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ARTICLE

Critical and Strategic Minerals in Brazil: A Sovereignty and Climate Agenda

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Abstract

The definition of critical and strategic minerals is linked to the susceptibility of the supply, the capacity of consumption and the commercial advantages that they provide to the country holding these resources. In Brazil, authorities have been striving to broaden the understanding of the role and importance of critical and strategic minerals in the country's economy, considering variations in technological trends and global market dynamics. In general, the countries of the European Union, as well as China, the United States, South Africa, India, Russia, Australia and Canada have coordinated government initiatives and programs to identify the essential minerals for their production chains, in order to develop supply strategies and the associated public policies to meet their demands.

The concept of mineral sovereignty, recently under discussion, is closely tied to the production and supply strategies of critical and strategic minerals among nations. Within this context, mineral sovereignty implies that the country must have the decision-making authority to extract and use its critical and strategic minerals. In addition, the proper use of critical and strategic minerals is also subject to the application of best practices of responsible mining, and countries should encourage public policies that boost the mineral sector in order to contribute to sustainable development, the green economy and decarbonization.

The article explores the concept of critical and strategic minerals in Brazil and discusses the challenges for their responsible and sustainable use in the country, taking into account their contribution to the just transition and climate agenda, and considering the important role of the small-scale mining sector in the use of critical and strategic minerals, predominantly found in smaller-scale mineral deposits.

KEYWORDS
Critical Minerals; Strategic Minerals; Mineral Sovereignty; Just Transition; Mineral Geopolitics.

Critical and Strategic Minerals in Brazil: A Sovereignty and Climate Agenda

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1. Introduction: what critical and strategic minerals are

"Critical minerals, often referred to as "high-tech minerals" or "green minerals," are essential for developing clean technologies and meeting societal demands. These minerals are important for the industry and are indispensable for the generation of renewable energy, such as wind turbines and solar panels, in addition to incorporating low-carbon infrastructures and technologies."

Critical minerals, often referred to as "high-tech minerals" or "green minerals," are essential for developing clean technologies and meeting societal demands. These minerals are important for the industry and are indispensable for the generation of renewable energy, such as wind turbines and solar panels, in addition to incorporating low-carbon infrastructures and technologies (Hine, Gibson and Mayes, 2023).

The "critical" and "strategic" nomenclature applied to these minerals lacks a global consensus, being subject of debates associated with constant technological evolution, as well as global crises and disruptions that affect supply chains. The definition of critical or strategic minerals varies among countries, leading to differing interpretations (Hayes and McCullough, 2018). Thus, the design of critical minerals is linked to their susceptibility to supply and their importance in the value chain. On the other hand, in the international market, strategic minerals are characterized by the commercial advantage they give to the country holding the resources.

1.1. The Brazilian definition

According to Decree N. 10.657, article 2, of March 24, 2021, the Brazilian definition of "strategic minerals" corresponds to the following groups (Brasil, 2021):

> Group I – Mineral goods that the country requires significant imports for the supply of vital sectors of the economy[4]: Sulfur; Phosphate Ore; Potassium Ore; and Molybdenum Ore.
>
> Group II – Mineral goods that are important in high-tech products and processes (both in Brazil and abroad): Cobalt Ore; Copper Ore; Tin Ore; Graphite Ore; Platinum group ores; Lithium Ore; Niobium Ore; Nickel Ore; Silicon Ore; Thallium Ore;

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4. According to Resolution CNDI/MDIC N. 1, of July 6, 2023, of the National Council for Industrial Development, the missions for the construction of industrial policy that directly impact critical and strategic minerals are: sustainable and digital agro-industrial chains for food and nutritional security; sustainable infrastructure, housing, sanitation and mobility for productive integration and well-being in large cities; digital transformation of industry to increase competitiveness; bioeconomy, decarbonization and energy transition and security to guarantee resources for future generations; and technologies of interest to national sovereignty and defense (CNDI, 2020).

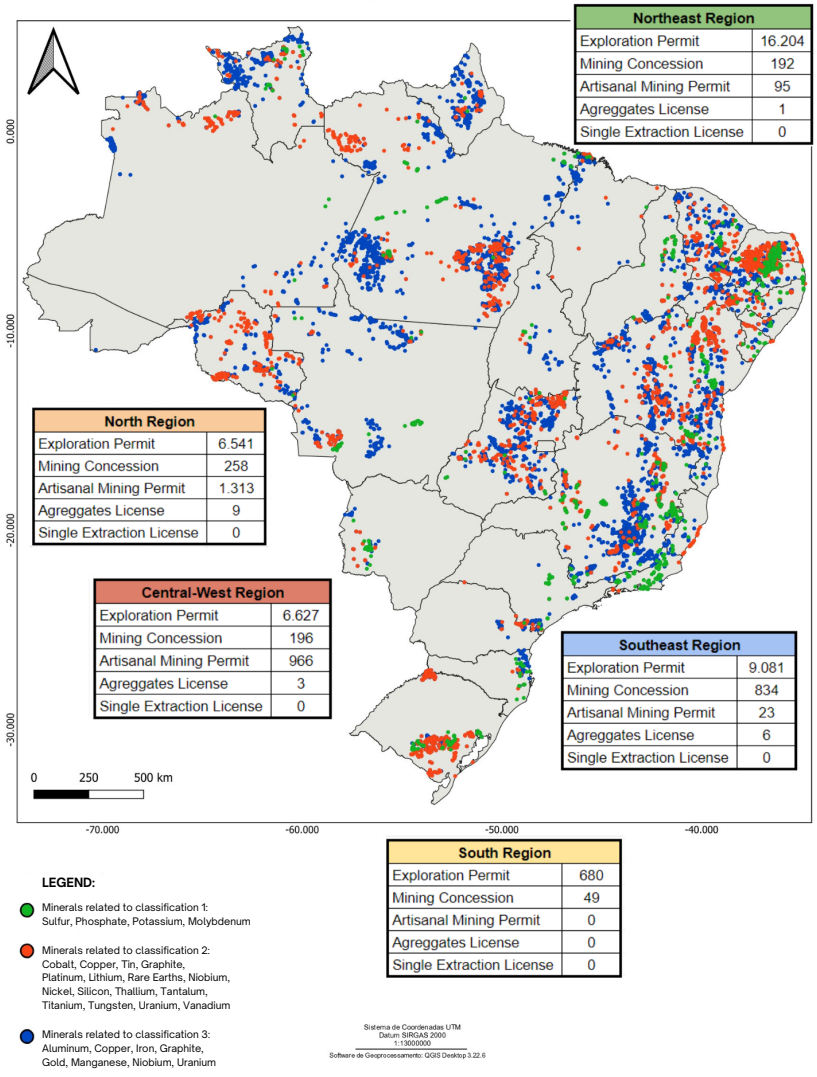
Tantalum Ore; Rare Earth Ore; Titanium Ore; Tungsten Ore; Uranium Ore; and Vanadium Ore.

Group III – Mineral goods that have comparative advantages and that are essential for the economy by generating a surplus in the country's trade balance: Aluminum Ore; Copper Ore; Iron Ore; Graphite Ore; Gold Ore; Manganese Ore; Niobium Ore; and Uranium Ore.

This definition of strategic minerals is categorized into three groups based on their significance in Brazil's applications, economy, and geopolitics. The first group covers mostly imported minerals, which promote, among other purposes, the agricultural sector with the production of fertilizers. The second group encompasses high-tech minerals, including battery manufacturing and green economy innovations. The third group consists of minerals that provide a comparative advantage and occur in abundance in the national territory.

On the other hand, the meaning of critical minerals for Brazil is not rigid or fixed in official documents. Instead, the country's approach for identifying and managing these vital resources is characterized by an ongoing process of research and development (SGB, 2024). Brazilian authorities have been striving to broaden the understanding of which minerals qualify as critical, recognizing that this classification may vary according to technological changes and global market dynamics.

Figure 1. Distribution of occurrences and mining titles for critical minerals in Brazil



Source: Developed by the authors.

Figure 1 shows the distribution of mineral occurrences according to the classification of critical and strategic minerals in Brazil. Despite the wide distribution of occurrences, there is a limited number of mining titles (Mining Concession), especially in the North, Northeast and Midwest regions.

The difficulties linked to obtaining data from these regions, in general, are associated with poor road infrastructure and lack of investments in mineral exploration and prospecting, as explained in the Integrated Management Report of the Brazilian geological service (SGB, 2022). Although there is a high potential for mineral discoveries in Brazil, investments in the Brazilian geological service are insufficient to meet the growing demand for mineral information about the national territory[5]. In this sense, the low number of mining concessions is a consequence of reduced investments in research, which generate less geological knowledge and, finally, a lower performance of the mineral sector in these regions – excluding any type of illegal operation, which is not the focus of this analysis.

1.2. The perspective of other countries

"In China, strategic minerals are seen as pillars of economic security and national defense. Since 1959, the country has adopted a protectionist approach in favor of its domestic industry, with investments in technology and innovation."

In China, strategic minerals are seen as pillars of economic security and national defense. Since 1959, the country has adopted a protectionist approach in favor of its domestic industry, with investments in technology and innovation (Gulley, Mccullough and Shedd, 2019). This policy extends mainly to research and intensive mineral exploration at the global level, as well as control over the processing of these minerals and the formation of strategic alliances with nations that hold valuable mineral reserves. China's influential position in the global market for energy transition technologies is reinforced by research and development programs for critical and strategic minerals, in addition to national programs for the acquisition of geological knowledge by mineral exploration and research (Vivoda, Matthews and McGregor, 2024).

In the United States, the criticality of minerals is defined by aspects such as the inclusion of non-fuel elements essential to maintain stability and economic development, as well as to protect the country's military interests. In addition, the sensitivity of supply chains in relation to logistics and geopolitical resilience in accessing these resources is evaluated. Another aspect is the manufacture of indispensable products, whose scarcity could have impacts on industrial sectors and national security. The United States' approach to critical and strategic minerals is in line with the principles of a free market economy, which prioritizes the role of US companies in strengthening supply chains (Castro, Peiter and Goes, 2022).

In the European Union (EU), the categorization of raw materials follows a dual approach, distinguishing between "critical" and "strategic", each reflecting different aspects of importance and risk. The classification is dynamic, adjusting to changing economic circumstances and potential resource scarcity. On the other hand, strategic minerals are those essential to boost key technologies in the energy transition and supply the defense and aerospace sectors. This classification is intrinsically linked to the EU's reindustrialization plan, focusing on the circular economy and the diversification of materials and technologies, according to the interpretation of authors such as Pope and Smith (2023).

In Australia and Canada, the definition on critical minerals embraces aspects that are essential to these countries' economies, modern technologies, and national security, with a focus on sustainability and strategic development. In Australia, the definition outlines critical minerals essential for modern technologies and for economic and security stability, always associated with the risk of supply chain disruptions. In Canada, the categorization of critical minerals includes the importance for the country's economic security, the need for

5. The increase in investments in mineral research and exploration implies the identification of new areas with mineral potential and, therefore, in new ventures. Two years after the publication of the lithium research carried out by the SGB-CPRM in 2016, in the Middle Jequitinhonha (MG), there was an increase in requests for research permits at the National Mining Agency (ANM, for its acronym in Portuguese) (>130). For example, Sigma Lithium made investments of US$150 million, leading to the discovery of the Grota do Cirilo deposit (SGB, 2022).

these minerals in the energy transition, and their role as sustainable and strategic sources for international allies and partners (Castro, Peiter and Goes, 2022; Pope and Smith, 2023).

In India, critical minerals refer to primary or processed resources that integrate the production processes of the economy and are part of green technologies, high-tech equipment, aviation sector, and national defense (CSEP, 2022). Given the domestic demand in the country, the non-availability or price instability of critical minerals is a constant concern linked to the theme.

The criticality of minerals for South Africa is based on factors such as economic growth, industrialization, technological advances, and energy transition, also considering geopolitical aspects, vulnerabilities in the supply chain, and environmental and social issues. The action plan of South Africa, and other African countries rich in critical minerals, has been increasingly export-oriented, along with efforts for the development of a local processing industry that can add value and drive sustainable economic growth. This focus includes the implementation of sustainable governance policies and the search for strategic partnerships that can strengthen local and regional value chains while meeting global needs for critical minerals (Müller, 2023).

For Russia, critical minerals are defined by their strategic importance for the economy, energy security and technological advancement, especially in contexts of transition to clean energy. These minerals are subject to price volatility and supply disruptions, especially due to geopolitical factors. For example, the war between Russia and Ukraine generated a significant increase in the prices of critical and strategic minerals, in addition to directly impacting global demand (Khurshid *et al.*, 2023).

Therefore, it is up to countries to coordinate initiatives to identify the essential minerals for their production chains, in order to develop a supply strategy, as well as the associated public policies to meet these demands. Besides, as the global economy moves toward decarbonization and energy transition, critical and strategic minerals will experience significant increases in demand, similar to the historical "gold rush" of the past (Hine, Gibson, and Mayes, 2023). This competition and the urgency to define, locate and establish more efficient supply chains for critical and strategic minerals intensify the need to defend the geopolitical interests of each country and affirm the sovereignty of their respective states.

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2. How critical and strategic minerals relate to the national sovereignty agenda

Historically, there are several definitions on the concept of the state (Rousseau, 1978; Weber, 2004; and Hobbes, 2019) based on views that attribute greater or lesser social influence. In general, there is a relationship established from the abdication of individual rights to the institution that has the power of the law (Hobbes, 2019), later defined as the holder of the monopoly of violence (Weber, 2004). Thus, it is constituted as a single abstract and impersonal institution that has sovereignty over all individuals (Skinner, 2002).

On the other hand, in the international field, there is the challenge around the creation of a supranational institution that can organize the relations between sovereign nations and international agents in an impersonal way (Nogueira and Messari, 2005), such as occurred with the institutionalization of the state. In this sense, there are organizations that emerged to mediate and engage in the standardization of relations between international agents (Accioly, Cassela and Silva, 2019; Onuki and Agopyan, 2021). However, structural, and conceptual problems have generated challenges related to legitimacy before international agents.

There are different contexts of state action, especially regarding the domestic and external spheres. Internally, the institution represents individuals from a rational organization, with its

elements focused on social and economic order (Weber, 2004). On the other hand, due to the lack of a consolidated supranational structure in the international domain, the state's performance revolves around maximizing its interests and increasing bargaining with others, which turns cooperation partially restricted (Nogueira and Messari, 2005; Keohane, 1998).

In both scenarios, the state has the responsibility to act against internal and external agents that cause social conflicts (Weber, 2004) or threats to its fundamental rights, such as non-intervention, the integrity of national territories and livelihoods (Accioly, Cassela and Silva, 2019; Hobbes, 2019). In the recent historiography of Latin America, however, there are problematic relationships around state sovereignty, particularly concerning mineral sovereignty, especially in the context of foreign intervention[6] (Israel and Pérez, 2023) and in the sense of internal disorder (Queiroz, 2023).

Therefore, the need for attention occurs due to the increased global relevance surrounding the mineral sources, especially in the face of social, economic, and geopolitical risks. The intense technological development on the world stage generates an abundant growth in the demand for critical and strategic materials (Pope and Smith, 2023), especially because of the importance of the elements in the technological production line (Castro, Peiter and Góes, 2022). Therefore, there are challenges related to the control of a territory's mineral sovereignty.

Faced with this scenario of imminent challenges, there is a central mechanism to mitigate risks and mobilize discussions on mineral sovereignty, especially given the importance of the window of opportunity driven by technological advancement: the governmental agenda. The inclusion of the theme in the governmental agenda makes it also central among policymakers (Brasil and Capella, 2019), representatives chosen by the groups of individuals in electoral periods, who are responsible for directing public policies, as shown in Table 1.

Table 1. The inclusion of topics on the governmental agenda over the years (and by governments)

	President Lula				President Lula				President Dilma			
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Government and Public Administration	57%	40%	14%	10%	10%	12%	8%	9%	16%	9%	10%	15%
Macroeconomics	13%	15%	13%	11%	33%	13%	31%	35%	11%	18%	12%	8%
Health	0%	0%	0%	0%	0%	3%	0%	0%	8%	8%	6%	2%
Agriculture, livestock and fisheries	0%	0%	9%	6%	0%	1%	3%	0%	1%	2%	4%	5%
Education and culture	0%	3%	4%	11%	5%	12%	0%	6%	12%	9%	8%	10%
Environment	0%	0%	0%	0%	1%	0%	0%	1%	6%	1%	2%	1%
Energy	0%	0%	1%	7%	4%	5%	1%	3%	6%	0%	6%	4%
Social Policies	9%	18%	13%	18%	20%	11%	19%	13%	13%	10%	8%	6%
Local Development and Housing	0%	0%	3%	11%	4%	2%	0%	4%	4%	4%	2%	1%
Natural Resources	0%	0%	0%	0%	1%	2%	0%	1%	0%	1%	3%	2%
Others	21%	24%	43%	26%	22%	39%	38%	28%	23%	38%	39%	46%

Note: The data cover the Introduction of Messages to the National Congress from 2003 to 2014. The percentages add up to 100% in the columns, indicating the relative share of attention in all subtopics.

Source: Adapted from Brasil and Capella (2019).

6. In this part, there is reference to the 1973 coup d 'état in Chile during the government of Salvador Allende (1970-73), which had as one of its main reasons the nationalization of a mineral resource: copper (previously controlled by US institutions).

"To take advantage of the opportunity to develop the critical and strategic minerals sector, it is essential that structural changes occur in the planning of the government agenda, in order to understand and prioritize discussions about the importance of mineral resources in the broader economic, political, and social landscape at home and abroad."

The data in Table 1 demonstrate that the natural resources agenda was one of the least important issues on the governmental agenda (Brasil and Capella, 2019) during the analyzed period (2003 - 2014). Contrary to international politics, this deprioritization clashes with the technological competition that directly influences a global race for critical and strategic minerals (Poppe and Smith, 2023). To take advantage of the opportunity to develop the critical and strategic minerals sector, it is essential that structural changes occur in the planning of the government agenda, in order to understand and prioritize discussions about the importance of mineral resources in the broader economic, political, and social landscape at home and abroad.

Therefore, the different attributions to the meaning of "sovereignty" reflect the changes in the world geopolitical scenario, whose supreme power of the territory is transmuted into diplomatic influence of a state or bloc – a set of two or more states brought together in favor of similar interests. Within the context of critical and strategic minerals, mineral sovereignty is discussed in the literature as a concept associated with accessibility to mineral resources, even though they are not geographically located in the same territory (Walker and Johnson, 2018). Mineral sovereignty for critical and strategic minerals implies that the country must have the decision-making power of extraction to boost sustainable development, the green economy and decarbonization.

For mineral production to drive sustainable socio-economic development, adequate investments are needed at all stages of the mine life cycle. Collaboration between mining companies and local communities, through investments in community projects, promotes sustainable development, in addition to ensuring the continuity of quality of life after the closure of the mines (Zvarivadza, 2018). This management model encompasses the participation of all stakeholders and transforms mineral capital into economic and social capital.

The extraction of critical and strategic minerals and the country's socioeconomic development are intrinsically linked to the capacity of developing countries to manage the use of resources in line with national and international goals while also valuing national sovereignty. Therefore, mineral extraction can be a key pillar for socioeconomic advancement when it is integrated into a development policy that includes strategic and sustainable investments.

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In this context, the concept of just transition presents an opportunity to align sustainability objectives with those of justice, highlighting the importance of the active participation of workers and communities directly involved in mining activites. This ensures that the most vulnerable groups receive fair treatment and proper consideration during energy change processes (Wang and Lo, 2022). Likewise, for the mining activity to effectively contribute to sustainable development, it is essential to provide an investment policy that favors mine closure with a specific focus on the future use of territories and the socioeconomic transition of these communities.

However, the incorporation of the concept of just transition also counters the fact that new responsible mining ventures require significant investments for their implementation. Like Brazil, other countries need to attract international investors to develop ventures that promote the use of critical and strategic minerals in accordance with the just transition agenda.

As a result, some countries have instituted specific incentives to attract investors, either directly or through bilateral agreements and broader trade agreements (Ayuk, Pedro and Ekins, 2020). This type of investment also contributes to the socioeconomic development of communities, such as investments in mineral cooperativism, which are organizations that support the miners through actions and policies to improve the mining practice and that aim to improve the socioeconomic conditions of the local population (Alves, Ferreira and Araújo, 2017).

Other recent examples of such initiatives in Brazil occured during the Covid-19 pandemic, a moment of global crisis that directly affected mining and production chains. In the global study led by the DELVE organization, carried out between April and June 2020 in more than 22 countries, the impact of the Covid-19 pandemic on the mining sector was analyzed and monitored. During this period, mineral cooperatives played an important role in assisting local communities, with emphasis on food and medicinal support (Delve, 2020; De Tomi, Araujo and Azevedo, 2021).

3. How critical and strategic minerals contribute to the just transition and climate agenda

The first definition of 'Just Transition' emerged in the 1980s, originally driven by the United States trade unions as a response to environmental policies that required the closure of polluting industries to protect air and water quality (Newell and Mulvaney, 2013). Just transition, in this perspective, focuses on safeguarding jobs in vulnerable sectors, avoiding the transfer of polluting industries to other countries, and requiring organizations to adequately prepare for a low-carbon economy.

The concept of 'Just Transition', as articulated by the United Nations (UN) Committee for Development Policy, stands out as a fair and equitable approach to address the necessary changes towards sustainable and low-carbon economies and societies (CDP, 2023). Central to this concept is the notion that the environmental and climate transition should leave no one behind, ensuring that both opportunities and challenges are shared fairly among all segments of society.

This principle recognizes the complexity and interconnectedness of climate action, social justice, and sustainable economic development (McCauley and Heffron, 2018). It reflects the need for an inclusive dialogue between governments, the private sector, communities, and individuals to create transition strategies that consider local, national and global realities as well as historical responsibilities related to climate change and environmental degradation.

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The just transition therefore aims at creating policies and practices that not only minimize the negative impacts on workers, marginalized groups and communities affected by the decommissioning of high-carbon industries, but also maximize the benefits of the shift to a green economy. This includes promoting new employment opportunities, developing skills, accessing clean and sustainable technologies, and ensuring social protection systems that support individuals during the transition (Pavloudakis, Karlopoulos and Roumpos, 2023).

In addition, the just transition concept emphasizes the importance of equity, inclusion, and respect for human rights in all policies and areas related to the transition. This aspect refers to targeted compensatory measures and the integration of justice and inclusion as fundamental elements in all sectors and policies (Qurbani, Heffron and Rifano, 2021).

Globally, a just transition requires that climate finance commitments are met, that damages and losses are offset, and that climate mitigation is undertaken in accordance with the Paris Agreement[7]. This implies transition strategies that consider the structure of global and regional supply chains, combating tensions linked to the theme and involving workers and relevant stakeholders in dialogue and decision-making processes along the supply chain (McCauley *et al.*, 2019; Ciplet and Harrison, 2020).

In an approach consisting of different sides of justice for the energy transition, Heffron and McCauley (2018) elaborate the 'JUST' framework, which introduces an assessment of the issues of justice, specific and universal, geographical location and time, as summarized in Table 1.

Distributive justice refers to equity in the distribution of resources in society. As the critical and strategic minerals sector expands, it is necessary to ensure the participation of mining-affected communities in decision-making that involves harnessing these resources and sharing the benefits generated from mineral activity. For example, taxation, a key concept

7. The Paris Agreement was a new agreement between 195 countries, adopted at the 21st Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC), whose objective is to unify a global position on the threat of climate change and strengthen the capacity of countries to combat the subsequent impacts of climate change. See the full document at: (https://unfccc.int/documents/9064).

in this regard, is essential so that the parties involved can know the destination of revenues and how the distribution of taxes occurs – and how they are returned to society in the form of investments. Procedural justice, on the other hand, focuses on the legal process of conducting a project, from planning to the final product, and whether all affected parties have the opportunity to be involved (or represented) in these different stages. Restorative justice is the mechanism to ensure that the future use of the territory in which mining took place is properly delivered to society, mitigating socio-environmental risks. Meanwhile, recognition justice questions the extent to which the rights of different groups in society are widespread and, more importantly, respected. Cosmopolitan justice, finally, proposes a reflection on the global effect of mining (Heffron, 2020).

Table 2. The 'JUST' analysis for the energy transition

J	Justice	Aspects of Justice considering 3 approaches to justice: • Distributive Justice • Procedural Justice • Restorative Justice
U	Universal	The Universal aspect considers two universal concepts of justice: • Recognition • Cosmopolitanism
S	Space	The Space aspect is associated with the locality, where the activities take place, considering the local, national and international levels.
T	Time	The Time aspect considers the time horizons for the transition, for example 2030, 2050, 2080, among others, in addition to the pace of the energy transition progress.

Source: Heffron and McCauley (2018).

Until an integrated framework between the concept of 'Just Transition' and the multiple occurrences of justice was obtained, the term has undergone changes throughout history. First, the historical roots of 'Just Transition' traced its origins to the workers' movement, through an interconnection between energy and economy. Then the energy transition came to include justice, particularly environmental, climate and energy.

As a result of the deepening of the justice element, 'Just Transition' is described in a framework format that brings together the principles of justice and employs the material dimensions of just transition. Subsequently, the concept also contemplates governance, perceptions, and public actions around the justice of low-carbon transitions (Wang and Lo, 2021).

In general, the reference to just transition does not create any direct legal obligations arising from the Paris Agreement. However, the concept introduced through its political function a new element of intrastate justice in international climate law that anticipates the need for distributive and procedural justice measures to create fair climate laws and policies. In addition, the just transition maintains legal relevance for its interpretative function, through which it clarifies and adds new dimensions to the interpretation of existing principles and obligations under the Paris Agreement (Johansson, 2023).

From these perceptions of 'Just Transition' it is noted that the concept has evolved in a positive way to the terms established in the Paris Agreement. From a work-centered focus, the concept has come to embody the importance of implementing climate measures that engage and protect vulnerable communities, strengthen justice, and advocate for national measures that promote socio-economic and sustainable development. In the case of critical and strategic minerals, mineral sovereignty is associated with the concept of 'Just Transition' and, therefore, with different manifestations of justice that must be incorporated into public policies in the sector.

Thus, the activities of prospecting, extraction, milling, concentration, smelting, refining, distribution, and sale must be outlined for a scenario of climate, environmental, energy and

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social justice. Since products from critical and strategic minerals are used daily by society, their importance must be recognized in global supply chains (Heffron, 2020). Thus, the development of critical minerals is a global issue that is part of value chains and plays a significant role in ensuring a just transition to a low-carbon economy around the world.

On the global stage, critical and strategic minerals are fundamental in the process of meeting the UN Sustainable Development Goals (SDGs). These objectives are a universal set of targets and indicators established to guide countries in promoting economic, social and environmental development that make up the UN 2030 Agenda. This involves economic growth, social inclusion, and environmental protection, ranging from eradicating poverty and hunger to combating climate change and preserving natural resources, especially in developing countries (UN, 2015; Franks, Keenan and Hailu, 2022).

In addition to emphasizing the need for global collective action, the SDGs recognize that sustainability is a shared responsibility between governments, the private sector, civil society and citizens. Thus, Brazil's critical and strategic minerals play a fundamental role, as they are essential resources for the energy transition, technological innovation, and the development of sustainable infrastructures.

Despite the indisputable importance of the Sustainable Development Goals, there are limitations and challenges when they are applied to the context and the needs of Global South countries. Since the SDGs have an ethnocentric approach, projected by countries mainly in the Global North, the values, and priorities of other countries, mostly located in the southern hemisphere, are not fully included, although they play a large role in achieving the established goals (Nsafon *et al.*, 2023).

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The Global South is strategically important for the transition to renewable energy, given its richness in minerals such as copper, lithium, cobalt, and nickel. To materialize this leadership, it is necessary however to recognize the unique requirements of these regions, which transcend the economic importance and security of supply, which are usually the main determinants of the criticality of minerals in the Global North. Creating a sustainable value chain for these critical minerals in the Global South requires the implementation of sound policies, as well as the adoption of legal and regulatory frameworks that emphasize environmental conservation, social responsibility and amplify the economic benefits derived from the expanding extractive industry (Nakanwagi, 2023).

With the effective implementation of policies directed at the growing importance of South America in the critical and strategic minerals sector, more sustainable economic models, global climate regulation and the energy transition can become a reality. Likewise, this reconstruction of internal actions can reinforce the influence of these countries in global decision-making. The success of South America depends on government action and companies that can invest in this sector (Bickel and Mia, 2023).

National cooperation and commitment to environmentally responsible and economically viable guidelines are crucial for South America and, specifically for Brazil, to position themselves as leaders in the global energy transformation and in the fight against climate change, highlighting the power of these minerals on the path to the future green economy.

3.1. Small-scale mining and the 'Just Transition' for critical and strategic minerals

In general, critical and strategic minerals are often found in small-scale deposits[8], extracted by Artisanal and Small-Scale Mining (ASM) (Hilson and Maconachie, 2020). Thus, the exploitation of these minerals, especially in the Global South, is commonly carried out by small-scale mining operations, an important economic sector for developing countries.

8. According to the National Mining Agency (ANM, for its acronym in Portuguese), the annual gross production of ore is what characterizes the deposits: the microscale has an annual production of less than 10,000 tons, while the small scale, between 10,000 and 100,000 tons.

Therefore, the discussion, formulation, and dissemination of public policies to address the challenges of small-scale mining within the context of the 'Just Transition' are initiatives that will directly benefit the critical and strategic minerals sector in Brazil.

In 2017, the Ministry of Mines and Energy (MME) surveyed the 9,530 mines in operation in the country and identified that 5,653 (59.3%) were micro-scale, 2,758 (28.9%) small-scale, 992 (10.4%) medium-sized and 135 (1.4%) large-sized. Thus, the micro and small mining sector is responsible for 87% of active mining titles in Brazil. In addition, approximately 25% of these titles correspond to Mining Concessions for a mineral considered critical and strategic by the Brazilian definition: gold (CNI, 2022; IBRAM, 2020).

The ASM sector is responsible for at least 300,000 direct and indirect jobs (MME, 2018; IGF, 2017) in Brazil. Of this total, companies working in the extraction of metallic minerals provide 31% of the sector's jobs, while the non-metallic minerals sector offers 42% of occupations, and the extraction of gems represents 27% of occupations. As for the distribution of labor by group of extracted substances, the group of non-metallic substances accounts for 78% of jobs, while the group of metallic substances accounts for 19%, and the group of gems accounts for 3% (MME, 2018).

Within the spectrum of ASM operations, it is crucial to discern between formal, informal, and illegal mining practices to properly understand the operational landscape, according to the information in Figure 2. Formal mining refers to activities that fully comply with current legislation, with all licenses and authorizations required by regulatory agencies for mining and mineral processing. In contrast, informal mining operates on the margins of some or all legal requirements, often due to lack of knowledge or access to regularization processes, resulting in an operation in an informal location.

Illegal mining – which is not addressed in this analysis – is that conducted in areas where the activity is expressly prohibited by law or without complying with established legal norms and is often referred to as "illicit mining"[9]. This type of mining constitutes a direct violation of current legislation and is a significant challenge for the governance and sustainability of the sector.

Figure 2. Characterization of mining production scales

		Production Scale			
Location	Documentation	Micro	Small	Medium	Large
Allowed	Complete	Formal Mining			
	Incomplete	Informal Mining			
Banned		Illegal Mining			

Source: Adapted from De Tomi, Araujo and Azevedo (2021).

In Brazil the mining activity is governed by a set of laws that seek to balance mineral exploration with environmental protection and the socioeconomic promotion of miners. The Federal Constitution of 1988 outlines that the state must encourage the organization of this activity in cooperatives, ensuring the compatibility between the use of resources and environmental conservation.

With this, Law N. 7.805/90 introduces the Artisanal Mining Permit regime, granted to both individuals and cooperatives, for the extraction of minerals in alluvial, eluvial and colluvial deposits[10], as well as other minerals classified as mineable by the National Mining

9. The term "illicit mining" is often used to identify illegal mining activities that are the target of operations by the Federal Police Department (DPF, for its acronym in Portuguese), which is a Brazilian police institution, subordinated to the Ministry of Justice (https://www.gov.br/pf/pt-br/assuntos/noticias/2019/10/operacao-azougue-combate-extracao-ilegal-de-mineriros-em-terra-indigena).

10. The terms alluvial, eluvial and colluvial mining refer to methods of extracting minerals from unconsolidated rocks, which do not require explosives and large equipment for their extraction and use (Peregovich, Mathis and Grelo, 2005).

Agency. This legislation specifies that mining can be carried out without the need for previous research work, according to the sole paragraph of article 1 of Law N. 7.805/89 (Brasil, 1989).

Subsequently, Law N. 11.685/2008, known as the Mining Statute, was enacted to align mining practices with the principles of Mining Law. This law establishes the rules for different forms of work in the mines and reiterates miners' responsibilities, including the requirement of appropriate titles for both the mining and the initial commercialization of extracted minerals (Brasil, 2008). Thus, the legislation in force structures a regulatory framework that seeks to guarantee the rights of miners, while imposing clear obligations, aiming at sustainability and legality in the use of mineral resources.

In view of the importance of micro and small-scale mining for critical and strategic mineral occurrences, in addition to the sector's role in socioeconomic and sustainable development, rises the challenge of assessing whether both large and small-scale mining are prepared to face the demands of the 21st century. This questioning is particularly relevant within the context of 'Just Transition', which requires a reassessment of mining practices in view of stricter sustainability, equity, and fairness criteria.

At an advanced stage of the energy transition, circular economy principles emerge as a promising alternative to linear models of production and consumption, which are currently characterized by extraction, use and disposal. Based on the reuse and recycling of materials and energy, the circular economy concept proposes a continuous life cycle for resources, minimizing waste and maximizing the value of products over time. This model seeks to optimize systems to be regenerative by design, leveraging innovations in processes and business models to reduce pressure on finite natural resources and mitigate environmental impact (Bag, Gupta and Foropon, 2019; Baldassarre *et al.*, 2023).

3.2. The circular economy and critical and strategic minerals

When applied to the management of critical and strategic minerals, the circular economy can offer pathways to more sustainable and resilient development practices. In a sector marked by intensive extraction and the potential for environmental degradation, the adoption of circular practices could revolutionize resource management. This would include the implementation of mining techniques that enable the recovery and reuse of minerals at various stages of a product's life cycle, and the development of technologies that facilitate the recycling of mineral components from discarded products (Hartley, Baldassarre and Kirchherr, 2024). Above all, circular economy can position the management of critical and strategic minerals as a central axis for a more adaptive global economy less susceptible to external shocks.

Currently, little attention has been paid to reuse, remanufacturing and extending lifespan, while recycling and reduction are heavily examined as circular economy strategies (Watari, Nansai and Nakajima, 2020). Although the circular economy is an objective for an energy transition scenario, there are still gaps that prevent the implementation of a system like this at the moment. Among other aspects, it is necessary to conclude this transition phase in which economic, social, and environmental agendas emerge in their completeness to integrate public policies in sectors that still have informality or illegality in the mining of critical and strategic minerals (Sovacool, 2019).

The challenges of developing countries also reflect the need for greater participation in international decision-making and in solving practical and structural aspects that we face in this transition phase. Effective implementation of reuse, remanufacturing, and lifespan extension requires significant changes in product design, support infrastructure, and consumer perception. In addition, the technological innovations needed to make these practices viable on a large scale is still under development. Therefore, while the goal of a closed-loop material cycle remains fundamental, it is evident that we have not yet reached the technological and cultural maturity necessary to implement the circular economy in

its entirety. As pointed out by Yuan *et al.* (2024), the current economic and political situation of emerging countries limits leadership capacity in international organizations.

"In general, the insertion of the critical and strategic mineral sector in the context of the circular economy and 'Just Transition' requires a broad public, private and society-wide commitment."

In general, the insertion of the critical and strategic mineral sector in the context of the circular economy and 'Just Transition' requires a broad public, private and society-wide commitment. Such a commitment must recognize and overcome the specific challenges surrounding this sector in Brazil, which is rooted in a traditional mining culture that has persisted for five centuries and that generates resistance to change (Bansah *et al.*, 2018). However, recent World Bank research (2023) indicates a growing awareness of miners in this sector about climate issues and an expressed desire to adopt clean and efficient technologies to minimize the environmental impact of their activities.

The extractive sector of critical and strategic minerals has often been cited in conflicts related to the management of the territory and the issue of mine closure and future use of the lands temporarily occupied by mining. For example, the Democratic Republic of Congo holds 70% of global cobalt reserves, but the extraction of this mineral has been surrounded by social conflicts, with the presence of approximately 120 different armed groups in the region where mining operations take place (CIGI, 2023). In the case of Brazil, the mining sector faces reputational challenges due to a history of adverse environmental impacts and social conflicts. This legacy has contributed significantly to a negative perception of these activities, and a constant association with socioeconomic and environmental problems arising from their operations (MJSP, 2023; Ramos, Victral and Rezende, 2023).

An effective commitment to insert the mining of critical and strategic minerals in public energy transition policies must address both the need for innovation and adaptation in the sector and the urgency of repairing its image and mitigating the damage caused. This involves facilitating miners' access to clean technologies, promoting the formalization and equitable regulation of mining activities, and actively engaging in the restoration of affected ecosystems.

4. Challenges for the use of critical and strategic minerals in Brazil

4.1. The geopolitics of critical and strategic minerals

Competition for critical and strategic minerals, in parallel with the search for national sovereignty, can stimulate geopolitical disputes. As discussed in the topic of Mineral Sovereignty, one of the mechanisms to ensure access to critical and strategic minerals is the adoption of bilateral agreements or trade agreements. In this context, the main international cooperation blocs related to mineral security are: the Minerals Security Partnership (MSP), led by the United States and formed by Australia, Canada, Finland, France, Germany, Japan, Norway, South Korea, Sweden, the United Kingdom and the European Union; and BRICS, composed of Brazil, Russia, India, China and South Africa. The consolidation of these blocs goes through challenges that include collaborative approaches, the adoption of common currencies, among others (Martins, 2023). The objective is to provide fair competition conditions for participating countries, prevent unfair practices and offer mechanisms for resolving commercial disputes.

For example, in the case of the BRICS bloc, although Saudi Arabia has not yet accepted the invitation to join the economic bloc, the country has already participated in the critical minerals sector in Brazil (Baskaran and Cahill, 2023; Vivoda, Matthews and McGregor, 2024). In view of the current geopolitical context, the different blocs have driven a race for sovereignty over critical and strategic minerals. In this sense, collaboration and competition are intertwined in the formation of a new, more diverse, and multipolar world order.

4.2. Policy instruments relevant to the critical and strategic minerals sector

The growth in demand for critical and strategic minerals generates greater speculation about the mineral resources important to the market. In this context, the role of the government vis-à-vis the nation is to defend social order and livelihoods against any threat (Accioly, Cassela and Silva, 2019; Weber, 2004). For this, it is necessary to increase the flow of control and information, in order to maximize the efficiency of the production chain of critical and strategic minerals.

In this line, public policies are essential to control and predict actions related to the production process of mineral resources and aim to set standards and ensure a safe and regulated ore exploration process. In this perspective, five policy instruments relevant to the control of the critical and strategic minerals sector are highlighted:

1. *Exploratory Work Plan (PTE, for its acronym in Portuguese):* in order to anticipate possible problems and frame mining activities within the regulatory scope, the Exploratory Work Plan (PTE) is required before the start of mineral extraction activities. Therefore, the duties performed by operators in the area undergo analysis by the competent authorities, which directs the tasks of the critical and strategic minerals sector to a regulatory standard, in order to ensure control over environmental impacts, safety and transparency of activities (ANP, 2023).

2. *National Policy for Climate Change (PNMC, for its acronym in Portuguese):* The PNMC aims to establish strategies to address the challenges of climate change. In this sense, a policy that aims to establish environmental regularizations within different sectors of society, such as the services of mining companies (Brasil, 2009).

3. *Brazilian Emissions Trading System (SBCE, for its acronym in Portuguese):* in addition to the PNMC, the SBCE aims to control greenhouse gas emissions, regulating the carbon market in Brazil under the logic of cap-and-trade — a market system that establishes a maximum number of CO2 emissions and, from that, a dynamics of buying and selling emissions (SBCE, 2022).

4. *New Growth Acceleration Program (PAC, for its acronym in Portuguese):* directed by the federal government to encourage economic growth and social inclusion in the country. For this, it covers monetary investment in specific sectors, such as: education, health, science, and technology. In the critical and strategic minerals sector, investments can be used to fund research and development of efficient and sustainable mineral extraction processes (Brasil, 2024a).

5. *New Industry Brazil (NIB):* this is an action plan for "neoindustrialization" in the next 10 years, in order to maintain incentives to the productive sector in a sustainable and profitable way. To this end, it is directed from six main missions (Brasil, 2024b):

    a. sustainable and digital agro-industrial chains for food, nutritional and energy security;

    b. resilient health industrial economic complex to reduce vulnerabilities of the Unified Public Health System (SUS, for its acronym in Portuguese) and expand access to health;

    c. sustainable infrastructure, sanitation, housing and mobility for productive integration and well-being in cities;

    d. digital transformation of the industry to increase productivity;

    e. bioeconomy, decarbonization, transition and energy security to ensure resources for future generations; and

f. technologies of national sovereignty and defense interest.

To complement, the aforementioned political instruments are part of or influence an important regulatory mechanism: public policies. Given the global context around critical and strategic minerals, these instruments increase security against threats, in addition to contributing to the standardization of minerals extraction process, enforcing them to comply with common interests and growing international agreements, which can generate great opportunities for the country in the global market.

Therefore, the prioritization of critical and strategic minerals in the government agenda should be considered as a key strategy for the country's development. The policy instruments highlighted above are essential for maintaining control over mineral resources and, through prioritization and investment plans, can intensify the process of responsible and sustainable extraction.

4.3. Action axes and public policies for the mining of critical and strategic minerals

Considering the challenges, obstacles and opportunities of mining, and in particular the small-scale mining sector, the responsible use of critical and strategic minerals in the various regions of Brazil depends on public policies and actions that drive a transformation process through four main axes, described below.

The first axis of transformation is related to the implementation of capacity-building initiatives, aiming at technological modernization, and increasing the competitiveness of the mining sector. Such initiatives represent a crucial pillar for the sustainable development of the activity. Inspired by the SENAR model for rural sector learning, the creation of a national service dedicated to responsible mining learning and practice can be proposed. This initiative needs to cover the entire country, taking into account the geological, logistical, and social contexts of each region where there are occurrences and mining operations of critical and strategic minerals. The objective should be to build a strong knowledge foundation and advanced techniques for miners in the ASM sector, with continuously updated capacity-building programs, and promoting excellence and environmental and social responsibility in Brazilian mining.

The second axis of transformation is related to the promotion of cooperativism and associativism as a strategy to strengthen and consolidate mining management and governance structures, especially in the small-scale mining sector. The expansion of the current programs on Mineral-Based Local Productive Arrangements[11] (APL, for its acronym in Portuguese) is also an important initiative to develop this transformation, in order to improve the organization and productive capacity of the ASM sector. This type of collective organization allows resource, knowledge, and strategy sharing, contributing significantly to the sustainable and integrated development of the sector.

The third axis of transformation considers the formulation of public policies that support small-scale mining, especially concerning formalization requirements. The provision of specific credit and financing lines for the sector aims to formalize and stabilize the business environment, mitigating the impacts of frequent regulatory changes. Furthermore, the proposition of a one-stop digital system for responsible mining aims to simplify processes, meeting miners' expectations and encouraging governance practices in mining operations, with the support of cooperatives and associations.

Finally, the fourth axis of transformation refers to the dissemination of coexistence practices between large-scale mining operations and the small-scale mining sector. Currently, coexistence programs have proven to be an effective mechanism to promote the evo-

11. The Mineral-Based Local Productive Arrangements (Mineral-Based APL) Program is a Ministry of Science, Technology and Innovation program that aims to assist, foster and encourage small mining companies and mining cooperatives (https://www.gov.br/ibict/pt-br/assuntos/informacao-tecnologica/rede-apl-mineral).

lution of small-scale mining in the world, with several success stories in Latin America and Africa. The coexistence model in mining encourages dialogue between stakeholders (Young *et al.*, 2022) and promotes conflict mediation between miners, regulators and involved communities.

A common point to the transformation axes of the mineral sector is the need for this sector to have strong and present official institutions and agencies. The success of such initiatives depends on strengthening the sector's official institutions.

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5. Final Considerations

Access to critical and strategic minerals represents a challenge for all nations due to the need to meet technological demands for the energy transition, as well as to supply minerals for strategic areas such as housing, industrial development, energy, climate change, transport, and subsistence of the population.

Public policies related to the critical and strategic minerals sector should not be limited to the supply of these substances but should also incorporate the concepts of mineral sovereignty and 'Just Transition'. In the case of mineral sovereignty, the exploitation of critical and strategic minerals and the socioeconomic development of the country are intrinsically linked to the ability to manage the use of resources in line with national and international goals while also valuing national sovereignty.

Therefore, mineral extraction can be a fundamental pillar for socioeconomic advancement when it is integrated into a development policy that includes strategic and sustainable investments. On the other hand, the exploitation of critical and strategic minerals is a global issue, which is part of value chains and plays a significant role in ensuring a just transition to a low-carbon economy around the world.

On the global stage, critical and strategic minerals are fundamental in the process of meeting the UN Sustainable Development Goals, which involve challenges of economic growth, social inclusion, and environmental protection, ranging from eradicating poverty and hunger to combating climate change and preserving natural resources, especially for developing countries, which still face challenges such as inequality, poverty, industrialization, among others.

An important aspect related to mineral sovereignty is Brazil's alignment with international cooperation blocs for the supply of critical and strategic minerals. For this, the transformation actions of the Brazilian mineral sector must consider the axes of capacity-building, cooperativism and associativism, coexistence in mining and public policies to support the sector, especially that of small-scale mining. A common point to the transformation axes of the Brazilian mineral sector, including critical and strategic minerals, is the need to have strong official institutions and agencies in the sector. Therefore, the responsible use of critical and strategic minerals requires both public and private actions and initiatives that enhance the mineral sector in order to contribute to sustainable development, the green economy and the decarbonization of developing countries.

"Therefore, the responsible use of critical and strategic minerals requires both public and private actions and initiatives that enhance the mineral sector in order to contribute to sustainable development, the green economy and the decarbonization of developing countries."

References

1. Accioly, H., Silva, G. E., and Casella, P. B. (2019) *Manual de Direito Internacional Público.* 24ed. São Paulo: Saraiva Educação.

2. Alves, W., Ferreira, P. and Araújo, M. (2017) 'Mining cooperatives in Brazil: an overview', *Procedia Manufacturing,* 13, pp. 1026–1033. doi:10.1016/J.PROMFG.2017.09.108.

3. ANP. (2023) 'Plano de Trabalho Exploratório - PTE', *National Agency for Petroleum, Natural Gas and Biofuels.* Available at: https://www.gov.br/anp/pt-br/assuntos/exploracao-e-producao-de-oleo-e-gas/orientacoes-aos-concessionarios-e-contratados/plano-de-trabalho-exploratorio-pte (Accessed: April 1, 2024).

4. Ayuk, E.T., Pedro, A.M., and Ekins, P. *et al.* (2020) 'Mineral resource governance in the 21st century: gearing extractive industries towards sustainable development', *International Resource Panel.* Available at: https://orbi.uliege.be/handle/2268/254890 (Accessed: March 31, 2024).

5. Bag, S., Gupta, S. and Foropon, C. (2019) 'Examining the role of dynamic remanufacturing capability on supply chain resilience in circular economy', *Management Decision,* 57(4), pp. 863–885. doi:10.1108/MD-07-2018-0724.

6. Baldassarre, B. *et al.* (2023) 'Analysis of Circular Economy Research e Innovation (R&I) intensity for critical products in the supply chains of strategic technologies', *Publications Office of the European Union, Luxembourg.* doi:10.2760/582527.

7. Bansah, K.J. *et al.* (2018) 'Socioeconomic and environmental assessment of informal artisanal and small-scale mining in Ghana', *Journal of Cleaner Production,* 202, pp. 465–475. doi:10.1016/J.JCLEPRO.2018.08.150.

8. Baskaran, G. and Cahill, B. (2023) 'Six new BRICS: Implications for energy trade', *Center for Strategic & International Studies,* August 25. Available at: https://www.csis.org/analysis/six-new-brics-implications-energy-trade (Accessed: February 1, 2024).

9. Bickel, J.P.M. and Mia, I. (2023) 'Geopolitics e Climate Change: The Significance of South America', *Survival: Global Politics and Strategy,* 65(4), pp. 123–138. doi:10.1080/00396338.2023.2239062.

10. Brasil, F.G. and Capella, A.C.N. (2019) 'Agenda governamental brasileira: uma análise da capacidade e diversidade nas prioridades em políticas públicas no período de 2003 a 2014', *Cadernos Gestão Pública e Cidadania,* 24(78). doi:10.12660/cgpc.v24n78.76950.

11. Brasil. (1989) 'Lei n° 7.805, de 18 de julho de 1989', *Presidency of the Republic, General Secretary, Legal Affairs, Brazilian government.* Available at: https://www.planalto.gov.br/ccivil_03/leis/l7805.htm (Accessed: April 1, 2024).

12. Brasil. (2009) 'Lei n° 12.187, de 29 de dezembro de 2009', *Presidency of the Republic, General Secretary, Legal Affairs, Brazilian government.* Available at: https://www.planalto.gov.br/ccivil_03/_ato2007-2010/2009/lei/l12187.htm (Accessed: April 1, 2024).

13. Brasil. (2008) 'Lei n° 11.685, de 2 de junho de 2008', *Presidency of the Republic, General Secretary, Legal Affairs, Brazilian government.* Available at: https://www.planalto.gov.br/ccivil_03/_ato2007-2010/2008/lei/l11685.htm.

14. Brasil. (2021) 'Decreto n° 10.657, de 24 de Março', *Presidency of the Republic, General Secretary, Legal Affairs, Brazilian government.* Available at: https://www.planalto.gov.br/ccivil_03/_Ato2019-2022/2021/Decreto/D10657.htm (Accessed: April 1, 2024).

15. Brasil. (2024a) 'Conheça o Novo PAC', *Presidency of the Republic.* Available at: https://www.gov.br/casacivil/pt-br/novopac/conheca-o-plano (Accessed: April 1, 2024).

16. Brasil. (2024b) 'Plano de Ação para a Neoindustrialização 2024-2026', *Ministry of Development, Industry, Trade and Services.* Available at: https://www.gov.br/mdic/pt-br/composicao/se/cndi/plano-de-acao/nova-industria-brasil-plano-de-acao.pdf (Accessed: April 1, 2024).

17. Castro, F. F., Peiter, C. C. and Góes, G. S. (2022) 'Minerais estratégicos e críticos: uma visão internacional e da política mineral brasileira', *Institute of Applied Economic Research,* pp. 7-31. doi: http://dx.doi.org/10.38116/td2768

18. CDP. (2023) 'Just transition', *Committee for Development Policy.* Available at: https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/CDP-excerpt-2023-1.pdf (Accessed: April 1, 2024).

19. CIGI. (2023) 'The Fight Over Critical Minerals Has Just Begun', *Centre for International Governance Innovation,* November 27. Available at: https://www.cigionline.org/articles/the-fight-over-critical-minerals-has-just-begun/ (Accessed: April 1, 2024).

20. Ciplet, D. and Harrison, J.L. (2020) 'Transition tensions: mapping conflicts in movements for a just and sustainable transition', *Environmental Politics,* 29(3), pp. 435–456. doi:10.1080/09644016.2019.1595883.

21. CNI. (2022) 'Plano de retomada e desenvolvimento da indústria mineral', *National Confederation of Industry,* November 2022. Available at: deaa585a-197a-f5e6-f347-b12d65ea878b (mme.gov.br) (Accessed: April 1, 2024).

22. CNID. (2020) 'Resolução CNDI/MDCI, n° 01, de 6 de julho de 2023', *Executive Secretary of the National Council for Industrial Development.* Available at: https://www.gov.br/mdic/pt-br/composicao/se/cndi/arquivos/decretos-e-portarias/arquivos/dou_2023-07-20-resolucao-cndi-mdic-no-1-de-6-de-julho-de-2023-missoes-republicacao/view (Accessed: April 1, 2024).

23. CSEP. (2022) 'Critical minerals for India: Assessing their Criticality and Projecting their Needs for Green Technologies', *Centre for Social and Economic Progress, New Delhi, India.* Available at: https://csep.org/wp-content/uploads/2022/09/Critical-Minerals-for-Green-Technologies_26-Aug-22.pdf (Accessed: April 1, 2024).

24. De Tomi, G., Araujo, C., Azevedo, J. Pequena Mineração Responsável; In: Junior, A., Macedo, A. (2021). *Cooperativismo mineral no Brasil: características, desafios e perspectivas.* Viçosa, Minas Gerais: Editora Asa Pequena.

25. Delve. (2020) 'Delve COVID-19 Impact Reporting', *Delve.* Available at: https://www.delvedatabase.org/covid-19-impact-on-asm/covid-data (Accessed: April 1, 2024).

26. Franks, D.M., Keenan, J. and Hailu, D. (2022) 'Mineral security essential to achieving the Sustainable Development Goals', *Nature Sustainability,* 6(1), pp. 21–27. doi:10.1038/s41893-022-00967-9.

27. Gulley, A.L., Mccullough, E.A. and Shedd, K.B. (2019) 'China's domestic and foreign influence in the global cobalt supply chain', *Resources Policy,* 62, pp. 317–323. doi:10.1016/j.resourpol.2019.03.015.

28. Hayes, S.M. and McCullough, E.A. (2018) 'Critical minerals: A review of elemental trends in comprehensive criticality studies', *Resources Policy,* 59, pp. 192–199. doi:10.1016/j.resourpol.2018.06.015.

29. Heffron, R.J. (2020) 'The role of justice in developing critical minerals', The Extractive Industries and Society, 7(3), pp. 855–863. doi:10.1016/J.EXIS.2020.06.018.

30. Heffron, R.J. and McCauley, D. (2018) 'What is the "Just Transition"?', Geoforum ,88, pp. 74–77. doi:10.1016/J.GEOFORUM.2017.11.016.

31. Hilson, G. and Maconachie, R. (2020) 'Artisanal and small-scale mining and the Sustainable Development Goals: Opportunities and new directions for sub-Saharan Africa', Geoforum ,111, pp. 125–141. doi:10.1016/J.GEOFORUM.2019.09.006.

32. Hine, A., Gibson, C. and Mayes, R. (2023) 'Critical minerals: rethinking extractivism?', *Australian Geographer,* 54(3), pp. 233–250. doi:10.1080/00049182.2023.2210733.

33. Hobbes, T. (2019) *Leviatã ou matéria, forma e poder de uma república eclesiástica e civil.* São Paulo: Martins Fontes.

34. IBRAM. (2020) 'Informações e análise da economia mineral brasileira', *Brazilian Mining Institute (IBRAM),* 4, Brasília, Federal District. Available at: https://ibram.org.br/wp-content/uploads/2020/12/ibram_4aedicao_informacoes-e-analises-da-economia-mineral-brasileira_port.pdf (Accessed: April 1, 2024).

35. IGF. (2017) 'Global Trends in Artisanal and Small-Scale Mining (ASM): A review of key numbers and issues', *Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development Winnipeg.* Available at: https://www.iisd.org/system/files/publications/igf-asm-global-trends.pdf (Accessed: April 1, 2024).

36. Israel, P. and Pérez, A. (2023) 'O golpe contra o terceiro mundo: Chile, 1973', *Tricontinental Institute for Social Research and Institute of Sciences Alejandro Lipschütz (Ical) – Centre for Social and Political Though and Research.* Available at: https://thetricontinental.org/pt-pt/dossie-68-golpe-contra-terceiro-mundo-chile-1973/ (Accessed: April 1, 2024).

37. Johansson, V. (2023) 'Just Transition as an Evolving Concept in International Climate Law', *Journal of Environmental Law,* 35(2), pp. 229–249. doi:10.1093/jel/eqad017.

38. Keohane, R. O. (1998). 'International Institutions: Can Interdependence Work?' *Foreign Policy,* No. 110, Special Edition: Frontiers of Knowledge, pp. 82-96+194. doi: https://doi.org/10.2307/1149278

39. Khurshid, A. *et al.* (2023) 'Critical metals in uncertainty: How Russia-Ukraine conflict drives their prices?', *Resources Policy,* 85. doi:10.1016/j.resourpol.2023.104000.

40. Martins, A. (2023) 'Brics confirmam entrada de mais seis países no bloco', *CNN Brasil,* August 24. Available at: https://www.cnnbrasil.com.br/internacional/brics-confirmam-entrada-de-mais-seis-paises-no-bloco/ (Accessed: February 1, 2024).

41. McCauley, D. and Heffron, R. (2018) 'Just transition: Integrating climate, energy and environmental justice', *Energy Policy,* 119, pp. 1–7. doi:10.1016/J.ENPOL.2018.04.014.

42. McCauley, D. *et al.* (2019) 'Energy justice in the transition to low carbon energy systems: Exploring key themes in interdisciplinary research', *Applied Energy,* 233–234, pp. 916–921. doi:10.1016/J.APENERGY.2018.10.005.

43. MJSP. (2023) 'PF intensifica combate ao garimpo ilegal na Terra Indígena Yanomami', Federal Police, *Ministry of Justice and Public Security,* May 5. Available at: https://www.gov.br/pf/pt-br/assuntos/noticias/2023/05/pf-intensifica-combate-ao-garimpo-ilegal-na-terra-indigena-yanomami (Accessed: February 1, 2024).

44. MME. (2018) 'Diagnóstico Socioeconômico e Ambiental da. Mineração em Pequena Escala no Brasil (MPE). Relatório Final', *Ministry of Mines and Energy.* Available at: https://www.gov.br/mme/pt-br/arquivos/document-0-16653670382796015-pdf.11631713987008974 (Accessed: April 1, 2024).

45. Müller, M. (2023) 'The "new geopolitics" of mineral supply chains: A window of opportunity for African countries', *South African Journal of International Affairs,* 30(2), pp. 177–203. doi:10.1080/10220461.2023.2226108.

46. Nakanwagi, S. (2023) 'Critical Minerals and the Global Energy Transition: Recognising Global South Perspectives', *Global Energy Law and Sustainability,* 4(1–2), pp. 115-137.

47. Newell, P. and Mulvaney, D. (2013) 'The political economy of the "just transition", *Geographical Journal,* 179(2), pp. 132–140. doi:10.1111/GEOJ.12008.

48. Nogueira, J. P. & Messari, N. (2005). *Teoria das Relações Internacionais.* Gen Atlas.

49. Nsafon, B.E.K. *et al.* (2023) 'The justice and policy implications of clean energy transition in Africa', *Frontiers in Environmental Science,* 11. doi:10.3389/fenvs.2023.1089391.

50. ONU. (2015) 'Adoção do Acordo Paris', *United Nations.* Available at: https://brasil.un.org/sites/default/files/2020-08/Acordo-de-Paris.pdf (Accessed: April 1, 2024).

51. ONU. (2015) 'Os Objetivos de Desenvolvimento Sustentável no Brasil', *United Nations.* Available at: https://brasil.un.org/pt-br/sdgs (Accessed: April 1, 2024).

52. Onuki, Janina. 'Organizações Internacionais: o debate teórico nas Relações Internacionais'. In: Onuki, Janina and Agopyan, Kelly (2021). *Regimes e Organizações Internacionais.* Curitiba: Editora Uninter.

53. Onuki, Janina. (2021) *Organizações e Regimes Internacionais.* Curitiba: Editora InterSaberes

54. Pavloudakis, F., Karlopoulos, E. and Roumpos, C. (2023) 'Just transition governance to avoid socio-economic impacts of lignite phase-out: The case of Western Macedonia, Greece', *The Extractive Industries and Society,* 14, p. 101248. doi:10.1016/J.EXIS.2023.101248.

55. Peregovich, B., Mathis, A., Grelo, E. (2005) 'Special Training for Small Scale Gold Miners In Pará and Amapá (Brazil)'. In: Communities and Small Scale Mining (CASM) - 5th Annual General Meeting and Learning Event September. Salvador: CASM, 2005.

56. Pope, N. and Smith, P. (2023) 'Minerais críticos e estratégicos do Brasil em um mundo em transformação', *Igarapé Institute*, pp. 3-12. Available at: https://igarape.org.br/wp-content/uploads/2023/10/Minerais-Criticos-e-Estrategicos.pdf (Accessed: March, 2024).

57. Queiroz, C. (2023) 'PF aponta participação de militares em esquema de garimpo ilegal no Amazonas', *CNN Manaus,* June 28. Available at: https://www.cnnbrasil.com.br/nacional/pf-aponta-participacao-de-militares-em-esquema-de-garimpo-ilegal-no-amazonas/ (Accessed: April 1, 2024).

58. Qurbani, I.D., Heffron, R.J. and Rifano, A.T.S. (2021) 'Justice and critical mineral development in Indonesia and across ASEAN', *The Extractive Industries and Society,* 8(1), pp. 355–362. doi:10.1016/J.EXIS.2020.11.017.

59. Ramos, A.M., Victral, D.M. and Rezende, S. (2023) 'Participation and social control in sanitation within the context of the reparation of damage from disasters in Mariana and Brumadinho, Minas Gerais, Brazil'. *Revista Brasileira de Estudos Urbanos e Regionais,* 25. doi: https://doi.org/10.22296/2317-1529.rbeur.202314en

60. Rousseau, J. (1978) *Do Contrato Social. Translated by Lourdes Santos Machado,* 2nd ed. São Paulo: Abril Cultural.

61. SBCE. (2022) 'Sistema Brasileiro do Comércio de Emissões (SBCE)', *Presidency of the Republic.* Available at: https://www.gov.br/planalto/pt-br/assuntos/cop28/sbce (Accessed: April 1, 2024).

62. SGB. (2022) 'Relatório Integrado de Gestão 2022'. Serviço Geológico do Brasil, *Ministry of Mines and Energy, Federal Government.* Available at: https://www.sgb.gov.br/documents/d/guest/relatorio_integrado_de_gestao_2022_310522-pdf (Accessed: April 2, 2024).

63. SGB. (2024) 'An overview of Critical e Strategic Minerals Potential of Brazil', *Brazilian Geological Service, Brasília – DF.* Available at: https://www.sgb.gov.br/pdac/media/critical_and_strategic_minerals.pdf (Accessed: April 1, 2024).

64. Skinner, Q. (1978). From the State of Princes to the Person of the State. In: *The Foundations of Modern Political Thought,* Cambridge University Press, Vol. 2.

65. Sovacool, B.K. (2019) 'The precarious political economy of cobalt: Balancing prosperity, poverty, and brutality in artisanal and industrial mining in the Democratic Republic of the Congo', *The Extractive Industries and Society,* 6(3), pp. 915–939. doi:10.1016/J.EXIS.2019.05.018.

66. Vivoda, V., Matthews, R. and McGregor, N. (2024) 'A critical minerals perspective on the emergence of geopolitical trade blocs', *Resources Policy,* 89, p. 104587. doi:10.1016/j.resourpol.2023.104587.

67. Walker, J. and Johnson, M. (2018) 'On mineral sovereignty: Towards a political theory of geological power', *Energy Research and Social Science,* 45, pp. 56–66. doi:10.1016/j.erss.2018.07.005.

68. Wang, X. and Lo, K. (2021) 'Just transition: A conceptual review', *Energy Research and Social Science,* 82. doi:10.1016/j.erss.2021.102291.

69. Wang, X. and Lo, K. (2022) 'Political economy of just transition: Disparate impact of coal mine closure on state-owned and private coal workers in Inner Mongolia, China', *Energy Research & Social Science,* 90. doi:10.1016/J.ERSS.2022.102585.

70. Watari, T., Nansai, K. and Nakajima, K. (2020) 'Review of critical metal dynamics to 2050 for 48 elements', *Resources, Conservation and Recycling,* 155. doi: 10.1016/J.RESCONREC.2019.104669.

71. Weber, M. (2004) *Economia e Sociedade: Fundamentos da sociologia compreensiva.* Translated by Regis Barbosa and Karen Elsabe Barbosa. São Paulo: UnB, Imprensa Oficial.

72. Young, R.E. *et al.* (2022) 'International principles e steards for the ecological restoration e recovery of mine sites', *Restoration Ecology,* 30(S2). doi:10.1111/REC.13771.

73. Yuan, X. *et al.* (2024) 'Structural analysis of global mineral governance system from the perspective of country', *Heliyon,* 10(1). doi:10.1016/J.HELIYON.2023.E23793.

74. Zvarivadza, T. (2018) 'Large scale miners - Communities partnerships: A plausible option for communities survival beyond mine closure', *Resources Policy,* 56, pp. 87–94. doi:10.1016/J.RESOURPOL.2017.12.005.