



The United States' Strategic Dependence on China's Dominance in Rare Earth Elements 2020-2023

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ABSTRACT

The aim of this study is to analyse the factors leading to the United States' strategic dependence on China's dominance in the rare-earth elements sector during the period 2020-2023. This study employs a qualitative methodology, comprising a literature review and an analysis of government reports and relevant academic articles. Dependency theory is used as an analytical framework to explain dependency within the global rare-earth elements supply chain. The findings indicate that the United States' strategic dependency is not primarily due to limited domestic reserves of rare-earth elements, but rather stems from China's dominance in the processing, refining and production of downstream products based on rare-earth elements

INTRODUCTION

Rare earth elements are a group of important minerals that play a crucial role in current international relations and support the development of modern industry and high-tech sectors.(Saragih et al., 2025) Rare earth elements are widely used in various strategic industries, such as electric vehicles, renewable energy, semiconductors, telecommunications, and modern weapons systems.(Dushyantha et al., 2020) Given the growing global demand for low-carbon technologies and the digital transformation, rare earth metals are increasingly viewed as a raw material that reflects a country's willingness to adapt to changing global conditions. (Sutisna et al., 2025)

Given the growing global demand for low-carbon technologies and the digital transformation, rare earth metals are increasingly seen as a raw material that reflects a country's ability to hold its own in the global landscape. (Taulli & Busby, 2025) The U.S. Department of Defense notes that rare earth metals are used in F-35 fighter jets, radar systems, Virginia-class submarines, Tomahawk missiles, and various other pieces of military equipment. (Gracelin Baskaran, 2025) In addition to the defense sector, rare earth elements are also key components in various strategic applications, including renewable energy, the transportation sector, and the high-tech industry—areas that have become a focal point of the United States' economic development.(International Energy Agency, 2026a)

Although the United States has its own deposits of rare earth metals, its processing and refining capacities remain limited. For decades, the most advanced processing of rare earth metals has been concentrated in China. (Park et al., 2023) As a result, U.S. industry remains dependent on global supply chains dominated by China. China is currently a major player in the global rare earth metals industry. It is not only the world's largest producer. (Whitlock et al., 2025) China also controls the majority of the processing and refining capacity for rare earth elements. (Depraiter et al., 2025) This position is underpinned by a long-term industrial policy that enables China to integrate the mining, processing, manufacturing, and technology development sectors related to rare earths. These conditions have made China a hub in the global rare earth supply chain.(Mancheri et al., 2019)

This study focuses on the period from 2020 to 2023, as this was when the issue of critical mineral supply security gained increasing prominence in U.S. foreign policy and national security. The COVID-19 pandemic in 2020 exposed vulnerabilities in global supply chains, while the escalating strategic rivalry between the United States and China has led to the development of various policy measures aimed at reducing dependence on strategic sectors dominated by China.(The White House, 2021) As part of efforts to strengthen the resilience of the national supply chain, the U.S. government subsequently issued Executive Order 14017 on U.S. supply chains, as well as various other measures related to critical minerals.(The White House, 2021)

This study offers a new perspective by placing the United States at the center of the analysis and explaining how China's dominance in the global rare earth supply chain creates a form of strategic dependence for the United States.

Furthermore, this study draws on dependency theory to analyze the unequal relationship between the two nations in the rare earth sector. Unlike previous studies that have emphasized China's dominance, this study seeks to explain why the United States remains dependent on China despite its own rare earth resources and various policy measures aimed at reducing this dependence.

Based on the preceding discussion, this study addresses the following research question Why was the United States strategically dependent on China's dominance in the rare earth sector during the period 2020–2023. Using dependency theory as an analytical framework, this study argues that the United States' strategic dependence is not primarily caused by limited rare earth reserves, but rather by China's dominance in the processing, refining, and manufacturing of downstream rare earth-based products, which leads to an unbalanced dependency relationship in the global supply chain.

LITERATURE REVIEW

This study is based on the approach of dependency theory, which assumes that relations between countries in this context do not always take place on an equal footing, as differences in economic, technological, and industrial capabilities can create relationships of dependency. According to, (THEOTONIO Dos SANTOS, 1970) Dependence does not always arise simply because a country lacks the necessary resources. Dependence can also arise when a country lacks the ability to manage these resources independently. In the context of the rare earth metals industry, the possession of mineral deposits does not automatically guarantee a country's self-sufficiency if that country remains dependent on others for the extraction, processing, or refining of the minerals. Therefore, the dependency theory employed in this study allows for an examination of dependency from a broader perspective, namely through the lens of industrial structures and global supply chains.

China holds a dominant position in the global *rare earth metals* industry, as it not only controls mining operations but also possesses the world's largest processing and refining capacities.(Riedho, 2024) (Tae-Yoon Kim, 2025) This suggests that the majority of global processing and refining activities in the *rare earth* sector remain concentrated in China. This dominance means that many countries, including the United States, continue to rely on industrial facilities in China to meet the needs of their strategic sectors. This situation demonstrates that relations between the United States and China in the field of *rare earths* are not only related to raw material trade but also to the global industrial structure, which gives China a dominant position. (Shao et al., 2025)

Based on previous research by (Mancheri et al., 2019) The report explains that China's dominance in the global rare earth industry is the result of a long-term industrial policy that has successfully integrated mining, processing, and manufacturing into a single competitive production chain. (Liu et al., 2025) which illustrates how geopolitical relations can influence the global trade in rare earths and (Wei-Qiang Chen, 2024) which analyzes the structure of the global rare earth supply chain and demonstrates that China dominates most stages of processing and manufacturing of rare earth-based products.

There are two gaps in the research: First, most studies to date have focused on China's dominance in the global rare earth industry, while specific studies focusing primarily on the United States remain scarce. Second, previous research has primarily addressed the economic and industrial aspects of rare earths, while discussions of U.S. strategic dependence from an international relations perspective remain scarce, particularly during the 2020–2023 period, which was marked by escalating strategic rivalry between the United States and China.

Given this gap, this study will offer a new perspective by focusing primarily on the United States in its analysis and demonstrating how China's dominance in the global rare earth supply chain creates a form of strategic dependence for the United States.

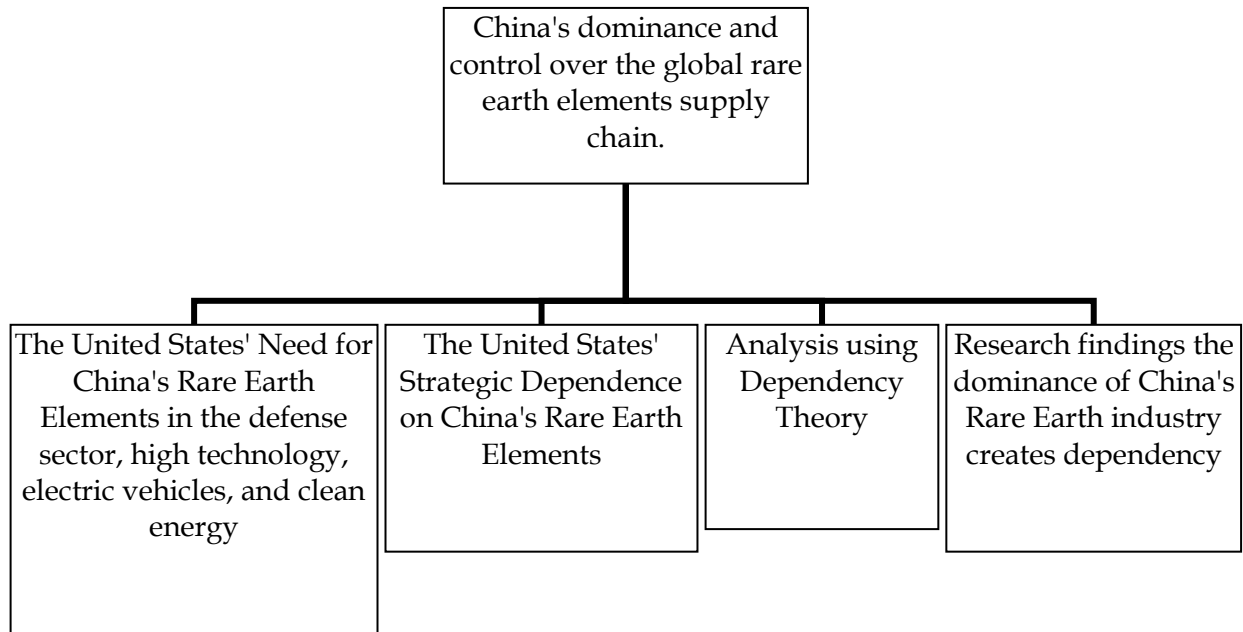
METHODOLOGY

This study uses qualitative research methods to analyze the United States' strategic dependence on China's dominance in the rare earth elements (REE) market during the period 2020–2023. Qualitative methods are used to gain an in-depth understanding of a social phenomenon by analyzing various relevant data sources (K. Khoirunnisa & Rusadi, 2023), and aims to provide a deep understanding and explanation of the interrelationships that have emerged within the global structure of the *rare earth elements* industry, rather than simply measuring the relationships between variables statistically. (Warahma Guferol, n.d.)

The data used in this study are secondary data obtained through literature reviews and document analysis. The data sources include various official government reports, scientific journal articles, and policy documents related to the *Rare Earth Elements* and critical minerals industries. The government reports used come from sources such as the *United States Geological Survey* (USGS) and the White House.

A *library search* on *rare earth elements* was used as the data analysis technique. The collected data was then analyzed using the framework of *Dependency Theory* to explain how China's dominance in the production, processing, and refining of rare earth elements creates a strategic dependency for the United States. Using this analytical technique, the study seeks to gain a comprehensive understanding of the factors driving the United States' strategic dependence on Chinese dominance in rare earths during the 2020–2023 period.

The analytical model used in this study serves to explain the United States' strategic dependence on China's dominance in the field of rare-earth elements during the period 2020–2023.



This analysis begins with China's dominance in the global supply chain, which centres on the processing and refining stages. In this study, this dominance is linked to high demand in the United States for rare-earth elements to support the defence, high-tech, electric vehicle and clean energy sectors. Dependency theory is used to explain how China's dominance of the global supply chain creates a dependency for the United States.

RESEARCH RESULT

The findings of this study show that the United States' strategic dependence on China's dominance in *rare earths* is not due to a lack of domestic mineral resources in the United States. Rather, this dependence stems from an imbalance in industrial capacity between the two countries, particularly in the areas of processing and refining. Consequently, an analysis of this dependence must focus on the industrial structure that links U.S. demand with China's dominance in the global supply chain for *rare earths*.

Although the United States has the Mountain Pass Mine—one of the largest rare earth mines outside of China—its domestic processing and refining capacities remained limited during the period under review. This suggests that the majority of the mine's output continues to require further processing at foreign facilities. This situation demonstrates that mining activities alone are insufficient to achieve industrial self-sufficiency in rare earths unless accompanied by adequate processing and refining capacities.

These limitations on domestic capacity are the reason why the United States remains dependent on an industrial system dominated by China. This dependence becomes even more apparent when one considers that the majority of global capacity for the separation and refining of rare earths remains in China. Consequently, even if the country is able to increase its domestic production, it still requires access to the industrial network that China has built up over several decade. .(Kalantzakos, 2020)

China is a dominant player that controls strategic stages in the supply chain for *rare earth elements*. Against this backdrop, the United States has limited options for completely withdrawing from an industrial system that China now dominates. In other words, China's dominant position is based not only on its high production volume but also on its ability to control the processes necessary for the use of *rare earth elements* in the industrial and defense sectors.

The findings of this study reinforce the research (Mancheri et al., 2019) which suggests that China's main strength in the rare earth metals industry lies in its control of the supply chain and processing capacity. However, this study makes an additional contribution by demonstrating that this dominance has created a form of strategic dependence for the United States, particularly as demand for *rare earth metals* has risen significantly during the 2020–2023 period.

According to the author, the main reason for the United States' strategic dependence lies not in limited mineral reserves, but rather in the United States' limited industrial capacity compared to China's. As long as China maintains its dominance in the processing and refining of *rare earths*, the United States will continue to struggle to achieve full self-sufficiency in the *rare earths* supply chain. Therefore, the strategic dependence observed during the 2020–2023 period can be more accurately understood as a consequence of an unbalanced global industrial structure rather than merely as a result of trade relations between the two countries.

DISCUSSION

The Importance of Rare Earth Elements to the United States, 2020–2023

Rare Earth Elements (REE) are a mineral resource that plays a critical role in supporting various strategic sectors in the United States. (Lisu Allo et al., 2025a) Advances in modern technology have increased the use of *Rare Earth Elements* in the defense industry, renewable energy, electric vehicles, and information technology. (Saragih et al., 2025) These circumstances make *rare earth elements* a critical component of the United States' efforts to maintain its economic competitiveness and national security. Therefore, any discussion of the United States' strategic dependence on China's dominance in *rare earth elements* must begin with an understanding of the importance of *rare earth elements* to various strategic sectors in the United States.

In 2020, the COVID-19 pandemic caused significant disruptions to global supply chains and prompted the U.S. government to focus on the security of critical mineral supplies. (Sulistiyawan et al., 2024) Disruptions in international logistics demonstrate that access to critical minerals is not only a matter of international trade, but also of a country's ability to sustain its economic activities and national security. (House 2020) During this period, the United States still relied on imports to meet most of its domestic demand for rare earth elements. Data from (United States Geological Survey, 2022) shows that China has become one of the main suppliers of rare earth elements used by U.S. industry.

Although the United States has a mine in the mountains of California, this domestic capacity is not yet sufficient to meet the entire national demand, particularly in the areas of processing and refining. The majority of the rare

earth concentrate produced must still be shipped to China for further processing before it can be used in the manufacturing industry. (Lisu Allo et al., 2025b) This situation indicates that the United States' dependence extends not only to the supply of raw materials but also to China's downstream industrial capabilities. The United States' dependence on China for rare earth elements could, in fact, create a vulnerability that China could exploit at any time. As discussed by (K. Khoirunnisa et al., 2025) that conflicts today are not always about military confrontations, but rather about how a country can undermine economic stability without having to take up arms.

From the perspective of dependency theory, this situation demonstrates that dependency can be a source of vulnerability when a country lacks full control over the resources or production processes necessary to meet its strategic needs. This insight supports the research thesis that the United States' dependence on *rare earths* is driven not only by industrial demand but also by its limited ability to independently control the supply chain.

In 2021, the Biden administration made the energy transition one of its top national policy priorities. Through (The White House, 2022) Under Executive Order 14017, the U.S. government is conducting an assessment of the supply chains for various strategic commodities, including critical minerals used in electric vehicles and clean energy technologies. The Supply Chain Review report published by the U.S. government indicates that China's dominance in the processing and refining of rare earth elements poses one of the primary challenges to U.S. economic and national security. (The White House, 2021)

The year 2022 marked a significant turning point as the U.S. government began to link the issue of *Rare Earth Elements* to national security. The Department of Defense and the Department of Energy actively identified *Rare Earth Elements* as critical minerals necessary for maintaining U.S. defense readiness and technological competitiveness (Depraite et al., 2025) In the same year, the government enacted various policies, such as the Inflation Reduction Act and the chips and Science Act, aimed at strengthening the capacity of domestic strategic industries. (The White House, 2022)

From the perspective of dependency theory, this trend suggests that dependency not only entails economic risks but can also undermine a country's ability to safeguard its strategic interests. In other words, the more critical a raw material is to national security, the greater the impact of dependence on external actors. Although various diversification measures have been implemented, the U.S. continues to face limitations when it comes to meeting its own demand for rare earths by 2023. Data from the USGS show that the majority of global rare earth processing and refining remains concentrated in China. (Geological Survey, 2024) As a result, U.S. industries remain dependent on supply chains linked to China's industrial capacity.

In the defense sector, *Rare Earth Elements* are used in various modern weapons systems that form the backbone of the United States' military power. (Bruno Venditti, 2025) explains that elements such as neodymium, praseodymium, samarium, and dysprosium are used in F-35 fighter jets, radar systems, missiles, nuclear submarines, military communication systems, and

advanced sensing technologies. (Rudi Setiawan, 2023) Permanent magnets made from *rare earth elements* make it possible to design military equipment that is smaller, more energy-efficient, and more powerful than equipment manufactured using conventional technology. Therefore, a steady supply of *rare earth elements* is a critical factor in maintaining the United States' defense readiness.

In addition to the defense sector, *rare earth elements* are also playing an increasingly important role in the electric vehicle industry. Through the Inflation Reduction Act and various measures aimed at the energy transition, the U.S. government intends to accelerate the adoption of electric vehicles—as part of its strategy to reduce CO₂ emissions. (Osdpa, 2022) Modern electric vehicle motors use neodymium- and dysprosium-based permanent magnets that are capable of delivering higher energy efficiency than other technologies.

As the renewable energy sector expands, so does the demand for *rare earth elements*. Offshore wind turbines and various clean energy technologies use permanent magnets containing *rare earth elements* to improve operational efficiency. (Rybak et al., 2024) (Renewable Energy Agency, 2023) indicates that the global energy transition toward low-carbon energy is causing demand for critical minerals, including *Rare Earth Elements*, to rise significantly. As one of the countries expanding its renewable energy capacity, the United States faces a steadily increasing demand for *Rare Earth Elements* during the 2020–2023 period.

China's Dominance in the Global Rare Earth Elements Industry, 2020–2023

Developments in the global *rare earth elements* (REE) industry suggest that control over strategic resources depends not only on the ownership of mineral deposits, but also on a country's ability to manage the production, processing, refining, and distribution processes. (Haryo Prasodjo, 2024) To understand the United States' strategic dependence on *rare earth elements*, it is important to examine China's position within the global industrial structure. This dependence cannot be explained solely by high demand from the United States; it must also be viewed in the context of the presence of an actor that has a dominant ability to meet that demand. In the global rare earth elements industry, this position is held by China, which over several decades has successfully built a competitive advantage in nearly every stage of the rare earth elements supply chain.

China's dominance is most evident in the manufacturing sector. According to data (United States Geological Survey, 2024), China was consistently the world's largest producer of *rare earth elements* during the 2020–2023 period. In 2020, China produced approximately 140,000 metric tons of REO (rare earth oxides), which then rose to about 168,000 metric tons in 2021, 210,000 metric tons in 2022, and approximately 240,000 metric tons in 2023. This figure far exceeds the production of other countries such as the United States, Australia, Myanmar, and Thailand. This high level of production demonstrates that China remains the primary supplier of *rare earth elements* to the global market.

China has not only mastered production and processing, but has also achieved industrial integration across the entire value chain, from upstream to

downstream. China's *rare earth* industry encompasses not only mining and refining, but also the manufacture of permanent magnets, (Arendse Huld, 2025) from batteries for electric vehicles to various high-tech products. This integration enables China to generate greater value added while strengthening its position in the global supply chain.

China's dominance in the rare earth industry is evident not only in its enormous production volume but also in its ability to maintain control over global processing and manufacturing sectors. Its strategic strength lies in its ability to control the industry structure, which forms the basis for other countries' dependence on it. (A. S. Khoirunnisa et al., 2026) From the perspective of dependency theory, China's dominance reflects its control over the industrial structures that form the source of its economic power. Consequently, through its dominance in the extraction, processing, and refining of *rare earth elements*, China has secured a very strong position within the global industrial structure.

***The United States' strategic dependence on China's dominance in rare earths
Dependence on China's production capacity for rare earth elements***

Although the United States has significant reserves of rare earth metals and operates the Mountain Pass mine in California, its domestic production capacity is not yet sufficient to meet the entire demand of the domestic industry on its own. Given the rising demand for rare earth metals in the defense, electric vehicle, renewable energy, and high-tech sectors during the 2020–2023 period, the United States remains dependent on additional supplies from the global market. (United States Geological Survey, 2022)

Data from the USGS show that China was consistently the world's largest producer of *rare earth elements* throughout the entire study period, accounting for more than 60 percent of global production. This position makes China the primary supplier in the international market and gives it significant influence over the stability of the global supply of *rare earth elements*. However, the United States' dependence at the production level is not the primary factor explaining the strategic interdependence between the two countries. The United States still has alternative sources of supply from other countries, such as Australia and Canada, which can be utilized to reduce its dependence on raw materials from China. Therefore, the greatest dependence lies in the later stages of the industry, namely processing and refining.

From the perspective of dependency theory, this situation suggests that dependency is not always attributable to a lack of natural resources, but rather to a country's inability to control the entire production process necessary to safeguard its national interests. (Dos Santos, 1970). Thus, the existence of domestic mines does not automatically eliminate dependence if the country still needs external actors in subsequent stages of the industry.

China's Reliance on Rare Earth Element Processing and Refining

The United States' strategic dependence on China is most evident in the processing and refining of rare earth metals. After being mined, rare earth metals must undergo a complex separation and refining process before they can be used in various strategic industries. (International Energy Agency, 2026b) It is precisely this phase that China has successfully navigated in recent decades through investment in industry, government support, and the development of mineral processing technologies.

(Wei-Qiang Chen, 2024) The article has shown that the United States possesses mining capacity for rare earth elements, specifically through the Mountain Pass Mine, which is expected to produce approximately 43 gigatons of rare earth elements in 2022. However, this production capacity is not yet matched by adequate processing and refining capacity. Consequently, the majority of U.S. rare earth production must continue to be shipped to China to be roasted and leached, extracted and separated, and electrolyzed before it can be used by the manufacturing industry. This situation demonstrates that the United States is not only dependent on the supply of raw materials but also relies on China's industrial capacity to produce ready-to-use rare earth products. (Wei-Qiang Chen, 2024) In his article, he also points out that the United States' greatest weakness lies not in the availability of mineral resources, but rather in the limited capacity of its manufacturing industry. (Wei-Qiang Chen, 2024) It also explains that China controls the majority of global rare earth processing and refining, while the United States' involvement in these stages remains limited. This situation prevents the United States from fully controlling the rare earth supply chain needed to support the defense, high-tech, and clean energy sectors.

These findings are consistent with the research (Mancheri et al., 2019) This suggests that China's dominance in the rare earth elements industry has been built up over several decades through the development of processing and manufacturing capabilities, creating a competitive advantage that other countries find difficult to match. This situation suggests that the United States' strategic dependence on China stems more from its failure to sustainably expand industrial capacity in the downstream rare earth sector than from limited natural resources. Although the United States possesses its own rare earth reserves and mines them, it has not yet established a processing and manufacturing system capable of operating independently and at a competitive scale. Consequently, the United States remains dependent on access to industrial facilities in China to meet the needs of its strategic sectors.

These findings are consistent with the research (Liu et al., 2025) This shows that China's dominant position in the global supply chain for *rare earth elements* is primarily based on its control over the processing and refining sector. The study confirms that China's industrial capabilities have created interdependencies from which consumer countries—including the United States—find it difficult to escape.

Under dependency theory, control over the manufacturing sector leads to an unequal relationship between the dominant and the dependent country.

China exercises greater control over strategically important stages of the industry, while the United States relies on access to these industrial capacities to meet its domestic needs. The resulting dependence is therefore not temporary, but rather a consequence of an unbalanced global industrial structure.

CONCLUSIONS AND RECOMMENDATIONS

This study found that this dependence is not primarily due to the United States' limited rare earth metal reserves. Rather, the main reason for this strategic dependence is China's dominant position in the processing, refining, and manufacturing of high-value-added REE-based downstream products within the global supply chain.

This study demonstrates that while the United States possesses production capacity through the Mountain Pass Mine and various policy measures to strengthen the critical minerals sector, the country remains constrained in its ability to independently develop its REE processing and manufacturing industry. Consequently, various strategic sectors such as defense, high technology, electric vehicles, and renewable energy remain dependent on supply chains dominated by China. This situation illustrates that control over downstream industrial stages has a greater impact than the mere possession of mineral resources.

The intended outcome of this research is publication in an international scientific journal. It is hoped that the results of this study will make a significant contribution to previous research and serve as a reference for future studies.

ADVANCED RESEARCH

This study has limitations because it focuses on the 2020–2023 period and uses secondary data derived from government reports, international organizations, and academic publications. Therefore, future research could expand the scope of the analysis by comparing the United States' supply chain diversification strategies for *Rare Earth Elements* with those of other countries, such as Japan, South Korea, or European Union member states. Additionally, future research could analyze the effectiveness of the United States' post-2023 critical mineral industrialization policies to assess the extent to which these efforts can reduce dependence on China's dominance in the *Rare Earth Elements* industry.

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