cammino non sei neanche in grado di gestire la meta.

(Giorgia Meloni)

Thesis Pitch

Please, access the Pitch Video presenting my thesis answering the research question "How are rare-earth elements reshaping geopolitical and economic dynamics between the European Union, China, and the United States?" via this link: https://youtu.be/w4TOvbuUI0Y

Statuary Declaration

I hereby declare that I have composed the present thesis autonomously and without use of any other than the cited sources or means. I have indicated parts that were taken out of published or unpublished work correctly and in a verifiable manner through a quotation. I further assure that I have not presented this thesis to any other institute or university for evaluation and that it has not been published before.

10/07/2026
Sara Tria

Sara Tria

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To my family: Mom, Dad, and my sister, who learned to say goodbye, knowing I would be leaving. You showed me, without ever saying it, that loving someone sometimes means letting them go. Whenever I came home, even just for a few days, everything was still there: the warmth, the noise, the scent. That was my constant, no matter where I was. Thank you for believing in me, even when I found it hard to believe in myself. This thesis belongs to you too.

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feeling lost, to trust myself in languages that were not my own, to find beauty even in instability. It was not always easy. There were evenings when the distance was heavy, when I wished I were somewhere else, when I wondered whether any of it was really worth it.

It was worth it.

This thesis proves that you can believe in something enough to build your whole journey around it. It shows that you can be far from everything you love and still come back, each time, more complete than before.

"Not until we are lost, in other words not until we have lost the world, do we begin to find ourselves." -Henry David Thoreau

Abstract

Rare earth elements (REEs) are essential to both green and digital transitions, functioning as critical inputs for renewable energy technologies, electric vehicles, advanced manufacturing, and defence systems. Rising demand for these resources, coupled with the concentration of global supply chains in refining and processing activities, has elevated REEs from industrial commodities to strategic geopolitical assets. This shift has heightened concerns regarding economic security, supply-chain resilience, and strategic dependence among major global actors.

This thesis analyzes the ways in which the structure of REE supply chains is reshaping geopolitical and geo-economic relations among the European Union, China, and the United States. Utilizing the concepts of structural power and geo-economics, the study analyzes how control over key stages of the value chain generates asymmetric dependencies and strategic leverage. The research methodology integrates a review of relevant literature with a comparative case study analysis of China, the United States, and the European Union, drawing on qualitative and quantitative data from official documents, international organizations, academic sources, and industry reports.

The findings indicate that control over refining and processing capacity, rather than resource ownership alone, represents the primary source of power within the global REE system. China's dominance in these strategic segments enables significant influence over global supply chains, whereas the United States has responded with diversification efforts and strategic partnerships. The European Union is identified as the most vulnerable actor, facing structural dependencies that are unlikely to be resolved in the short term.

The thesis concludes that complete supply-chain autonomy is neither feasible nor desirable for the European Union. Instead, it is recommended that the EU pursue a strategy of managed dependency, emphasizing domestic capacity-building, recycling and circularity initiatives, diversified partnerships, and enhanced resilience to future supply disruptions.

Abbreviations

*in order of appearance in the text

REE / REEs	Rare Earth Element(s)
EU	European Union
IEA	International Energy Agency
CSIS	Center for Strategic and International Studies
HREE	Heavy Rare Earth Element(s)
GCMO	Global Critical Minerals Outlook
CRMA	Critical Raw Materials Act
CDI	Concentration and Dependency Index
HHI	Herfindahl-Hirschman Index
ECB	European Central Bank
WTO	World Trade Organization
OECD	Organisation for Economic Co-operation and Development
NdFeB	Neodymium-Iron-Boron
EV	Electric Vehicle
SASAC	State-owned Assets Supervision and Administration Commission
CREG	China Rare Earth Group
MIC 2025	Made in China 2025
BRI	Belt and Road Initiative
UNIDO	United Nations Industrial Development Organization

DoD	Department of Defense (United States)
NDAA	National Defense Authorization Act
MSP	Minerals Security Partnership
CLEPA	European Association of Automotive Suppliers
GATT	General Agreement on Tariffs and Trade
ECL	Export Control Law
MOFCOM	Ministry of Commerce (China)
MIIT	Ministry of Industry and Information Technology (China)
JOGMEC	Japan Organization for Metals and Energy Security
LKAB	Luossavaara-Kiirunavaara Aktiebolag

List of Figures

List of Tables

Table of contents

1. Introduction

1.1. Context

Until recently, rare earth elements (REEs) were known mainly to specialists, such as chemists, geologists, and materials scientists and engineers. In the 21st century, however, REEs have gained broader attention in the media because (1) the public has become aware of the crucial, specialized properties REEs provide to modern technologies, (2) China dominates the production and supply of REEs, and (3) much of the world depends on China for its REE needs.

Since the late 1990s, China has supplied about 85–95 percent of the world's REEs. In 2010, the country announced plans to cut REE exports. During this same period, global use of REEs rose sharply. These elements are key components in many high-tech products, including smartphones, digital cameras, computer hard drives, fluorescent and LED lights, flat-screen televisions, computer monitors, and other electronic displays. Significant amounts of certain REEs are also used in clean energy and defense technologies. Because REEs are so important, technologically advanced nations such as Japan, the United States, and members of the European Union expressed serious concern over China's announcement. As a result, exploration efforts to identify economically viable REE deposits and bring them into production have expanded.

Today, rare-earth elements are at the epicenter of a global scramble for energy security. Experts continue to debate the confusing terminology and geopolitical complexities that surround these resources, whose extraction and production have long shaped international dynamics. Once overlooked, REEs shot to global prominence in 2010, when China's restrictions on rare earth exports to Japan signaled a new era of strategic competition. Now, the world's major powers race to secure these materials with digital and green technologies converging as a prerequisite for sustainability. Against this backdrop, the critical question emerges: where do rare-earth elements fit in the new world order?[1]

[1] International Energy Agency (IEA), Rare Earth Elements 2025, IEA, Paris, 21 May 2025. https://www.iea.org/reports/rare-earth-elements-2025. Licence: CC BY 4.0.

1.2. The Problem: Structural Dependency and the Limits of Current Responses

The strategic and academic literature has begun to grapple seriously with REE supply chains, but significant gaps remain. Most analyses treat REE dependency either as a technical supply chain problem to be resolved through diversification or as a geopolitical hazard to be managed through stockpiling and allied partnerships. What is missing is a framework that systematically connects supply-chain structure to geopolitical power, one that explains not only what the dependency looks like but also how it functions as a mechanism of influence, and why existing responses have so far been insufficient.

China today accounts for approximately 60% of global mining output for magnet rare earths, 91% of global refining and separation capacity, and 94% of sintered permanent magnet production.[2] No other country operates the full integrated chain from ore to finished magnet at commercial scale. The April 2025 export controls on seven heavy rare earth elements and their escalation in October 2025 into a comprehensive licensing framework crystallized the stakes. The IEA estimated that full implementation would put USD 6.5 trillion per year in downstream production at risk globally, with the United States and European Union each facing direct losses exceeding USD 1.5 trillion.[3] The European Parliament described China's position as quasi-monopolistic and explicitly characterized the measure as coercive.[4] Yet despite these warnings, no single country outside China currently possesses all the prerequisites: feedstock access, cheap energy, advanced infrastructure, technical expertise, regulatory clarity, and political stability to replicate its integrated position independently.[5]

Table 1.1 — China's Market Share Across the REE Value Chain (2024, with 2035 Projections)

Supply Chain Stage	China Share 2024	Ex-China Share 2035 (proj.)	Gap Severity	IEA Source
Mining (magnet REEs)	**~60%**	~40% (improving)	Manageable	REE 2025

[2] IEA, Rare Earth Elements 2025. China's share of global refining for magnet rare earths: approximately 91%; sintered permanent magnet production: approximately 94%.
[3] IEA, "With New Export Controls on Critical Minerals, Supply Concentration Risks Become Reality," IEA Commentary, October 23, 2025. https://www.iea.org/commentaries/with-new-export-controls-on-critical-minerals-supply-concentration-risks-become-reality.
[4] European Parliament, "Commission Must Tackle China's Export Restrictions on Rare Earth Elements," July 10, 2025. https://www.europarl.europa.eu/news/en/press-room/20250704IPR29456.
[5] Gracelin Baskaran and Meredith Schwartz, "Developing Rare Earth Processing Hubs: An Analytical Approach," CSIS, Washington D.C., 28 July 2025. https://www.csis.org/analysis/developing-rare-earth-processing-hubs-analytical-approach.

Refining / Separation	**~91%**	~25% projected	Critical	REE 2025
Permanent Magnet Production	**~94%**	<20% projected	Severe	REE 2025
HREE Separation (Dy, Tb)	**~99%**	Near zero	Extreme	CSIS 2025
All critical minerals (avg)	**~70%**	Slow progress expected	High	GCMO 2025

Source: IEA, Rare Earth Elements 2025 (REE 2025); IEA, Global Critical Minerals Outlook 2025 (GCMO 2025); Baskaran & Schwartz, CSIS (2025). HREE separation figure refers to 2023 data.

The European Union represents the most acute instance of this structural problem. Its import dependency on China for certain rare earth compounds approaches 98%. Its domestic processing capacity is negligible. Its policy response, the 2024 Critical Raw Materials Act, sets ambitious targets for domestic extraction, processing, and recycling by 2030, but the structural gap between ambition and capability remains large.[6] Understanding how the EU arrived at this position, what options it realistically faces, and how it can navigate between a China it depends on and a United States it partners with is the central analytical challenge this thesis addresses.

Table 1.2 — Timeline of China's major REE export control actions (2006–2025).

Year	Policy Action	REEs / Materials Affected	Market Impact
2006	Introduction of export quotas	All REEs	Limited global supply; upward price pressure
2010	Temporary de facto export ban to Japan	Nd, Dy (and others)	700% dysprosium price spike; WTO dispute
2011	Reduction of export quotas	All REEs	Continued price volatility across REE categories
2015	Removal of quotas (post-WTO ruling)	All REEs	Short-term stabilization; licensing maintained

[6] European Commission, Critical Raw Materials Act, Regulation (EU) 2024/1252, Official Journal of the European Union, 3 May 2024.

2018–2020	Threats during the US-China trade war	Critical minerals broadly	Strategic uncertainty; market disruption risk
April 2025	Export licensing controls	Sm, Gd, Tb, Dy, Lu, Sc, Y + compounds + magnets	Sharp export drop; automotive shutdowns
October 2025	Escalation of controls	Expanded categories	Institutionalized regulatory leverage mechanism

Sources: Demir et al. (2026); IEA (2024); Tam & Durmuş (2026).

1.3. Research Question and Sub-questions

The central research question guiding this thesis is:

How are rare-earth elements reshaping geopolitical and economic dynamics between the European Union, China, and the United States?

To explore this question in depth, the following sub-questions structure the analysis:

- How does China's dominance in REE extraction and, above all, refining affect global power relations?
- How do REE supply chains generate new vulnerabilities, commercial coercion, and forms of strategic pressure?
- How can the EU reduce dependence and increase strategic resilience while pursuing cooperation with China and the United States?
- What tools do the United States and the European Union use to diversify supply and secure access to critical minerals?
- What long-term governance models, if any, could emerge in a context of fragmented and unstable bilateral arrangements?
- To what extent do existing global governance frameworks, including WTO rules, constrain or enable state strategies in rare-earth supply chains?

1.4. Hypothesis

This thesis advances the hypothesis that rare-earth element supply chains have evolved into strategic infrastructures that amplify geopolitical asymmetries. Control over key stages of the value chain, particularly refining and processing, generates structural power and enables forms of economic coercion.

While diversification strategies and international cooperation can mitigate certain risks, the European Union remains structurally constrained by its limited control over critical segments of the supply chain and by the erosion of effective multilateral governance. As a result, its ability to act strategically is shaped by persistent dependencies and by the broader dynamics of competition between China and the United States.

1.5. Methodology and Scope

This research adopts a comparative case study methodology focusing on three key actors: China, the United States, and the European Union. These cases are selected because they represent distinct positions within the global rare-earth element (REE) supply chain, respectively characterized by control, strategic response, and structural vulnerability. China is analyzed as the central node of the global REE system, with particular attention to its dominance in refining and processing and its use of export controls and industrial policy as instruments of geo-economic strategy. The United States is examined as a reactive actor pursuing diversification, domestic capacity building, and strategic partnerships to reduce its dependence on Chinese supply chains. The European Union is analyzed as the most structurally vulnerable actor, seeking to reconcile its ambitions for strategic autonomy with persistent external dependencies. This comparative framework enables the identification of how supply-chain structures translate into different forms of power, vulnerability, and strategic behavior across actors.

The research relies on a combination of primary and secondary sources. Primary sources include official policy documents and institutional materials such as European Commission communications, the Critical Raw Materials Act, Council conclusions, and European Parliament reports. For the United States, relevant sources include the Department of Energy and the Department of Defense strategies, as well as national security and industrial policy frameworks. For China, the analysis draws on official policy announcements, export control measures, and regulatory developments. In addition, documents from international organizations such as the OECD, IEA, World Bank, and WTO are used to contextualize global supply-chain dynamics and governance constraints. Secondary sources include peer-reviewed academic literature, think tank analyses, and industry reports.

The research adopts a mixed qualitative–quantitative approach within a comparative political economy framework. The quantitative component provides a factual description of the evolution of REE supply chains over time, focusing on production shares, refining capacities, trade flows, and dependency patterns. The qualitative component analyses how these structures generate geopolitical outcomes, particularly regarding strategic leverage, economic coercion, and vulnerability. The empirical analysis focuses on the period from late 2023 to mid-2026, capturing the latest policy developments, while a historical perspective contextualizes the evolution of current structural conditions. The scope is limited to the interactions among China, the United States, and the European Union, while other actors are considered only when relevant to supply-chain diversification and partnership strategies.

1.6. Thesis Roadmap

This thesis is divided into seven chapters.

- **Chapter 2** reviews the literature, bringing together academic debates on REE supply chains, structural power, geo-economics, and EU strategic autonomy. It also highlights the main gaps that this research aims to address.
- **Chapter 3** introduces the analytical and theoretical framework, defines key concepts like structural power and asymmetric interdependence, and explains the comparative political economy approach used in the analysis.
- **Chapter 4** explains the material and technical foundations of the REE supply chain and presents three case studies. These include China's shift from passive accumulation to using supply chain dominance as a tool, the United States' security-focused response and efforts to diversify with allies, and the European Union's structural weaknesses, policy responses, and the difference between the goals of the Critical Raw Materials Act and actual progress.
- **Chapter 5** compares the strategies of the three actors and points out the structural differences in processing capacity, response times, and policy tools that shape the EU's strategic choices.

- **Chapter 6** looks at legal and governance issues, including the WTO framework, national regulations in China, the United States, and the European Union, and the limits of multilateral rules for managing sensitive supply chains.
- **Chapter 7** draws together the thesis's findings and offers a policy-oriented assessment of how the EU can navigate between cooperation and competition in an increasingly contested geopolitical environment.

2. Literature Review

2.1. Introduction to the Literature

Rare-earth elements (REEs) have garnered significant scholarly attention as both critical industrial inputs and strategic resources within broader geopolitical and economic contexts. Their significance is attributed primarily to the structure of their supply chains, which are highly concentrated and technically complex, particularly in the downstream stages of refining and processing, rather than to geological scarcity. Consequently, REEs have transitioned from niche commodities to essential components in advanced manufacturing, energy transition technologies, and defense systems.[7]

Recent studies demonstrate a shift from a primarily resource-based perspective to a more systemic approach that links supply-chain organization, state strategies, and global power relations. There is a broad consensus that supply-chain concentration, especially in refining and processing, constitutes the principal source of both vulnerability and strategic leverage.

Within this framework, China is consistently identified as the dominant actor, though interpretations vary between economic and geopolitical analyses of its influence. Concurrent research investigates the responses of the United States, primarily framed in terms of security and diversification, and the European Union, frequently characterized as structurally vulnerable and seeking to enhance resilience through policy initiatives. Another strand of literature addresses global governance, emphasizing tensions between World Trade Organization (WTO) rules and the growing use of strategic and industrial measures in critical-raw-material markets.

This review covers four key areas:

[7] International Energy Agency (IEA), Rare Earth Elements 2025, IEA, Paris, 21 May 2025. https://www.iea.org/reports/rare-earth-elements-2025.

- the transformation of REEs into strategic resources and the significance of supply-chain organization;
- the role of refining and processing as central sources of structural power;
- the strategies and positions of China, the United States, and the European Union;
- the implications for global governance and the limitations of existing institutional frameworks.

Through this review, the thesis aims to provide an analytical foundation for understanding how REE supply chains influence geopolitical relations and policy constraints in an increasingly contested global environment.

2.2. Discussion of the Literature

2.2.1. Rare-Earth Elements as Strategic Resources: From Industrial Inputs to Geopolitical Assets

REEs are essential components in renewable energy, electric vehicles, and defence applications. Their strategic relevance derives not from physical scarcity but from the organisation of their supply: extraction, separation, and refining are technically complex, environmentally costly, and highly concentrated in a small number of countries. This concentration transforms REEs from industrial inputs into strategic assets, when a limited number of actors control critical stages of the supply chain, access becomes uneven and potentially conditional. The transition from commodity to geopolitical instrument is not inherent to the material itself but results from the structure of the supply chain, as demonstrated most clearly by China's export halt to Japan in 2010 and the escalating controls of 2023–2025.

2.2.2. Supply-Chain Structure and the Strategic Importance of Refining and Processing

The REE value chain runs from extraction through separation, refining, and component fabrication. Extraction is geographically distributed; downstream stages are not. Refining and processing require advanced technology, substantial investment, and specialised expertise that cannot be replicated quickly, they are the bottlenecks where control is most effective and most durable. Even countries with significant deposits depend on external actors for processing, which shifts strategic competition from resource possession to transformation capacity. The IEA's 2025 assessment captures this precisely: China holds approximately 60% of global mining for magnet REEs, but 91% of global refining and 94% of sintered permanent magnet production. The value chain does not diversify as it deepens, it concentrates.

Table 2.1 — The REE Value Chain: Stages, Actors, and Technical Barriers

Stage	Key Process	Dominant Actor(s)	Value Added	Technical Barrier
Mining	Open-pit or in-situ leaching	China 60%, USA 11%, AUS 13%	Low	Low–Moderate
Concentration	Crushing, froth flotation	Co-located with mines	Low–Med	Moderate
Separation	Solvent extraction (100s of steps)	China ~91%	High	Very High
REO Production	Calcination, precipitation	China dominant	High	High
Metal & Alloy	Metallothermic reduction	China dominant	Very High	High
Magnets	Sintering, bonding, coating	China 94% of sintered magnets	Very High	Very High

Source: Author's elaboration based on IEA, Rare Earth Elements 2025; Baskaran & Schwartz, CSIS (2025); SFA (Oxford), Rare Earth Processing & Refining (2024).

2.2.3. China's Dominance in the REE Sector: Economic Efficiency, Industrial Policy, or Geopolitical Leverage?

China's centrality in the global REE system results not from geological endowment but from the deliberate construction of processing and refining capacity over three decades. Scholarly and policy analyses identify three key drivers: sustained state support, sectoral consolidation, and the capacity to internalize environmental and technological costs that market-based competitors could not absorb. When downstream activities are centralized in a single actor, dependency endures even if mining is diversified globally; China's dominance is a form of structural control established through industrial policy and technological lock-in, not resource possession alone.

The literature presents two interpretations of China's REE policy: one emphasizing economic and developmental motivations, industrial consolidation, environmental management, transition to higher-value production, and one emphasizing strategic leverage, treating dominance as a geo-economic asset enabling asymmetric pressure in trade and technology disputes. These readings are not mutually exclusive. Industrial capability, once established, generates geopolitical leverage. Export controls mark the point at which this transition becomes explicit: the European Parliament characterized China's April 2025 restrictions as coercive, and the OECD has documented a sharp increase in export restrictions on critical raw materials since then.

2.2.4. The United States' Response: Securitization, Diversification, and Allied Supply Chains

The United States has progressively reframed REEs as a national security concern, embedding them in critical minerals strategies to reduce exposure to Chinese supply disruptions. Domestic reshoring has followed, though it remains partial: the Department of Defense has supported capacity-building in processing, but structural constraints, cost, environmental regulations, technological gaps, prevent a complete supply chain reconfiguration.

To complement reshoring, the US has pursued friend-shoring: restructuring supply chains around politically aligned partners, including Australia and Canada, through frameworks such as the Minerals Security Partnership. The objective is not autarky but distributed resilience, replacing a single concentrated supplier with a network of trusted partners across extraction and processing stages.

2.2.5. The European Union: Vulnerability, Strategic Autonomy, and Resilience-Building

The EU is the most structurally vulnerable actor in the REE supply chain: almost entirely dependent on China for refined materials and downstream components, with negligible domestic processing capacity. The ECB's Occasional Paper No. 311 confirms this through its Concentration and Dependency Index framework, for both light and heavy REEs, the EU exceeds all three dependency thresholds simultaneously: high import concentration, near-total absence of domestic alternatives, and no substitutability.

The EU's policy response, centered on the Critical Raw Materials Act and its 2030 benchmarks, frames REEs within a broader strategic autonomy agenda and promotes external diversification through partnerships with aligned resource-rich countries. Yet a structural gap persists between ambition and capability, constrained by limited industrial capacity, stringent regulatory standards, and fragmented coordination among member states. The ECB's 2025 Economic Bulletin is unequivocal: China supplies 70% of EU direct REE imports, over 80% of large European firms are within three supply-chain steps of a Chinese producer, and the 2025 export controls demonstrated that Beijing is prepared to use this position as an active instrument of economic statecraft.

Table 2.2 – The CDI Framework: Reading Import Dependency for Critical Raw Materials

Indicator	Measures	Threshold (highest dependency)	Meaning for REEs
CDI1 – Import concentration (HHI)	Supplier concentration	> 0.4	Few external suppliers; China dominant
CDI2 – Scarcity	Absence of EU domestic production	> 0.5	Almost all supply is extra-EU

CDI3 – Substitutability	Ratio of imports to domestic output	> 1	EU cannot substitute for its own production
Combined threshold	All three exceeded simultaneously	All three	Product classified as of 'highest dependency' — impossible to substitute if imports are restricted

Source: ECB Occasional Paper No 311 (IRC-OSA, 2023), Box 6, pp. 78–81. Table compiled by author.

2.2.6. Global Governance and the Limits of Multilateral Frameworks

The governance of rare-earth element supply chains highlights the limits of existing multilateral frameworks in managing strategically sensitive resources. Global trade rules, especially those of the World Trade Organization, were designed when raw materials were treated mainly as market commodities rather than geopolitical assets. However, the growing use of export restrictions, industrial policy, and security-driven measures has created tensions between formal trade rules and state behavior. While WTO disciplines formally limit export controls and discriminatory practices, enforcement remains weak, especially when states justify interventions on national security or environmental grounds.[8]

This gap between rules and practice reflects a broader shift toward fragmented governance. Instead of multilateral coordination, major actors increasingly adopt unilateral or bilateral strategies to secure access to critical materials. As a result, REE supply chains are governed less by common rules and more by strategic interaction, where cooperation coexists with competition. Multilateral frameworks remain relevant but insufficient: they provide a baseline for trade relations but do not fully capture the geopolitical dimension of critical raw materials or effectively constrain state behavior in highly concentrated and strategic sectors.

2.2.7. REEs, Interdependence, and Structural Power: Broader Theoretical Debates

[8] Juliane Proelss, Denis Schweizer, and Volker Seiler, "Do Announcements of WTO Dispute Resolution Cases Matter? Evidence from the Rare Earth Elements Market," Energy Economics 73 (June 2018): 1–23.

The literature on REEs can be situated within broader theoretical debates on interdependence and structural power. REE supply chains are explicitly framed as "strategic infrastructures" that shape power relations and constrain policy choices.

From this perspective, interdependence is not neutral. While global supply chains create mutual reliance, they are often asymmetrical, with some states occupying more advantageous positions. In the case of REEs, this asymmetry is evident in the concentration of refining and processing capacity, enabling certain actors to influence others.[9] This form of power does not rely on direct coercion but on control over critical nodes within production networks. Actors dominating these nodes can shape access, create bottlenecks, and impose constraints on dependent economies.

At the same time, the literature highlights that interdependence can generate both vulnerability and leverage. While dependent actors face exposure to supply disruptions, dominant actors risk incentivizing others to diversify and adopt strategic responses. This dynamic reinforces the idea that REE supply chains are not static but are part of an evolving system of competition, adaptation, and strategic positioning.[10]

2.3. Synthesis of the Literature

The literature agrees that the strategic relevance of rare-earth elements depends more on how their supply chains are organized than on resource availability alone. Control over key value chain stages creates uneven dependencies and different positions among actors. Interpretations diverge on whether these dynamics are driven mainly by market forces or deliberate strategic behavior. Meanwhile, interactions between major actors reflect distinct approaches to managing risk and securing access. Overall, the literature points to a system characterized by increasing strategic competition and limited effectiveness of existing governance frameworks.

2.4. Gaps in the Literature

This research aims to address several gaps:

[9] Robert O. Keohane and Joseph S. Nye, Power and Interdependence: World Politics in Transition (Boston: Little, Brown, 1977).
[10] Speaker 1, written communication to Sara Tria, 2026.

- It integrates REEs into broader analyses of geopolitical competition by linking supply-chain control to global power shifts and strategic rivalry, examining REEs as instruments of geopolitical influence and constraint.
- The research moves beyond EU vulnerability and dependency, assessing the strategic consequences of REE supply chains for the European Union and analyzing how such dependencies create economic coercion and restrict policy autonomy amid major power conflict.
- It also examines the influence of REE supply chains on diplomatic behavior, alliance formation, and strategic positioning vis-à-vis China and the United States. Through a comparative lens, the study captures the dynamic power relations around REEs and offers, in its concluding chapter, concrete policy recommendations on what the EU should do in the future and a direct response to the central research question: how can the EU successfully navigate between cooperation and competition with China and the United States.

3. Analytical Framework and Methodology

This chapter builds upon the foundations of chapters 1 and 2 by introducing the analytical and methodological tools that inform the original analysis presented from chapter 4 onward. The chapter proceeds in four steps: (i) defining the key concepts that structure the argument, situating the research within its theoretical tradition, (ii) describing the research design and data collection approach, and (iii) outlining the scope and limitations of the study.

3.1. Key Concepts

Three concepts underpin the argument presented in this thesis. Rather than serving as independent analytical tools, they function as an integrated system: structural power elucidates the architecture of the rare earth elements (REE) system; asymmetric interdependence clarifies the positioning of actors within this system; and geo-economics interprets the behavior of these actors. Collectively, these concepts form the analytical vocabulary for the empirical examination of China, the United States, and the European Union.

Structural Power. The concept of structural power, as developed by Susan Strange, denotes the capacity to shape the frameworks within which other actors operate, not through direct commands but by controlling the structures of production, finance, security, and knowledge that determine the conditions for all participants.[11] In the context of rare earth elements, structural power is exercised through control over critical stages of the supply chain, thereby significantly constraining others' available options. An actor that dominates refining and separation capacity does not require explicit ultimatums; the architecture of dependency itself enforces compliance. This form of power is enduring because it is embedded in infrastructure, accumulated expertise, and industrial scale, none of which can be replicated rapidly. As demonstrated empirically in this thesis, China's dominance in the refining and processing stages of the REE value chain exemplifies structural power in the contemporary context.

Asymmetric Interdependence. Keohane and Nye demonstrated that mutual dependence between states is seldom symmetrical; the actor less reliant on the relationship possesses

[11] Susan Strange, States and Markets (London: Pinter, 1988), pp. 24–29.

greater leverage.[12] In rare earth supply chains, this asymmetry is structural, resulting from the concentration of processing capacity at specific stages of the value chain. Consequently, even ostensibly mutual trade relationships conceal significant imbalances in bargaining power. Farrell and Newman expanded this framework with the concept of weaponized interdependence, illustrating that global economic networks are hierarchical structures in which actors at critical chokepoints can selectively impose costs on dependent partners. These costs are distributed asymmetrically because the dominant actor retains access to alternatives unavailable to the dependent actor.[13] This thesis employs the concept of asymmetric interdependence to analyze the European Union's structural position relative to China and to elucidate why the EU's policy options are more constrained than its stated ambitions indicate.

Geo-Economics. Geo-economics, as initially formulated by Luttwak and further developed by Blackwill and Harris, refers to the use of economic instruments such as export controls, investment screening, industrial subsidies, and trade policy to achieve objectives that are fundamentally geopolitical. These objectives include altering the distribution of power, constraining rivals' options, and securing strategic advantages in areas where military force is either inapplicable or insufficient.[14][15] In the context of rare earth elements, geo-economics serves as an analytical framework that clarifies the rationale behind the policy choices of all three actors examined in this thesis. China's escalation of export controls from 2006 to 2025, the United States' use of the Defense Production Act and its friend-shoring strategy, and the European Union's Critical Raw Materials Act with binding diversification targets each represent distinct forms of geo-economic statecraft. This concept enables the thesis to interpret these actions not as isolated policy decisions but as components of a coherent strategic competition.

These three concepts function as an integrated analytical system. Structural power explains the geopolitical significance of the REE system by demonstrating that control over its critical stages confers an influence that is difficult to challenge. Asymmetric interdependence

[12] Robert O. Keohane and Joseph S. Nye, Power and Interdependence: World Politics in Transition (Boston: Little, Brown, 1977), pp. 8–11.
[13] Henry Farrell and Abraham Newman, "Weaponized Interdependence: How Global Economic Networks Shape State Coercion," International Security 44, no. 1 (2019): 42–79.
[14] Edward Luttwak, "From Geopolitics to Geo-Economics: Logic of Conflict, Grammar of Commerce," The National Interest 20 (1990): 17–23.
[15] Robert D. Blackwill and Jennifer M. Harris, War by Other Means: Geoeconomics and Statecraft (Cambridge, MA: Harvard University Press, 2016), pp. 1–20.

addresses the relational aspect, illustrating how structural positions translate into leverage over specific actors, particularly the European Union. Geo-economics addresses the behavioral dimension, explaining how states utilize economic instruments to navigate, exploit, or mitigate the structural asymmetries they encounter. The subsequent empirical analysis proceeds through these three analytical registers, linking the material realities of the REE value chain to the strategic decisions of the actors involved.

3.2. Theoretical Framework

The three previously defined concepts are rooted in a specific intellectual tradition within international political economy. Rather than drawing eclectically from multiple competing theories, this research is situated within two complementary theoretical strands that together provide the interpretive framework for the analysis. The first strand examines the structure of the international economic system and the power relations it produces. The second focuses on the behavior of states within that structure, particularly how they employ economic instruments as tools of statecraft. Neither strand is sufficient in isolation: the first clarifies why rare earth elements (REEs) possess geopolitical significance, while the second elucidates how major actors respond to the conditions created by that significance.

International Political Economy and the Architecture of Structural Power. The first theoretical strand draws on the International Political Economy tradition, specifically Strange's concept of structural power and Farrell and Newman's framework of weaponized interdependence. Both frameworks share a core insight relevant to this analysis: power in the global economy is rooted not in compelling specific behaviors, but in controlling the nodes through which actors must pass to access essential goods. An actor positioned at such a node can impose costs asymmetrically, without facing equivalent exposure. This mechanism is evident in China's dominance over rare earth element (REE) refining and processing.

When applied to the rare earth element (REE) supply chain, this theoretical tradition elucidates a phenomenon that conventional trade economics cannot address: China's dominance in rare earth refining and processing constitutes a qualitatively distinct form of power from ordinary market concentration. The critical issue is not merely China's control over a large share of supply, but rather that the structure of the REE value chain positions China at a pivotal node, specifically the refining and separation stage, through which all other actors must pass to obtain materials lacking short-term substitutes. This exemplifies structural power as defined by Strange, while the progressive weaponization of this position through export controls illustrates Farrell and Newman's mechanism in practice.[16] The International Political Economy tradition offers the analytical tools to describe this phenomenon precisely, differentiate it from simpler forms of market power, and explain why diversification strategies focused solely on the mining stage fail to resolve the underlying structural issue.

Geo-Economics as a Framework for State Behavior. The second theoretical strand is based on geo-economics as developed by Luttwak, Blackwill, and Harris. This approach emphasizes the use of economic instruments such as export controls, subsidies, and investment screening to achieve fundamentally geopolitical objectives. The framework is directly applicable to all three actors examined in this thesis. China's escalation of export controls, the United States' friend-shoring strategy, and the European Union's Critical Raw Materials Act each exemplify geo-economic statecraft, in which economic tools are employed to alter structural conditions in domains where military instruments are not relevant.

This framework is directly applicable to all three actors analyzed in this thesis, enabling their policy choices to be interpreted as components of a coherent strategic competition rather than as isolated national decisions. China's three-decade consolidation of state-owned REE enterprises, its 2023 ban on the export of processing and separation technologies, and its increasingly stringent licensing regime for rare earth exports from 2025 are not conventional market interventions; rather, they are geo-economic strategies intended to entrench structural advantages and increase the cost of exit for dependent actors. The United States' invocation of the Defense Production Act, its equity investment in MP Materials, its establishment of the Minerals Security Partnership, and its bilateral framework with Australia reflect the same geo-economic logic, but from the perspective of a state aiming to reduce structural vulnerability rather than exploit it.[17] The European Union's Critical Raw Materials Act, with its binding benchmarks, strategic project designations, and single-country supply caps, constitutes a third approach: an effort to employ regulatory and industrial policy instruments

[16] International Energy Agency (IEA), Rare Earth Elements 2025, IEA, Paris, 21 May 2025. https://www.iea.org/reports/rare-earth-elements-2025. Licence: CC BY 4.0.
[17]Gracelin Baskaran and Meredith Schwartz, "Developing Rare Earth Processing Hubs: An Analytical Approach," CSIS, Washington D.C., 28 July 2025. https://www.csis.org/analysis/developing-rare-earth-processing-hubs-analytical-approach

to develop the structural capabilities currently lacking in the EU, particularly in a context where policy initiatives outpace industrial transformation.

Together, these two strands form the interpretive backbone of the thesis: the first explains why REE supply chain concentration produces geopolitical power; the second explains how states respond to it through deliberate policy choices. The hypothesis of this thesis sits precisely at their intersection.

3.3. Methodological Approach

3.3.1. Comparative Case Study Approach

This research adopts a comparative case study methodology focusing on three key actors: China, the United States, and the European Union. These cases are selected because they represent distinct and structurally differentiated positions within the global rare-earth element supply chain, respectively characterized by control, strategic response, and structural vulnerability. This structural differentiation is what makes the comparison analytically productive: it allows the thesis to trace how the same underlying dynamic (the concentration of REE processing capacity in a single actor) generates different policy responses, forms of leverage, and strategic constraints depending on each actor's position within the system.

- ***China*** is analyzed as the central node of the global REE system, with particular attention to its dominance in refining and processing and its use of export controls and industrial policy as instruments of geo-economic strategy.
- ***The United States*** is examined as a reactive actor that has progressively shifted from market dependence to securitization, pursuing diversification, domestic capacity building, and strategic partnerships to reduce its structural exposure to Chinese supply chains.
- ***The European Union*** is analyzed as the most structurally vulnerable of the three, seeking to reconcile ambitious green and digital transition targets with persistent upstream dependencies that its policy frameworks have so far been unable to resolve at the pace required.

This comparative framework facilitates the analysis of how supply-chain structures manifest as distinct forms of power, vulnerability, and strategic behavior among actors. Furthermore, it examines how interactions among these actors influence the broader geopolitical landscape of rare earth element (REE) competition. Rather than ranking actors or declaring a winner, the comparison aims to clarify the system's structural logic and evaluate the feasibility and limitations of the strategic options available to each actor, with particular emphasis on the European Union.

3.3.2. Data Collection and Sources

This research utilizes primary and secondary sources selected for their institutional authority, verifiability, and academic standing.

- Primary sources comprise official policy documents from all three actors: European Commission communications, the Critical Raw Materials Act, and the RESourceEU Action Plan for the European Union; Executive Orders, National Defense Authorization Acts, and Department of Defense strategy documents for the United States; and Ministry of Commerce regulatory announcements for China, which are used alongside corroborating international evidence due to the limited transparency of Chinese official data. Reports from the International Energy Agency (IEA), Organization for Economic Co-operation and Development (OECD), World Bank, and World Trade Organization (WTO) provide the quantitative foundation of the analysis, supplemented by industry assessments from the Center for Strategic and International Studies (CSIS), SFA Oxford, and Benchmark Minerals Intelligence.
- Secondary sources, including peer-reviewed literature, think tank analyses, and investigative journalism, are employed to interpret policy choices and contextualize findings within broader scholarly debates.
- Additionally, the research includes a written communication with a policy officer at the European Commission, who requested anonymity and is referred to as Speaker 1. This source offers practitioner-level insight into European Union policy deliberations and is evaluated with the same critical standards as other primary sources, without serving as the sole basis for any claim.

The author acknowledges the use of Claude, an artificial intelligence system created by Anthropic (Anthropic, 2026), in the preparation of this work. Specifically, AI-generated assistance was limited to language refinement and organizational editing of written content, on the basis of analysis, reasoning, and sources independently gathered and elaborated by the author. The intellectual ownership of all conceptual frameworks, empirical results, interview materials, bibliographic references, and final conclusions rests entirely with the author.

3.3.3. Scope and Limitations

The empirical analysis focuses on the period from late 2023 to mid-2026 and incorporates a broader historical perspective to trace the structural conditions underlying current dependencies. The geographic scope is restricted to China, the United States, and the European Union. Other actors are discussed only when relevant to diversification and partnership strategies, but are not examined as primary cases.

Two limitations should be acknowledged. First, Chinese rare earth element (REE) data are inherently constrained by limited official disclosure. Where figures are uncertain, corroborating evidence from international organizations is used. This limitation is addressed by using the source to supplement, rather than replace, documentary evidence. Second, the rapidly evolving nature of the subject means that some elements may reflect conditions that have since changed. This is an inherent constraint of real-time research and is acknowledged as such.

4. Case Studies

4.1. The Strategic Architecture of REE Supply Chains

Rare earth elements are 17 metallic elements, the 15 lanthanides plus yttrium and scandium, whose strategic relevance derives not from geological scarcity but from the organization of their supply. Most REEs are more abundant in Earth's crust than silver or gold; cerium alone is more plentiful than copper. The real challenge is concentration and extraction: REEs occur as trace impurities dispersed across vast volumes of rock, requiring the processing of enormous ore quantities to yield usable quantities of separated material.[18]What makes REEs irreplaceable is encoded in their electron structure. Each lanthanide adds an electron to an inner 4f orbital rather than to its outermost shell, which means the elements are chemically nearly identical, co-occur in the same deposits, and are notoriously difficult to separate, yet are physically distinct. Neodymium's 4f electrons generate magnetic fields that iron cannot replicate. Dysprosium stabilizes those magnets at high temperatures. There is no substitute, because no other element in the periodic table has that 4f shell. This is the foundation on which all geopolitical leverage ultimately rests.

The REE supply chain runs from mine to magnet through four stages: extraction, separation, metal and alloy production, and component fabrication. Geographical diversification has made some progress at the mining stage: in 2024, China accounted for approximately 69% of global REE mine production, followed by the United States at 11.5% and Australia at around 10%. But at the refining and separation stage, China's share rises to approximately 91%. For sintered permanent magnets, it reaches 94%. The value chain does not diversify as it deepens; it concentrates.[19][20]

This concentration is not a geological accident. It was built deliberately. China's southern provinces host ion-adsorption clay deposits in which heavy rare earths are loosely bound to clay minerals and are accessible through simple in situ leaching, a deposit type with no equivalent anywhere else in the world. More importantly, China developed over decades the

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[18] U.S. Geological Survey (USGS). Mineral Commodity Summaries 2025: Rare Earths. U.S. Department of the Interior, 2025, pp. 132–133. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-rare-earths.pdf

[19] China Briefing. "China's Rare Earth Elements: What Businesses Need to Know." August 29, 2025. https://www.china-briefing.com/news/chinas-rare-earth-elements-dominance-in-globalsupply-chains/ — citing USGS Mineral Commodity Summaries 2025.

[20] International Energy Agency (IEA). Global Critical Minerals Outlook 2025. Paris: IEA, 2025. https://www.iea.org/reports/global-critical-minerals-outlook-2025, Licence: CC BY 4.0.

solvent extraction chemistry required to separate chemically near-identical lanthanides into high-purity individual streams. No single country outside China currently operates the full integrated chain from ore to finished magnet at commercial scale.[21][22]

Applications span every sector of the modern economy. Neodymium-iron-boron magnets power EV traction motors (2–4 kg per vehicle) and offshore wind turbines (approximately 120 kg of neodymium and 12 kg of dysprosium per direct-drive unit). A single F-35 aircraft contains approximately 920 pounds of rare earth materials. Global end-of-life recycling rates remain below 1% because the quantities embedded in each device are microscopic and separation costs are prohibitive. Demand for magnet REEs is projected to surpass 175 kilotonnes by 2050, driven overwhelmingly by the energy transition.[23]

4.2. China: Control, Concentration and Strategic Leverage

China's role in the global REE system is qualitatively different from that of a conventional commodity exporter. While its 69% share of global mine output is notable, it is not without precedent in critical mineral markets.[24] What is exceptional is what comes after the mine. At the separation and refining stage, China's share increases to approximately 91% of global capacity. For sintered NdFeB permanent magnets, the share reaches approximately 94%.[25]This structure constitutes the core of the supply chain chokepoint: manufacturers in Germany, Japan, or the United States that assemble wind turbines or EV motors require processed oxides and magnet alloys, not raw ore, and for those products, the market is effectively a Chinese monopoly.

A frequently neglected dimension reinforces this dominance. A 2026 patent landscape report identified 22,040 global patent families filed between 2014 and 2024 in rare-earth-related technologies, with China accounting for 81% of these filings.[26] Entities seeking to establish

[21] Mackiewicz, Michael. "Rare earth elements (Part 4): Strategic resources at the intersection of geology, technology, and global responsibility." Deposits Magazine, November 29, 2025. https://depositsmag.com/2025/11/29/rare-earth-elements-part-4-strategic-resources-at-theintersection-of-geology-technology-and-global-responsibility/ — citing USGS (2024) for the 83% carbonatite figure.

[22] Gracelin Baskaran and Meredith Schwartz. "Developing Rare Earth Processing Hubs: An Analytical Approach." CSIS, Washington D.C., 28 July 2025. https://www.csis.org/analysis/developing-rare-earth-processing-hubs-analytical-approach

[23] Critical Mineral Insights – Rare Earth Elements, African Development Bank Group & Intergovernmental Forum on Mining (IGF), 2025, p. 2.

[24] U.S. Geological Survey (USGS). Mineral Commodity Summaries 2026: Rare Earths. Reston, VA: U.S. Department of the Interior, 2026. https://pubs.usgs.gov/periodicals/mcs2026/mcs2026-rare-earths.pdf

[25] International Energy Agency (IEA). Global Critical Minerals Outlook 2025. Paris: IEA, 2025. https://www.iea.org/reports/global-critical-minerals-outlook-2025, Licence: CC BY 4.0.

[26] EPO / DEPA. Patent Landscape Report: Rare Earth Technologies. 2026. Cited in Wikipedia, "Rare-earth industry in China".

independent refining or magnet manufacturing capacity will face not only existing Chinese producers but an extensive and expanding portfolio of Chinese-held intellectual property.

4.2.1. How the Dominance Was Built

China's processing dominance was developed deliberately over three decades through state subsidies, industrial consolidation, and regulatory frameworks that have proven extremely difficult to replicate. The foundation was established in the 1980s and 1990s, when the government implemented a 17% tax credit on REE exports and invested in research infrastructure through Programs 863 and 973, which supported the development of industrial-scale solvent extraction chemistry.[27] By the time international competitors began to engage seriously with the sector, Chinese producers had already secured a first-mover advantage in processing expertise, workforce skills, and equipment configurations.

The second pillar is sectoral consolidation. In 2011, the State Council established the Big Six state-owned enterprise groups, which collectively held 77 of China's 78 REE mining licenses.[28] In December 2021, three groups merged into the China Rare Earth Group (CREG), headquartered in Ganzhou, Jiangxi.[29] By 2024, only Northern Rare Earth and CREG appeared on the official production quota list. Decisions on capacity, pricing, and technology investment are now directed by the State-owned Assets Supervision and Administration Commission (SASAC), not by market mechanisms.[30]

The third pillar is accumulated process chemistry expertise. Rare earth separation requires isolating each element from chemically similar lanthanides using cascading solvent extraction circuits that demand precise control of temperature, pH, and reagent concentrations. This knowledge is largely absent at an industrial scale outside China. Chinese facilities have also historically operated under environmental standards that would not meet regulatory requirements in OECD countries, resulting in structurally lower costs that non-Chinese producers cannot easily undercut.

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[27] Oxford Institute for Energy Studies. "China's Rare Earths Dominance and Policy Responses." CE7, June 2023. https://www.oxfordenergy.org/wpcms/wp-content/uploads/2023/06/CE7-Chinas-rare-earths-dominance-and-policy-responses.pdf

[28] Baker Institute for Public Policy. "Of Chinese Behemoths: What China's Rare Earths Dominance Means for the US." December 19, 2022. https://www.bakerinstitute.org/research/chinese-behemoths-what-chinas-rare-earths-dominance-means-us

[29] SDM Magnetics. "China Rare Earth Group Undergoes Major Consolidation." January 11, 2024. https://sdmmagnetics.com/china-rare-earth-group-undergoes-major-consolidation/

[30] Oxford Institute for Energy Studies, CE7 (2023), op. cit.

4.2.2. Export Controls as Strategic Instruments

While refining dominance constitutes China's structural advantage, export controls serve as its tactical instrument. Over the past fifteen years, Beijing has employed this tool with increasing confidence and precision, transitioning from broad quota reductions to a highly calibrated licensing regime capable of exerting targeted pressure on specific countries, product categories, or end uses.

The first significant application occurred in 2006, when China began reducing REE export quotas, citing environmental protection. A subsequent 40% reduction in 2010 coincided with the Senkaku/Diaoyu Islands territorial dispute, during which Japan experienced near-complete supply disruption.[31] Rare earth prices increased tenfold within the year.[32] In 2014, the WTO ruled against China's quota regime as inconsistent with accession commitments; Beijing eliminated the quotas but introduced an export licensing system equally effective at regulating flows, supplemented by discretionary administrative delays that can extend from weeks to months depending on geopolitical conditions.[33]

In April 2025, Beijing imposed restrictions on heavy rare earths and permanent magnets, causing immediate disruptions across allied defense and industrial supply chains.[34] On 9 October 2025, China's Ministry of Commerce announced its most comprehensive revision to date, expanding controls to twelve of the seventeen REEs and requiring foreign companies to obtain Chinese licenses to export parts or components containing Chinese-sourced REE materials or produced using Chinese REE technologies.[35] According to RSIS analysis, this constituted a more sophisticated form of economic statecraft than the broad measures of 2010, precisely calibrated to exert pressure while preserving diplomatic flexibility.[36]

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[31] Yang (2022), op. cit.

[32] Navigating geopolitical risks: The impact of the Senkaku/Diaoyu Islands dispute on global rare earth markets and diversification strategies. ScienceDirect, 2025. https://www.sciencedirect.com/science/article/abs/pii/S0301420725001734

[33] IEA. "With New Export Controls on Critical Minerals, Supply Concentration Risks Become Reality." IEA Commentary, October 23, 2025. https://www.iea.org/commentaries/with-new-export-controls-on-critical-minerals-supply-concentration-risks-become-reality, Licence: CC BY 4.0.

[34] Meredith Schwartz, "Rare Earth Export Restrictions One Year Later," CSIS, April 27, 2026. https://www.csis.org/analysis/rare-earth-export-restrictions-one-year-later.

[35] SFA (Oxford). "China's Rare Earth Export Controls: Impact and Western Response." October 10, 2025. https://www.sfa-oxford.com/market-news-and-insights/sfa-china-s-rare-earth-export-controls-and-their-impact-on-global-supply-chains/

[36] RSIS Commentary. "Analysing China's 2025 Rare-Earth Export Controls." December 23, 2025. https://rsis.edu.sg/rsis-publication/rsis/analysing-chinas-2025-rare-earth-export-controls/

In January 2026, China imposed targeted restrictions on Japan following Prime Minister Takaichi's remarks on Taiwan.[37] This confirmed the qualitative shift in the October 2025 framework: Beijing now employs export controls as a precision instrument, capable of targeting individual partners for diplomatic signalling. Scholars emphasise that export controls are fundamentally distinct from tariffs: while tariffs generate price signals that markets may eventually circumvent, export controls impose absolute constraints on availability. When applied to materials without short-term substitutes and without scalable alternative processing capacity, these constraints cannot be addressed through economic mechanisms alone.[38]

Table 4.1 — China's REE export control milestones, 2006-2026

Year	Measure	Context / Effect
2006	First reduction of REE export quotas	Resource conservation framing; early market disruption
2010	40% quota cut; de facto temporary embargo on Japan	Senkaku/Diaoyu crisis; global prices spike up to tenfold
2014	WTO rules against China's quota regime	Quotas removed; replaced by licensing controls
2023	Export controls on gallium and germanium processing technologies	Extends control logic beyond REEs to semiconductors
Apr 2025	Heavy REE and permanent magnet restrictions triggered	Response to US semiconductor restrictions; allied defence chain disruptions
Oct 2025	Controls extended to parts/components containing Chinese REE materials or produced using Chinese REE technologies (extraterritorial extension later suspended one year)	Most extensive framework to date; covers 12 of 17 REEs

[37] CSIS. "China's Rare Earth Campaign Against Japan." February 25, 2026. https://www.csis.org/analysis/chinas-rare-earth-campaign-against-japan

[38] Ghori, Umair Hafeez. "The Geo-Economic Fulcrum: US-China Decoupling and the Use of Export Controls on Semiconductors and Rare Earths." Bond University, 2025. Summarised in Rare Earth Exchanges, December 5, 2025.

Jan 2026	Targeted controls applied specifically to Japan following PM Takaichi's Taiwan remarks	Confirms precision-targeting capability against individual partners (Source: The Diplomat)

Source: author's elaboration based on IEA Commentary (October 2025); CSIS (Schwartz, 2026); SFA Oxford (October 2025); RSIS Commentary (December 2025).

4.2.3. REEs within China's Broader Geo-Economic Strategy

Rare earth policy in Beijing functions as part of a broader strategic framework that employs trade, infrastructure, industrial policy, and technology as instruments of statecraft. The two most significant frameworks are Made in China 2025 (MIC 2025) and the Belt and Road Initiative (BRI). MIC 2025 established explicit targets for self-sufficiency in ten high-technology sectors (new-energy vehicles, advanced robotics, aerospace), all of which rely on REEs as critical enablers.[39] By controlling both the processing of these materials and the manufacturing of end products, China achieves a compounding competitive advantage: foreign manufacturers must compete with Chinese firms that control not only input costs but also the intellectual property embedded in those inputs.

The BRI has provided Chinese state-affiliated companies with preferential access to mining development opportunities in resource-rich economies across Africa, Central Asia, and Southeast Asia, extending China's upstream influence beyond its borders and fostering trade dependencies that enhance the effectiveness of export leverage. A 2024 UNIDO report projects that by 2030, China will account for 45% of global manufacturing value added, compared to 11% for the United States.[40] The durability of this strategy lies in its multiple instruments: export quotas, licensing requirements, state enterprise consolidation, domestic manufacturing promotion, and precision targeting of individual partners, each reinforcing the others.

4.3. The United States: Diversification and Strategic Response

The leverage described in the preceding section did not emerge in isolation. In the United States, China's consolidation of refining, magnet manufacturing, and export control authority

[39] Council on Foreign Relations. "China's Massive Belt and Road Initiative." Updated 2023. https://www.cfr.org/backgrounders/chinas-massive-belt-and-road-initiative
[40] UNIDO. World Manufacturing Report 2024. Vienna: UNIDO, 2024. Cited in Chatham House (2025), op. cit.

impacted an industrial base progressively weakened over three decades, a defense procurement system reliant on assumptions of open global markets, and a policy establishment that, throughout most of the post-Cold War era, regarded critical mineral security as a peripheral concern. When China implemented export licensing restrictions in April 2025, certain US automotive production lines ceased operations. The response in Washington was not surprise, it was a delayed acknowledgment of a vulnerability that officials had documented but largely failed to address since at least 2017.[41]

4.3.1. From Market Dependence to Securitization

Throughout most of the twentieth century, the United States was the leading global producer of rare earth elements. Mountain Pass in California supplied international markets until the 1980s. Its closure in 1998, prompted by environmental compliance costs and competition from Chinese producers benefiting from subsidies, shifted the industry's center of gravity to China within a few years. The US government did not intervene, operating under the prevailing assumption that global commodity markets would consistently supply the economy with necessary resources at competitive prices, regardless of production location.

A notable paradox emerged following Mountain Pass's resumption of production in 2017. The United States became, counterintuitively, one of the largest exporters of rare earth concentrates to China because extraction capacity was restored without corresponding investment in downstream processing infrastructure.[42] American ore was shipped to Chinese refiners, processed into separated oxides and permanent magnets, and subsequently reimported as components of manufactured goods. When China's export licensing measures in April 2025 affected US industry, the IEA described the disruptions as evidence that supply concentration risks had transitioned from theoretical to operational concerns.[43] Secretary of State Rubio publicly stated that China had "cornered the market" on rare earths and that

[41] Heidi Crebo-Rediker, "America's Most Dangerous Dependence," Foreign Affairs, 7 May 2025. https://www.foreignaffairs.com

[42] Chen, Wei-Qiang et al., "Interdependence in Rare Earth Element Supply between China and the United States Helps Stabilize Global Supply Chains," One Earth 7 (2024), 242–252. https://doi.org/10.1016/j.oneear.2024.01.011.

[43] International Energy Agency, "With New Export Controls on Critical Minerals, Supply Concentration Risks Become Reality," IEA Commentary, 23 October 2025. https://www.iea.org/commentaries/with-new-export-controls-on-critical-minerals-supply-concentration-risks-become-reality

American industrial capability was "deeply dependent on a number of potential adversary nation-states, including China, who can hold it over our head."[44]

4.3.2. REEs as a National Security Issue

The formal securitization of REEs commenced with Executive Order 13817, signed in December 2017, directing federal agencies to assess supply chain vulnerabilities in critical minerals and develop strategies to reduce import dependence.[45] Executive Order 14017, issued by President Biden in February 2021, expanded this mandate into a comprehensive government-wide review encompassing semiconductors, pharmaceuticals, batteries, and critical minerals.[46] Successive National Defense Authorization Acts mandated the gradual elimination of Chinese-sourced REEs from US defense procurement, with full implementation targeted for 2026.[47] Each F-35 Lightning II aircraft requires approximately 920 pounds of rare earth materials, including yttrium and terbium for laser targeting systems; comparable dependencies exist in precision-guided munitions, submarine sonar arrays, and radar systems.[48]

The National Defense Stockpile, valued at nearly $42 billion in critical materials at its Cold War peak, had been reduced to approximately $912 million by the early 2020s, covering only half the Pentagon's estimated defense requirements and approximately one-tenth of critical civilian infrastructure needs. The resulting funding gap is estimated at $13.5 billion.[49] In July 2025, the Trump administration acquired a 15% equity stake in MP Materials, the operator of Mountain Pass, for $400 million, making the Pentagon its largest shareholder, a structural shift from grant-based industrial policy to direct state equity participation.[50] As of the period under analysis, Mountain Pass produced no heavy rare earths domestically; commissioning of a dedicated HREE separation facility, targeting dysprosium and terbium, was scheduled for mid-2026 but had not yet reached operational scale. The separation bottleneck, the most

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[44] U.S. Department of State, Statement by Secretary of State Marco Rubio on rare earths and critical minerals, June 2025. Quoted in: International Journal of Economics, Business and Politics, vol. 10(1), 2026.
[45] Executive Order 13817, "A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals," 20 December 2017.
[46] Executive Order 14017, "America's Supply Chains," 24 February 2021. https://www.whitehouse.gov/briefing-room/presidential-actions/2021/02/24/executive-order-on-americas-supply-chains/
[47] National Defense Authorization Act (NDAA) 2020, Section 871, and subsequent amendments through NDAA 2023.
[48] Congressional Research Service, Rare Earth Elements in National Defense: Background, Oversight Issues, and Options for Congress, Report R41744, 23 December 2013. https://www.everycrsreport.com/reports/R41744.html.
[49] Crebo-Rediker (2025), citing Defense Logistics Agency Strategic Materials data.
[50] U.S. Department of Defense, "DoD Announces $400 Million Investment in MP Materials," July 2025.

strategically decisive stage of the value chain, therefore remained substantially unresolved during the period analysed.[51]

Table 4.2 – US Policy Instruments for REE Supply Chain Resilience (2017–2025)

Instrument	Administration / Year	Key Action
Executive Order 13817	Trump I, Dec 2017	Critical minerals strategy; federal supply chain vulnerability assessment mandated
Executive Order 14017	Biden, Feb 2021	100-day whole-of-government supply chain review; critical minerals alongside semiconductors and batteries
Defense Production Act investments	Biden, 2021–2024	First integrated magnet facility; lithium scale-up; R&D in mining waste recovery; non-traditional feedstocks
NDAA defense procurement mandate	2020–2023	Phased elimination of Chinese-sourced REEs from U.S. defense procurement; full implementation targeted 2026
E-VAC Magnetics agreement	DoD, Sept 2023	$94.1M for domestic rare earth permanent magnet manufacturing; high-volume production target 2025
DoD equity stake in MP Materials	Trump II, July 2025	$400M for ~15% equity stake; Pentagon becomes largest shareholder; direct state participation model
National Energy Dominance Council	Trump II, 2025	Centralized critical minerals strategy; expedited permitting; federal land access expanded for mining

Source: Author's elaboration. Executive Orders 13817 (2017) and 14017 (2021); NDAA 2020–2023; U.S. DoD press releases (2022, 2023, 2025); Crebo-Rediker, Foreign Affairs (2025).

4.3.3. Strategic Partnerships and Friend-Shoring

Domestic capacity-building addresses only part of the challenge. The lack of allied refining and processing infrastructure outside China has prompted a parallel strategy: the intentional restructuring of supply chains around politically aligned partners, friend-shoring.[52] The

[51] U.S. Department of Defense, Office of the Assistant Secretary of Defense for Industrial Base Policy, "Department of Defense Enters an Agreement to Expand Domestic Manufacturing to Strengthen U.S. Supply Chains for Rare Earth Magnets," 19 September 2023. https://www.defense.gov/News/Releases/Release/Article/3529874/

[52] Vivoda, V. and Matthews, R. (2023), as cited in: Energy Economics 146 (2025), 108496. https://doi.org/10.1016/j.eneco.2025.108496.

institutional embodiment of this strategy is the Minerals Security Partnership (MSP), launched in June 2022 and comprising thirteen countries plus the European Union.[53] The MSP functions as a coordination mechanism: a framework through which member governments align public investment, mitigate risks in private financing, and identify priority projects across the critical mineral value chain.

Australia has become the most significant bilateral partner. On 20 October 2025, President Trump and Prime Minister Albanese signed the United States–Australia Framework for Securing Supply in the Mining and Processing of Critical Minerals and Rare Earths, committing both governments to mobilize at least USD $1 billion in financing within six months and establishing a rapid-response mechanism co-chaired by the US Secretary of Energy and the Australian Minister for Resources.[54] Canada has participated in processing cooperation under the Defense Production Act, and Brazil's monazite reserves have been drawn into US resource diplomacy, though Brazil's resource-nationalist stance on domestic processing complicates a straightforward extraction partnership.

The limitations of friend-shoring warrant direct acknowledgment. ECB model-based assessments indicate that friend-shoring increases costs and generates new dependencies, even while mitigating certain geopolitical risks.[55] Peer-reviewed research adds further complexity: heightened geopolitical risk does not necessarily reduce Chinese supply dominance; a one-percent increase in the global geopolitical risk index correlates with a 3.8-tonne rise in rare earth permanent magnet exports, partly because China may strategically expand output in response to competitive pressures, undercutting the economics of alternative projects before they reach commercial viability. The Critical Materials Future Act, introduced in bipartisan form in 2024, would authorize the Department of Energy to provide price floors, advance market commitments, and forward contracts to eligible processing projects, but as of mid-2026, had not been enacted.[56]

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[53] U.S. Department of State, Minerals Security Partnership, launched June 2022. https://www.state.gov/minerals-security-partnership/

[54] United States–Australia Framework for Securing of Supply in the Mining and Processing of Critical Minerals and Rare Earths, signed 20 October 2025. https://www.whitehouse.gov/briefings-statements/2025/10/united-states-australia-framework-for-securing-of-supply-in-the-mining-and-processing-of-critical-minerals-and-rare-earths

[55] Energy Economics 146 (2025), 108496. https://doi.org/10.1016/j.eneco.2025.108496.

[56] Crebo-Rediker (2025). The Critical Materials Future Act (2024), proposed in bipartisan form, would authorise the Department of Energy to offer price floors, advance market commitments, and forward contracts to eligible rare earth processing projects.

Since 2017, the United States has established a policy framework centered on securitization, diversification, and allied supply chains. The industrial capacity these policies are intended to foster remains underdeveloped. The structural power identified in the preceding section as stemming from China's dominance in refining and processing has not shifted; it has merely been recognized.

4.4. The European Union: Vulnerability and Strategic Constraints

The European Union occupies a distinctive position within the global rare earth supply chain. While it ranks among the world's largest consumers of technologies reliant on rare earth elements (electric vehicles, wind turbines, defense systems, and semiconductors) it exerts minimal control over the upstream supply chain. The EU does not engage in large-scale mining, refining, or the commercial production of permanent magnets. Its primary strength lies in manufacturing advanced finished products that depend on these inputs. This combination of advanced industrial end-use without corresponding upstream capabilities defines the EU's structural vulnerability.

4.4.1. From Critical Classification to Structural Dependency

Since 2020, the European Commission has designated rare earth elements as critical raw materials, following a foresight study that identified China as the source of up to 98% of certain REE compounds consumed within the EU.[57] The Commission's criticality framework assesses two dimensions: economic importance and supply risk. A material is classified as critical when both exceed established thresholds.[58] However, the framework does not directly assess the consequences of supply disruptions: factory shutdowns, price volatility, strategic constraints. The disparity between formal designation and operational emergency was exposed by the events of 2025.

The ECB's 2023 Occasional Paper applies a more granular approach using three Concentration and Dependency Indicators: CDI1 measures import concentration; CDI2 measures scarcity of domestic alternatives; and CDI3 measures substitutability. A product

[57] European Commission: Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Critical raw materials for strategic technologies and sectors in the EU – A foresight study, Publications Office, 2020, https://data.europa.eu/doi/10.2873/58081

[58] European Commission: Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Study on the critical raw materials for the EU 2023 – Final report, Publications Office, 2023, https://data.europa.eu/doi/10.2873/725585

qualifies as of the “highest dependency" when all three thresholds are exceeded simultaneously.[59] For rare earth elements, the CDI analysis places them in the high-concentration, high-scarcity, low-substitutability quadrant. In 2019, the EU imported more than USD 15 billion worth of CRMs from extra-EU sources.[60] China emerged as the dominant supplier for antimony, barite, bismuth, graphite, magnesium, rare earths, scandium, and tungsten. Rare earths exceed all three CDI thresholds simultaneously.

The dependency is dynamic. EU demand for rare earth elements is projected to increase sixfold by 2030 and eleven- to fourteenfold by 2050, primarily driven by EV deployment and offshore wind expansion.[61] Demand for lithium and graphite is expected to grow even more rapidly. As the EU accelerates decarbonization, its reliance on materials it cannot produce domestically deepens, increasing dependence on the very supplier it aims to diversify away from. Global end-of-life recycling rates for rare earths remain below 1%, and the IEA projects that Europe will not generate sufficient end-of-life magnet feedstocks from wind turbines and EV fleets until 2030 to make recycling a meaningful supply pillar, and only if the necessary infrastructure is built well before then.[62]

4.4.2. The EU's Position in the Global Value Chain

The EU does not produce rare earth elements in commercially significant quantities. Eurostat data for 2024 indicate that the EU imported approximately 12,900 tonnes of REEs, a 29.3% decrease from 2023, reflecting reduced demand and emerging supply tensions rather than a genuine reduction in dependence.[63] China remained the largest supplier, providing 46.3% of total REE imports. Russia accounted for 28.4% and Malaysia for 19.9%. Collectively, these three countries accounted for over 94% of EU REE imports.

These headline figures, however, understate the actual exposure. Over 80% of large European firms are no more than three intermediaries removed from a Chinese REE producer. When European companies purchase processed components from South Korea, Japan, or Vietnam,

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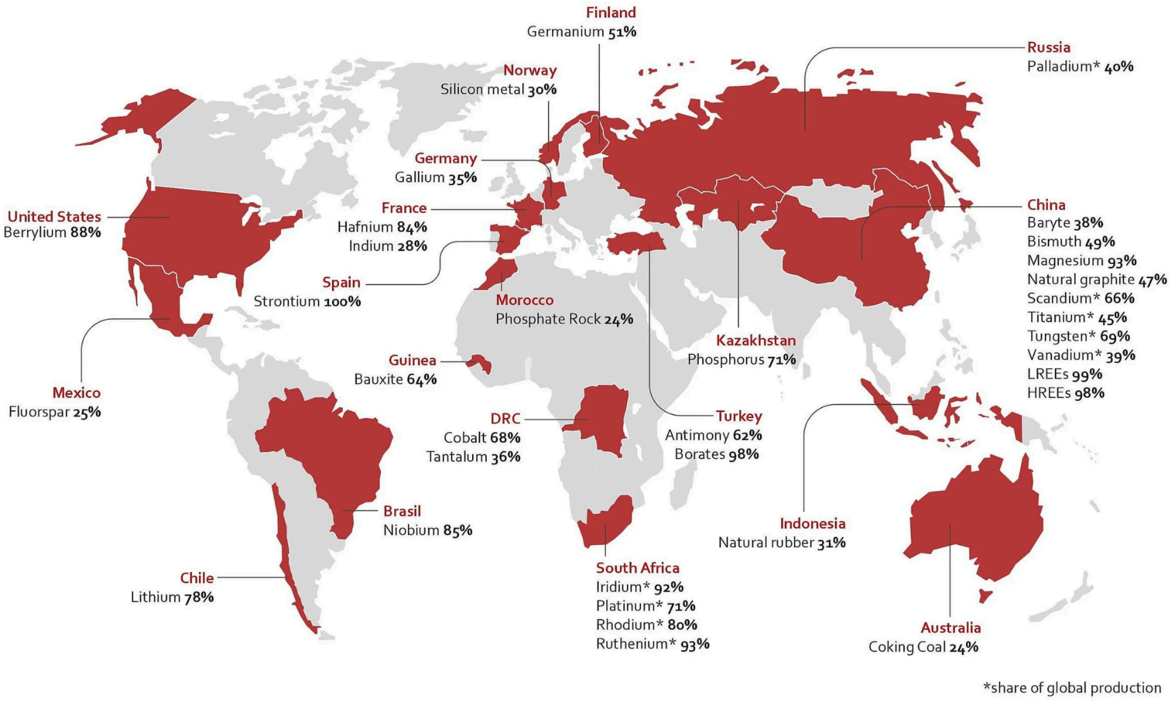
[59] IRC-OSA, ECB Occasional Paper No 311, 2023, Box 6, pp. 78–81.
[60] IRC-OSA, ECB Occasional Paper No 311, 2023, Section 2.3, p. 51.
[61] Capucine Nobletz, Romain Svartzman and Simon Dikau, "The EU's Dependency on Critical Materials," CETEX / IEP@BU Policy Report, September 2024.
[62] International Energy Agency, Rare Earth Elements: Pathways to Secure and Diversified Supply Chains, IEA Publications, 2025. https://www.iea.org/reports/rare-earth-elementfrom 2023, reflecting reduced demand and emerging supply tensions rather than a genuine reduction in dependences
[63] Eurostat, "International trade in critical raw materials", European Commission, 2025. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_trade_in_critical_raw_materials

the rare earth elements within those components typically originate in China.[64] Apparent diversification in trade statistics conceals substantial concentration further along the value chain. Nobletz, Svartzman, and Dikau (2024) of the Grantham Research Institute observe that the EU remains "far behind the curve" in critical material extraction and processing, rendering it "highly vulnerable to the impacts of strategies that critical mineral-supplying countries may implement."[65]

[64] European Central Bank, "How vulnerable is the euro area to restrictions on Chinese rare earth exports?", Economic Bulletin Focus, September 2025. https://www.ecb.europa.eu/press/economic-bulletin/focus/2025/html/ecb.ebbox202506_01~44d432008e.en.html

[65] Nobletz C., Svartzman R. and Dikau S., "The EU's dependency on critical minerals," CETEx / Grantham Research Institute, September 2024.

Figure 1. The concentration of the EU's critical raw materials imports.



Source: figure adapted from: European Commission (2020). Action Plan on Critical Raw Materials

The EU's processing capacity for REEs is minimal. A limited number of operations exist in Finland, Belgium, and France, but these do not constitute the basis of a robust industrial ecosystem. The European Commission's 2020 Action Plan reported that China supplied 99% of EU light REE imports and 98% of heavy REE imports.[66] Although Malaysia and Russia have since emerged as additional transit and processing hubs, the overall concentration of supply has not significantly improved.

4.4.3. The 2025 Export Shock: From Theory to Crisis

For many years, the EU's vulnerability to REE supply disruptions was primarily a theoretical concern. This changed in April 2025, when China imposed export licensing requirements on seven rare earth elements, including dysprosium, terbium, and gadolinium.[67] In May 2025, Chinese exports of rare-earth permanent magnets to Europe declined by approximately 75% compared with the same month in the previous year. Automotive component plants in

[66] European Commission, Action Plan on Critical Raw Materials, September 2020.
[67] European Parliament Think Tank, "China's rare-earth export restrictions", EPRS, November 2025.

Germany and Austria were compelled to shut down in June 2025 due to depleted magnet inventories.[68] CLEPA reported that only about 25% of EU applications for Chinese export licenses were successfully processed.[69] Dysprosium oxide prices tripled within weeks; terbium oxide more than doubled. One company surveyed by the European Chamber of Commerce in China anticipated costs exceeding €250 million.

In July 2025, the European Parliament adopted a resolution by 523 votes to 75, characterizing China's actions as "unjustified" and "coercive."[70] China subsequently suspended the second wave of controls in October 2025 and extended the suspension until November 2026. This provided a temporary reprieve but did not address the underlying structural issues. The ECB's analysis was unequivocal: the EU had not stockpiled rare earth elements prior to the restrictions, and its interconnected supply chains left it highly vulnerable.[71]

The structural explanation is historical. Beginning in the 1980s, China offered inexpensive REEs by absorbing the environmental and social costs of mining, prompting Western firms to withdraw from extraction and processing. European industry not only offshored raw material production but also the associated technical expertise. As Commissioner Breton acknowledged in 2023: "We lost our competitive edge in mining and processing because we have for maybe too long considered that decarbonizing meant relocating outside of the EU. We cannot replace a fossil fuel dependence with a raw material one." The asymmetry is stark: China can restrict supply within days; Europe requires nearly a decade to establish a separation facility. The supply-side coercion demonstrated in 2025 can be implemented more rapidly and decisively than any demand-side countermeasure.[72]

4.4.4. Policy Response: From CRMA to RESourceEU and Its Limits

The Critical Raw Materials Act (Regulation (EU) 2024/1252, May 2024) marks a shift from open trade to open strategic autonomy. Its four 2030 benchmarks- 10% domestic extraction, 40% domestic processing, 25% recycling, and a 65% single-country supply cap are ambitious

[68] Persistence Market Research, "China's 2025 Rare Earth Export Ban Threatens Auto Sector", June 2025.
[69] European Association of Automotive Suppliers (CLEPA), press release, 4 June 2025.
[70] European Parliament, "Commission must tackle China's export restrictions on rare earth elements", press release, 10 July 2025. https://www.europarl.europa.eu/news/en/press-room/20250704IPR29456/
[71] European Central Bank, "How vulnerable is the euro area to restrictions on Chinese rare earth exports?", Economic Bulletin Focus, September 2025
[72] MERICS Forum, "How can the EU navigate China's rare earths export controls", October 2025.

given that Europe currently sources 85–90% of its REE requirements from Chinese supply chains. RESourceEU, adopted in December 2025 in direct response to China's export controls, adds a Critical Raw Materials Center, a buyer-supplier matching mechanism, and a coordinated stockpiling strategy, projecting a 30–50% reduction in single-country dependency by 2029.

The strategy remains insufficient on four counts: environmental permitting cannot be waived, European capital markets have been withdrawing from mining for a decade, rebuilding the supply chain will take fifteen to twenty years, and the benchmarks are non-binding. As the Jacques Delors Center notes, RESourceEU "falls short of delivering a broader structural shift just yet." The policy dimension is examined in detail in Chapter 5.

5. Comparative Analysis

5.1. Methodological Note

This chapter presents a comparative analysis based on the case study evidence from Chapter 4 and applies the analytical framework established in Chapter 3. The analysis evaluates China, the United States, and the European Union across four dimensions: structural position in the rare earth elements (REE) value chain, primary policy instruments, the strategic logic underlying these instruments, and the constraints limiting their effectiveness. Rather than ranking actors or predicting outcomes, the comparison aims to identify structural asymmetries that influence the European Union's strategic options and to assess the feasibility of its available responses. Quantitative data are sourced from Chapter 4, and the interpretive framework follows the International Political Economy approach to structural power and geo-economics developed in Chapter 3.

5.2. Competing Models of Control in REE Supply Chains

The three actors examined in this thesis exemplify structurally distinct models of engagement with the global REE system, each reflecting a different theory of how to exercise or resist supply chain power.

China's model is characterized by integrated structural control. This approach relies on the accumulation of mutually reinforcing advantages throughout the value chain, including unique geological endowment in heavy rare earth element (HREE)-bearing clay deposits, state-directed industrial consolidation into two nationally controlled entities, decades of process chemistry expertise, an 81% share of global REE-related patents filed between 2014 and 2024, and a licensing system that can be adjusted to exert pressure on specific countries, sectors, or product categories without violating World Trade Organization (WTO) rules.[73] The export control escalation of 2025 exemplifies the weaponization of this model as described by Farrell and Newman: the transformation of structural position into targeted coercive leverage, applied asymmetrically against dependent actors lacking short-term alternatives.

[73] International Energy Agency (IEA). Rare Earth Elements 2025. Paris: IEA, 2025. https://www.iea.org/reports/rare-earth-elements-2025.

The United States employs a model of reactive securitization and distributed resilience. This approach has shifted from passive market dependence to formal securitization, including the designation of REEs as national security inputs in executive orders and National Defense Authorization Acts (NDAAs). The current strategy combines domestic capacity-building with the development of allied supply networks. The underlying premise is that no single country outside China can independently replicate an integrated value chain. The friend-shoring logic of the Minerals Security Partnership distributes supply chain functions among politically aligned partners rather than pursuing autarky.[74] The structural weakness of this model is visible in the Mountain Pass paradox: the United States restored extraction capacity well before corresponding refining infrastructure. A dedicated heavy rare earth separation facility targeting dysprosium and terbium was scheduled for commissioning at Mountain Pass in mid-2026, but had not yet reached operational scale during the period analysed, leaving the most strategically decisive stage of the value chain substantially unresolved.[75]

The European Union's model is defined by regulatory ambition constrained by structural dependency. The Critical Raw Materials Act (CRMA) 2030 benchmarks and RESourceEU's operational tools constitute the most comprehensive effort by a democratic polity to employ regulatory and industrial policy instruments to reshape supply chain exposure. However, the EU faces a fundamental timing challenge: available instruments such as permitting acceleration, strategic project designation, and partnership frameworks operate over decade-long timescales, whereas China's export control mechanisms can be implemented within days.[76] The 2025 export shock highlighted this operational asymmetry, as the EU's Anti-Coercion Instrument was designed for market-access disputes rather than for input denial.

5.3. Comparative Assessment

Table 5.1 — Comparative Assessment: China, the United States, and the EU in the REE System

Dimension	China	United States	European Union

[74] Gracelin Baskaran and Meredith Schwartz. "Developing Rare Earth Processing Hubs: An Analytical Approach." CSIS, July 2025. https://www.csis.org/analysis/developing-rare-earth-processing-hubs-analytical-approach

[75] Heidi Crebo-Rediker. "America's Most Dangerous Dependence." Foreign Affairs, 7 May 2025.

[76] European Commission. Critical Raw Materials Act, Regulation (EU) 2024/1252, Official Journal of the European Union, 3 May 2024.

Value chain position	Dominant processor and magnet manufacturer: 91% refining, 94% magnets	Miner without refiner: Mountain Pass extracts, China processes	Consumer without upstream: imports 94%+ of REE needs
Primary instrument	Export controls, state enterprise consolidation, IP accumulation	Securitisation, Defense Production Act, equity stakes, MSP	CRMA benchmarks, strategic projects, external partnerships
Strategic logic	Weaponise structural power; lock in downstream dependency	Reduce exposure; build allied network to bypass China midstream	Achieve strategic autonomy; balance cooperation with diversification
Key constraint	Geopolitical backlash accelerates decoupling efforts	No domestic HREE refining; processing gap persists	Non-binding targets; 15–20 year lead times; financing gap
2025 turning point	Export controls on 7 HREEs; October framework covers 12 of 17	DoD equity stake in MP Materials; US–Australia Framework signed	Factory shutdowns; EP resolution; RESourceEU adopted Dec 2025

Source: Author's elaboration based on IEA (2025); CSIS, Baskaran & Schwartz (2025); ECB Economic Bulletin (2025); European Commission CRMA (2024).

This comparison reveals three distinct asymmetries with particular clarity.

The first is a processing asymmetry. China possesses 91% of global rare earth element (REE) refining capacity and 94% of sintered permanent magnet production. The United States has partially restored mining operations but lacks significant capacity for heavy rare earth element (HREE) refining. The European Union holds virtually no capacity at any stage. This imbalance is structural rather than temporary: The IEA projects that, even with all planned expansions, refining capacity outside China will meet only approximately 25% of projected global demand by 2035. The second is a temporal asymmetry. China can restrict supply within days through administrative licensing decisions. In contrast, the United States requires several years to scale domestic processing, and even the most optimistic projections for allied

HREE separation capacity indicate meaningful output will not occur before 2027 to 2028. The European Union requires a decade or more from permitting to commercial production. This temporal mismatch between coercive capacity and defensive response constitutes the primary strategic vulnerability for both Washington and Brussels.

The third is an instrument asymmetry. China employs tools such as export controls, licensing delays, and state enterprise pricing, which are direct, administratively straightforward, and legally defensible under national security exceptions. In contrast, the United States and the European Union rely on instruments such as equity stakes, strategic project designation, partnership frameworks, and recycling targets, which are indirect, institutionally complex, and dependent on private capital mobilization and sustained political commitment. According to the European Central Bank's (ECB) model-based analysis of friend-shoring, these instruments increase costs and create new dependencies, even as they mitigate certain geopolitical risks.

6. Global Governance, WTO Rules and the Limits of Regulation

The preceding chapters traced how China, the United States, and the European Union have each built, or attempted to build, their own regulatory architecture around rare earth elements. This chapter brings those frameworks together explicitly, examining the legal instruments each actor has adopted, the extent to which the multilateral trading system constrains or fails to constrain them, and the fragmented governance landscape that has emerged as a result.

6.1. The WTO Framework and Critical Raw Materials

The multilateral trade regime has already been tested directly on rare earth export restrictions, and it has already ruled. In 2014, a WTO panel and Appellate Body found that China's export quotas, duties, and licensing requirements on REEs, tungsten, and molybdenum violated its GATT and Accession Protocol obligations.[77] The ruling rejected China's environmental justification under GATT Article XX(g), finding that the restrictions had increased rather than reduced domestic resource consumption by lowering domestic prices and that a member's sovereign right over its natural resources does not extend to controlling international markets and distribution.[78] China complied by removing the quotas, but, as the following section sets out, replaced them with a licensing architecture that has proven at least as effective at controlling flows, while remaining formally distinct from the measures the WTO had struck down.

The 2025 European Parliament resolution explicitly invokes this 2014 precedent, noting that China "has, in the past, already been found in breach" of its WTO obligations and that the 2025 measures represent "a clear pattern of action" rather than an isolated incident.[79] Yet the

[77] World Trade Organization, China — Measures Related to the Exportation of Rare Earths, Tungsten and Molybdenum, Panel Report, March 2014, and Appellate Body Report, August 2014.

[78] WTO Appellate Body Report, China — Measures Related to the Exportation of Rare Earths, Tungsten and Molybdenum, August 2014. The Appellate Body held that a member's sovereign right over its natural resources does not extend to controlling international markets and the distribution of raw materials, and that China's measures did not satisfy the Article XX(g) exception for conservation of exhaustible natural resources.

[79] European Parliament, Motion for a Resolution on Tackling China's Critical Raw Materials Export Restrictions, B10-0329/2025, 2025. The resolution notes that China has previously been found in breach of its WTO Accession Protocol commitments and Article XI(1) GATT for unjustified export restrictions on REEs, and characterises the 2025 measures as part of "a clear pattern of action."

resolution does not call for fresh WTO litigation, a telling indicator that the EU itself no longer regards the WTO route as a credible primary remedy for this category of measure.

6.2. National Regulatory Frameworks: China, the United States, and the European Union

Each of the three actors examined in this thesis has developed its own domestic regulatory architecture for rare earth elements. These frameworks are not merely implementing measures for the strategies described in Chapter 4, they are the legal instruments through which structural power, securitisation, and strategic autonomy are operationalised.

6.2.1. China: The Export Control Law and the Dual-Use Architecture

China's modern regulatory framework for REEs rests on two pillars.

- The Export Control Law (ECL), adopted in October 2020 and effective from December 2020, consolidated export-control authority under the Ministry of Commerce (MOFCOM) and introduced an explicit extraterritorial dimension, allowing China to regulate foreign-made products incorporating Chinese-origin inputs.[80]
- The Regulations on Rare Earth Management, first issued in draft form by the Ministry of Industry and Information Technology (MIIT) in January 2021, cover the entire REE supply chain, proposing strategic reserves, supply-chain traceability, and restrictions on foreign investment in REE exploration, mining, and processing.[81]

Under this architecture, REEs are formally classified as "dual-use" items, goods with both civilian and military applications, subject to the Regulations on Export Control of Dual-Use Items. The April 2025 measures on seven heavy rare earth elements were issued explicitly

[80] China's Export Control Law (ECL), adopted October 2020, effective December 2020, consolidates export-control authority under the Ministry of Commerce (MOFCOM) and introduces an explicit extraterritorial dimension. Andersen Institute, "China's Export Control Architecture and Its Use of Critical Minerals as Strategic Pressure Points," April 2026. https://anderseninstitute.org/chinas-export-control-architecture-and-its-use-of-critical-minerals-as-strategic-pressure-points/

[81] Ministry of Industry and Information Technology (MIIT), Regulations on Rare Earth Management, draft issued 15 January 2021. China-Briefing, "China Tightens Control Over Management of Rare Earths," June 2, 2021. https://www.china-briefing.com/news/china-tightens-control-over-management-of-rare-earths/ See also IEA, "Regulations on the Management of Rare Earths," policy database entry. https://www.iea.org/policies/25387-regulations-on-the-management-of-rare-earths

under the ECL and the Dual-Use Items Regulations, citing national security and non-proliferation obligations.[82] This legal basis matters: it places REE export decisions within the same self-judging national security framework that GATT Article XXI shields from meaningful multilateral review.

The October 2025 measures represented a further escalation in legal technique rather than merely in scope. Under Article 49 of the Dual-Use Items Regulations, MOFCOM asserted jurisdiction over foreign-made goods manufactured outside China that contain specified Chinese-origin rare earth materials or are produced using Chinese-origin technologies, the first practical application of this extraterritorial provision.[83] Combined with a "50% rule" extending controls to entities majority-owned by parties on China's control list, and a requirement that foreign exporters obtain MOFCOM approval even for goods containing only trace amounts of Chinese-origin REEs, this created what legal analysts described as the most extensive extraterritorial export control regime applied to any civilian materials category.[84] The extraterritorial "Foreign Product Rule" and "De Minimis Rule" were scheduled to take effect from 1 December 2025 following a grace period, before being suspended for one year alongside several other measures after bilateral talks between Chinese and US officials in Kuala Lumpur in late October 2025.[85][86]

The legal architecture is significant to the central argument because it demonstrates that China's leverage extends beyond informal administrative discretion. Instead, it is codified in primary legislation and implementing regulations that explicitly invoke national security and

[82] Sasakawa Peace Foundation, "China's Rare Earth Export Restrictions and Other Countries' Responses: Strategies for the Main Battleground of Economic Security," SPF China Observer, July 9, 2025. The 4 April 2025 measures were issued under the Export Control Law and the Regulations on Export Control of Dual-Use Items, citing national security and non-proliferation obligations. https://www.spf.org/spf-china-observer/en/document-detail062.html

[83] White & Case LLP, "China Imposes Extraterritorial Jurisdiction and a 50% Rule for Export Controls on Rare Earth Elements and Other Items," October 2025. Article 49 of China's Regulations on Export Control of Dual-Use Items permits MOFCOM to exercise extraterritorial jurisdiction over foreign-made items containing specified Chinese-origin items or technologies.
https://www.whitecase.com/insight-alert/china-imposes-extraterritorial-jurisdiction-and-50-rule-export-controls-rare-earth

[84] Center for Security and Emerging Technology (CSET), "Ministry of Commerce Notice 2025 No. 61: Announcement of the Decision to Implement Controls on Exports of Rare Earth-Related Items to Foreign Countries," November 2025. The notice requires Chinese and foreign exporters to obtain Chinese government approval to export dual-use items containing even trace amounts of certain Chinese-origin rare earths, applying to goods manufactured outside China. https://cset.georgetown.edu/publication/mofcom-notice-2025-61/

[85] Lexology, "China Introduces New Rules of Export Control on Rare Earth and Semiconductor Items," October 9, 2025. The extraterritorial De Minimis Rule and Foreign Product Rule took effect from December 1, 2025, following a grace period. https://www.lexology.com/library/detail.aspx?g=fbe6e7bd-347d-4ef3-9055-e6222e09eb82

[86] Pillsbury Law, "China Suspends Export Controls on Certain Critical Minerals and Related Items," November 13, 2025. China suspended for one year the implementation of six dual-use export-control announcements issued on 9 October 2025, following bilateral talks with the United States in Kuala Lumpur in late October 2025. https://www.pillsburylaw.com/en/news-and-insights/china-suspends-export-controls-certain-critical-minerals-related-items.html

non-proliferation grounds, which are the same categories of justification that the World Trade Organization (WTO) framework treats as largely self-judging.

6.2.2. The European Union: The Critical Raw Materials Act

The EU's principal regulatory instrument is the Critical Raw Materials Act (Regulation (EU) 2024/1252, May 2024), which establishes binding 2030 benchmarks, 10% domestic extraction, 40% domestic processing, 25% recycling, and a 65% single-country supply cap for strategic raw materials including REEs for magnets, alongside Strategic Project designation and accelerated permitting procedures.[87] RESourceEU, adopted in December 2025 in direct response to China's export controls, supplements the CRMA with a Critical Raw Materials Centre, a buyer-supplier matching mechanism, and a coordinated stockpiling strategy.[88]

As established in Chapter 4, the European Union's regulatory framework differs fundamentally from that of China in its legal character. The Critical Raw Materials Act (CRMA) sets policy targets supported by procedural facilitation, rather than enforceable obligations accompanied by sanctions for non-compliance. This approach represents a deliberate institutional choice that reflects both the European Union's internal competence structure, in which extraction and industrial policy remain under significant member state authority, and its preference for market-based instruments instead of command-and-control regulation. As further examined in Chapter 7, the result is that the European Union's regulatory framework operates according to a fundamentally different enforcement logic than China's. It incentivises compliance rather than mandating it, and its implementation timeline is measured in years, whereas China's licensing decisions are typically made within weeks.

6.2.3. The United States: Procurement Restrictions and Allied Frameworks

The United States has not adopted a single comprehensive REE regulatory statute comparable to the CRMA or China's Export Control Law. Instead, its framework operates primarily through defence procurement restrictions and bilateral or plurilateral partnership agreements.

[87] European Commission, Critical Raw Materials Act, Regulation (EU) 2024/1252, Official Journal of the European Union, 3 May 2024.
[88] Jacques Delors Centre, "The EU's critical raw materials predicament: ReSourceEU to the Rescue?" December 2025.

- Successive National Defense Authorization Acts (NDAA 2020 Section 871, with amendments through NDAA 2023) mandate the phased elimination of Chinese-sourced rare earth materials from US defence procurement, with full implementation targeted for 2026.[89]
- The Minerals Security Partnership, launched in June 2022 with thirteen countries plus the EU, coordinates public investment and risk mitigation across the critical mineral value chain among politically aligned partners.[90]
- Bilateral frameworks, such as the United States-Australia Framework for Securing Supply in Critical Minerals and Rare Earths signed in October 2025, establish dedicated financing and rapid-response mechanisms outside any multilateral structure.[91]

This regulatory approach reflects the friend-shoring logic described in Chapter 4: rather than a domestic command-and-control framework, the United States constructs a network of procurement rules and partnership agreements that collectively aim to exclude Chinese-origin materials from strategically sensitive supply chains, without claiming the extraterritorial reach that characterises China's 2025 measures.

6.3. Limits of Multilateral Regulation and Emerging Fragmented Governance

Three structural features explain why multilateral rules have proven insufficient for REE governance specifically. First, the national security exception under GATT Article XXI is essentially self-judging, and China's 2025 framework is explicitly grounded in national security and non-proliferation law, placing it squarely within this exception's scope. Second, dispute settlement operates on a timescale of years, while the leverage China exercises through licensing delays operates on a timescale of weeks: by the time any WTO ruling could be issued, the immediate economic damage, factory shutdowns, contract renegotiations, price shocks, has already occurred and cannot be undone by a future verdict.[92]

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[89] National Defense Authorization Act (NDAA) 2020, Section 871, and subsequent amendments through NDAA 2023, mandating the phased elimination of Chinese-sourced rare earth materials from U.S. defense procurement, with full implementation targeted for 2026.

[90] Department of State, Minerals Security Partnership, launched June 2022.

[91] United States–Australia Framework for Securing of Supply in the Mining and Processing of Critical Minerals and Rare Earths, signed 20 October 2025.

[92] IEA, "With New Export Controls on Critical Minerals, Supply Concentration Risks Become Reality," IEA Commentary, October 23, 2025.

Third, and most fundamentally, WTO rules were designed for a trade order in which raw materials were treated as ordinary commodities subject to market discipline, traded across borders between identifiable buyers and sellers. They were not designed for a regime that asserts jurisdiction over foreign-made products manufactured outside the exporting country's territory on the basis of trace material content, the situation created by China's October 2025 Article 49 measures. Even a fully favourable ruling under the existing framework could not address a control mechanism that operates, by design, outside the conventional categories of cross-border trade in goods that WTO law was built to regulate.

In the absence of an effective multilateral remedy, governance of REE supply chains has shifted toward overlapping bilateral and club-based arrangements. The Minerals Security Partnership, the US-Australia critical minerals framework, and the EU's CRMA strategic partnerships each operate as self-contained regimes with their own membership criteria, financing instruments, and standards, coordinating supply security among aligned states rather than establishing universal rules.

This fragmentation reproduces at the governance level the same asymmetry identified throughout this thesis. Farrell and Newman's account of weaponised interdependence applies equally to governance architecture: an actor with structural power can codify that power into binding domestic law with extraterritorial reach and need not seek multilateral cover, while structurally dependent actors, the EU foremost among them, have an interest in building rule-based coalitions precisely because they lack the unilateral leverage to act alone.[93] The result is a two-tier system: a residual WTO framework that addresses only the narrowest category of REE measures, and which neither China nor the EU currently treats as a credible primary remedy, and a growing layer of plurilateral arrangements among like-minded states that substitute for, rather than reform, multilateral governance. Whether this fragmented architecture can deliver the supply chain resilience that formal rules have failed to guarantee is the question the EU's strategic choices, examined in the final chapter, must ultimately answer.

[93] Henry Farrell and Abraham Newman, "Weaponized Interdependence: How Global Economic Networks Shape State Coercion," International Security 44, no. 1 (2019): 42–79.

7. Recommendations to the EU and Conclusions

This thesis has examined how rare earth elements are reshaping the geopolitical and economic relationships among the European Union, China, and the United States. More specifically, it has explored how the EU can effectively navigate the balance between cooperation and competition with the two dominant powers in the global rare earth element system. The preceding chapters have established the structural conditions of this system, analyzed the strategies of the three actors, and assessed the regulatory architecture and governance frameworks that influence their interactions. This final chapter synthesizes these findings, first outlining recommended actions for the EU based on the analysis, and then addressing the central research question.

7.1. Future Directions for the European Union

The central finding of this thesis is that the European Union faces a structural challenge rather than a policy failure. The dependency in question has developed over decades, operates through complex mechanisms that cannot be quickly reversed by any single policy instrument, and is actively sustained by a state with both the capacity and intent to use it as leverage. This analysis suggests that the realistic objective for the EU is not supply chain autonomy, which remains unattainable within any foreseeable policy horizon, but rather the strategic management of an unavoidable dependency. The following recommendations are structured according to this revised perspective.

7.1.1. Prioritise the Midstream, Not the Mine

The EU risks a major strategic error if it measures progress by extraction rather than processing. As this thesis demonstrates, the main bottleneck in the REE value chain is refining and separation, not mining, which is also the EU's weakest area. The CRMA's target of 40% domestic processing by 2030 is the most strategically important of its four goals, yet it remains the most challenging to achieve.[94] The EU should focus its limited resources on a few

[94] European Commission, Critical Raw Materials Act, Regulation (EU) 2024/1252, Official Journal of the European Union, 3 May 2024. https://eur-lex.europa.eu/eli/reg/2024/1252/oj

viable, co-located refining and separation hubs, as seen in CRMA Strategic Projects like CAREMAG in France and the LKAB ReeMAP project in Sweden, instead of spreading capital across the entire chain.[95] Establishing a single operational HREE separation facility in Europe would reduce structural vulnerability more effectively than opening several new mines whose output would otherwise be sent abroad for processing.

7.1.2. Treat Circularity as Strategic Infrastructure

Recycling is an area where the EU holds a structural advantage. As Europe's first generation of wind turbines and electric vehicles reaches end-of-life, the continent is expected to generate about half of the world's end-of-life magnet feedstock by 2030.[96] This represents a strategic asset, not just a waste-management issue. The RESourceEU amendment to the CRMA, which restricts the export of permanent magnet scrap and incentivises the recovery of magnet manufacturing waste, is a positive step. However, it should be complemented by mandatory recycled-content requirements and product passports to ensure magnets are traceable and recoverable by design.[97][98] Pilot projects such as REEPRODUCE[99] and REMHub shows that a closed European magnet-recycling loop is technically feasible. The priority is to scale these initiatives to industrial volume before the feedstock wave arrives. If the EU misses this opportunity, it will export end-of-life magnets to China for recycling, perpetuating the same dependency seen in primary supply.

7.1.3. Convert Demand and Standards into Bargaining Power

The EU's comparative advantage in the rare earth elements (REE) sector is not in upstream production. Instead, it lies in its significant industrial demand, strong regulatory standards, and its role within a network of like-minded economies. The EU should actively use these strengths as strategic tools. Through the Minerals Security Partnership and the US-Australia

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[95] European Council, Critical Raw Materials infographic. https://www.consilium.europa.eu/en/infographics/critical-raw-materials/

[96] International Energy Agency, Rare Earth Elements: Pathways to Secure and Diversified Supply Chains, IEA, 2025. The IEA projects that by 2030 Europe will generate approximately 50% of global end-of-life magnet feedstocks from wind turbines and 25% from EV motors.

[97] European Commission, RESourceEU Action Plan, adopted 3 December 2025. https://circulareconomy.europa.eu/platform/en/news-and-events/all-news/european-commission-adopts-resourceeu-action-plan See also Commission press release IP/25/2891.

[98] European Commission, RESourceEU Action Plan, December 2025. The plan introduces a targeted amendment to the CRMA expanding product labelling requirements and incentivising the recycling of permanent magnet manufacturing waste, including scraps, trimmings, and defective products.

[99] https://cordis.europa.eu/project/id/101057733

framework, the EU represents the largest coordinated demand bloc outside China and offers the most advanced regulatory system for sustainability and traceability.[100] To leverage this position, the EU should aggregate demand by coordinating joint purchasing through the new Critical Raw Materials Centre. This approach can help mitigate offtake risk, which currently discourages private investment in non-Chinese processing capacity.[101] Establishing a guaranteed European market for responsibly produced, non-Chinese REEs is more effective than subsidies, as it addresses the core challenge: the lack of buyers willing to pay a premium for secure supply, rather than issues related to geology.

7.1.4. Build Buffers and Binding Force

Two final actions address the EU's most significant vulnerabilities. First, the absence of strategic reserves left the EU without buffer inventory during the 2025 export shock, exposing manufacturers within weeks.[102] The coordinated stockpiling strategy and the Critical Raw Materials Centre should be implemented following the model of Japan's JOGMEC, a central body with the authority and budget to hold strategic reserves and conduct joint purchasing, rather than remaining a coordination forum without operational capacity. Second, the CRMA's enforcement architecture is weak. The benchmarks are non-binding, and the 65% single-country cap lacks an enforcement mechanism. As the Jacques Delors Centre notes, the framework "falls short of delivering a broader structural shift just yet."[103] If the EU is committed to strategic autonomy, it must make these targets binding. A target that no one is required to meet is a statement of intent, not a policy.

Table 7.1 — A Five-Pillar Strategic Agenda for the EU

Pillar	Recommended Action	Time horizon
1. Build midstream capacity	Prioritise refining and separation over extraction; concentrate financing on a small	Medium (5–10 yrs)

[100] United States–Australia Framework for Securing of Supply in the Mining and Processing of Critical Minerals and Rare Earths, signed 20 October 2025.
[101] European Parliament, Critical Raw Materials Centre, Legislative Train Schedule. https://www.europarl.europa.eu/legislative-train/theme-a-new-plan-for-europe-s-sustainable-prosperity-and-competitiveness/file-critical-raw-materials-centre
[102] ECB Economic Bulletin, Issue 6/2025, "How vulnerable is the euro area to restrictions on Chinese rare earth exports?". https://www.ecb.europa.eu/press/economic-bulletin/focus/2025/html/ecb.ebbox202506_01~44d432008e.en.html
[103] Jacques Delors Centre, "The EU's critical raw materials predicament: ReSourceEU to the Rescue?" December 2025.

	number of viable processing hubs rather than dispersing it across the value chain	
2. Scale circularity	Treat magnet recycling as strategic infrastructure, not waste policy; mandate recycled content and product passports; restrict magnet scrap exports	Medium (5–10 yrs)
3. Position within allied networks	Deepen integration with the MSP and US–Australia framework; convert EU demand and standard-setting power into bargaining leverage	Short (1–5 yrs)
4. Build strategic buffers	Operationalise the coordinated stockpiling strategy and the Critical Raw Materials Centre as a JOGMEC-style central purchasing and reserve body	Short (1–5 yrs)
5. Add binding force	Strengthen the enforcement architecture behind the CRMA benchmarks and the 65% cap; treat them as binding obligations, not aspirational targets	Short–medium

Source: Author's elaboration based on the analysis developed in Chapters 4–6, the CRMA (Regulation (EU) 2024/1252), and the RESourceEU Action Plan (2025).

These five pillars are unified by a common rationale. None seeks autonomy, as autonomy is currently unattainable. Instead, each pillar is designed to increase the cost to China of exercising leverage, while reducing the cost to Europe of resisting such pressure. This approach aims to gradually shift the asymmetry of interdependence in favor of the European Union. As one Commission practitioner noted, the primary challenge for the EU is not identifying appropriate policies, but rather maintaining the political coherence necessary to implement them consistently across member states and electoral cycles[104]. The necessary instruments are now in place; however, it remains uncertain whether the resolve to apply them with discipline will persist once the immediate pressures of the 2025 crisis subside[105].

[104] Speaker 1, written communication to Sara Tria, 2026.
[105] Robert Schuman Foundation, "Towards a Sovereign and Resilient Europe: The Urgent Need for a Comprehensive Security Doctrine," European Issues no. 821.

7.2. Answering the Question: Cooperation or Competition?

The central question of this thesis concerns how the European Union (EU) can effectively navigate the dynamics of cooperation and competition with China and the United States. The analysis demonstrates that the EU is not faced with a binary choice; rather, it is structurally required to engage in both cooperation and competition simultaneously, depending on the partner and the specific segment of the value chain involved.

The EU's relationship with China is characterized by unavoidable, asymmetric, yet mutual interdependence. Decoupling from Chinese processing is not feasible in the foreseeable future, and any abrupt attempt would likely cause greater immediate harm to European industry than to China. Consequently, cooperation, maintaining trade, sustaining diplomatic engagement, and avoiding escalation that could provoke retaliation, is a necessity in the short term. However, this cooperation should be pursued from a position of managed dependency rather than passive exposure. The EU must engage with China while concurrently developing alternative capacities that, over time, diminish China's leverage. The events of 2025 illustrated both the risks of dependency and its limitations; Beijing's willingness to suspend controls under bilateral pressure demonstrated that escalation imposes costs on both parties.

The EU's relationship with the United States is defined by strategic alignment tempered by significant unpredictability. Both actors share an interest in mitigating Chinese dominance, and initiatives such as the Minerals Security Partnership and related frameworks provide the EU with its most viable route to distributed resilience. Nevertheless, the United States also competes for the same limited non-Chinese resources, implements tariff policies that can undermine the multilateral trust essential for cooperation, and pursues a securitized, domestically oriented agenda. The EU's strategic objective with respect to Washington is to strengthen collaboration on supply chain resilience while maintaining sufficient autonomy to prevent replacing dependence on China with reliance on an unpredictable ally.

Thus, successful navigation, as posed in the thesis title, should be understood not as a fixed endpoint but as an ongoing strategic posture. This entails cooperating with China to address immediate challenges, collaborating with the United States and allied partners to shape future outcomes, and systematically developing European capabilities in processing, circularity, and strategic reserves. These efforts are essential for transforming the EU from a passive participant in global strategic competition to an actor with its own leverage. While the European Union may not be positioned to dominate the rare earth sector, it can avoid continued disadvantage by adopting this approach, which constitutes a realistic benchmark for success given its current circumstances.

This thesis has demonstrated that rare earth supply chains function as strategic infrastructures that intensify geopolitical asymmetries, and that control over refining and processing confers structural power independent of direct confrontation. The European experience exemplifies these dynamics: despite its wealth and technological sophistication, the EU has become strategically vulnerable due to the configuration of a value chain it previously expected market forces to govern. Whether the EU can apply the lessons of the past five years to develop the disciplined and sustained strategy required for the coming decade remains, at the conclusion of this analysis, an open question, though it is now a thoroughly examined one.

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