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The New Dynamic of Global Competition: The Technological Utilization of Rare Earth Elements and Their Impact on International Relations

Küresel Rekabetin Yeni Dinamikliği: Nadir Toprak Elementlerinin Teknolojik Kullanımı ve Uluslararası İlişkiler Üzerindeki Etkisi

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Abstract

Aim: *This study aims to analyze the technological utilization, global reserve distribution, and production structures of rare earth elements (REEs), as well as the structural concentration and vulnerability of their supply chains, and to evaluate their implications for international relations, geopolitical power dynamics, and economic dependency. The study examines the strategic consequences of China's dominance in global REE production and processing and develops policy recommendations regarding Türkiye's potential integration into global value chains.*
Method: *The research is designed as a secondary-data-based study employing a structured descriptive and comparative content analysis. Quantitative and qualitative datasets obtained from internationally recognized institutions, including the International Energy Agency (IEA), the U.S. Geological Survey (USGS), European Commission reports, and relevant national authorities, were systematically analyzed to assess reserve distribution, production concentration, and sectoral utilization patterns.*
Results: *The findings demonstrate that REEs have evolved beyond their role as industrial raw materials and have become strategic instruments of global power projection. The high concentration of global production and processing capacity in China generates significant supply security risks and structural economic dependencies for advanced economies. While Türkiye's declared reserve potential in Beylikova represents a substantial strategic opportunity, limitations in domestic processing capacity and high value-added manufacturing constitute major structural challenges.*
Conclusion: *REEs have emerged as strategic commodities at the center of twenty-first-century geoeconomic competition, particularly in the contexts of energy transition, defense industries, and digital technologies. Ensuring sustainable supply security requires not only reserve diversification but also the development of refining capabilities, recycling technologies, and multilateral cooperation mechanisms. Türkiye's ability to position itself as a reliable actor in global REE markets depends on the formulation of an integrated national strategy.*
Originality: *This study contributes to the literature by approaching REEs through an interdisciplinary framework that integrates technological, geoeconomic, and international relations perspectives, thereby moving beyond purely geological or technical analyses.*
Key Words: *Rare earth elements, geopolitical competition, international relations, supply security, economic dependency.*

Öz

Amaç: *Bu çalışma, nadir toprak elementlerinin (NTE'ler) teknolojik kullanımını, küresel rezerv dağılımını ve üretim yapılarını, ayrıca tedarik zincirlerinin yapısal yoğunlaşmasını ve kırılganlığını analiz etmeyi ve bunların uluslararası ilişkiler, jeopolitik güç dinamikleri ve ekonomik bağımlılık üzerindeki etkilerini değerlendirmeyi amaçlamaktadır. Çalışma, Çin'in küresel NTE üretim ve işleme kapasitesindeki hâkimiyetinin stratejik sonuçlarını incelemeyi ve Türkiye'nin potansiyelinin küresel değer zincirine entegrasyonu bağlamında politika önerileri geliştirmeyi hedeflemektedir.*

Yöntem: *Araştırma, ikincil verilere dayalı betimsel ve karşılaştırmalı içerik analizi yöntemi ile tasarlanmıştır. Uluslararası Enerji Ajansı (IEA), ABD Jeoloji Araştırmaları Kurumu (USGS), Avrupa Komisyonu raporları ve ulusal kurum verileri temel alınarak küresel rezerv, üretim ve sektör bazlı kullanım verileri sistematik biçimde analiz edilmiştir.*

Bulgular: *NTE'lerin yalnızca ileri teknoloji üretiminin temel girdileri değil, aynı zamanda küresel güç projeksiyonunun stratejik araçları haline geldiğini göstermektedir. Küresel üretim ve işleme kapasitesinin büyük ölçüde Çin'de yoğunlaşması, gelişmiş ekonomiler açısından ciddi tedarik güvenliği riskleri ve ekonomik bağımlılıklar doğurmaktadır. Türkiye'nin Beylikova sahasında ilan edilen yüksek rezerv potansiyeli ise önemli bir fırsat sunmakla birlikte, işleme teknolojileri ve katma değerli üretim kapasitesi konularında yapısal eksiklikler barındırmaktadır.*

Sonuç: *NTE'ler, enerji dönüşümü, savunma sanayi ve dijital teknolojiler bağlamında 21. yüzyılın stratejik hammaddeleri olarak küresel jeoekonomik rekabetin merkezine yerleşmiştir. Sürdürülebilir tedarik güvenliği için yalnızca rezerv çeşitlendirmesi değil; işleme kapasitesi geliştirme, geri dönüşüm teknolojileri ve çok taraflı iş birliği stratejileri kritik öneme sahiptir. Türkiye'nin bu alanda başarılı olabilmesi, entegre bir ulusal strateji geliştirmesine bağlıdır.*

Özgünlük: *NTE'leri yalnızca jeolojik ve teknik bir konu olarak değil; uluslararası ilişkiler, güvenlik politikaları ve ekonomik bağımlılık çerçevesinde bütüncül bir perspektifle ele alarak literatüre disiplinlerarası bir katkı sunmaktadır.*

Anahtar Kelimeler: *Nadir toprak elementleri, jeopolitik rekabet, uluslararası ilişkiler, tedarik güvenliği, ekonomik bağımlılık.*

Introduction

The rapid advancement of science, technology, and industrial production globally has profoundly impacted the methodologies used by states in strategic frameworks related to natural resources (Barteková and Kemp, 2016, p. 153). In the modern political and economic landscape, raw materials used in high-value-added domains, such as digitalization, artificial intelligence, development of materials, renewable technologies, electric as well as autonomous automobiles, and defense, have moved beyond market competition to attain considerable geopolitical significance. Within this context, rare earth elements (REEs) are now at the heart of world politics due to their outstanding significance in highly sophisticated industrial processes (Zhao et al., 2025, p. 7011). Described as "the seeds of technology" and "industrial gold," REEs occupy an important position in the strategic architectures of modern economies (Opare et al., 2021, p. 9; Chen et al., 2022, p. 1).

REEs are essential inputs in a wide range of high-technology applications, including permanent magnets, lasers, smartphones, wind turbines, military radar systems, and electric vehicle motors. This multifunctional role positions REEs simultaneously as scientific assets and strategic resources (Alonso et al., 2012, p. 1; Chen et al., 2022, p. 2). In the literature, they are commonly classified as “critical minerals,” reflecting not only their economic importance but also their relevance for national security and international relations, particularly due to supply risks, market concentration, and the limited availability of viable substitutes (Shuai et al., 2023, p. 1; Abbadi and Mucsi, 2024, p. 2).

China has emerged the main actor playing a critical role in the international production and supply chain of REEs (Sanglier-Contreras et al., 2025, p. 1). With the policies state-led, China has acquired dominance of about 70% in REEs production within the global economy since the 1990s (Mancheri et al., 2019, p. 102; U.S. Geological Survey, 2025, p. 145). This dominance has generated both economic advantages and significant geopolitical leverage. China's strategic use of REEs as an instrument of economic statecraft became evident during the 2010 diplomatic dispute with Japan, when export restrictions were imposed. The crisis was triggered by a collision between a Chinese fishing vessel and Japanese Coast Guard ships near the Senkaku/Diaoyu Islands, resulting in the arrest of the Chinese captain by Japanese authorities. The disagreement stemmed from two interrelated issues: Japan viewed the incident primarily as a legal matter, applying its national laws to the collision, whereas China perceived Japan's actions as a violation of its territorial sovereignty. In response, China restricted REEs exports to Japan, using its dominant position in critical materials as a tool of diplomatic and economic leverage. This episode illustrates how conflicts over sovereignty can intensify into economic coercion when one party possesses strategically vital resources (Bradsher, 2010, p. 1; Klinger, 2019, p. 2; Vekasi, 2019, p. 2). This event culminated in high price volatility and raised concerns about the supply reliability of these elements. In response, major global actors—including the European Union (EU), the United States (US), Japan, and South Korea-have started adopting REEs into their strategic policy agendas. These nations have used strategies of diversification, including stockpiling and alternative supply chains, in order to reduce their dependence on the Chinese supply chains and processing of these elements (Yua, et al., 2022, p. 1; Cheilas et al., 2025, p. 2).

Beyond their technological utility, the limited number of countries capable of economically viable REE extraction and processing have turned these materials into the position of geopolitical assets (Dang, et al., 2021, p. 523). So, the strategic importance of the REEs spans beyond mining and materials engineering into sustainable supply chains, recycling strategies, domestic manufacturing capability, and long-term technology and industrial policies.

This study employs a structured secondary-data methodology to systematically analyze the technological utilizations of REEs and their impact on international relations through an interdisciplinary approach. The study will assess the global reserve and production distribution of REEs, the effects of these components on global power dynamics and their role in diplomatic crises, and proposes targeted political and strategic recommendations for Türkiye. The purpose of the study is to highlight the diverse relevance of REEs not only in scientific and technological terms, but also in international politics and security. The study seeks to answer the question: how do the technological uses, global production patterns, and geopolitical significance of REEs influence international relations, and what policy implications can be drawn for decision makers? Additionally, it aims to contribute to the literature by providing an integrated scientific assessment of REEs from a material-oriented and technical-economic perspective.

Literature Review

Studies on REEs demonstrate that these materials have become increasingly critical not only for high-technology production but also for technology policies and international relations. A unifying theme across the literature is that REEs are no longer viewed merely as strategic raw materials; rather, they are conceptualized as fundamental components of geoeconomic power projection and technological supremacy. The competition surrounding REEs has thus evolved from traditional resource-centered debates into a struggle shaped by technological dominance, supply-chain control, and structural dependency relations.

Within this framework, Murphy and Johnston (2025) interprets China's REEs strategy not as a simple exercise in resource control but as a form of geostrategic leverage constructed through export regulations, supply-chain dominance, and technology-oriented industrial policies. According to Murphy, these mechanisms generate a structural dependency particularly for the US and its allies, positioning REEs as an increasingly important instrument of China's foreign policy influence.

According to Woods (2025), China's advantage stems not only from its reserves and production capacity but also from the establishment of patent-dense midstream processes, technical standard-setting power, and accumulated tacit knowledge. These factors create structural entry barriers for follower states, transforming REEs competition into a form of rivalry defined by institutionalized technological asymmetry rather than by price or output.

In the context of supply security, Salim et al.'s (2022) contribution is particularly significant. Salim conceptualizes the REEs supply chain as a highly uncertain and complex socio-technical system, arguing that risk analysis, criticality assessment, and resilience frameworks must be considered jointly. Although circular-economy initiatives, recycling technologies, domestic production, and supply diversification strategies carry strategic importance, Salim emphasizes that the current global power configuration limits their short-term effectiveness.

Liu et al. (2025), looking from the perspective of international trade and geopolitical interaction, demonstrate that global REEs trading networks are highly sensitive to levels of geopolitical cooperation and conflict. According to Liu's findings, nations should abandon short-term transactional approaches and instead develop an integrated, multidimensional framework for REEs trading.

İncekara (2025), argues that the China-centric supply chain creates strategic vulnerabilities for many countries, and conceptualizes REEs as essential components of power, security, and strategic autonomy in the 21st-century global economy.

Günsan (2024), on the other hand, approaches the REES ecosystem from the perspective of industrial policy and economic security. Günsan argues that national REEs strategies must go beyond ensuring secure access to raw materials and should instead incorporate domestic production capacity, technology-transfer mechanisms, and regional cooperation models.

When assessed in its entirety, the literature indicates that competition over REEs converges around three core analytical dimensions. First, REEs possess disproportionate geostrategic significance, such that even marginal supply disruptions can reverberate across global production systems. Second, structural power in the REEs supply chain stems less from raw material availability and more from control over processing technologies, intellectual property, and specialized technical capabilities. Third, China's entrenched leadership in these domains limits other states' diversification and domestic capacity-building efforts, reinforcing a persistent pattern of asymmetric dependence. Collectively, these dynamics position REEs as foundational elements shaping the geoeconomic architecture of the twenty-first century.

This study differs from previous research by providing a comprehensive and integrated assessment of REEs that simultaneously examines their technological functions, global reserve and production structure, supply-chain concentration, geopolitical implications, and Turkey's strategic positioning. Unlike earlier works, which typically analyze REEs from a single perspective (such as geopolitics, supply security, technology, or economics), this research unifies these dimensions within an interdisciplinary international political economy framework. Moreover, it offers a country-specific, policy-oriented evaluation for Türkiye, linking global REEs dynamics with national capabilities, vulnerabilities, and strategic opportunities-an angle that the existing literature has not systematically developed.

Definition, and Classification of REEs

REEs comprises fifteen elements in Group 3B of the periodic table, commencing with Lanthanum (La) and concluding with Lutetium (Lu), alongside Scandium (Sc) and Yttrium (Y), which exhibit analogous physical and chemical characteristics to this group. Elements ranging from Lanthanum (La) to Samarium (Sm) are categorized as light REEs, whilst Yttrium (Y) and those from Europium (Eu) to Lutetium (Lu) are classified as heavy REEs (Cheisson and Schelter, 2019, p. 490; Chai et al., 2023, p. 39). This classification relies on the atomic weights of the elements and their prevalence in the Earth's crust. Light REEs are typically more prevalent and economically viable to extract. Heavy REEs possess greater value owing to their scarcity and the challenges associated with their extraction (Ministry of Energy and Natural Resources, 2023).

"Rare" does not specifically denote a lower concentration of elements in the earth's crust, but highlights the challenges associated with the economic separation of these elements (Cheisson and Schelter, 2019, p. 2). For example, despite Ce having a higher concentration than copper, its scattered nature complicates extraction. This circumstance directly influences the security of the supply chain for REEs (Ortiz and Viana Júnior, 2014, p. 362).

Beyond their chemical properties, REEs are considered strategic materials due to their critical role in advanced technologies and high-value industrial applications. Their extraction, processing, and distribution directly impact industrial competitiveness and supply chain security, making them vital for both national and global technological development. Furthermore, the strategic significance of REEs extends into the international political economy, as their availability and technological utilization influence global economic and geopolitical dynamics. Table 1 delineates the atomic numbers, symbols, classifications, and abundance levels of these elements.

Table 1: Symbols, oxides, tines and abundances of REEs

Atomic Number	Elements	Symbol	Oxide	Type	Abundance (ppm)
21	Scandium	Sc	Sc_2O_3		14
39	Yttrium	Y	Y_2O_3	Heavy	21
57	Lanthanum	La	La_2O_3	Light	31
58	Cerium	Ce	Ce_2O_3	Light	63
59	Praseodymium	Pr	Pr_2O_3	Light	7,1
60	Neodymium	Nd	Nd_2O_3	Light	27
61	Promethium	Pm	-	Light	-
62	Samarium	Sm	Sm_2O_3	Light	4,7
63	Europium	Eu	Eu_2O_3	Heavy	1
64	Gadolinium	Gd	Gd_2O_3	Heavy	4
65	Terbium	Tb	Tb_2O_3	Heavy	0,7
66	Dysprosium	Dy	Dy_2O_3	Heavy	3,9
67	Holmium	Ho	Ho_2O_3	Heavy	0,83
68	Erbium	Er	Er_2O_3	Heavy	2,3
69	Thulium	Tm	Tm_2O_3	Heavy	0,3
70	Ytterbrium	Yb	Yb_2O_3	Heavy	2
71	Lutetium	Lu	Lu_2O_3	Heavy	0,31

Source: Dushyantha et al., 2020, p. 2; Stegen, 2015, p. 2.

This table provides an overview of the atomic numbers, symbols, classifications, and natural abundance levels of REEs. It shows that some elements, such as cerium (Ce) and neodymium (Nd), are relatively abundant, while others, including thulium (Tm) and lutetium (Lu), are extremely scarce. These differences in natural abundance indicate that certain REEs have strategic importance in technological applications, as their limited availability can pose challenges for supply and critical industries.

Materials and Methods

This study was designed as a secondary-data-based research article aiming to evaluate the technological relevance, production structures, and supply characteristics of REEs within a systematic and reproducible analytical framework. The methodology relies on structured descriptive content analysis of validated scientific, geological, and techno-economic datasets (Ültay and Comardoğlu, 2021, p. 806). This approach commonly employed in interdisciplinary research at the intersection of political economy, geoeconomics, and strategic resource studies.

The primary materials of the study consist of quantitative datasets on REE reserves, production volumes, and sectoral utilization patterns. These data were obtained from internationally recognized and scientifically validated sources, including the International Energy Agency (IEA), 2025; The U.S. Geological Survey (USGS), 2025; Reports of the European Commission on Critical Raw Materials, 2020; national-level sources such as the Ministry of Energy and Natural Resources, 2023; and the General Directorate of Mineral Exploration and Research (MTA) of Türkiye, 2017; as well as peer-reviewed academic publications.

The analysis was conducted using a systematic descriptive and comparative evaluation approach. Methodological steps included sectoral allocation analysis to quantify REEs utilization across key technology sectors, normalization of reserve and production data to ensure cross-country comparability. Particular attention was given to the evolution of China's share in global REEs production and processing, in order to evaluate patterns of supply dependency and their implications for geopolitical leverage and international relations.

Results and Discussion

This section delineates the findings of a qualitative analysis of the pivotal functions of REEs in technological applications and their strategic ramifications in international relations. REEs are analyzed comprehensively under categories including their technical applications, reserve and production capabilities, Turkey's reserve potential, and policy frameworks. The strategic orientations and multilateral partnerships of entities such as China, The US, Japan, and The EU in this domain are examined. The findings indicate that REEs are not only raw minerals, but have evolved into a crucial element of global power projection.

The Technological Utilization of REEs

The constituents listed under Table 1 are important foundational compounds that are vital in the fabrication of sophisticated technological items that include superconductors, permanent magnets, lasers, catalysts, and hybrid vehicles, wind power generators, and optoelectronic gadgets. For instance, Neodymium and praseodymium, which are important for the fabrication of permanent magnets that include Nd-Fe-B (Neodymium-Iron-Boron) permanent magnets, are crucial components of the electric vehicle and military industry (Golev et al., 2014, p. 52; Mancheri, 2016, p. 262; Farina and Anctil, 2022, p. 2).

The technological significance of REEs arises from their distinctive magnetic, optical, and catalytic characteristics. The utilization of these REEs is attributed to their superior electrical conductivity, thermal resistance, and stability (Chen and Zheng, 2019, p. 2; Vivoda et al., 2025, p. 284). Elements such as Nd, Sm, and Dy are predominant constituents utilized in the production of rare magnets. La and Ce are essential for automobile catalysts and battery applications. Furthermore, Y, is essential for high-temperature superconductors (Laurent, 2014, p. 18; Liu et al., 2022, p. 51).

Table 2 delineates the applications, utilization rate, and materials of REEs.

Table 2: Utilizations and Proportions of REEs

Applications	Utilization Rate	Materials Utilized
Magnetic Materials	26%	Nd, Pr, Dy, Tb
Alloys & Metallurgy	19%	La, Ce, Nd, Sm
Catalyst	16%	Ce, La, Pr, Nd
Polishing Agents	15%	Cerium oxide (CeO_2)
Phosphors	6%	Eu, Tb, Y, Gd
Glass	6%	Nd, Er, Ho, Tm
Ceramics	6%	La, Nd, Ce
Other Applications (nuclear reactor control rods, medical imaging)	6%	Gd, Sm, Nd, Pr, Tb, Eu, Y

Source: Ministry of Energy and Natural Resources, 2023.

The advantageous characteristics of these elements ensure they are used in the following fields:

- Defense Industry: Utilized in strategic defense apparatuses including laser targeting systems, missile guidance systems, and night vision equipment, among others. The materials, namely Tb and Eu, with their excellent resolution, are primarily utilized in bright display panels.

- Renewable Energy: The motors of electric vehicles, the generators of wind turbines, and the energy storage technologies utilize components with REEs.

- Biomedical Technologies: Compounds containing REEs have key applications for various technologies used in the medical field, for instance, MRI machines, surgery lasers, radiation shields, and contrast agents.

- Electronics and Information Technologies: Used in various electronic items, which include cellphones, laptops, LCD and LED screens, fiber optic cables, and hard disk drives (Naumov, 2008, p. 22; Aslan and Say, 2022, p. 148; Ferreira and Critelli, 2022, p. 58; Nkiawete and Vander Wal, 2025, p. 1).

Although REEs are essential for modern technologies, renewable energy systems, and advanced defense applications, their extraction and processing can produce substantial environmental burdens, including soil and water contamination, radioactive waste, and ecosystem degradation (Feffer, 2023). Traditional mining practices often generate residues containing thorium and uranium, which can leach into water systems and persist in the environment. To mitigate these impacts, sustainable extraction and processing methods-such as hydrometallurgy, electrokinetic techniques, bioleaching, wastewater treatment, and reclamation of mine sites-have been developed and are increasingly incorporated into regulatory frameworks in major producing countries, including the US, Australia, and China (Vo et al., 2024, p. 2; Kavak, 2025, p. 36).

Distribution of Reserves and Production of REEs

REEs represent a group of elements in the periodic table that exhibit broad chemical similarity but are found in geologically dispersed and low-grade deposits. Though REEs are distributionally abundant in geological terms, their scarcity with respect to economic availability bestows them with importance. Their extraction and separation are thus technically complicated and cost-intensive processes. The total identified reserves across the world in the year 2025 have been recorded at around 85 million tons, with the annual production standing at 390,000 tons (U.S. Geological Survey, 2025, p. 145). When only the extractable and economically viable portions of these total deposits are considered, the percentage is approximately 0.46%. This comparatively low ratio has emerged as a crucial topic regarding supply security and sustainable production. The imbalance between ample reserves and constrained production is a primary criterion that elevates REEs to the classification of strategic resources.

Distribution of reserves

Little is known about REEs deposits in Europe, apart from limited amounts found in Great Britain, Germany, Ireland, Norway, Sweden and Türkiye (Balaram, 2023, p. 2). According to data from the year 2025, China has the largest reserves of REE, which amount to around 44 million tons, this being the majority found worldwide. After China, there is Brazil with around 21 million tons, India with 6.9 million tons, Australia with 6.3 million tons, and Russia with around 3.8 million tons (U.S. Geological Survey, 2026, p. 153). Table 2 shows distribution of global REE reserves by country between 2010 and 2025.

Table 3: Distribution of Global REE Reserves by Country (2010-2025)

	2010	2016	2018	2021	2025
Australia	1,600,000	3,400,000	3,400,000	4,000,000	6,300,000
Brazil	48,000	22,000,000	22,000,000	21,000,000	21,000,000
China	55,000,000	44,000,000	44,000,000	44,000,000	44,000,000
India	3,100,000	6,900,000	6,900,000	6,900,000	----
Russia	19,000,000	18,000,000	12,000,000	21,000,000	3,800,000
US	13,000,000	1,400,000	1,400,000	1,800,000	1,900,000
Other	22,000,000	6,700,000	4,400,000	4,300,000	4,800,000
Vietnam	---	22,000,000	22,000,000	22,000,000	3,500,000

Source: USGS, 2010-2025.

The data presented in Table 3 indicate that the global distribution of REEs reserves remains highly concentrated in a limited number of countries. China continues to hold a dominant position, while countries such as Vietnam, Brazil, India and Russia also possess significant reserves. Over the period from 2010 to 2025, the overall structure of global reserves has remained relatively stable. This concentration has long been recognized as a key factor shaping the geopolitical significance of REEs. During his 1992 trip of southern China, former Chinese President Deng Xiaoping emphasized the concentration of his nation's deposits, asserting, "There is oil in the Middle East; there is REE in China" (Biedermann, 2014, p. 276). This concentration engenders significant geographical and supply weaknesses in global supply security, enabling China to leverage REEs as a strategic asset.

Distribution of production

The concentration of reserves constitutes merely the beginning phase; the principal strategic advantage resides in production and processing capabilities. As far as the current data is concerned, the level of production globally in 2024 is around 390,000 tons. 270,000 tons were produced in China, leading to a larger comparative share in the world market. The production in the USA is also reported to be around 51,000 tons, with the USA being the highest producer after China (U.S. Geological Survey, 2026, p. 153). Table 2 shows distribution of global REEs production by country between 2010 and 2025.

Table 4: Distribution of Global REEs Production by Country (2010-2025)

	2010	2016	2018	2021	2025
Australia	---	14,000	20,000	22,000	29,000
Brazil	---	1,100	1,000	500	2,000
China	130,000	105,000	120,000	168,000	270,000
India	2,700	1,700	1,800	2,900	2,900
Russia	---	3,000	2,600	2,700	2,600
US	---	---	15,000	43,000	51,000
Other	1,000	2,500	7,600	38,000	31,800

Source: USGS, 2010-2025.

As shown in Table 4, global REEs production is even more concentrated than reserve distribution. China has maintained a leading role in global production, accounting for a substantial share of total output. Although some countries, including the US and Australia, have increased their production in recent years, the global supply chain of REEs remains heavily dependent on Chinese production capacity. This situation shows rather than more production, processing is a responsibility as equally important as production and necessitates that nations concentrate not alone on mining but also on ancillary businesses and technical expenditures. In this context, the head of the China Society of REEs said: “The real value of REEs is realized in the final product.” (Abraham, 2015, p. 33).

Strategic Rivalry and Political Utilization of REEs

REEs possess distinctive magnetic, optical, and catalytic capabilities, rendering them essential in high technology, the military industry, renewable energy, and electronics sectors. The international rivalry in these areas has enhanced REEs beyond simple economic worth, establishing them as political and geopolitical tools. Dominance over resources and the assurance of supply are fundamental to fierce competition among international actors. During the trade disputes between China and Japan in 2010 and between the US and China from 2018-2020, China's threat to restrict REE sales clearly demonstrated the potential usefulness of these as economic sanctions and diplomatic leverage tools (Li et al., 2023, p. 5). This situation underscores that REEs serve not merely as raw resources but also as strategic “geopolitical leverage” in global power dynamics.

The growing reliance on REEs has prompted nations to reevaluate and reformulate their supply security plans. Advanced economies, like the US, the EU, and Japan, have designated REEs as “critical resources” and developed comprehensive policies in this area (US House, 2011; European Commission, 2011; Yan and Li, 2019, p. 5; Vivoda et al., 2025, p. 283). The US issued a presidential executive order to enhance domestic production of REEs, diminish dependence on imports, and secure the supply of these resources considered vital for national security (Chen et al., 2025, p. 505). Concurrently, the EU has concentrated on supply diversification, recycling, and sustainable mining strategies via projects like the “European Commission Critical Raw Materials Action Plan” and the “Raw Materials Alliance” (European Commission, 2020). The Resource Nationalism strategy, emphasizing equitable commodity revenue allocation and value chain management, has also guided policy frameworks in these countries (Bremmer and Johnston, 2009, p. 151).

Building upon these foundational shifts, major global actors have pursued increasingly comprehensive strategies to reduce their structural dependence on China while reinforcing the geopolitical value of REEs. The US, for instance, has adopted a dual-track approach involving both domestic revitalization and international diversification. The reopening of the Mountain Pass mine—once the cornerstone of U.S. REEs production—symbolizes Washington’s intention to rebuild a fully integrated supply chain independent of Chinese processing (Artekin, 2022, p. 197). Simultaneously, U.S. defense-oriented policies have tied REEs supply security directly to national security imperatives, mandating the elimination of Chinese-sourced REEs from defense procurement by 2026 (VoA Türkçe, 2022). This policy orientation demonstrates how REE governance has expanded from industrial planning into the realm of strategic statecraft. Similarly, Japan has crafted perhaps the most comprehensive non-Chinese REE security framework, shaped largely by its acute exposure during the 2010 REEs crisis. Tokyo’s strategy rests on three pillars: (i) international supply diversification through long-term partnerships with Vietnam, India, Kazakhstan, and Australia; (ii) technological substitution and innovation, including advanced R&D programs on REE-lean or REEs-free permanent magnets; and (iii) urban mining, which has transformed end-of-life electronics into a masjor secondary REEs source through firms like Hitachi, Honda, and Mitsubishi (Barteková and Kemp, 2016, p. 159). Japan’s model illustrates how middle powers may leverage technological capabilities and recycling infrastructure to partially offset structural resource scarcity.

The EU has leaned heavily on resource diplomacy and circular-economy governance. With limited domestic extraction, the EU has sought to anchor supply via partnerships in Africa, Latin America, and the Arctic, while simultaneously strengthening recycling pathways and domestic processing capabilities. As part of its pursuit of technological autonomy, the EU allocates substantial resources to research and innovation programmes. The EURARE Project seeks to map Europe’s REE deposits, develop new extraction and processing technologies, and strengthen the regional scientific workforce. Complementary initiatives such as NANOPYME, which develops REE-free magnetic materials, further aim to bolster the EU’s long-term competitiveness in strategic value chains. This approach underlines the EU’s preference for multilateral coordination, private-sector networks, and environmental governance rather than purely statist interventions (Barteková and Kemp, 2016, p. 158).

Beyond the established industrial powers, new actors have begun reshaping the geopolitical landscape of REEs. Australia-home to one of the world’s richest deposits at Mount Weld—has emerged as the leading non-Chinese upstream supplier. Its decision to process REEs in Malaysia through the Lynas Advanced Materials Plant facility reflects a strategic alignment between resource endowment, foreign investment, and regulatory arbitrage (Barteková and Kemp, 2016, p. 159). Vietnam, possessing the world’s second-largest reserves, has attracted large-scale Japanese and Korean investment in extraction and processing. Russia has pursued state-driven expansion centered on its Tomtor deposit, aiming to produce 30,000 tons of REEs annually by 2030 as part of its broader Arctic resource strategy. Brazil, with major reserves but historically low output, has begun integrating REEs into its national mining expansion plans (Daigle, and DeCarlo, 2021, pp. 19-21). Türkiye’s recent discovery of the Eskişehir-Beylikova deposit-now recognized as one of the world’s most substantial REE reserves—marks a significant geopolitical development. Türkiye’s establishment of institutions such as The REEs Research Institute, and Nuclear and Mineral Research Institution signals an ambition to transcend the role of raw-material exporter by developing processing capabilities, integrating REEs into its defense and energy-transition strategies, and positioning itself as a new pole in global REEs diplomacy (Artekin, 2022, p. 198).

Moreover, technologically advanced economies such as Japan and South Korea have been participating in these initiatives through strategic partnerships and financial collaborations. In this context, the involvement of Lynas Rare Earths becomes significant to the value chain of non-Chinese REEs with its operations in Australia and strategic collaborations in Japan and the US, also with the support of direct financial assistance and tax incentives from the Japan government (Yan and Li, 2019, p. 4; Depraiter et al., 2025, p. 4). Even as new reserves have been discovered in various locations like Greenland, Canada, Tanzania, and Madagascar, lack of advanced separation and processing tools, coupled with environmental, socio-political, and economic factors, still pose a challenge to the commercial production of minerals.

New ventures in Australia, Russia, Canada, India, and Vietnam have been established to reduce dependence on REEs currently sourced from China, reflecting a broader effort to diversify global supply chains and mitigate strategic vulnerabilities (Gasanov et al., 2018, p. 505; Yan and Li, 2019, p. 2). However, these initiatives face various geopolitical and domestic challenges. In Vietnam, allegations of corruption and mismanagement within the REE sector have generated political tensions, highlighting the potential risks associated with governance and regulatory instability in emerging REEs-producing countries (Vu and Guarascio, 2023, p. 1). Similarly, Russia's ongoing war in Ukraine and the resulting Western sanctions have hindered the participation of U.S. and allied firms in Russian REEs projects, restricting access to critical technology, capital, and international partnerships (Daly, 2025). These developments demonstrate how geopolitical dynamics, domestic politics, and armed conflicts can directly impact the expansion of alternative REEs sources and complicate efforts to diversify global supply chains.

In addition to the search for alternative sources, recycling and circular economy have a strategic value. Numerous studies have been undertaken on the recovery of electronic waste; however, the low concentration of REEs, high energy consumption, expensive recycling processes, and deficiencies in separation technologies hinder advancement in this field. Nonetheless, the advancement of sustainable development objectives will lead to a rise in the utilization of secondary resources, and the replacement of essential elements (Xu et al., 2016, p. 123; Bhavan et al., 2023, p. 1; Liang et al., 2024, p. 1). Such development will not only diversify supply in REEs markets but also contribute to the long-term solution of strategic dependencies.

Geopolitical Competition in REEs: The US-China Rivalry

The strategic significance of REEs has markedly escalated geopolitical rivalry between the US and China. These elements are crucial for sophisticated military systems, renewable energy technologies, and modern manufacturing processes. The US has progressively aimed to diversify its supply chains and diminish strategic reliance on Chinese resources due to China's dominance in global REEs mining and processing capabilities (Shuai, et al., 2023, p. 1). Like this, REEs have emerged as a critical aspect of technological competition and geopolitical rivalry between the two nations.

One of the most notable examples of this strategic rivalry is China's export restrictions on REEs. In 2010 China imposed export quotas and restrictions on REEs, triggering a major international dispute and raising global concerns about supply security (Chen and Zheng, 2019, p. 2). The US, the EU, and Japan complained to the World Trade Organization (WTO) about the threat to the circulation of REEs in the market. Following a panel discussion in 2014 that stated China's export quota decision violated WTO regulations, Beijing was forced to suspend its export quota application in 2015 (Uğur and Abbasigil, 2024, p. 324). These export policies demonstrate that China has significantly increased its influence in global supply chains and raise serious concerns about securing the supply of REEs (Golev et al., 2014, p. 52).

Between 2018 and 2020, the escalation of the US-China trade war increasingly encompassed strategic raw materials, including REEs. The Trump administration's imposition of broad tariffs on hundreds of billions of dollars of Chinese imports in 2018 prompted Beijing to respond not only with reciprocal trade measures but also with threats to restrict exports of critical minerals, such as REEs, that are vital to advanced technologies and defense manufacturing. China's considerations to limit certain REEs exports signaled the strategic dimension of the dispute, as policymakers in Beijing viewed control over these resources as a lever in broader commercial and geopolitical negotiations. Although a definitive export ban was not implemented before the Phase One deal of early 2020, which aimed to partially ease tariff tensions, the episode underscored how REEs supply controls became a flashpoint within the trade conflict and highlighted the vulnerability of global high-technology supply chains to political and economic coercion (Wong and Koty, 2020, 2020).

In response to these vulnerabilities, the US has increasingly turned to strategic partnerships aimed at diversifying its REEs supply chains. One recent example is the agreement signed between the US and Australia on October 20, 2025, to strengthen cooperation in REE production, processing, and supply chain development. Finalized after five months of negotiations, the agreement aims to accelerate the creation of resilient and allied mineral supply chains and reduce reliance on competitors. Australia possesses some of the world's largest REEs deposits and is home to major companies such as Lynas Rare Earths, making it a critical partner in efforts to reduce reliance on Chinese supply chains. Such initiatives reflect the broader efforts of Western countries to establish alternative supply networks and strengthen critical mineral security (Baskaran and Horvath, 2025).

Beyond cooperation with allied countries, the US has also shown increasing strategic interest in resource-rich regions that could help reduce its dependence on Chinese REEs supply chains. In this context, Greenland has emerged as a region of growing geopolitical importance due to its significant reserves of REEs and other critical minerals. The island hosts major undeveloped deposits such as Kvanefjeld and Tanbreez and is considered one of the most promising alternative sources of REEs outside China. Recent political developments have further highlighted this strategic interest. Following the U.S. military operation in Venezuela that resulted in the capture of President Nicolás Maduro, President

Donald Trump emphasized on January 5 that the US needed Greenland “from the standpoint of national security,” reviving discussions about expanding U.S. influence over the island and its resources. At the same time, China has also attempted to expand its presence in Greenland through investments and cooperation in mining and infrastructure projects as part of its broader Arctic strategy. Briefly, Greenland has become an emerging arena of geopolitical competition where resource security and great-power rivalry increasingly intersect (Schwartz and Baskaran, 2026, p. 1). This development illustrates how the competition for critical minerals is no longer limited to traditional mining regions but increasingly shapes geopolitical strategies in resource-rich areas across different parts of the World.

Venezuela’s significant reserves of strategic minerals, including coltan, gold, and potentially REEs, have increased the country’s geopolitical importance in recent years. These minerals are considered critical for advanced technologies, defense systems, and high-tech manufacturing, particularly within the context of the growing strategic competition between the US and China. Although the official justification for U.S. military and security operations in Venezuela has primarily focused on combating transnational crime and narcotics trafficking, some geopolitical analyses suggest that the country’s substantial mineral resources may also constitute an indirect strategic consideration. In this context, Venezuela’s resource potential can be interpreted as a factor that enhances its relevance within the broader framework of global competition over critical raw materials (Uren, 2026, p. 1; Yavuz, 2026, p. 1). Taken together, these developments demonstrate that REEs have become central to contemporary geopolitical competition. Export restrictions, strategic partnerships, defense industry demand, and resource diplomacy all illustrate how REEs supply chains are increasingly embedded within the broader strategic rivalry between the US and China.

Türkiye's REE Reserves and Policies

Türkiye announced in 2022 of the discovery of about 694 million tons of REEs located in Beylikova, Eskişehir, as a result of exploration activities carried out in the region. It is recognized to have the second biggest potential reserves, after China, which holds the first position globally. It has been reported that at least 11 out of the 17 REEs can be economically extracted from this deposit (Boltuc, 2022, p. 1). Nevertheless, the circumstances that emerged following the discovery and the subsequently formulated policy might be encapsulated as follows.

- The Turkish government perceives this reserve not simply as a "mineral deposit," but as a strategic asset that will provide essential inputs for the domestic sector in the production of high-technology goods. The Ministry of Energy and Natural Resources has declared that Türkiye aspires to be "among the world's top five producers of REEs." (Alhan, 2025).
- The creation of a pilot plant and the enhancement of local processing capabilities at the Beylikova site illustrate Türkiye’s aspiration to establish itself in both mineral extraction and the manufacturing of processed vital minerals. A preliminary processing capacity of 1 200 tons annually is planned, with future phases targeting an increase to 570 000 tons per year (Alhan, 2025).
- Türkiye should prioritize the development of domestic refining and processing capacities for REEs. Establishing these capabilities would reduce reliance on imports, retain more value within the national supply chain, and strengthen Türkiye’s strategic position in the global REEs market (National Intelligence Academy, 2025, p. 20).
- Türkiye is taking this reserve to the global stage at the same time as it is striving to improve its position in global supply chains. In 2025, Turkey joined the 'Critical Minerals Security Partnership' initiative together with other countries wishing to improve their negotiating position through the reduction of dependence on China (Alhan, 2025).
- Prioritizing investment in R&D for advanced REE alloys and processing technologies can enhance Turkey’s competitiveness in high-tech applications, improving its position in global supply chains (National Intelligence Academy, 2025, p. 20).
- Integrating circular economy approaches — including recycling and recovery technologies — can reduce external dependency while mitigating environmental impacts of primary extraction (National Intelligence Academy, 2025:20).

Notwithstanding this possible benefit, Türkiye encounters specific significant vulnerabilities:

- While the declared size of the reserve is significant, the extent of its truly economic and exploitable portions remains unclear. Adopting internationally recognized standards for reserve verification (e.g., JORC/NI-43-101/UMREK) will strengthen confidence among foreign and domestic investors, thereby increasing Turkey’s credibility as a reliable REE supplier (National Intelligence Academy, 2025, p. 20).
- Inadequacies in local processing and refining facilities present substantial obstacles to the objective of generating high value-added products for export.
- Given the paramount significance of REEs for worldwide technology and defense sectors, their increasing value within the framework of climate policies adopted by developed countries, the exchange of international information concerning their production techniques is still constrained.
- Environmental consequences and local community resistance to mining operations generate doubts over the advancement of these projects.

Global Security, Diplomatic Relations, and Economic Dependence

REEs have increasingly become central to global strategic debates due to their indispensable role in advanced technologies, defense systems, renewable energy infrastructures, and high-tech manufacturing. As the global economy continues to shift toward digitalization, green transformation, and technologically intensive production, the demand for these elements has grown significantly (Artekin, 2022, p. 186; Balaram, 2023, p. 2). This situation has transformed REEs from purely geological resources into strategic assets with far-reaching geopolitical and economic implications. In particular, the concentration of reserves and production in a limited number of countries has created new forms of strategic competition, supply vulnerability, and geopolitical leverage in international relations (Sanglier-Contreras et al., 2025, p. 3).

Beyond their technological importance, REEs have also become critical components in shaping global security structures, diplomatic interactions, and economic interdependence among states (Vekasi, 2019, p. 1). Countries that control the extraction, processing, and export of these resources may gain significant influence over global supply chains and high-technology industries (Fan et al., 2022, p. 2). Like this, the strategic value of REEs extends beyond economic considerations and directly affects national security policies, international diplomatic alignments, and patterns of economic dependency within the global system (Vekasi, 2019, p. 1).

REEs have therefore evolved from being primarily industrial minerals into strategic instruments within international political economy (Günsan, 2024, p. 156). Their role in advanced military technologies, renewable energy systems, and high-technology manufacturing has significantly increased their geopolitical value. As states attempt to secure stable access to these resources, REEs supply chains have increasingly become intertwined with national security strategies, technological competition, and international diplomatic negotiations. Like this, the control of REE extraction, processing capacity, and trade flows has emerged as an important determinant of geopolitical influence in the twenty-first century. These dynamics have encouraged states to diversify supply sources, establish strategic partnerships, and implement policy measures aimed at reducing vulnerabilities in critical mineral supply chains (İncekara, 2025, p. 151-153).

Within this framework, the geopolitical implications of REEs can be examined through three interconnected dimensions: the relationship between the defense sector and national security, diplomatic equilibriums and multilateral collaboration, and international economic dependence.

The relationship between the defense sector and national security

REEs are indispensable for modern defense technologies due to their unique magnetic, luminescent, catalytic, and electrochemical properties (Zhou et al., 2017, p. 3). Advanced military platforms-including precision-guided missiles, radar and sonar systems, satellite communication networks, laser targeting systems, and high-performance jet engines-depend on components containing REEs (Humphries, 2013). A prominent example is the F-35 fighter jet produced by Lockheed Martin, which integrates neodymium- and dysprosium-based permanent magnets in its high-performance electric motors, radar arrays, and targeting systems. These magnets enable miniaturization, high energy efficiency, and operational reliability, which are critical for propulsion, guidance, and targeting functionalities. Additionally, REEs such as terbium, europium, and yttrium are employed in advanced displays, sensors, and night-vision technologies, enhancing situational awareness, electronic warfare capabilities, and precision in targeting (Aslan and Say, 2022, p. 170). The F-35 contains approximately 410 kg of REEs, while the Arleigh Burke-class DDG-51 destroyer requires about 2.36 tons, and the Virginia-class nuclear submarine incorporates roughly 4.17 tons of these critical minerals. Beyond these platforms, REEs are also essential for Tomahawk cruise missiles, Predator unmanned aerial vehicles, advanced early-warning radar networks, and smart munitions, demonstrating their widespread integration across multiple high-tech military systems (Lopez, 2024; Milli İstihbarat Akademisi, 2025, p. 13)

The strategic importance of REEs for defense capabilities has elevated them to a critical position in national security policies. Countries that depend heavily on external suppliers for these resources may face vulnerabilities in maintaining military readiness and technological superiority. For this reason, many governments have begun to treat REEs supply chains as a matter of national security and have implemented policies aimed at diversifying supply sources, developing domestic production, and strengthening strategic reserves (Grasso, 2011, p. 10; Islam, 2025, p. 3).

As modern military systems increasingly integrate miniaturized electronics, high-efficiency motors, and precision-guided platforms, access to reliable REE supply chains becomes a strategic necessity, shaping national security planning, defense policy, and international competition. Platforms such as the F-35 exemplify this dynamic, highlighting how the operational effectiveness of advanced military technology is directly dependent on REEs, and emphasizing why states consider control over these resources a critical component of both technological dominance and national defense strategy.

Diplomatic equilibriums and multilateral collaboration

REEs and other critical raw materials have become central to contemporary international cooperation frameworks due to their strategic importance for green, digital, and defense technologies. The European Critical Raw Materials Act (CRMA) represents a comprehensive policy approach by the EU to strengthen the resilience and sustainability of supply chains for critical minerals. The Act seeks to reduce dependency on imports from individual third countries by building up capacities across extraction, processing, recycling, and strategic stockpiling, and by setting benchmarks for domestic supply chain capacities to be achieved by 2030. Importantly, the CRMA also emphasizes international engagement and cooperation with like-minded partners to develop mutually beneficial partnerships, including through coordinated trade actions, the establishment of a Critical Raw Materials Club, and expanded networks of sustainable investment and free trade agreements (European Commission, 2023). This reflects a broader diplomatic strategy in which the EU seeks to work with emerging markets and allied economies to diversify sources, enhance supply chain resilience, and support the global transition to sustainable and secure production of critical technologies.

Beyond domestic policies, bilateral and multilateral partnerships have emerged as central tools to counterbalance China's strategic position in the global REE market. The US has pursued formal cooperation with allied countries, exemplified by the 2025 agreement with Australia, which aims to coordinate technology, industrial policy, and supply chain governance (Baskaran and Horvath, 2025, p. 1). East Asian actors have similarly engaged in diplomatic collaboration: Japan has entered strategic agreements and joint research initiatives with France to ensure diversified access to REEs (Obayashi, 2025, p. 1). South Korea and Brazil, in 2026, signed multiple memorandums of understanding and adopted a four-year action plan targeting critical minerals, industrial cooperation, and trade, reflecting a concrete framework for multilateral engagement (T.C. Ticaret Bakanlığı, 2026).

In addition to these initiatives, other emerging actors have also begun to position themselves within the evolving diplomatic landscape of critical minerals. Türkiye has signaled strategic interest in its domestic REEs potential, emphasizing regulatory clarity and potential multilateral cooperation without repeating production-scale data (SDE, 2025). Similarly, Russia has sought to strengthen its role in the global REE supply chain through international collaboration and policy coordination aimed at increasing its presence in the strategic minerals market. Both Russian President Vladimir Putin and U.S. President Donald Trump have indicated that the two countries could potentially collaborate, particularly in REEs field (Abay, 2025, p. 1). These developments indicate that not only Western economies but also emerging resource-holding countries are increasingly engaging in diplomatic and economic strategies related to critical minerals governance.

At the multilateral level, REEs have become subjects of policy coordination and international institutional collaboration. Industrialized economies seek to establish alternative supply chains, support exploration projects, and promote responsible mining practices through bilateral and multilateral platforms. Such initiatives demonstrate that REEs are no longer merely economic commodities—they are instruments of resource diplomacy shaping global collaboration, geopolitical alignment, and strategic competitiveness.

International economic dependence

REEs have gained strategic importance in the global economy due to their essential roles in high-technology applications, including electric vehicle batteries, wind turbines, advanced defense systems, and digital technologies. As nations transition toward green energy and digitalization, ensuring secure access to REEs has become a critical concern for industrialized economies, which remain heavily dependent on highly concentrated global supply chains, particularly in China. This concentration has created a systemic economic dependence that exposes industrialized nations to supply disruptions, price volatility, and strategic coercion. China currently controls a dominant share of REE extraction, refining, and downstream processing, there is asymmetric interdependence in global production networks (Liu et al., 2025).

An official assessment of the EU's reliance on REEs highlights that up to 98 % of certain REE imports derive from China, making EU industries vulnerable to geopolitical shifts and trade weaponization (Vigna, 2023, p. 2). This dependency is not limited to Europe: the US and its allies similarly face elevated exposure, with approximately 70 % of global REE output originating from China and resulting in potential economic and military vulnerabilities in the event of supply disruptions (USGS, 2026). Diversification initiatives, including investment in alternative mining projects, recycling technologies, and multilateral cooperation, are underway but have yet to fully mitigate these structural risks. REEs supply chain dependencies represent a critical factor in contemporary discussions of economic security, technological competitiveness, and resilience in global value chains.

The REEs import levels of high-technology producing economies are presented in Table 5, illustrating the degree of dependency on external sources for these strategic materials.

Table 5: REEs Import Levels of High-Technology Producing Economies (2024)

Country / Economy	Import Value (United States Dollar (USD) Thousand)	Import Quantity (kg)
China	23,246	346,870
EU	7,462	509,197
Germany	2,251	193,086
Japan	246,235	8,336,930
South Korea	9,900	145,173
US	4,695	80,262

Source: World Bank, 2024.

The data presented in Table 5 indicate that high-technology producing economies are significant importers of REEs, which are essential inputs for advanced manufacturing sectors such as electronics, semiconductors, renewable energy technologies, and defense systems. Countries such as Japan, South Korea, the US, and members of the EU rely heavily on imported REEs to sustain their high-technology industries. This situation highlights the strategic importance of global REE supply chains and demonstrates the growing dependence of technologically advanced economies on external sources for critical raw materials.

In response to these dependencies, major industrialized economies have initiated targeted investments to diversify supply sources and strengthen strategic autonomy. Japan, for example, has invested approximately 250 million USD in seabed exploration near Minami-Torişima Island and 120 million USD in the Caremag REEs processing project in France to secure alternative REE supply chains (Obayashi, 2025, p. 1; Demirbaş, 2026, p. 1). The US has similarly pursued strategic investments, including 400 million USD from the Department of Defense to MP Materials to guarantee 10 years of neodymium-praseodymium production, and the proposed 2.2 billion USD support for Lithium Americas' Thacker Pass project to ensure domestic lithium supply (Midas, 2025). The EU has launched a 3 billion Euro (EUR) investment and financing program under the Critical Raw Materials Act to develop mining projects, processing facilities, and recycling technologies, aiming to reduce external dependency (CNNTürk, 2025). Russia, through Rusal's planned Ural Mountains facility producing 1.5 tons of scandium annually with a 500 million ruble investment, is also strengthening its position in the strategic mineral market (Bloomberg HT, 2025).Economic dependence on REEs can generate tensions not only between producing and consuming states but also between multinational corporations and governments, highlighting the strategic dimensions of these materials.

Consequently, ensuring secure and diversified access to REEs has become a key priority in national industrial, economic, and security strategies.

Political and Strategic Proposals for Türkiye

Türkiye ought to formulate a comprehensive "National REEs Strategy" to guarantee the sustainable and enduring exploitation of these elements' potential. This approach must include reserve identification, processing technologies, environmental consequences, integration with domestic industry, and international collaboration. The value generation of strategic reserves like Beylikova relies not alone on ore extraction but also on augmenting capabilities for separation, purification, and incorporation into advanced technological products. While developing refining infrastructure and enabling the utilization of REEs in products such as magnetic materials, laser systems, and batteries could enhance Türkiye's strategic position, it is important to acknowledge that competing with a global leader like China involves substantial technological and financial challenges. Moreover, Türkiye may benefit from exploring international agreements or collaborations with China and other REE-producing countries to ensure stable supply chains, optimize production costs, and balance geopolitical considerations. In response to potential market monopolization or export restrictions by dominant players like China, Türkiye could pursue multiple strategies: diversifying import sources, investing in domestic refining and processing infrastructure, developing recycling and recovery technologies, and fostering strategic international partnerships to secure a stable supply of REEs.

Collaborations need to be encouraged among universities, research centers (e.g. Munzur University Rare Earth Elements Application and Research Center), and the business world in order to promote the domestic technology for the industrial application of REEs. Incentive mechanisms may be developed through TUBITAK and KOSGEB organizations. Support should be provided for innovative Research&Development (R&D) projects, especially in recycling, sustainable mining, and alternative material creation.

The environmental impacts of REE mining can be significant. Therefore, the procedures for conducting an environmental impact assessment (EIA) must be transparent, allowing local communities to participate effectively. By adopting sustainable mining principles, negative effects on both the natural environment and society should be minimized.

Türkiye should perceive REEs not merely as economic resources but also as strategic tools. Strategic alliances under the Critical Minerals Security Partnership (CMSP), the EU Green Deal, and collaborations with Asia-Pacific nations would facilitate Türkiye's emergence as a dependable supplier on the global stage.

In addition to these strategic policy measures, domestic economic conditions may also influence the development of REEs policies in Türkiye. Since late 2021, the country has experienced a period of high inflation and economic challenges, which has shaped policy discussions in several strategic sectors. In this context, debates occasionally emerging in domestic political discourse regarding the management or potential export of REEs resources may create a degree of policy uncertainty, which could affect investment decisions and international cooperation in the critical minerals sector. Such considerations are particularly relevant for the long-term development and strategic management of major deposits such as the Beylikova REEs reserve (Nogay, 2025; T.C. Cumhurbaşkanlığı İletişim Başkanlığı, 2025).

To mitigate global supply shocks, national strategic stockpiling initiatives might be established for particular categories of REEs. Such steps would bolster resilience against anticipated supply interruptions in critical sectors, including defense and energy transition industries.

Conclusion

REEs, due to their unique physical and chemical properties, are acknowledged as strategic raw commodities of contemporary significance and are becoming increasingly pivotal in the field of international political economy. Their critical roles in energy transition, defense industries, advanced technology, and communication sectors enhance these elements beyond mere economic value, establishing them as vital assets in geopolitical and diplomatic contexts, so influencing global power dynamics significantly.

The present concentration of REEs production in a singular geographic region establishes a precarious framework concerning global supply security. China's preeminence in this area necessitates that other nations cultivate alternate sources and fortify their supply chains. In addition to these global dynamics, Türkiye has recently attracted increasing attention in the context of REEs due to the discovery of significant reserves. These developments suggest that Türkiye may emerge as a potential actor within the global REEs supply chain. However, transforming this potential into a strategic advantage will depend on the development of domestic extraction capacity, processing technologies, and long-term resource management policies. Accordingly, forthcoming methods must be multifaceted and extensive in nature.

- Policy formulation: It is imperative to develop long-term policies concerning the raw materials of REEs at both the domestic and global spheres. These policies should encompass the establishment of strategic reserves, the enforcement of environmental standards, and the adoption of a balanced approach in diplomatic relations.
- R&D and Recycling: Enhancing research and development efforts on alternative materials, developing recycling technologies, and integrating them into circular economy frameworks are essential for guaranteeing supply security.
- International Cooperation: To mitigate dependencies associated with REEs, the establishment of multilateral partnerships among nations, the exchange of technological expertise, the advancement of environmentally sustainable mining practices, and the assurance of trade sustainability are very important.

These steps will facilitate technological progress and help manage certain uncertainties in international political economy, though the global order continues to be reshaped by both its conflictual roots and the asymmetric waves of technology geopolitics, creating additional risks and uncertainties.

In conclusion, REEs have become a decisive factor as a pivotal determinant in both technological advancement and the configuration of global power dynamics. The policies implemented by nations in this domain will produce strategic results on economic benefit, national security, environmental sustainability, and diplomatic efficacy. The commercialization and control of REEs have evolved beyond economic concerns, becoming a crucial factor in the power dynamics of international relations. REEs are positioned as a crucial element in the reorganization of global strategic balances. Moreover, REEs are the unseen yet indispensable building blocks of contemporary technology. Due to their essential roles in global production, military, and energy security, these elements must be addressed in both scientific and political-economic studies.

As a result of all the assessments, it appears that, as Pitron (Pitron, 2022, p. 137) also emphasized; “The 20th century was the era of black gold; the 21st will undoubtedly be the era of metals”.

Future research should build on these findings by exploring advanced processing technologies, sustainable recycling methods, and strategic supply chain approaches to ensure the resilient and effective utilization of REEs in both technological and geopolitical contexts.

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