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# FINANCIAL AND ECONOMIC TRENDS OF THE RARE EARTH MARKET IN LIGHT OF GLOBAL LEADERSHIP

## ABSTRACT

The article explores the contemporary financial and economic trends shaping the global rare earth elements market in the context of strategic competition among states for resource and technological leadership. The authors examine how geoeconomic factors, institutional policies, stock dynamics, and investment models are constructing a new architecture of global power distribution around critical minerals, thus determining the conjuncture of the REE market. The study aims to identify the financial and economic preconditions, policy instruments, and national models of the United States, China, Australia, Canada, and African countries amid geopolitical turbulence and technological transformation. Particular attention is given to Ukraine's potential as a future player in the global REE market. The methodological framework integrates approaches from geoeconomics, resource security, sustainable development, and strategic planning. Both quantitative methods (correlation-regression and trend analysis of financial indices (MVIS Global Rare Earth, NASDAQ, etc.) and qualitative methods (systems analysis, comparative policy evaluation, and content analysis) are employed. Empirical findings reveal a close interrelation between the dynamics of the REE market and clean technology indices. The article also outlines emerging global challenges that influence financial and economic trends in the REE sector: China's market monopolization, fragmentation due to "friend-shoring" strategies, uneven investment access, underdeveloped processing infrastructure in resource-rich but undercapitalized countries (notably Ukraine), and the absence of a coherent global regulatory framework. Based on a comparative analysis of national strategies, the authors propose potential directions for Ukraine's breakthrough and integration into Euro-Atlantic supply chains: the development of a dedicated critical minerals strategy, attraction of foreign partnerships, and formation of localized processing and industrial ecosystems. The authors argue that advancing the REE industry in Ukraine is a vital component of post-war economic recovery and a driver for strengthening the country's geopolitical standing, conditional upon the modernization of scientific, educational, and industrial infrastructure. The study offers a strategic vision of Ukraine's participation in the global REE market on a par with leading geoeconomic actors.

**Keywords:** global market, Rare Earth Elements, financial trends, global leadership, stock indices, MVIS Global Rare Earth Index, strategic resources, geoeconomics, resource policy, investment policy, Reconstruction Investment Fund

**JEL Classification:** F01, O20, O33, L72

## INTRODUCTION

The current stage of global economic evolution is marked by sweeping technological renewal across key production and service sectors. This transformation is driven by the global transition toward green, digital, and overall sustainable models of development. At the heart of strategic initiatives in leading countries lies the implementation of the United Nations Sustainable Development Goals, accompanied by the rapid deployment of innovative solutions in energy, transport, communications, healthcare, and defense industries. Particularly intensive growth has occurred in technologies related to renewable energy, electric vehicle production, telecommunications, medical equipment, aviation, and aerospace. A defining feature of these transformations is the widespread use

of rare earth elements (REE), whose unique physical and chemical properties are critical to the functionality of modern technological processes and high-performance products.

At the international level, the International Energy Agency emphasizes the pivotal role of critical minerals, such as lithium, nickel, cobalt, rare earth elements, and graphite, in enabling the clean energy transition (International Energy Agency, 2021). The reliable and predictable supply of these materials is essential for the successful transformation toward a low-carbon economy and the large-scale deployment of clean technologies.

In recent years, global competition among leading countries for dominance in the rare earth sector has become increasingly intense. This evidence extends beyond rare earth elements and encompasses the broader category of critical raw materials. Major economic powers are actively seeking to secure access to strategic mineral resources, recognizing their vital role in industrial development, technological advancement, national security, and global influence. These efforts are not limited to resource extraction but are increasingly reflected in national investment strategies, the formation of international alliances, and the deployment of economic instruments to reshape global supply chains. In this context, financial and economic trends in the rare earth market are closely intertwined with geopolitical dynamics and investor behavior. Shifting capital flows, the volatility of strategic metals indices, and growing interest in supply chain resilience have become key indicators of strategic leadership. Therefore, a comprehensive understanding of these interconnected forces is essential to assess the evolving architecture of power in the rare earth sector and to anticipate future shifts in global economic leadership.

## LITERATURE REVIEW

Recent studies confirm that financial and economic developments in the REE market are deeply affected by geopolitical dynamics and global strategic competition. Research by Giol, Panazan, and Gheorghe (Calefariu Giol et al., 2025) reveals that financial volatility exerts a long-term systemic influence, while geopolitical events trigger the most dramatic price fluctuations in the REE market (such as the U.S.-China trade conflict, the war in Ukraine, etc.). These shocks are further amplified by cyber threats, which contribute to short-term instability. A large-scale study by Nasir, He, and Kim (Nasir et al., 2024), using quantile-based and time-frequency econometrics, identified geopolitical risks as key drivers of cross-market volatility among REEs, the technology sector, and the energy industry. The authors emphasize that these effects became particularly pronounced after the full-scale Russian invasion of Ukraine in 2022. Notably, energy and tech markets not only respond to geopolitical tensions but also transmit financial shocks back to the REE sector.

Based on three decades of Japanese import data, Fan, Omura, and Roca provide empirical evidence that heightened geopolitical tensions are strongly correlated with rising REE prices, particularly for imports from China (Fan et al., 2023). Their findings support the view that rare earths have become instruments of diplomatic leverage in international relations. Park, Tracy, and Ewing (Park et al., 2023) argue that geopolitical rivalry is a major factor behind the decline of domestic REE production in the United States. According to their analysis, enhanced international cooperation may help mitigate dependency risks and improve the resilience of global supply chains.

Other studies have highlighted the influence of technological progress on the financial performance of the REE market. Scientists demonstrate that price formation correlates with demand-supply expectations surrounding new technologies for REE recovery (Deng et al., 2021). This aligns with broader evidence of the transformative impact of Industry 4.0 on the global mining and mineral extraction sector (Hushko et al., 2021).

The literature also identifies the formulation and implementation of national strategies as primary indicators of competition for leadership in the critical minerals sector. This includes policy frameworks in the United States (Rowan & Linda, 2025; U.S.Department of Commerce, 2022), the European Union (Perincek & Goldthau, 2025), Australia (Korolev & Wu, 2024), and Canada (Government of Canada, 2024), as well as reporting on global reserves, extraction, processing, and trade patterns by leading international institutions and analytical centers (Baskaran & Wood, 2024; National mining association, 2025). Regional cooperation and intergovernmental initiatives, such as joint projects between the United States and Norway or Canada (Government of Canada, 2020; Government of Norway, 2024), further underscore the importance of multilateral approaches to securing mineral supply chains. In this geoeconomic context, core actors such as the United States, the European Union, Australia, China, and Canada have intensified efforts to design and implement national strategies for critical raw materials (Shuai et al., 2025; Calabrese, 2025; Bulin, 2023). Thus, the U.S. strategy places emphasis on supply diversification and alliance formation to counterbalance China's dominance. The EU has adopted a systemic approach, regularly updating its criteria for classifying mineral criticality. Australia focuses on securing stable supply chains through regional project development and governmental support for the mining sector. Canada’s policy is centered on energy security, green investments, and international partnerships.


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Amid the emergence of new players and the impact of the ongoing war, the Ukrainian case is gaining visibility in the academic discourse. Two important themes characterize current research on this issue. First, in the context of global leadership, scholars such as Reznikova, Panchenko, and Ivashenko (Reznikova et al., 2021) stress the importance of understanding how REE market conditions influence economic and energy security. They propose the emergence of a new form of "resource nationalism" — defined not by protectionism, but by the strategic use of national resources to stimulate demand and capture technological leadership from consumer countries. Second, in line with international classifications, REEs are increasingly considered part of the broader group of critical raw materials. Another research (Yemelyanov et al., 2024) analyzed IEA energy transition scenarios and emphasized the significance of demand volumes, geographic concentration of production, and supply resilience. They identified Ukraine's potential to reduce EU dependence on Chinese REE processing by transitioning from raw material exports to higher-value-added production — an approach more effective than the regulatory reforms adopted between 2021 and 2024. Third, the literature reflects growing concern about the implications of geopolitical escalation for global mineral markets. Authors highlight Ukraine's strategic role in future geopolitical rivalries, arguing that the outcome of the war may be influenced not only by military and diplomatic efforts but also by control over Ukraine's vast mineral wealth (Muggah et al., 2025). Resource sovereignty will shape Europe's energy future and the global distribution of critical materials. Should Ukraine retain control over these assets, it could emerge as a pivotal actor in the regional economy. Conversely, if these resources fall under Russian control, it would reinforce Europe's dependency and exacerbate global instability.

## AIMS AND OBJECTIVES

The purpose of the study is to identify the financial and economic trends and policy instruments employed by leading global powers in the competition for leadership in the rare earth elements market, with a particular focus on assessing the strategic potential of Ukraine in this context.

The specific research objectives are as follows:

1. To characterize the distinctive features of national leadership models in the REE market within the framework of the evolving financial and economic landscape.
2. To analyze the dynamics of REE-related financial indices in relation to broader economic and geopolitical trends affecting the global market.
3. To evaluate the influence of geoeconomic and investment-related aspects of competition among major REE market leaders (namely, the United States, China, Australia, Canada, and selected African nations) and to substantiate the financial challenges and pathways for Ukraine's competitive integration.
4. To determine the financial, economic, and strategic preconditions for Ukraine's breakthrough in the global rare earth elements market.

## METHODS

The methodological framework of this study is based on an interdisciplinary approach that integrates concepts from geoeconomics, resource security, sustainable development, and strategic planning. To achieve the stated objectives, the research employs a combination of general scientific and specialized analytical methods.

The quantitative component of the study includes correlation-regression analysis and trend analytics. At the initial stage, in order to investigate the financial and economic trends of the global rare earth elements (REE) market, a comparative analysis was conducted on the dynamics of the MVIS Global Rare Earth/Strategic Metals Index in relation to a set of representative global indicators. These included the Global Mining Index, S&P Global Natural Resources, NASDAQ Clean Edge Green Energy, and NASDAQ Composite. The selection of these indices is justified by their capacity to reflect various dimensions of interrelations that shape the REE market (Table 1).

**Table 1. Direct and Contextual Linkages Between the MVIS Global Rare Earth Index and Selected Market Indices, taken in methodology.**

| Index | Direct Linkages | Contextual Linkages |
|---|---|---|
| Global Mining Index | Includes extractive and metal production companies, with some overlap with REE producers | Reflects sector-wide commodity volatility, geopolitical disruptions, and mining-specific investment cycles |
| S&P Global Natural Resources | Covers diversified resource companies, including those engaged in strategic metals | Captures macro demand for resources, commodity pricing trends, and global inflationary impacts |
| NASDAQ Clean Edge Green Energy | Includes direct REE consumers: EV, batteries, wind turbines, solar tech manufacturers | Signals clean tech transformation trends and investor expectations for climate-neutral technologies |
| NASDAQ Composite | Contains tech giants who use REE-based components in electronics and high-tech sectors | Represents alternative capital flows; influenced by monetary policy, tech market booms, or risk aversion |

The data samples for all indices were compiled using publicly available datasets from two key sources: MarketVector (MarketVector Indexes, 2025) and Investing (Investing.com, 2025). These platforms are considered reliable and relevant for this study due to their consistent tracking of sector-specific financial instruments and comprehensive coverage of strategic commodity markets. MarketVector is a recognized global index provider affiliated with VanEck and is widely used by financial institutions for ETF and portfolio benchmarking. Investing, in turn, offers real-time financial data and historical time series used by analysts and researchers worldwide.

At the next stage, correlation analysis was conducted to assess the overall relationships between the dynamics of the MVIS Global Rare Earth/Strategic Metals Index and the selected global indices. This assessment was carried out both in terms of absolute values and relative changes (growth rates) over a 39-month period from February 2022 to April 2025 (see Table 2).

**Table 2. Computed Pearson Correlation Coefficients.** *(Source: authors' calculation based on open data MarketVector Indexes, 2025; Investing.com, 2025)*

| Index | Correlation with MVIS Global Rare Earth/Strategic Metals | | |
|---|---|---|---|
| | By Absolute Values | By Growth Rates | Interpretation |
| Global Mining Index | -0.438 | 0.610 | Divergent long-term trends (possibly due to different compositions), yet similar market volatility patterns |
| S&P Global Natural Resources | 0.485 | 0.707 | Moderate structural correlation with higher synchronicity in dynamics |
| NASDAQ Clean Edge Green Energy | 0.950 | 0.768 | Strong functional and structural interdependence driven by REE demand in the green economy |
| NASDAQ Composite | -0.810 | 0.510 | Opposing trends in levels, yet synchronous short-term dynamics |

The obtained results reveal an important distinction between structural and dynamic interdependencies among the indices. The rare earth metals market is closely linked to clean technologies, as evidenced by the high correlation coefficients observed both in absolute levels and in growth rates. In particular, a very strong positive correlation between MVREMX and the NASDAQ Clean Edge Green Energy Index indicates a direct functional relationship: demand for rare earth elements — such as lithium, cobalt, and neodymium — directly influences the market capitalization of companies in the clean energy sector. At the same time, the negative correlation between MVREMX and the NASDAQ Composite Index in terms of absolute values suggests a potential divergence in capital flows between the high-tech sector and the strategic raw materials sector.

The most pronounced direct correlations are observed specifically in the growth rate dynamics of the indices (Figure 1).


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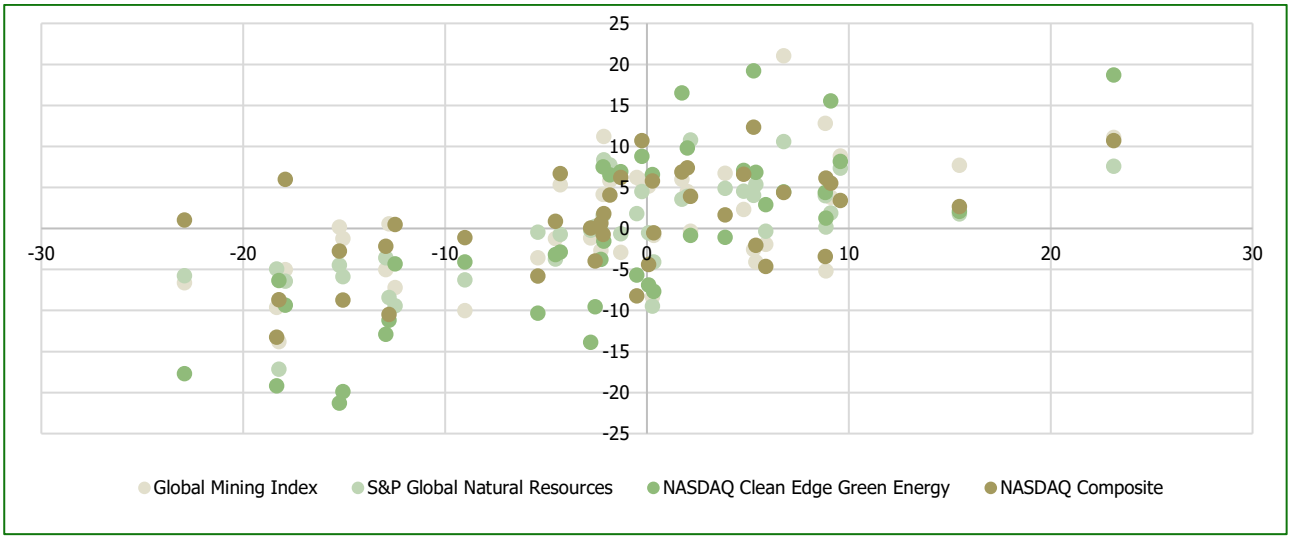


**Figure 1. Paired Growth Dynamics of the MVIS Global Rare Earth/Strategic Metals Index with Other Market Indices, data sample: February 2022 - April 2025.** *(Source: authors' development based on open data MarketVector Indexes, 2025; Investing.com, 2025)*

As part of the methodological framework, Figure 1 visualizes the paired growth dynamics between the MVIS Global Rare Earth/Strategic Metals Index (MVREMX) and selected benchmark indices. This comparative scatter plot enables the identification of short-term co-movement patterns that characterize market behavior under conditions of economic volatility and geopolitical uncertainty. The observed dispersion suggests differentiated synchronicity levels across sectors. Most notably, NASDAQ Clean Edge Green Energy (grey) exhibits a relatively tight cluster with MVREMX, confirming a strong positive correlation driven by parallel trends in demand for rare earth elements in clean energy technologies. In contrast, the broader NASDAQ Composite (yellow) shows a wider spread, indicating asynchronous responses and supporting the hypothesis of divergent capital allocation between the high-tech sector and strategic commodity markets.

The results of the quantitative stage of the research methodology support the formulation of a hypothesis regarding the significant influence of contextual factors — particularly geoeconomic shifts and intergovernmental relations among leading countries — on the financial and economic dimensions of the global rare earth elements (REE) market. This hypothesis is substantiated by the empirical findings of the study.

To explore this further, a set of qualitative research methods was applied. The systems analysis method was used to identify the interconnections between REE extraction, the geopolitical interests of major powers, and global value chains. The comparative analysis method enabled the evaluation of Ukraine's resource potential in relation to that of other key market players, including China, Australia, the United States, and EU countries. Additionally, content analysis of contemporary academic publications, analytical reports by international organizations (including the International Energy Agency, the European Commission, and the U.S. Geological Survey), as well as strategic documents of countries leading in the critical mineral's domain, allowed the identification of major trends, risks, and future directions for the formation of a new global resource paradigm within the context of geopolitical leadership.

## RESULTS

The modern global REE elements market is undergoing rapid transformation driven by growing demand for high-tech products and innovative solutions in the energy, defense, electronics, and transportation sectors. At the end of 2024, the global REE market was valued at over USD 16–17 billion, with projections indicating growth to USD 30-33 billion by 2030, representing a compound annual growth rate exceeding 10-12% (Presley, 2024). China maintains a dominant position in the market, accounting for more than 60% of global production, 85% of processing capacity, and holding 37% of the world's REE reserves. The European Union imports 98% of its REE supply from China, highlighting Europe's critical dependency in the context of the green energy transition (Abbas et al, 2024). Permanent magnets based on NdFeB (neodymium-iron-boron) represent the most powerful commercially available type of permanent magnets, which remains the primary driver of market growth, with neodymium (Nd) and dysprosium (Dy) comprising the bulk of consumption, particularly in electric vehicles and wind turbines. Demand for Nd and Dy is projected to grow annually by 16–30% (Heim & Vander Wal, 2023). According to estimates by the International Energy Agency, the critical minerals market, including

REEs, reached record USD 320 billion in 2021 and continues to grow rapidly as a result of the global shift toward low-carbon technologies (International Energy Agency, 2021).

The overall financial and economic dynamics of the global rare earth market are shaped by a variety of interrelated factors. These trends include, but are not limited to, the following:

1. Geopolitical risks, cyber threats, and financial volatility as structural drivers of REE price fluctuations.
   - Long-term financial volatility is a major factor influencing REE markets.
   - Geopolitical conflicts (e.g., the Russia–Ukraine war, US–China trade tensions) lead to sudden price shocks.
   - Cybersecurity incidents increase short-term market instability.
2. Sectoral reconfiguration of REE demand and application.
   - Growing demand for neodymium (Nd) and dysprosium (Dy) in permanent magnets for EV motors and wind turbines.
   - The lower economic value of REEs used in catalytic converters compared to magnets.
3. China's continued dominance and signs of global diversification.
   - China maintains control over most REE production and processing.
   - The US, Australia, Russia, and others are advancing alternative supply chains to reduce dependency.
4. Accelerated growth of REE demand driven by green energy.
   - Annual growth projections for Nd, Dy, Tb, and Pr range from 16% to 30%.
   - The green transition in transport and energy significantly boosts REE consumption.
5. National strategic initiatives and international resource alliances.
   - Countries are adopting national strategies for critical minerals (e.g., U.S. Federal Strategy, EU CRM Act).
   - Formation of alliances to counterbalance Chinese dominance and enhance supply chain resilience.
6. Financialization of REE markets through indices and capital instruments.
   - Emergence of dedicated REE-related financial indices (e.g., MVIS Global Rare Earth/Strategic Metals Index).
   - Increased investor interest in ETFs and structured products linked to rare earths.
7. Environmental and regulatory transformations.
   - China's green reforms may reduce illegal mining and environmental degradation.
   - Global regulatory efforts aim to improve transparency and sustainability in REE production.
8. Strategic potential and financial positioning of emerging players like Ukraine.
   - Ukraine's REE reserves offer potential for EU supply diversification.
   - Opportunities exist to attract investment in processing and value-added production under the Green Deal framework.

The current dynamics of the global rare earth elements (REE) market are largely determined by the geoeconomic characteristics of mineral resource distribution and the dominance of specific countries in securing these resources. The spatial concentration of rare earth deposits, combined with asymmetric access to extraction and processing technologies, generates strategic dependencies between states and intensifies competition over control of critical materials.

At present, rare earth ore deposits have been identified in 34 countries. However, the challenge lies in extracting, refining, and rendering them usable for industrial purposes (Fan et al., 2023). The production of rare earths requires the integration of environmental, technical, and political factors. Once extracted, REE-bearing ores are transported to separation facilities, where they are processed and isolated from other minerals. The production of certain rare earths is associated with radioactive by-products. Their extraction and refinement can disrupt local ecosystems, posing risks of air emissions and contamination of groundwater resources (Reznikova et al., 2021). Rare earth elements constitute a group of 17 chemically similar elements that possess unique physical, chemical, and functional properties essential to modern technologies. This group includes scandium (Sc), yttrium (Y), and 15 lanthanides (International Energy Agency, 2021): lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu), gadolinium (Gd),


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terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), and lutetium (Lu). Their unique magnetic, optical, and catalytic properties make these elements indispensable in the manufacturing of high-tech products, including permanent magnets, battery systems, fiber optics, laser technologies, electronics, energy equipment, and defense applications.

Increasingly, the rare earth market has acquired a geostrategic dimension, becoming a focal point of national policies, regulatory mechanisms, and international cooperation frameworks in the field of critical raw materials. In this context, the positioning of individual countries in relation to major types of critical minerals serves as a key indicator of their strategic orientation (Figure 2).

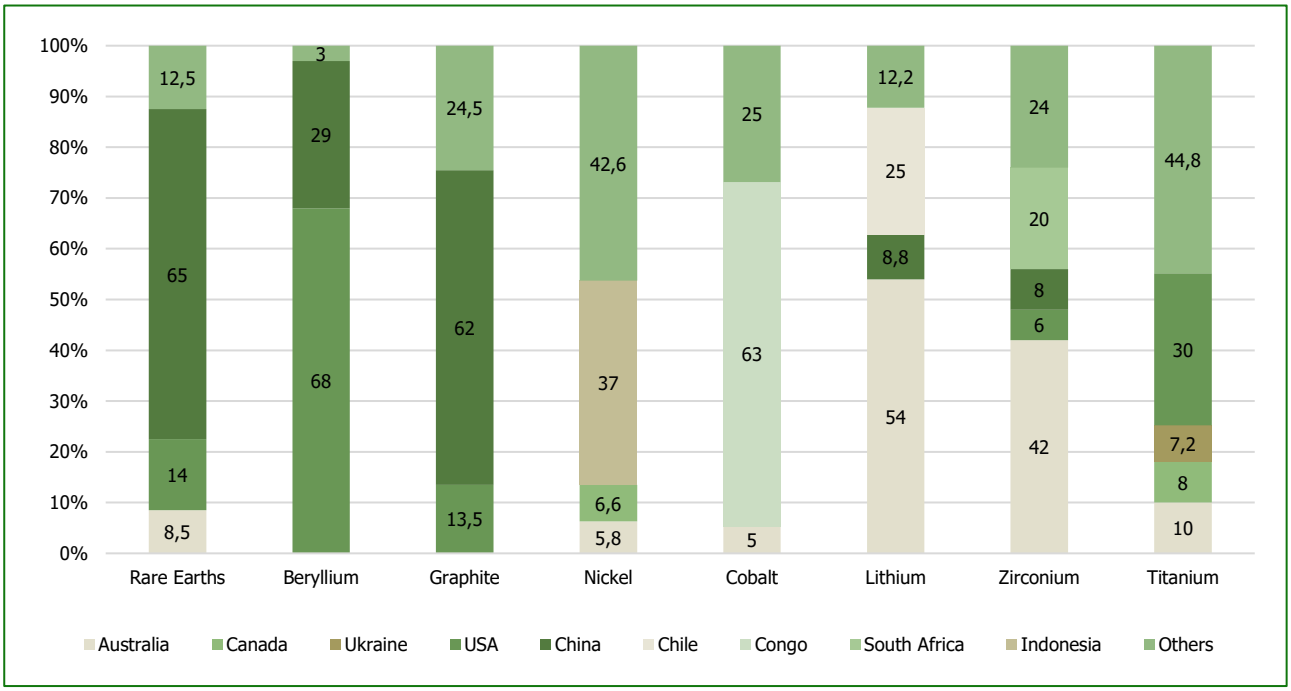


**Figure 2. Global leadership by key REE in 2024 (top countries' shares).** *(Source: authors' development based on U.S. Geological Survey, 2025)*

It is important to emphasize that the financial and economic trajectory of the REE market is closely tied to broader structural issues in the global mining industry. The global mining and metallurgical sector is characterized by a high degree of concentration, often resulting in oligopolistic or low-competition market structures. At the international level, a small number of powerful transnational corporations dominate the industry. These firms operate across multiple countries and control a substantial share of global production and trade (IRENA, 2022).

Effectively, such corporations possess the financial strength, technological capacity, and managerial expertise required to explore, develop, and operate geologically complex mineral deposits. This market structure not only grants them control over a significant portion of the world's extraction and distribution of strategic minerals but also enables them to exert decisive influence over pricing mechanisms, supply conditions, and access to key raw material flows. The concentration of resources and market power in the hands of a limited number of actors presents serious challenges for countries with underdeveloped mining sectors and intensifies geoeconomic tensions surrounding critical minerals.

This is reflected in the trends of stock market indicators (Figure 3).

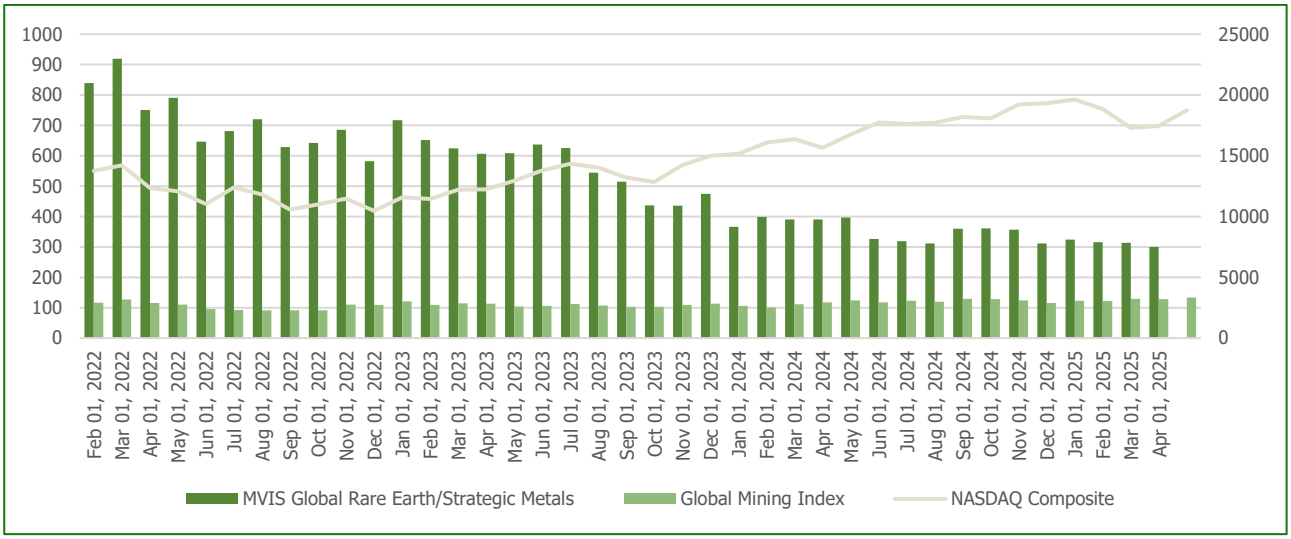


**Figure 3. Dynamics of Stock Market Indices Relative to the MVIS Global Rare Earth/Strategic Metals Index.** *(Source: authors' development based on open data MarketVector Indexes, 2025; Investing.com, 2025)*

Analysis of index dynamics from February 2022 to May 2025 reveals a pronounced asymmetry in market trends, offering deeper insight into the financial and economic tendencies shaping the global REE market. The MVIS Global Rare Earth/Strategic Metals Index displays a steady downward trajectory over the entire observation period, with occasional short-term surges in activity. This pattern can be interpreted as a result of market oversaturation due to excessive supply or declining demand from the green energy sector. Key factors contributing to the reduced investment appeal of strategic metals include geopolitical risks, particularly the high concentration of supply in China, as well as cyclical price volatility of lithium, cobalt, neodymium, and other critical elements. Notably, the war in Ukraine and trade tensions between the U.S. and China have undermined supply chain stability and the investment attractiveness of the REE market (Gao et al., 2024).

In contrast, the Global Mining Index exhibits a relatively stable horizontal trend with limited volatility. This stability can be attributed to the index's broader coverage of the mining sector, encompassing traditional metals (e.g., copper, iron ore, gold) and energy minerals. Meanwhile, the NASDAQ Composite shows a pronounced upward trend, particularly from the second half of 2023. The main growth drivers include heightened investment activity in high-tech companies and increasing interest in artificial intelligence, cloud computing, and digital innovations. This trend also reflects a shift in capital from the real sector of strategic resources toward the technology sector, which is perceived as more profitable amid a soft monetary policy environment.

The pairwise analysis of index relationships further substantiates these interpretations (Figure 4).

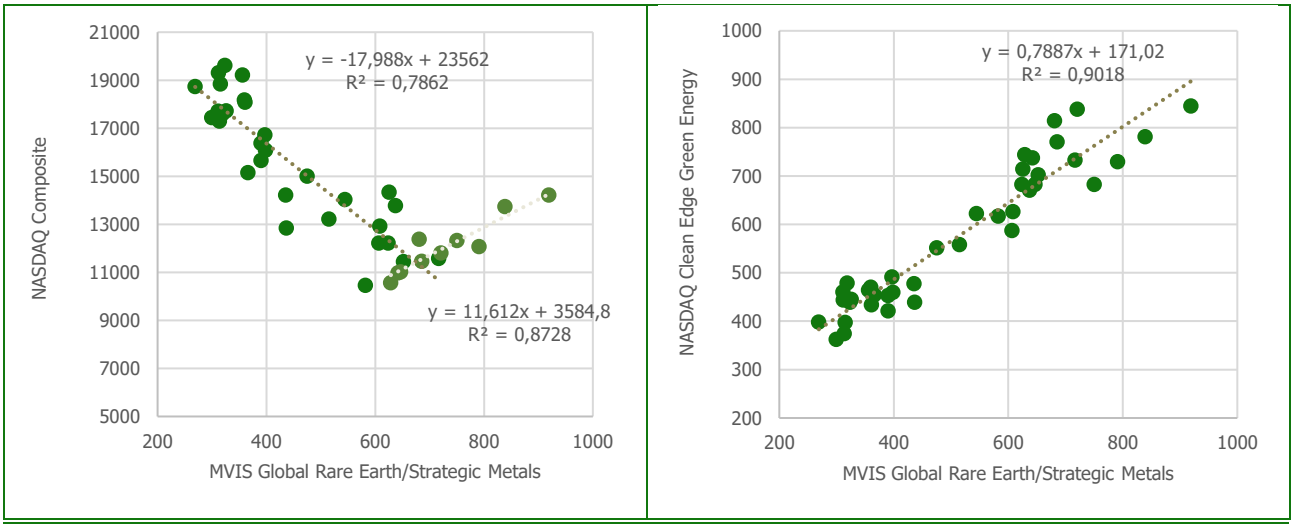


**Figure 4. Dynamics of the MVIS Global Rare Earth/Strategic Metals Index, data sample: February 2022 - April 2025.** *(Source: authors' development based on open data MarketVector Indexes, 2025; Investing.com, 2025)*


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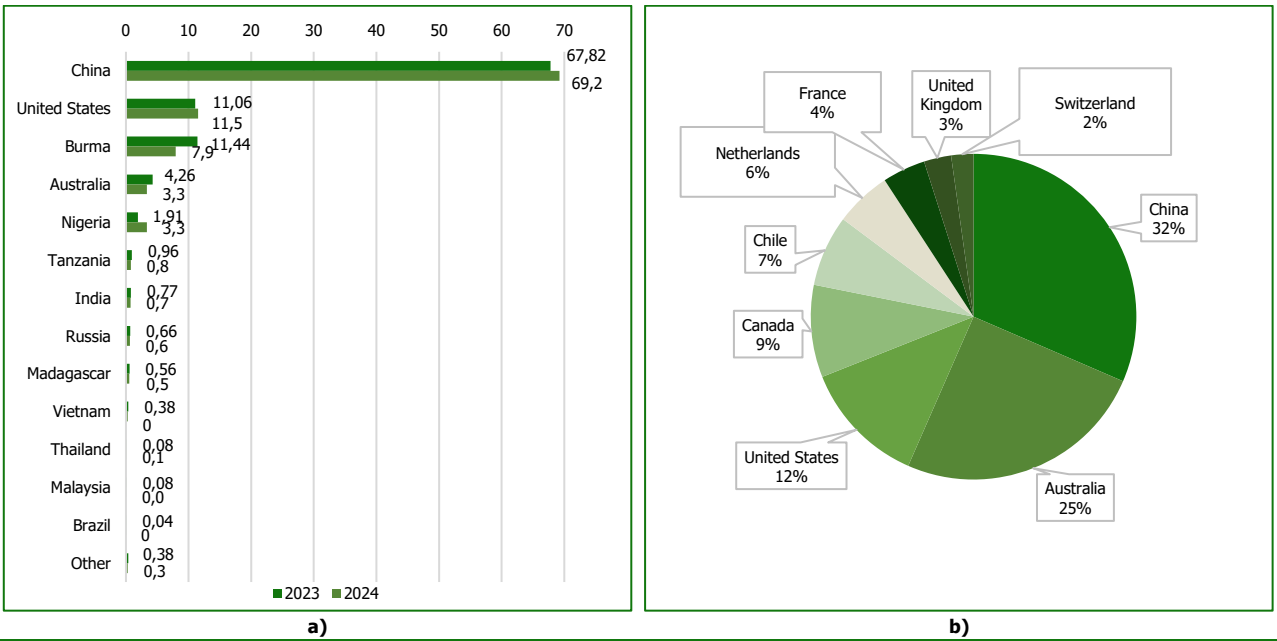
A distinct two-phase correlation structure is observed between the MVIS Global Rare Earth/Strategic Metals Index and the NASDAQ Composite Index (Figure 4), which can be approximated by two separate linear trends with high coefficients of determination ($R^2$ = 0.7862 and $R^2$ = 0.8728, respectively). In the first phase (MVIS Global Rare Earth < USD 600), a stable inverse relationship is recorded: as the NASDAQ Composite increases, the value of the rare earth metals index decreases. This trend is explained by the capital shift from resource-based sectors toward high-tech companies driven by the growing attractiveness of the innovation market.

However, upon reaching threshold values of the MVIS Global Rare Earth around USD 600–650, a structural break in the trend is observed, followed by a shift to a direct relationship between the indices. This reversal may indicate a transition in investment logic — from capital differentiation to synchronized growth of both the high-tech and raw material sectors — under the influence of broader macroeconomic stimuli (e.g., expectations of monetary easing, rising demand for strategic resources in clean-tech industries). Notably, this phase was particularly evident during 2022–2023. Subsequently, the trend reverted to an inverse relationship. One major driver of this reversal appears to be the declining demand for electric vehicles (EVs) and the green energy sector during 2023–2024, especially in China and the European Union (EU), which decreased the need for rare earth elements such as neodymium (Nd) and dysprosium (Dy) — both key components in permanent magnets used in electric traction motors (Nkiawete & Vander Wal, 2025).

At the same time, the model constructed for MVIS Global Rare Earth and the NASDAQ Clean Edge Green Energy Index (Figure 4) exhibits an exceptionally high degree of linear correlation ($R^2$ = 0.9018), confirming a strong functional dependency between the rare earth metals market and the valuation of clean energy companies. This is driven by the structural demand for elements like lithium, cobalt, and neodymium, which are indispensable in battery systems, electric motors, solar, and wind technologies. Consequently, the financial capitalization of the REE market closely follows investment waves in the clean-tech sector, creating a synchronized trajectory of market dynamics.

These empirical observations validate the hypothesis that the dynamics of the rare earth metals market are influenced not only by clean-tech demand but also by a broader set of factors. These include the geopolitical landscape, strategic leadership of specific countries (particularly China, the United States, and Australia), and their national policies related to access to critical raw materials, export regulation, technological development, and the transition to a low-carbon economy.

Against this background, the global rare earth metals market has developed a clearly defined structure of national leadership in terms of production positions (Figure 5a, b).




a) b)

**Figure 5. Global Leadership in the Extraction of Critical Materials in 2024.** Notes: a) Leading Countries by Share in Global Production; b) Country share in the MVIS Global Rare Earth Market Index Assessment *(Source: authors' development based on U.S. Geological Survey, 2025)*

The institutional geography of supply chains, the transformation of investment cycles, and the capital competition between high-risk extractive and high-tech sectors further shape a complex configuration of interdependencies. The observed divergence in trends between MVIS Global Rare Earth and other indices reinforces the argument for a comprehensive, multidimensional approach to the financial evaluation of the REE sector within the global investment and policy environment.

China emerged as the global leader in REE production as early as the 1990s, surpassing the United States. This development was catalyzed by a technological push driven by Taiwanese companies' growing interest in mining and processing mineral resources and rare earths, which intensified after China's economic opening. However, China's monopoly first became a critical issue for foreign technology companies in 2010, when export restrictions on rare earth metals triggered a price surge. These restrictions were lifted in 2015 following intervention by the World Trade Organization. The resulting uncertainty in the stability of Chinese supplies prompted several countries to invest in domestic REE production capacities, leading to a doubling of output between 2017 and 2019 (Shuai et al., 2023).

China's dominant position in the global supply chains of critical minerals is the result of long-term investments in clean energy transitions, technological development, and production know-how. This innovation-led process enabled China to gain advantages in production scale and environmentally friendly technologies used in the processing of strategic raw materials. In 2021, China announced the merger of several major rare earth enterprises into a single state-owned conglomerate (National Mining Association, 2021). Its monopoly in this sector is underpinned by a combination of extensive reserves, strong state support for mining and processing, and stringent export controls.

Amid intensifying geoeconomic competition, the governments of the United States, the European Union, and other countries have accelerated their efforts to diversify critical mineral supplies in order to reduce strategic dependence on China. This policy shift creates new opportunities for establishing alternative supply chains and integrating new market participants. Ukraine, in particular, holds potential to contribute to resource security for the European region.

In recent years, the United States has demonstrated a consistent intensification of its resource policy, aiming to reduce critical dependence on China for the supply of strategic minerals. This strategic pivot has been reinforced by analytical reports from the White House and the U.S. Geological Survey, which revealed significant vulnerabilities in the American economy. The United States was shown to be dependent on China for the production and processing of 26 out of the 50 minerals classified by the U.S. government as critical. As of today, the U.S. fully imports 12 of these 50 minerals, and for another 29, import dependence exceeds 50% (U.S. Department of Commerce, 2022; Shuai et al., 2023). This dominant position stems from decades of China's industrial and foreign policy centered on mineral resource control, with the country repeatedly demonstrating its willingness to use these materials as geopolitical tools.

China has tightened control over strategic mineral markets in the past two years introducing export restrictions and even full bans on materials such as antimony, gallium, and germanium, and maintaining a dominant position in mineral processing (refining between 40% and 90% of global supplies of REEs, graphite, lithium, cobalt, and copper) (Baskaran & Wood, 14). Meanwhile, the U.S. government has responded with a suite of national and international initiatives. Domestically, several legislative and executive actions have been implemented, including the U.S. Critical Minerals Security Act, aimed at stimulating domestic mining, processing, and strategic stockpiling of key minerals; the Executive Order on America's Supply Chains; the Inflation Reduction Act, and others. These initiatives collectively represent substantial measures to secure alternative sources of strategic minerals.

At the international level, the United States has established a range of strategic partnerships aimed at countering China's dominance in the supply chains of critical minerals. In 2022, the Critical Minerals Partnership Act was introduced under the Quadrilateral Security Dialogue, which includes the United States, Australia, India, and Japan. This initiative was designed to address the national security threat posed by China's control over nearly two-thirds of the global supply of critical minerals (Korolev & Wu, 2024). From a financial and economic standpoint, this reflects a broader trend of geoeconomic securitization of raw materials, as nations seek to shield their strategic industries from supply shocks and price manipulation.

Further reinforcing this trajectory, the United States released its Indo-Pacific Framework for Prosperity in 2022, a policy blueprint focused on securing access to essential mineral resources and resisting China's market hegemony. In parallel, the launch of the Multilateral Minerals Security Partnership marked a significant shift toward "friend-shoring" critical mineral supply chains — i.e., restructuring supply routes to rely on allied and geopolitically aligned countries rather than global adversaries.

This financial-economic realignment, underpinned by national security imperatives, has direct implications for investment flows, global trade patterns, and resource pricing volatility. The MSP includes key advanced economies (Australia, Canada, Finland, France, Germany, Japan, the Republic of Korea, Sweden, the United Kingdom, the United States, and the European Commission) reflecting a coordinated effort to mobilize financial, technological, and regulatory capacities to establish resilient, transparent, and sustainable mineral value chains. These developments not only aim to reduce China's market power but also reconfigure global capital allocation in the mining and materials sectors, particularly by prioritizing investments in exploration, processing infrastructure, and strategic reserves in friendly jurisdictions. Key trade partners and allies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are also taking active measures to ensure the security and diversification of critical mineral supply chains. In 2024, the United States partnered with Canada through joint investments in two Canadian critical mineral projects: Fortune Minerals Limited, located in the Northwest Territories, and Lomiko Metals Inc. in Quebec. In the same year, the European Union introduced a new policy via the European Critical Raw Materials Act, which envisages strategic investments in global projects, while similar political initiatives are being implemented or developed in Japan, Australia, the United Kingdom, and other countries. France has also invested in the InfraVia fund to finance key mineral resource projects. Joint priorities on supply chain security and diversification are increasingly promoted on the global stage, particularly through forums such as the International Energy Agency and the G7.

At the same time, it is important to highlight the evolving situation surrounding REE on the African continent, which possesses a significant share of global reserves of critical minerals. Despite its high potential, Africa's level of production remains relatively low, primarily due to institutional instability, underdeveloped infrastructure, and heavy dependence on foreign investment. In this context, the competition between the United States and China for access to additional resource bases in Africa has taken on strategic importance. Africa is increasingly viewed as a key region for investment in the extraction and processing of strategically important minerals (such as cobalt, lithium, nickel, and rare earth elements), which are foundational to advanced technologies ranging from electric vehicle production to renewable energy infrastructure. These resources play a central role in the global energy transition and digital transformation.

Notably, leading geoeconomic actors demonstrate varying degrees of economic engagement in the region. In 2023, the volume of China's economic involvement in Africa under the "Belt and Road Initiative" was estimated at USD 21.7 billion, of which approximately USD 8–10 billion was allocated to mineral resource development projects (Shuai et al., 2023). In contrast, according to the U.S. Bureau of Economic Analysis, total U.S. investment in African countries amounted to USD 7.4 billion, with only about USD 300 million (less than 4%) directed toward the mining sector (U.S. Department of Commerce, 2022). This indicates that China currently holds the largest portfolio of strategic resource extraction projects in Africa, reflecting Beijing's systematic policy aimed at securing long-term access to critical minerals essential for achieving its economic and technological ambitions.

While both the U.S. and China demonstrate similar strategic interests in Africa's critical minerals market, they are investing in mining projects alongside railway infrastructure to enhance mineral trade. However, their financing models and underlying motivations differ. China's approach is characterized by state-backed investments and a focus on securing long-term resource access. Chinese development banks frequently fund African governments, state-owned banks, or Chinese state enterprises operating abroad. In contrast, the United States prioritizes private sector involvement and supply chain diversification, aiming to reduce dependency on China while advancing clean energy, national security, and economic goals. The U.S. engages in Africa primarily through the International Development Finance Corporation (DFC), which provides financial support for critical mineral mining projects. The U.S. seeks to position the DFC as a key instrument in encouraging African partners to collaborate with American stakeholders and reduce reliance on Chinese capital, particularly in the critical minerals industry.

Another prominent example of the formation of national policy concerning rare earth elements is Australia, which continues to maintain a strong leadership position in this sector. The binary geopolitical reality "China versus the United States" has compelled Australia, a country rich in many critical minerals, to adopt a zero-sum geopolitical logic in its approach to global supply chains (Korolev & Wu, 2024). In the Australia–China relationship, a high degree of complementarity is observed: Australia serves as a primary supplier of raw minerals, while China dominates the global processing segment. China remains the largest buyer of Australian mineral commodities, and Chinese investors such as Tianqi and Ganfeng have provided long-term capital to support and expand Australia's extraction capacities. Meanwhile, the United States has expanded the application of its subsidy mechanisms to Australia, thereby incentivizing Canberra to restructure its mineral industry in alignment with U.S. strategic interests.

Australia's Critical Minerals Strategy for 2023–2030 aims to address concerns regarding China's dominance in global critical mineral supply chains by strengthening cooperation with like-minded partners, including the United States, the United Kingdom, Japan, South Korea, India, and the European Union. The practical implementation of this strategy includes: allocating AUD 2 billion in financing to domestic miners and processors of critical minerals to reduce dependence on China and support U.S.-led supply chains; curbing Chinese ownership in strategic mining projects by blocking proposed Chinese investments in favor of capital from the United States and allied democracies; and promoting collaboration through multilateral mechanisms such as the Supply Chain Resilience Initiative (involving Australia, India, and Japan), as well as the Australia–India Critical Minerals Investment Partnership. For China, these initiatives signal a departure from the previous model of mutual complementarity in China–Australia relations. In this emerging paradigm, Australia is increasingly perceived as a geopolitical pawn in the broader strategic rivalry between the United States and China.

The strategic rationale for diversifying critical mineral supply chains is economically justified as part of national policy. However, a geopolitically driven discriminatory approach toward foreign investors may undermine Australia's critical minerals sector and broader economic stability for several reasons.

First, erosion of trust in Australia as a reliable and independent partner could drive major Chinese clean energy firms (such as battery and EV producers CATL and BYD) to accelerate investment in alternative mineral assets abroad. China's recent initiatives in Africa, Latin America, and Mongolia, as well as Russia's role as the world's fourth-largest supplier of critical minerals, highlight the potential reorientation of Chinese demand. A Chinese pivot away from Australian supply could entail significant financial losses, particularly given Australia's short-term inability to replace China's large-scale processing capacity.

Second, viable alternatives to Chinese capital are limited. Australia cannot afford to fully decouple from China, which remains both its largest buyer and key supplier in the battery and critical minerals value chain. New investments in domestic processing infrastructure may take years to yield returns. Even under optimistic scenarios, commissioning a lithium hydroxide plant would require 5–6 years. As a result, the near-term financial prospects of Australia's critical minerals strategy remain uncertain amid escalating U.S.–China tensions.

Canada presents another notable example of a national strategy in the critical minerals sector. In December 2022, the federal government released the Canadian Critical Minerals Strategy following extensive consultations with industry, academia, Indigenous groups, and provincial authorities. Nearly USD 4 billion was allocated from the 2021–2024 federal budgets. The Strategy aims to increase the supply of responsibly sourced critical minerals while fostering the development of both the green and digital economy, domestically and globally. A core economic element is the integration of all stages of the value chain within national borders — shifting from raw material exports and re-imports to the creation of industrial ecosystems that retain processing, manufacturing, and commercialization capabilities in Canada and its trade networks. According to the 2024 Annual Report (Government of Canada, 2024), Canada is well-positioned to capitalize on the growing global demand for critical minerals due to its resource endowment, skilled workforce, advanced enterprises, and infrastructure capable of scaling up sustainable mining and processing operations. As of mid-2024, Canada possesses all 34 minerals listed in its Critical Minerals List, ranks among the top 5 producers of 10 key minerals (including potash, niobium, uranium, palladium, tellurium, indium, aluminum, platinum, titanium, and nickel), and maintains 56 active critical minerals mines, 26 processing facilities, and 151 advanced-stage projects. In 2023, USD 1.9 billion was invested in exploration and USD 3.08 billion allocated via strategic innovation programs such as the Strategic Innovation Fund, the Critical Minerals Infrastructure Fund, and R&D and local partnership initiatives.

Canada's scientific community plays an active role in advancing research related to critical minerals through projects focused on more sustainable mining practices, battery recycling, innovative recovery methods for strategic minerals, and exploration of new mineral sources. For instance, lithium iron phosphate (LFP) batteries are gaining prominence in the electric vehicle sector. As EVs reach the end of their lifecycle, recycling their batteries becomes essential to recover and reuse critical minerals, thus reducing dependency on primary raw materials. Researchers at Natural Resources Canada, in collaboration with industry partners, have developed a process for simultaneously recycling used LFP batteries and producing new LFP and lithium manganese iron phosphate cathode materials, which can be used in new battery manufacturing. This "melt synthesis" method converts end-of-life batteries and industrial manufacturing waste into viable new sources of battery materials. Government support has been pivotal in scaling this innovation from laboratory stage to pilot implementation, with expectations of broader deployment in the future.

Nonetheless, mining remains the cornerstone of Canada's Critical Minerals Strategy, which aims to support the entire lifecycle of mine development. According to S&P Global, opening a new mine takes nearly 16 years on average and involves multiple phases, such as exploration, feasibility, construction, operation, closure, and reclamation. Each stage is influenced by geological conditions, drilling outcomes, capital investment, market dynamics, and a host of regulatory and community factors. Mining projects typically engage diverse stakeholders, including industry operators, federal and provincial governments, regulators, local communities, and environmental consultants. To reduce investment risks and inform ESG-compliant decisions, the Critical Minerals Geoscience and Data Initiative has funded 54 research projects aimed at mapping critical mineral sources, exploring new deposits, and applying advanced analytics to model geological potential for future development.

An analysis of the strategies and policies adopted by key players in the REE market (namely China, the United States, Canada, Australia, and African nations) reveals an intensifying contest over critical minerals, which are foundational to both the digital and energy transitions. What began as economic competition has evolved into a geostrategic rivalry, focused on controlling supply chains and technological platforms.


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Several financial and economic fault lines are shaping current tensions in the global REE market:

1. China's near-monopoly on critical mineral processing creates strategic vulnerability for other countries, driving investment risk and supply chain insecurity across clean-tech and high-tech industries.
2. The geopolitical competition between the U.S. and China for control over extractive assets in Africa, Latin America, and the Indo-Pacific raises the cost of resource diplomacy and redirects foreign direct investment into contested regions.
3. Selective investment access in U.S.-aligned countries (e.g., Australia, Canada) risks market segmentation, limiting global capital mobility, and increasing uncertainty for multinational investors.
4. Asymmetries between extraction and processing capabilities in individual countries hinder the development of vertically integrated value chains, slowing industrial scale-up and reducing economic returns from domestic mineral endowments.
5. The absence of a global institutional coordination mechanism in the critical minerals domain contributes to regulatory fragmentation, increasing compliance costs, and creating a volatile policy environment for investors.

To reduce geopolitical tensions and ensure greater stability in the global REE market, it is essential to strengthen international regulatory architecture. This includes both the development of robust national frameworks for supply chain security and the establishment of global coordination mechanisms — either through the creation of new institutions or by expanding the mandate of existing organizations (e.g., IEA, G7, OECD) to cover critical mineral governance. Strengthened coordination would reduce market fragmentation, improve investment climate predictability, and enhance the long-term financial sustainability of the sector.

Given its substantial potential in the field of critical minerals, Ukraine possesses a unique window of opportunity to integrate into emerging governance architectures as a strategic partner. A comparative analysis of national strategies and policies implemented by leading REE-producing countries provides a valuable basis for identifying policy insights and best practices that could be adapted and applied in the Ukrainian context (Table 3).

**Table 3. Key Policy Features of Global REE Leaders and Prospective Directions for Ukraine.**

| Country | Distinctive Policy Features | Potentially Applicable Directions for Ukraine |
|---|---|---|
| USA | Reducing dependence on China, diversifying supplies, maintaining national security, and strategic reserves | Developing a comprehensive regulatory framework, creating a state fund for the development of critical minerals, and attracting strategic partnerships |
| China | Market monopolization, dominance in processing, and supply control as a geoeconomic tool | State support for production and processing, development of internal technologies, and geo-economic positioning in the market |
| Africa | Attracting foreign investment, strategic positioning in the global supply chain, and competition between major players | Integration into projects with international investors, stimulation of infrastructure initiatives, and development of public-private partnerships |
| Australia | Reducing dependence on China, moving to partnerships with democratic countries, and maintaining control over strategic assets | Blocking non-transparent investments, prioritizing alliances with G7 countries, and expanding state support for producers and processors |
| Canada | Value chain integration, support for technological development, environmental standards, battery recycling, and research | Formation of a full-cycle ecosystem: extraction - processing - production, R&D support, environmental requirements, compliance |

The experience of global REE leaders offers instructive insights for Ukraine in shaping its own critical minerals policy. Currently, Ukraine lacks a standalone national strategy for critical raw materials. Relevant policy measures are outlined in the amended Law of Ukraine "On the Nationwide Program for the Development of Ukraine's Mineral Resource Base until 2030" (No. 4154-IX of December 18, 2024). The updated priorities focus on environmental sustainability, transparency, and investment attraction in the exploration of strategic minerals. Amendments to the Subsoil Code of Ukraine introduced by this law include: criteria for classifying minerals as critical or strategic; mechanisms for regularly assessing supply security risks; definitions of minerals essential for the defense industry and aligned with EU lists; expansion of strategic partner countries; and the creation of a digitalized platform for domestic and foreign investors to access geological data. The legislation aims to foster economic growth through advanced technologies and Ukraine's integration into global critical minerals value chains. Its adoption was driven by the National Security and Defense Council decision of July 16, 2021, enacted by Presidential Decree No. 306/2021.

According to the program, rare earth elements (such as scandium, yttrium, cerium), as well as tantalum, niobium, lithium, beryllium, gold, silver, germanium, and hafnium, are categorized as Group B resources. These are deposits known and explored in Ukraine, yet either extracted in limited volumes or not at all. Under current economic conditions and technological constraints, their domestic processing is deemed uncompetitive compared to imports. However, their strategic relevance may increase with the adoption of new enrichment technologies or Ukraine's entry into high-tech markets.

Ukraine possesses reserves of 21 out of the 30 minerals classified by the European Union as critical raw materials. These include lithium, cobalt, scandium, graphite, tantalum, and niobium (Figure 6). UN forecasts indicate that over the next two decades, global demand will rise by over 40% for copper and REEs, by 60–70% for nickel and cobalt, and by nearly 90% for lithium (State Service of Geology and Mineral Resources of Ukraine, 2023). Preliminary estimates suggest that Ukraine's total reserves of rare minerals may be valued at approximately USD 100 billion (Muggah & Rohozinski, 2025).

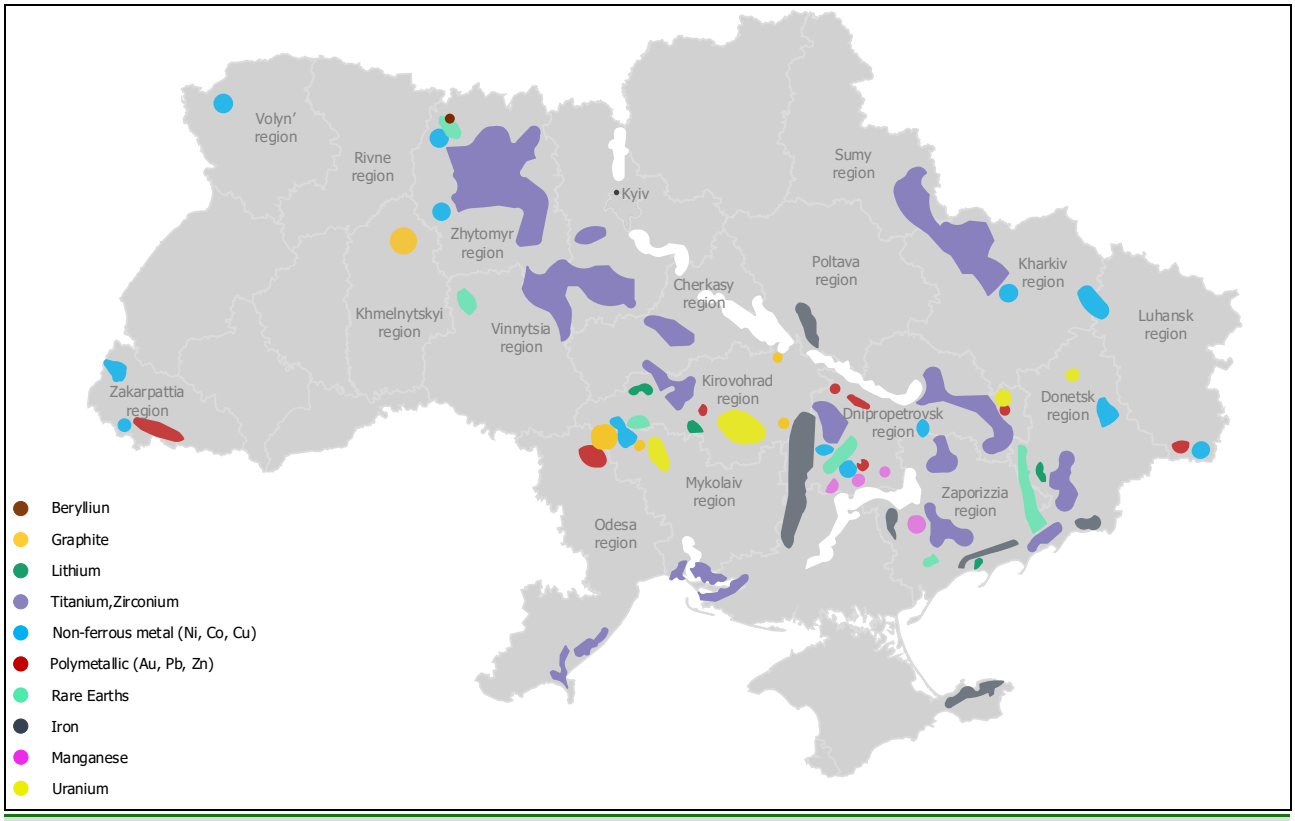


**Figure 6. Map of Rare and Rare Earth Metal Deposits.** *(Source:* State Service of Geology and Mineral Resources of Ukraine, 2023*)*

Ukraine holds significant strategic advantages in the global critical raw materials market, as evidenced by the volume of proven reserves and its geo-economic location within Europe's supply chains. According to the United States Geological Survey (U.S. Geological Survey, 2025), Ukraine has the potential to strengthen its position in several key segments: graphite, lithium, titanium, beryllium, and uranium. All these RRE are essential for clean energy technologies, electromobility, defense industries, and nuclear fuel production. Notably, Ukraine ranks among the EU leaders in confirmed reserves of graphite (6% of global reserves, No.1 in the EU), lithium (1% globally, also No.1 in the EU), and titanium (the largest rutile reserves in Europe, 7% of global output) (State Service of Geology and Mineral Resources of Ukraine, 2023). These reserves fall within the mid-range of the global cost curve, offering conditions for competitive extraction and regional localization of intermediate and end-product manufacturing in Europe. Against the backdrop of a global structural deficit in lithium and graphite, Ukraine is positioned to develop production of lithium carbonate and hydroxide, as well as spherical graphite, which are core materials for cathodes and anodes, respectively, driven by rapidly rising battery demand. In the long term, this enables Ukraine's integration into the European battery value chain.

In the defense and nuclear sectors, Ukraine possesses the largest uranium reserves in Europe (Top-10 globally, 2% of world reserves) and currently supplies up to 40% of its domestic demand. Beryllium also demonstrates strong potential, with proven deposits capable of covering global demand for up to 40 years (State Service of Geology and Mineral Resources of Ukraine, 2023).


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In summary, with adequate investment, modernization of production assets, and expanded geopolitical partnerships with G7 and EU countries, Ukraine could become a central European hub for critical mineral supply chains — not only as a raw material source but also as a processing and industrial center supporting the green and digital transition toward a low-carbon economy.

In 2025, Ukraine made a pivotal move toward integration into the global REE market by signing strategic agreements with the United States. These agreements have the potential to reshape the geo-economic architecture of the critical minerals sector, position Ukraine as an emerging REE supplier, and influence the financial dynamics of the global market.

On April 30, 2025, a multilateral agreement between Ukraine and the United States led to the establishment of a Joint Development Investment Fund based on a 50/50 parity model (Government of Ukraine, 2025). Under the agreement, the U.S. provides capital, technology, and expertise for the exploration and extraction of resources such as rare earth elements, titanium, lithium, uranium, and energy carriers (oil and gas), while Ukraine retains full sovereignty over its subsoil. Profits are shared equally, and part of the revenue is reinvested into strategic sectors, including infrastructure, mining, defense, and energy. This model aligns public and private interests while mitigating risks of excessive foreign control.

From a financial-economic perspective, Ukraine's entry introduces a new source of supply to the global REE market, partially counterbalancing China's dominance, diversifying supply chains, and potentially reducing speculative price volatility for specific elements. Moreover, the agreement enhances the attractiveness of Ukraine's REE sector for institutional investors and strengthens overall investment confidence.

In parallel, Ukraine joined the European Union's initiative within the Memorandum of Understanding between the European Union and Ukraine on a Strategic Partnership on Raw Materials (EU Parliament, 2020). According to the European Parliament, Ukraine possesses 22 of the 34 raw materials classified by the EU as critical for strategic autonomy. This collaboration includes the development of integrated value chains, access to EU funding mechanisms such as Horizon Europe and the Raw Materials Alliance, and regulatory harmonization for environmentally responsible extraction. These developments have several implications for the global REE market. First, the EU's resource base is reinforced through Ukrainian deposits, enhancing the region's energy and technological security. Second, Ukraine's integration into the EU framework accelerates the green transition of European economies, creating sustained demand for REEs. Third, joint EU–Ukraine projects offer technological alternatives to China's dominance. This poses a vital factor amid the global redistribution of influence in high-tech sectors.

In sum, Ukraine's strategic partnerships with the U.S. and EU are shaping a new financial-economic reality for the global REE market. These alliances promote the decentralization of supply sources, improve the investment climate in Eastern Europe, and lay the groundwork for a multipolar, more stable critical minerals market in the long term. In the context of increasing geopolitical tensions, global resource reconfiguration, and shifting security models, Ukraine must define the key determinants shaping its national policy on rare earth elements. These determinants should reflect both external challenges and domestic potential, ensuring the country's integration into the emerging global architecture of strategic resource distribution.

Critical minerals, particularly REEs, should be considered not only economic assets but integral components of national security. Developing domestic resource autonomy, reducing import dependence on unstable or hostile suppliers, and positioning Ukraine as a reliable actor on the global market of critical materials must become fundamental policy goals. Active participation in international supply chains and security frameworks will enhance Ukraine's geopolitical agency in the post-war world.

A significant barrier to the industrialization of Ukraine's REE sector is the underdeveloped scientific and technological infrastructure. The establishment of interdisciplinary research clusters, involving academia, technical universities, and industry, will facilitate the development of domestic expertise in geological exploration, hydrometallurgy, REE compound synthesis, and recycling technologies. Expanding specialized educational programs is essential to ensure a qualified workforce for an innovation-driven, energy-efficient, and environmentally responsible industry.

The full-scale military invasion by the Russian Federation has necessitated a fundamental reassessment of the country's resource policy. In wartime conditions, control over mineral resources becomes not only an economic factor but also a critical element of national defense, particularly in combat zones.

The REE sector holds significant potential to serve as a driver of Ukraine's post-war economic recovery. Its development can be integrated into global initiatives for green reconstruction and energy transition. A targeted state policy supporting investment in exploration, extraction, processing, and advanced value-added manufacturing should be complemented by

the creation of industrial parks, export-oriented clusters, and innovation zones. This approach will facilitate the attraction of international funding and strategic partners that view Ukraine as a credible alternative supply source.

Long-term sectoral sustainability requires the establishment of a domestic REE market with transparent rules, institutional support, and incentives for deep processing. Harmonizing national regulation with EU standards and international frameworks such as ESG criteria, responsible sourcing, and traceability protocols is a necessary step toward Ukraine's integration into Euro-Atlantic supply chains. Foreign policy in this area should focus on strategic cooperation with initiatives such as the Minerals Security Partnership, and with countries including Canada, Australia, the United States, and Japan.

To ensure strategic resource autonomy and integration into global value chains, Ukraine must develop a technologically advanced critical minerals industry based on modern technologies, innovative materials, and high-value-added production. This requires not only the modernization of existing resource bases, but also the establishment of new transnational industrial supply chains in cooperation with international alliances, including the EU and MSP-type platforms.

A necessary condition for this transformation is a revision of national subsoil policy, emphasizing circular economy principles and considering industrial waste as a source of secondary raw materials. Current reliance on outdated mining and processing technologies (many originating from the 1930s to 1950s) results in energy-intensive, environmentally unsustainable systems that produce large volumes of toxic by-products, including slags, sludges, ashes, and contaminated waters. Available assessments suggest that concentrations of valuable components in these technogenic deposits often exceed those in primary ores, indicating a strong potential for secondary extraction.

Implementing such a model requires active involvement from the scientific community. This includes comprehensive chemical analysis of industrial waste, mapping of technogenic sites, development of environmentally safe and resource-efficient recycling technologies, and the creation of an appropriate regulatory framework. Given the specific chemical profiles of Ukraine's technogenic resources, effective technological solutions are likely to be developed primarily by national research institutions. These institutions urgently require institutional, human, and financial support. Without modernization of the research infrastructure and the integration of applied science into production, the realization of Ukraine's REE potential will remain fragmented and underexploited.

## DISCUSSION

The findings of this study demonstrate that the rare earth elements market is not only driven by traditional supply and demand factors, but is increasingly shaped by geostrategic considerations and investment flows associated with clean energy and technology transitions. The observed strong positive correlation between the MVIS Global Rare Earth/Strategic Metals Index and the NASDAQ Clean Edge Green Energy Index ($r = 0.950$ by absolute values) confirms the market's structural dependence on demand from the green tech sector. These results are consistent with previous studies (e.g., Deng et al., 2021; Nasir et al., 2024), which emphasized the financialization of REEs as a result of their embeddedness in clean energy value chains. Furthermore, the research confirms the asymmetric relationship between capital-intensive, low-return extractive sectors and high-growth technology markets. The inverse correlation between MVREMX and the NASDAQ Composite Index by absolute values ($r = -0.810$) suggests diverging investor strategies during periods of geopolitical instability and macroeconomic adjustment. This observation aligns with researchers (Fan et al., 2023), who highlighted the capital flight from extractive markets toward digital innovation hubs during geopolitical crises. While existing literature has discussed REEs as commodities or geopolitical tools, our analysis advances the understanding of their dual identity as both physical resources and financial instruments.

However, this study is not without limitations. First, the reliance on publicly available financial indices may omit more granular dynamics, such as specific company behavior or bilateral trade deals. Second, the geopolitical analysis remains primarily qualitative and could benefit from more rigorous modeling of scenario-based outcomes, particularly regarding Ukraine's integration into global value chains. Third, while the paper identifies Ukraine's strategic potential, its actualization is subject to post-war reconstruction capabilities, investor confidence, and institutional reforms—factors that could not be empirically validated within the scope of this research.

Despite these constraints, the study offers a novel interdisciplinary synthesis of REE financial trends, geopolitical configurations, and strategic planning insights. The implications of the findings are twofold. First, the REE market is increasingly susceptible to external policy shocks, investor sentiment, and alliance-driven supply chain restructuring. Second, countries like Ukraine, with latent resources and geostrategic assets, can emerge as key nodes in future mineral governance — provided institutional modernization and international cooperation are accelerated.


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## CONCLUSIONS

The global REE market is undergoing a strategic transformation, increasingly serving as a determinant of geo-economic leadership. Access to critical minerals now defines the economic competitiveness of states, their defense capabilities, and participation in the global energy transition. REE policies are increasingly viewed as instruments in shaping a new global power configuration centered on resource and technology dominance. The bipolar rivalry between the United States and China over reducing dependence on critical mineral imports is prompting other nations to develop national strategies for critical raw materials, particularly in relation to domestic production of electric vehicles, consumer electronics, medical equipment, aerospace, and defense technologies.

The analysis of index dynamics has shown that financial trends in the REE sector cannot be considered in isolation from the broader geoeconomic context. They reflect the strategic priorities of states, investors, and alliances in the fields of energy and technological security. The results of the correlation-trend analysis confirm that the rare earth elements (REE) market exhibits high sensitivity to geopolitical events and macroeconomic shifts. In particular, the exceptionally strong positive correlation between the MVIS Global Rare Earth/Strategic Metals Index and the NASDAQ Clean Edge Green Energy Index indicates a structural dependency on demand from green energy sectors during the study period from 2022 to 2025. At the same time, the negative correlation with the NASDAQ Composite in terms of absolute values points to diverging investment trajectories between the raw materials sector and high-tech companies, especially during periods of geopolitical instability.

The global structure of REE production and processing is highly concentrated and geopolitically vulnerable. China retains dominance through a vertically integrated system of extraction, processing, and export, supported by state subsidies and strict export controls. The United States is establishing a robust legal and institutional framework to ensure resource autonomy and is building global alliances aimed at "friend-shoring" and reducing dependence on Chinese exports. Australia cautiously navigates between economic cooperation with China and security partnerships with the U.S. Canada is implementing a systemic value chain development model, integrating environmental, technological, and social priorities. Africa, despite its resource wealth, remains a battleground for external investors, with limited local participation in the value chain. Among the critical tension points in the global REE market are China's monopolization of mineral processing, U.S.–China geopolitical competition for control over extraction assets in Africa, Latin America, and the Indo-Pacific, imbalances between mining and processing capacities in various countries, and the absence of a global institutional mechanism to coordinate critical mineral policies. De-escalating market tensions and stabilizing global REE supply chains will require a strengthened international regulatory architecture, including the expansion of national supply security regimes and the establishment of global coordination mechanisms through new or existing international institutions.

Ukraine possesses considerable resources and geo-economic potential in the REE sector. However, the realization of this potential is constrained by outdated extraction and processing technologies, a weak research and development base, the absence of a comprehensive national strategy on critical minerals, and limited integration into global supply chains. The full-scale war with Russia has exacerbated these challenges, placing some mineral deposits within conflict zones, damaging infrastructure, and drastically reducing investment activity. At the same time, the conflict has intensified the urgency of establishing resource autonomy, strategic reserves, and a functioning domestic REE market as a component of national security and post-war economic reconstruction.

The strategic potential of Ukraine's REE sector can only be realized through a combination of government leadership, international partnerships, and environmentally responsible governance. A dedicated national strategy on REEs must be developed and strengthened, with a particular emphasis on building scientific and innovation capacity. This includes support for applied research in chemistry, materials science, geotechnologies, and waste recycling. Establishing interdisciplinary research clusters and specialized educational programs will help develop the technological competence needed to initiate domestic REE production and industrialize the sector based on innovative, high-value solutions.

Ukraine's breakthrough in the global REE market depends on the development of effective financial and economic instruments, institutional support (e.g., funds, banks, concessional lending), and an integrated strategy encompassing the entire value chain from extraction and processing to downstream industrial applications and infrastructure development. Given the long payback periods and the delayed economic returns characteristic of the sector, national subsoil policy must prioritize added value production, alignment with climate neutrality objectives, and integration into the digital and aerospace sectors. Without such a strategic orientation, Ukraine risks reinforcing a raw material export model incompatible with long-term competitiveness in the knowledge-driven global economy.

## ADDITIONAL INFORMATION

### AUTHOR CONTRIBUTIONS

*All authors have contributed equally.*

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*The Authors declare that there is no conflict of interest.*

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## ФІНАНСОВО-ЕКОНОМІЧНІ ТЕНДЕНЦІЇ РИНКУ РІДКІСНОЗЕМЕЛЬНИХ ЕЛЕМЕНТІВ У СВІТЛІ ГЛОБАЛЬНОГО ЛІДЕРСТВА

У дослідженні розкрито сучасні фінансово-економічні тенденції розвитку світового ринку рідкісноземельних елементів у контексті стратегічного суперництва держав за ресурсне й технологічне лідерство. Автори комплексно вивчають, як геоекономічні чинники, інституційна політика, індексна динаміка та інвестиційні моделі формують нову архітектуру світового розподілу сил навколо критично важливих мінералів, обумовлюючи кон'юнктуру ринку рідкісноземельних елементів. Метою дослідження є ідентифікація фінансово-економічних передумов, економічних моделей і політик США, Китаю, Австралії, Канади та країн Африки в умовах геополітичної турбулентності й технологічної трансформації. Особливу увагу приділено потенціалові України як майбутнього гравця світового ринку рідкісноземельних елементів. У межах методології об'єднано підходи геоекономіки, ресурсної безпеки, сталого розвитку та стратегічного планування. Використано кількісні методи — кореляційно-регресійний і тренд-аналіз фінансових індексів (MVIS Global Rare Earth, NASDAQ та ін.), а також якісні — системний аналіз, компаративну оцінку та контент-аналіз. Емпіричні результати демонструють тісний взаємозв'язок між динамікою ринку рідкісноземельних елементів і поведінкою індексів чистих технологій. У статті також охарактеризовано нові глобальні виклики ринку рідкісноземельних елементів, що обумовлюють фінансово-економічні тенденції: монополізацію Китаєм, фрагментацію ринків через політику «дружніх постачальників», нерівномірний доступ до інвестицій, слабку переробну інфраструктуру в країнах із потенціалом (зокрема в Україні), а також відсутність глобального механізму регулювання. На основі порівняльного аналізу національних стратегій запропоновано потенційні напрями для прориву України та інтеграції в євроатлантичні ланцюги постачання: створення власної стратегії критичних корисних копалин, залучення іноземних партнерств, розвиток переробки й локалізованих індустріальних екосистем. Автори аргументують, що розвиток індустрії рідкісноземельних елементів в Україні є складовою поствоєнного економічного відновлення та підвищення її геополітичної ваги за умови модернізації наукової, освітньої та промислової інфраструктури. Дослідження репрезентує стратегічне бачення участі України в глобальному ринку рідкісноземельних елементів за паритетом із провідними геоекономічними гравцями.

**Ключові слова:** світовий ринок, рідкісноземельні елементи, фінансові тренди, глобальне лідерство, біржові індекси, індекс рідкісноземельних елементів MVIS, стратегічні ресурси, геоекономіка, ресурсна політика, інвестиційна політика, Фонд інвестицій у відновлення

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