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Green Initiative and Mineral Governance: The Interplay of EU Policies and Romania's Regulatory Framework

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Abstract: The global shift toward green technologies presents a dual challenge: surging demand for clean technology products and an increasing reliance on critical raw materials (CRMs). While the existing literature has largely concentrated on economic, geopolitical, or general governance perspectives, scant attention has been devoted to the legal, institutional, and justice dimensions of mineral resource governance. This article addresses this gap by examining the European Union's evolving policy framework—particularly the Critical Raw Materials (CRM) Act—and its implications for Romania's national regulatory landscape. Employing a mixed-method approach that combines a systematic literature review and a SWOT analysis, this study assesses Romania's capacity to align its mineral governance with the EU's objectives for supply security, environmental sustainability, and strategic autonomy. Its findings underscore the urgent need for Romania to streamline its regulatory frameworks, enhance institutional coherence, clarify property rights, and reform licensing and fiscal regimes to attract investment and ensure legal predictability. Advancing green mining technologies, recycling initiatives, and sustainability-focused innovations is also vital for aligning national practices with the EU's environmental and economic goals. By foregrounding issues of transparency, good governance, and procedural justice, this article offers new insights into how national and supranational governance structures intersect in the context of the green transition. This study provides valuable recommendations for policymakers, industry actors, and scholars seeking to strengthen Romania's position within the EU's broader resource security and sustainable development strategies.



Academic Editor: Tim Gray

Received: 2 March 2025

Revised: 5 May 2025

Accepted: 8 May 2025

Published: 15 May 2025

Citation: Alexandru, D.-G.; Balan, E.; Berceanu, I.B.; Iftene, C.; Varia, G.

Green Initiative and Mineral

Governance: The Interplay of EU

Policies and Romania's Regulatory

Framework. *Sustainability* **2025**, *17*,

4512. <https://doi.org/10.3390/su17104512>

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Keywords: critical minerals; legal framework; institutional design; circular economy; mining sustainability

1. Introduction

Presently, the global demand for critical raw materials is growing, and the forthcoming era will rely on metals, which will be challenging. The economic growth of any nation is closely linked to the large-scale utilization of minerals as a source of high-tech materials and metals [1], and due to their essential role in advancing these new clean and efficient technologies, many European countries have started to pay increased attention to strategic raw materials. The field literature shows that the persistent demand for resources, which is driven by population growth, economic expansion, and technological innovation, presents a dynamic picture of the crucial link between mineral resources and the trajectory of

human development [2]. This heightened focus is driven by the imperative to ensure a secure supply and the European Union's commitment to promoting a circular economy. In 2011, the U.S. Department of Energy published a Critical Materials Strategy [3], while the European Commission prioritized 14 critical raw materials in its raw materials initiative [4]. Other countries in other parts of the world have also addressed their long-term national raw materials security by publishing reports on energy-critical elements and rare earth materials [5].

The criticality of raw materials or minerals can be defined according to certain parameters. Economic importance and supply risk are two widely applied criteria for classifying a material as critical [6,7]. Supply risk encompasses factors such as the geographical concentration of reserves, the governance conditions in producer countries, trade, geopolitics, and technological advancements in end-use and recycling, determining existing and likely supply restrictions [8–10]. Thus, the definition of “critical” minerals varies and has been discussed in the literature using different terms. However, there is a consensus that the concept of criticality revolves around the security of supply and the probability of its disruption [11,12].

An assessment of different mineral demand scenarios suggests that a shortage of critical minerals is likely to occur [13]. This scarcity and the supply risk pose challenges in mineral resource governance for achieving sustainable development goals [14]. The unequal distribution of critical minerals reserves globally highlights the importance of the spatial aspect to governance. The location and governance mechanisms of host countries play a crucial role in determining supply security [15].

Strategic minerals being located in fragile countries may contribute to heightened tension and conflict, introducing uncertainty into the supply chain [16]. OECD [17] forecasts that competition for critical raw materials and their concentration among a limited number of countries could give rise to geopolitical risks. Increased focus has been placed on the geopolitical challenges associated with accessing critical minerals, particularly considering the dominance of a few global suppliers in rare earth materials and other minerals crucial to achieving climate neutrality goals [12,18].

The European Union (EU) faces significant dependence on imports for most of the minerals and metals it deems critical to its economy [19]. This concern has persisted for decades [20]. Nonetheless, it is important to highlight that Romania possesses considerable mineral wealth and a diverse array of potentially exploitable mineral resources. Statistics on the global economy in 2021 positioned Romania as the fourth highest-ranking country in the EU for its GDP revenue from mineral resources. This mirrors the same rank held in 2015, with analysts placing Romania in the fourth or fifth position in Europe for mineral resources [21].

The Romanian Mining Law (Act 85/2003) [22], along with subsequent amendments, provides the legal foundation for mineral resource governance in the country. This act regulates exploration, exploitation, and mine closures while outlining licensing and permitting processes, land use provisions, environmental protection requirements, and royalty allocations. However, despite its comprehensive scope, the act has faced criticism due to its inconsistent implementation, procedural inefficiencies, and challenges in aligning public and private interests. These issues, where unaddressed, hinder Romania's ability to fully leverage its mineral wealth to support both domestic growth and EU strategic objectives.

In recent years, Romania has adopted policies to address these challenges, such as the Mineral Resources Policy and Strategy 2023 [23], which integrates sustainable practices, “green mining” initiatives, and resource efficiency. These efforts align with the European Union's strategic objectives to secure critical raw materials and reduce its dependency on external sources.

Access to resources is a strategic security question for Europe, especially in the pursuit of the Green Deal. The new industrial strategy emphasizes the need to strengthen Europe's open strategic autonomy, cautioning that EU must ensure diversified and undistorted access to global markets for minerals. As if this challenge was not enough, the COVID-19 crisis and the energy crisis sparked by Russia's war of aggression against Ukraine have revealed just how fast and how deeply global supply chains can be disrupted. In response, the European Commission [19] has put forth an ambitious recovery plan aiming to enhance resilience, promote open strategic autonomy, and facilitate the shift toward a green and digital economy. The development of diversified, resilient supply chains of sustainable raw materials is part of this strategy.

In 2020, an action plan on critical raw materials (CRMs) was adopted, and the List of Critical Raw Materials, which is subject to regular review, was updated [19,24]; in 2023, a fifth list comprising 34 CRMs was published. This act provided a framework for assessing criticality, promoting international diversification, fostering research and innovation, and developing the CRM production capacity within the EU. However, non-regulatory measures have proven insufficient to guarantee the EU's access to a secure and sustainable supply of critical raw materials. Therefore, the European Parliament has adopted a regulatory framework [25] specifically designed to systematically mitigate the supply risks across a spectrum of critical raw materials.

Mineral resource governance, while seemingly abstract, is explicitly linked to and should consistently reference the internationally agreed UN sustainable development goals established in 2015 [26,27]. Mineral resource governance should also address the need to decouple economic growth from negative impacts on the global ecosystem that supports life. Governance constitutes the fourth dimension of sustainable development, complementing the commonly used economic, environmental, and social dimensions that characterize the concept of sustainable development [28,29]. In relation to the mineral resource and metal industry, governance can be characterized as the framework encompassing laws, regulations, voluntary initiatives, standards, norms, practices, and institutions [30,31].

Effective governance necessitates the rigorous implementation of verifiable measures and an unwavering commitment from all stakeholders to upholding this framework [32]. The purpose of this paper therefore is to address the challenges that arise in establishing and implementing effective policies, institutional frameworks, and regulations within the mineral sector. The following two sections of this paper explore the challenges of EU's mineral policies and their impact on the governance of minerals in Romania. Further, in the Results and Discussion sections, complex issues, intricate dynamics, and many opportunities are explored based on the SWOT analysis. The conclusions offer valuable insights into critical concerns and help identify areas that require attention and action.

2. Materials and Methods

2.1. *The Context of the Legal and Institutional Framework for Mineral Governance in Romania*

2.1.1. The Legal Framework

Romania is a unitary state with 41 counties, each with its own local authorities elected by the local communities. According to the Constitution of Romania [33], its subsoil resources are the property of the Romanian State, and its interests are expressed through mineral resource policy documents and through a non-energy mineral resource strategy adapted to a new economic reality. The main legal framework guiding the mining industry in Romania is Mining Law no.85/2003 [22]. The framework for the sector sets a clear direction, focusing on (i) fostering responsible mining practices; (ii) ensuring inclusivity, particularly by providing municipalities and residents in mining areas with opportunities

to participate in decision-making; and (iii) enhancing mine safety and minimizing the environmental impacts resulting from mining activities.

The Ministry of Economy has finalised a project [34] using European non-reimbursable funds to contribute to the systematisation and simplification of the active background of the legislation and reduce the administrative burden on the business environment to develop evidence-based policies. As per the official legislative record of the Legislative Council, there are currently two legislative funds in force in Romania, namely the old fund from 1864 to 22 December 1989, which is in continuous decline, and the legislative fund created in 1989 and in force from then until now, which is in continuous expansion.

According to the database [34], the Inventory of Non-Energy Mineral Resources contains a total of 1255 national and European regulations, as well as guides and manuals on good practice, selected according to the criteria of regulatory incidence. In view of the situation observed, it is necessary both to continue the process of simplification, systematization, and updating of the main regulations and to harmonize the field of mineral resources using the conditions and limitations imposed by the challenges that have arisen in the national and European contexts.

2.1.2. Institutional Design

The design of governmental institutions is crucial to natural resource governance. It influences the power dynamics, stakeholder responsibilities, and decision-making processes. This includes equitable sharing of the benefits and costs associated with natural resources [30]. Additionally, Freyfogle [35] shows that natural resource policy is predominantly determined by governments rather than the communities where the resources are located. Therefore, an analysis of the institutional framework responsible for the mineral resources in Romania is necessary.

As pointed out by Constantinescu et al. [21], the role of governments through its institutions is a key one in the development and use of the mineral potential that states have. The institutional framework, illustrated in Figure 1, is crucial for building operationalization, implementation, monitoring, and evaluation mechanisms. This is essential to achieving the intended results of the local content policy and other national development objectives. The organizational and institutional design outlines the main tasks of key institutions in driving the economy towards transformation and long-term sustainable growth and development.

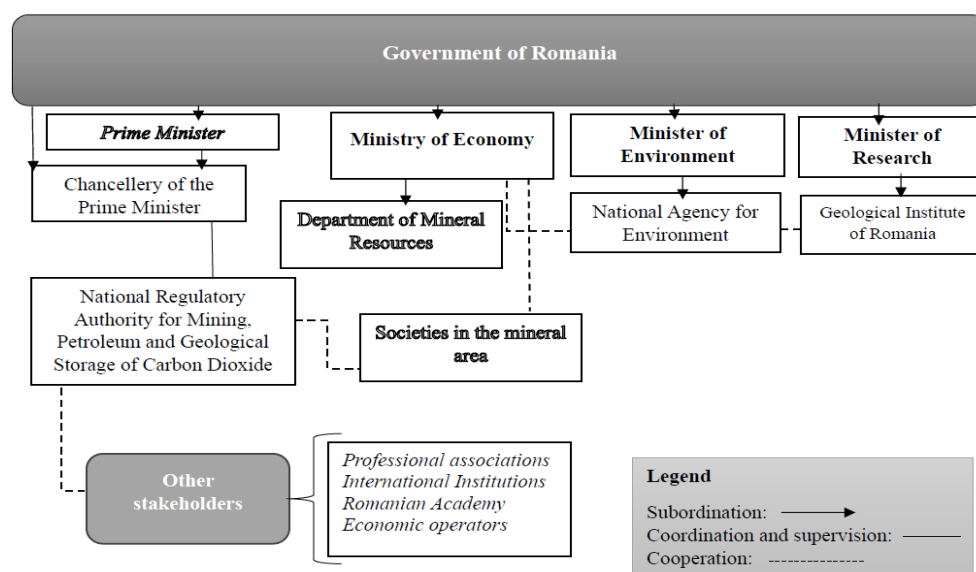


Figure 1. Institutional design. Source: the authors.

According to the Administrative Code [36], the Government of Romania is the main authority responsible for the balanced functioning and development of the national economic and social system. Among its key functions are regulatory oversight to develop the necessary framework for strategic objectives and the administration of state property, including the public-interest wealth of the subsoil, such as mineral resources. The key institutions in Romania forming the institutional framework for mineral resource management include the Ministry of Economy, Digitalization, Entrepreneurship and Tourism (referred to as the Ministry of Economy—ME). It operates as a specialized body within the central public administration, reporting to the government. Its role involves executing the strategy and government programs in various economic domains, including mineral resources [37].

The ME manages a portfolio of ten companies relevant to mineral resource sectors, undertaking operations in the exploitation, extraction, processing, and valorization of such resources. The Ministry's undertakings in non-energy mineral resources are overseen by the Direction of Mineral Resources (DMR). The DMR is a subordinate entity within the ME, with the objective of facilitating the attainment of the ME's goals within this domain. These include the harmonization of legislative frameworks with national and European legislation pertaining to non-energy mineral resources and sustainable development, as well as enhancement of the value added throughout the non-energy mineral resource cycle. The ME and the DMR engage in collaborative efforts with a multitude of agencies and institutes that are engaged in mineral-resource-related activities. One such example is the Geological Institute of Romania, which is the institution that is authorized to undertake the compilation, editing, and printing of national geological, hydrogeological, geophysical, and metallogenic maps at various scales.

Until June 2024, the National Agency for Mineral Resources (NAMR) operated as a prominent institution within the government's jurisdiction. Moreover, it was responsible for the management of mineral resources and the oversight of licensing and permitting processes on behalf of the state. It was also tasked with the dissemination of information to the public. In June 2024, the Romanian Government adopted an emergency ordinance [38] establishing the National Regulatory Authority for Mining, Petroleum and Geological Storage of Carbon Dioxide (ANRMPSG), a specialized body of the central public administration, with legal personality, financed entirely from its own revenues, subordinated to the government and coordinated by the Prime Minister, through the Chancellery of the Prime Minister. This new authority was created through the reorganization and transformation of the National Agency for Mineral Resources (ANRM), which was abolished.

The ANRMPSG will pursue several general objectives, including the development and systematization of the National Geological Fund and the National Fund of Resources and Reserves and the rational exploitation and development of mineral resources and oil reserves, in accordance with the strategies in the field and reductions in its environmental impact.

In the execution of its duties, the ANRMPSG maintains a few collaborative relationships. It engages in collaborative activities with ministries and other specialized bodies of the central or local public administration. As illustrated in Figure 1, a significant aspect of this collaboration is partnership with stakeholders over oil and geological storage of carbon dioxide. It is therefore vital to consider the implications of the current institutional design created by the recent new regulations when analyzing the suggestions for improving collaboration. One such suggestion is to give more powers to the Romanian Academy, which contributes scientific expertise relevant to mineral resource exploration and geohazard assessments, especially in the context of sustainable development and geological risk management.

The ANRMPSG engages in collaborative partnerships with the regulatory authorities of other states, including the European Commission, with the objective of harmonizing the regulatory framework for the development of the regional market. This framework encompasses the rules on cross-border trade in mineral resources, oil, and natural gas, as well as those pertaining to the management and allocation of interconnection capacities. Additionally, the ANRMPSG may conclude collaborative partnerships with Romanian or foreign research institutions.

2.2. Methods

This paper entails an analysis and synthesis of findings derived from the literature regarding the influence of the European Union's policies on mineral governance within the backdrop of climate challenges. For the Romanian legal framework concerning mineral governance, this research followed the guidelines provided by the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) [39], which is considered a critical advancement in the methodological refinement of evidence synthesis [40] for transparent identification and screening of the eligibility of pertinent sources. Systematic reviews are characterized through strict adherence to a set of scientific methods explicitly designed to minimize systematic error or bias. This is achieved by systematically identifying, appraising, and synthesizing all pertinent studies, regardless of their design [41].

Using the Scopus database, as the primary repository for academic journals and magazines [42], to find the relevant sources on Romanian mineral legislation, a search for "Romania mining legislation" was performed, which retrieved 1252 documents. After screening the titles, abstracts, and keywords, 55 records were identified and sought for retrieval that referred to the Romanian legislation on mining. The criteria used for the inclusion and exclusion of the studies were the following: (i) The inclusion of academic publications: journal articles, conference proceedings, and book chapters. (ii) The inclusion of academic sources published within the timeframe of 2003–2024. We chose this specific timeframe starting with the adoption of the Romanian Mining Law no.85/2003 to follow the developments reflected in the academic literature up to 2024. (iii) The exclusion of academic sources not published in English. In the second stage, the remaining 41 sources, which included 21 articles, 19 conference papers, and 1 book chapter, underwent a full-text screening, and this process is illustrated in Figure 2.

The 41 studies cover a range of thematic areas that include Environmental Science (20), Earth and Planetary Science (19), Energy (8), Social Sciences (5), Engineering (4), Chemistry (3), Computer Science (3), Agricultural and Biological Sciences (2), and Arts and Humanities (2). Regarding the country/territory, the large majority refer to Romania (37), followed by the United Kingdom (2) and United States (2) and by Australia (1), Finland (1), Greece (1), Hungary, and Serbia (1). The second stage of the screening process indicates that the legislative framework concerning mining in Romania is often approached in relation to environmental protection, with a focus on prominent accidents like the 2000 Baia Mare mining accident, sustainable land management and ecological rehabilitation, mine closures, and the effects of economic restructuring on different mining regions. The legal framework on mining in Romania has been treated sporadically, resulting in what we consider a lack of comprehensive treatment of this topic in the scientific literature indexed in Scopus.

Widely used in the field of social sciences, content analysis is a commonly employed method, particularly concerning legal documents and legal analyses [43,44]. This method was used as a complement to the analysis and synthesis method, with the aim of identifying recommendations or trends and assessing the strengths or weaknesses present in the Romanian legal and institutional framework. The initial phase of the analysis involved mapping the substantive scope of mineral governance, and it then moved to the

operational scope of the SWOT analysis. Prioritizing actions involving interaction and compliance with other policies, the analysis then delved into an examination of the legal and institutional framework.

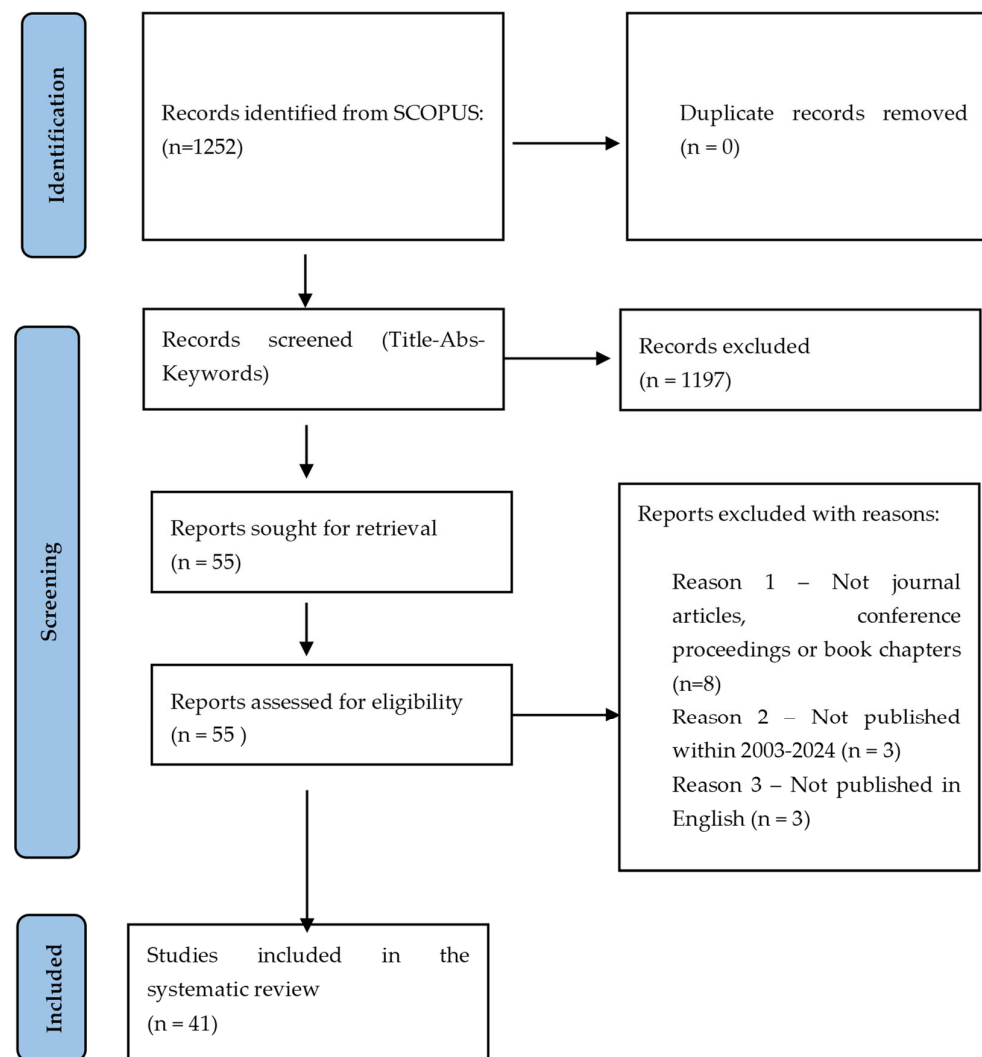


Figure 2. The network of the keywords “Romania mining legislation”. Source: the authors, using the PRISMA model [39].

This examination focused on identifying positive aspects (strengths and opportunities), as well as potential drawbacks (weaknesses and threats). The findings, presented below, serve as a basis for the critical assessment of mineral governance, employing the SWOT analysis as a research method. The SWOT analysis serves as a valuable method for exposing potential future effects, particularly during the evaluation stage. Its four components categorize the factors into either internal or external categories.

Strengths pertain to internal elements within an organization that facilitate the achievement of its goals, while weaknesses involve internal factors that impede organizational success. Opportunities are external aspects that are essential for success and fill in the gaps and offer new activities to explore. Conversely, threats or challenges encompass external elements that pose obstacles to organizational success [45]. Both academics and practitioners have employed SWOT analysis as a tool to assess the positions of organizations and consequently to define their strategies [45]. This method systematically examines and brings attention to all characteristics, relationships, and synergies among the internal and external factors pertaining to a phenomenon [46].

3. Results

The SWOT analysis of Romania's mineral resource sector must be situated within the broader context of the increasing global demand for critical raw materials and the evolving frameworks of mineral governance, as informed by the literature on the resource security, sustainability, and geopolitics of supply [8,12]. Moreover, the integration of the SWOT analysis with future-oriented strategies in mineral resource management not only facilitates a deeper understanding of navigating imminent challenges and opportunities but is also of critical importance in ensuring adaptability to the evolving landscape of global mineral resource management and assuring the implementation of strategies that are resilient and forward-looking [47]. By integrating insights from academic research and EU policy directives, we can critically evaluate Romania's strengths, weaknesses, opportunities, and threats in mineral governance while addressing the necessary adjustments for policy alignment and sustainable development. The SWOT analysis of Romania's mineral resource governance reveals a nuanced perspective on its strengths, weaknesses, opportunities, and threats, especially when examined within the broader context of global and EU mineral governance frameworks. Figure 3 provides a synthesized visual representation of these elements, offering a clear and concise overview that supports the subsequent discussion.

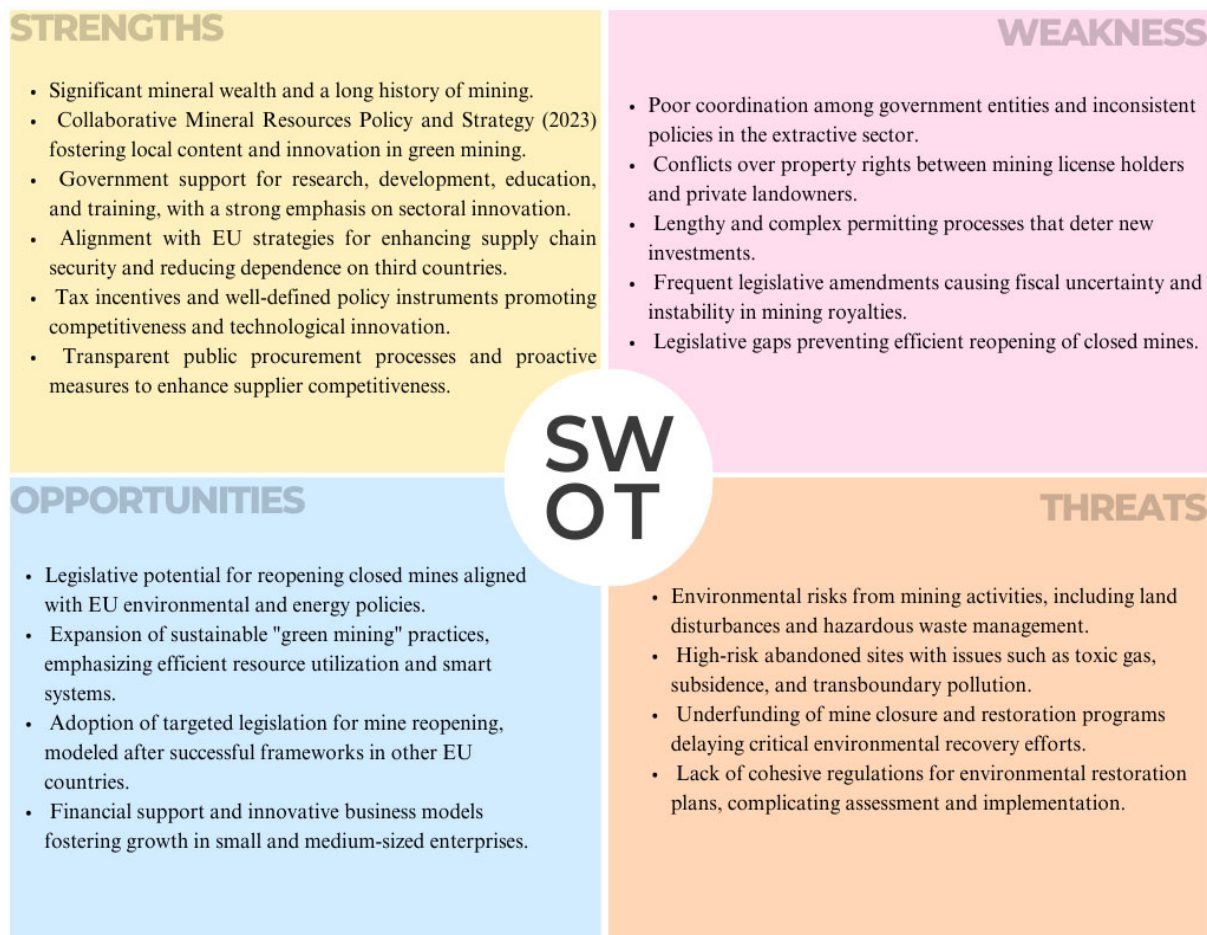


Figure 3. A SWOT analysis of Romania's mineral resource governance. Source: the authors.

3.1. Strengths: Strategic Resources and Policy Alignment

Romania's key strength lies in its extensive mineral endowment and its long-established mining industry, which provide a substantial foundation for the country's alignment with the EU's critical raw material strategy [19]. As the literature highlights, the criticality of minerals is often tied to their economic importance and supply risk [7,11]. Ro-

mania's significant reserves of copper, gold, and rare earth elements position it as a crucial player within the EU's broader strategy to reduce its dependency on external suppliers and enhance its resource security.

The adoption of Romania's Mineral Resources Policy and Strategy in 2023 reflects an effort to modernize the sector and align with EU priorities, particularly those outlined in the EU Green Deal and the Circular Economy Action Plan. By emphasizing sustainable practices, including "green mining" initiatives and recycling efforts, Romania aims to decouple its economic growth from environmental impacts, echoing the EU's commitment to achieving climate neutrality [27,29]. This strategic shift, supported by investment in research and development (R&D) and educational programs, enhances Romania's capacity to innovate and aligns with the best practices in mineral resource governance, which emphasize the integration of economic, environmental, and social dimensions [30].

The move from direct state intervention to a facilitative governance role has created a more favorable investment climate, consistent with international recommendations for responsible mineral governance [32]. By implementing tax incentives and financial support for small businesses, Romania has strengthened its competitive advantage, aligning its strategies with the EU's Raw Materials Initiative, which encourages member states to foster innovation and support domestic mining industries.

3.2. Weaknesses: Regulatory Fragmentation and Investor Uncertainty

Despite its strategic advantages, Romania's mineral resource governance exhibits critical weaknesses, particularly in regulatory coherence and policy implementation. As Mu et al. suggest [15], the effectiveness of mineral governance is significantly influenced by the alignment of regulatory frameworks and the capacity of institutional bodies. In Romania, a lack of coordination between government entities has resulted in fragmented policy execution, undermining the comprehensive legal framework established by the Mining Law. This inconsistency is compounded by frequent amendments to the legal framework, particularly regarding royalties, which create an unpredictable fiscal environment that discourages both domestic and foreign investment [17].

The literature on supply risk and governance conditions emphasizes the need for stable and predictable legal environments to attract sustained investment [11,13]. Romania's frequent changes to its Mining Law contrast with EU directives that advocate regulatory stability and transparency. Additionally, the extended duration of mining licenses without competitive re-auctioning limits market access, stifling innovation and contradicting the EU's recommendations for transparent and fair market practices [24].

Furthermore, the protracted and complex permitting process in Romania hinders efficient project approvals, delaying the development of critical raw material sources. This procedural inefficiency is highlighted in the literature as a significant barrier to resource security [6]. The EU's Action Plan on Critical Raw Materials calls for simplified permitting procedures to accelerate sustainable mining projects, yet Romania's current administrative delays reflect a misalignment with these policy objectives.

3.3. Opportunities: Aligning with the EU's Strategic Autonomy and Green Transition

The rising global demand for critical raw materials, driven by the transition to clean energy technologies, presents a significant opportunity for Romania. The European Union's focus on strategic autonomy and diversified supply chains, as articulated in the Critical Raw Materials Act, aligns well with Romania's potential to exploit its mineral wealth more effectively. Access to environmentally friendly and economically sustainable recycling will also be crucial. More than 50% of metals, such as iron, zinc, and platinum, are recycled, and data suggest that this accounts for more than 25% of the consumption needs in the

EU. As far as CRMs are concerned, the recovery rate from secondary sources is below 1%, and therefore they contribute little to meeting rapidly growing demand. Even if recycling were to become more efficient by 2050, it could not close the large gap that currently exists between the future demand and supply of CRMs by itself [48]. The global literature on critical minerals underscores the importance of developing local production capacities to reduce geopolitical risks and enhance supply security [12,18]. By leveraging its abundant resources, Romania can play a key role in the EU's strategy to secure reliable access to critical minerals, thereby contributing to the resilience of European supply chains.

Romania's ongoing investments in green mining technologies and recycling initiatives align with the EU Green Deal's emphasis on sustainability and resource efficiency. The integration of recycling practices into the mining value chain reflects the circular economy principles advocated in the literature, which highlight the importance of reducing waste and maximizing resource recovery [29]. Enhanced R&D in sustainable mining techniques could position Romania as a leader in eco-friendly mineral extraction, tapping into EU funding opportunities designed to promote innovation and environmental sustainability [19].

The legislative gap regarding the reopening of closed mines also presents an opportunity for Romania to update its regulatory framework. As suggested by the international best practices, developing specific guidelines for mine reopening that adhere to strict environmental safeguards could unlock additional reserves while ensuring compliance with EU standards [16]. This would align Romania's policies with the EU's broader goal of maintaining a low-carbon economy and enhancing resource independence.

3.4. Threats: Geopolitical Risks and Environmental Concerns

The threats to Romania's mineral resource governance are closely tied to broader geopolitical and environmental challenges identified in the literature. The unequal distribution of critical mineral reserves globally and the dominance of a few key suppliers exacerbate supply risks [11,18]. Romania's reliance on outdated regulations and the absence of a comprehensive strategy for environmental restoration present significant risks, particularly as the EU tightens its environmental standards under the Green Deal and the Circular Economy Action Plan [24].

Environmental degradation and inadequate waste management are pressing issues that undermine Romania's alignment with the EU's sustainability objectives. The literature on mineral governance stresses the importance of robust environmental regulations and comprehensive post-closure land rehabilitation [28,30]. Romania's current underfunding of environmental conservation programs and the absence of strong financial guarantees of restoration exacerbate the risks of land degradation and ecological damage, threatening compliance with the EU's directives and sustainable development goals [26].

Additionally, the geopolitical risks associated with concentrated supply chains for critical minerals pose a threat to Romania's aspirations for enhanced resource security. The disruptions caused by the COVID-19 pandemic and geopolitical tensions, such as the conflict in Ukraine, have highlighted the vulnerabilities in global supply chains [17]. In summary, Romania's current mineral resource policy framework demonstrates strategic intent but requires significant improvements to address regulatory inconsistencies, enhance legal clarity, and foster a more investor-friendly environment. By focusing on policy coherence, streamlined regulations, and sustainable innovation, Romania can revitalize its mining sector and align with EU objectives for resource security and sustainable growth.

4. Discussion

This section advances a set of policy recommendations designed to address the governance gaps identified in Romania's mineral resource framework. Drawing upon a European

Union (EU) perspective, the recommendations are organized into the form of a Policy Recommendations Matrix (Table 1), which systematically links key national challenges to potential interventions and responsible actors.

Table 1. Policy Recommendations Matrix: strengthening Romania’s mineral governance. Source: the authors.

Issue/Challenge	Current Gap/Weakness	Recommended Action	Responsible Actors
Weak institutional coordination	Fragmented governance between environmental, economic, and mining agencies	Establish inter-agency taskforces to align environmental protection, mining regulation, and labor policies	Romanian ministries (environment, economy, labor)
Low community trust and social licenses	Limited stakeholder engagement; local communities excluded from decision-making	Introduce mandatory community consultation processes and benefit-sharing agreements in mining projects	Local governments, mining companies, civil society
Environmental and biodiversity impacts	Partial implementation of the EU Natura 2000 and biodiversity safeguards	Strengthen environmental impact assessment (EIA) processes by integrating climate and biodiversity considerations	National Environmental Protection Agency, EU bodies
Critical raw material supply security	Overreliance on a narrow set of domestic mining actors; insufficient diversification	Promote the exploration of diversification through public–private partnerships and leveraging EU funding mechanisms	National Geological Institute, Ministry of Economy, EU funding arms
Transparency and anti-corruption	Weak public disclosure on mining licenses, revenues, and environmental performance	Fully implement Extractive Industries Transparency Initiative (EITI) standards, including regular public reporting	Ministry of Finance, National Integrity Agency, watchdog NGOs

The lens employed here serves two analytical purposes. First, it underscores that many of the institutional and regulatory deficiencies facing Romania—such as fragmented inter-agency coordination, insufficient stakeholder engagement, and the incomplete implementation of environmental safeguards [49]—are not isolated phenomena but reflect broader governance challenges observable across EU member states. Second, the integration of a European framework highlights Romania’s obligations and opportunities under the evolving legal and policy landscape in the EU. Instruments such as the Critical Raw Materials (CRM) Act, the European Green Deal, and the Just Transition Mechanism create both normative and financial incentives for member states to align their national mineral governance with broader EU sustainability and resilience objectives. As such, these recommendations are not only intended to strengthen Romania’s domestic regulatory framework but also to facilitate its active and constructive participation in the EU’s emerging raw materials governance regime.

The matrix below synthesizes the principal policy proposals emerging from this analysis, aligning the governance gaps identified with targeted recommendations, the responsible implementing actors, and comparative experiences from the EU.

While this matrix provides a structured roadmap for reform, it is critical to recognize that policy transfer is seldom a straightforward process. Romania’s post-communist governance trajectory, regional socio-economic disparities, and historically rooted public distrust toward extractive industries [50] necessitate a careful process of contextual adaptation.

Moreover, successful implementation will require sustained political commitment, cross-sectoral coordination, and the mobilization of financial and technical resources [51] including those available through EU mechanisms such as the Just Transition Fund, Horizon Europe, and the European Investment Bank. In this regard, enhancing transparency, promoting meaningful stakeholder engagement, and embedding robust environmental safeguards are not merely matters of regulatory compliance but are essential components for building institutional legitimacy and ensuring the long-term sustainability of Romania's mineral governance regime within the broader European context.

5. Conclusions

In recent years, academic and policy debates have increasingly recognized the critical role of minerals in advancing the clean energy transition, securing supply chains, and promoting a circular economy. However, much of the existing literature remains focused on economic and geopolitical perspectives, with limited attention to the legal, institutional, and justice dimensions of mineral governance. This study addresses this gap by providing a systematic analysis of Romania's evolving mineral governance framework, situated within the broader European Union (EU) context, using a mixed-method approach informed by environmental governance and resource justice theories.

Our findings reveal that Romania's governance framework demonstrates both strategic foresight—exemplified by the 2023 Mineral Resources Policy and Strategy—and persistent structural challenges, including regulatory fragmentation, the inconsistent application of land use and mineral policies, and tensions between strict environmental safeguards and economic imperatives. While the government's shift from being a direct market participant to a facilitator has encouraged investment and innovation, weaknesses in legal coherence, property rights, and environmental rehabilitation funding continue to limit the sector's potential.

To address these challenges, we introduce a Policy Recommendations Matrix (included in this manuscript), summarizing actionable steps to enhance policy coherence, streamline licensing procedures, stabilize royalty regimes, and integrate green mining innovations. Drawing on a comparative EU–local perspective, we situate Romania's experience alongside that of other EU member states, identifying both transferable lessons and context-specific divergences.

Crucially, we foreground the often-overlooked issue of justice, emphasizing the need to strengthen procedural justice (transparency, stakeholder inclusion), distributive justice (the fair allocation of benefits and burdens), and intergenerational justice (long-term environmental stewardship). Addressing these dimensions is essential for improving the legitimacy of domestic policy and aligning Romania's governance practices with the EU's Green Deal and climate objectives.

As a conceptual innovation, we propose a generalizable governance framework that synthesizes the legal, institutional, and policy lessons drawn from the Romanian case. This framework offers a transferable analytical tool for assessing governance dynamics and justice integration across other EU mineral governance regimes.

Finally, we outline several focused research directions to be explored further: empirical investigations into how national governance mechanisms contribute to climate mitigation outcomes; undertaking comparative cross-country analyses to identify the best practices and regulatory gaps in EU mineral governance; and evaluating the social and environmental justice implications of mineral extraction, with particular attention to stakeholder engagement, benefit-sharing, and intergenerational sustainability.

By pursuing these research avenues, scholars and policymakers can work toward building a more comprehensive, just, and effective governance architecture for the critical

raw material sector—one that supports Europe’s green and digital transitions on a stable, equitable, and sustainable foundation.

Author Contributions: Conceptualization: D.-G.A., E.B. and I.B.B. Methodology: D.-G.A. and I.B.B. Formal analysis: C.I. and E.B. Writing—original draft preparation: D.-G.A., I.B.B. and G.V. Writing—review and editing: D.-G.A., I.B.B. and G.V. Funding acquisition: D.-G.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by a project financed by the Lucian Blaga University of Sibiu through the research grant LBUS-IRG-2023-09.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Information about data availability are contained within the article.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

ANRMPSG	National Regulatory Authority for Mining, Petroleum and Geological Storage of Carbon Dioxide
DMR	Direction of Mineral Resources
ME	Ministry of Economy, Digitalisation, Entrepreneurship and Tourism
NAMR	National Agency for Mineral Resources
CMR	Critical Raw Materials

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