Challenges in the Critical Commodities Market

Ioana Claudia Dobre
„Ovidius" University of Constanta, Faculty of Economic Sciences, Romania
dobre_claudia@yahoo.com

Abstract

To ensure resource security, to have access to resources for a sufficiently long period of time, it is necessary to take action to diversify the sources of raw and secondary materials, to reduce dependence on particular sources and to increase resource efficiency and circularity. It is generally valid for all raw materials, including basic raw materials, but especially for critical raw materials.

In this paper we analyse what are the critical raw material resources at global and European level, the legislation in this field and the main challenges countries are facing at the moment.

Key words: critical minerals, raw materials, strategy
J.E.L. classification: K32, L61, O13, O25, Q01

1. Introduction

The importance of the subject under analysis is given by the global transition to clean energy, that represents the biggest economic transformation since the Industrial Revolution.

Critical minerals are the building blocks of the green and digital economy. Are mineral resources that are essential to the economy and whose supply can be disrupted. The „criticality" of a mineral changes over time as supply and society's needs change.

They are essential to the energy transition: without them, there would be no batteries, no electric cars, no wind turbines and no solar panels. The sun provides raw energy, but it is copper that enables electricity to circulate. Wind turbines need manganese, platinum and rare earth magnets. Nuclear power needs uranium. Electric vehicles need magnets, as do batteries containing lithium, cobalt and nickel. Finally, indium and tellurium are essential to the manufacture of solar panels.

Metal requirements for batteries are growing steadily. For example, a plant producing 30 GWh of batteries consumes around 33,000 tonnes of graphite, 25,000 tonnes of lithium, 19,000 tonnes of nickel and 6,000 tonnes of cobalt, each in the form of „battery-grade active materials". The active battery materials market was valued at $7.45 billion in 2017 and could reach $26 billion by 2025. (Chalmin P. and Y. Jégourel, 2023)

In 2021, the International Energy Agency (IEA) estimated that demand could increase 42-fold for lithium, almost 20-fold for nickel and cobalt, and almost 3-fold for copper by 2040 for the electrification of transport (IEA, 2022). In 2023, the update of the IEA report highlighted the doubling in size of the markets for so-called transition metals (lithium, cobalt) over the past five years, to around $320 billion. These markets are now as important as the traditional metal segments (zinc, lead, etc.) in terms of turnover. With metal consumption set to rise over the coming decades, policies to secure supplies in the main consumer countries and the strategies of producer countries are likely to have a lasting impact on access to mineral raw materials, international competition and, ultimately, the international geopolitical order.

2. Literature review

In line with our research objective, we proceeded to identify nationally and internationally similar research in the field.

Reports from international organisations seeking to identify critical minerals for the energy transition and the risks in terms of energy security: IEA, OECD, World Bank Documents from the

EU, and the European Commission in particular, on the strategy for securing supplies, from the first list of critical materials in 2011 to the „Raw Material Act" of 2023.

At European level, In March 2024, the Council adopted the „European Act on Critical Raw Materials", as the demand for rare earths will grow exponentially over the next period, due to the fact that critical raw materials are raw materials of high economic importance for the EU, with a high risk of supply disruption due to the concentration of their sources and the lack of good and affordable substitutes. The final text identifies two lists of materials (34 critical and 17 strategic) that are essential on the digital and ecological transition as well as for the defence and space industries.

A very recent study on critical minerals and their imports and exports is WTO – „High demand for energy-related critical minerals creates supply chain pressures" which was published on 10 February 2024. According to this study, the last five years have seen an acceleration in the value of trade in unprocessed critical minerals.

In Romania, the „National strategy for non-energy mineral resources, horizon 2035" was adopted last year, which sets out the general development directions, objectives, proposed measures, international standards for sustainable mining and how non-energy mineral resource activities can contribute to achieving sustainable development goals.

The Strategy was developed by the Ministry of Economy within the working group attended by representatives of academia and universities, employers and businessmen, research institutes, other specialists in the field of non-energy mineral resources. The strategy was based on the excellent work prepared by the Romanian Academy - Romania's Development Strategy for the next 20 years, integrated in the sectoral project „Natural Resources - Strategic Reserves, what we use and what we leave to future generations". In the government programme, in order to ensure Romania's balanced and cohesive development, priority objectives include policies for the reindustrialisation of Romania through the creation of industrial ecosystems, networks of industrial hubs, the promotion of digital technologies, modern production techniques, new materials and the development of the circular economy.

3. Research methodology

In this paper we will use a quantitative analysis in order to compare the results reflected in a graph.

Quantitative analysis is extremely appealing for research as it is possible not only to quantify properties but also to quantify the relationships between them.

Any analysis starts with the sketching of a conceptual scheme, keeping the phenomenon of interest (also called the dependent variable) in focus. Measured metrically, any phenomenon has a certain amount of variation caused by one or more factors (also called independent variables), either directly, through a causal chain or through mutual connections.

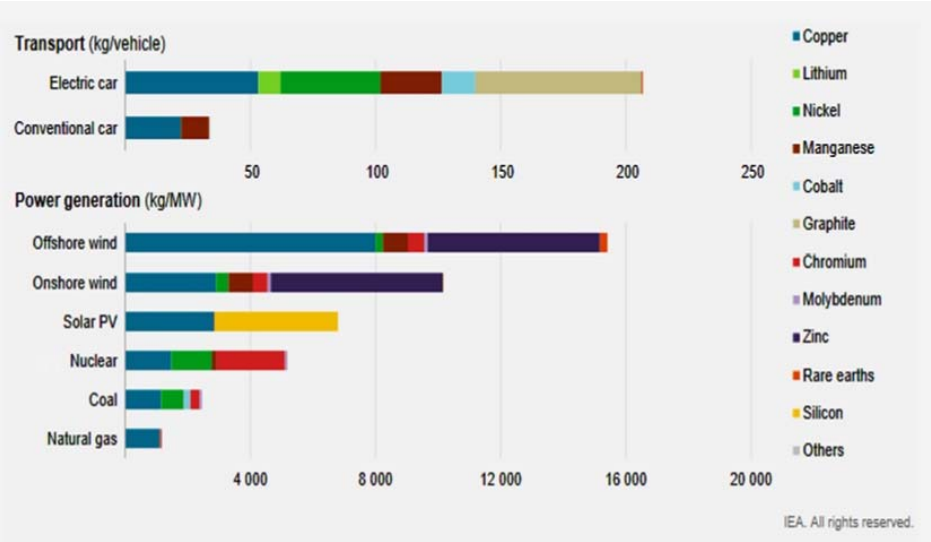
4. Findings

4.1. Mapping the world's deposits and reserves

Critical raw materials are those raw materials which are particularly important in the economy and which are accompanied by an increased risk regarding their availability and supply. Critical raw materials are essential for many industrial ecosystems to function and not grind to a halt. Thirty-four critical raw materials have been identified at European level, of which 17 have been selected as strategic raw materials, as the demand for them will grow exponentially, with complex production requirements and high supply risk.This list is reviewed periodically.

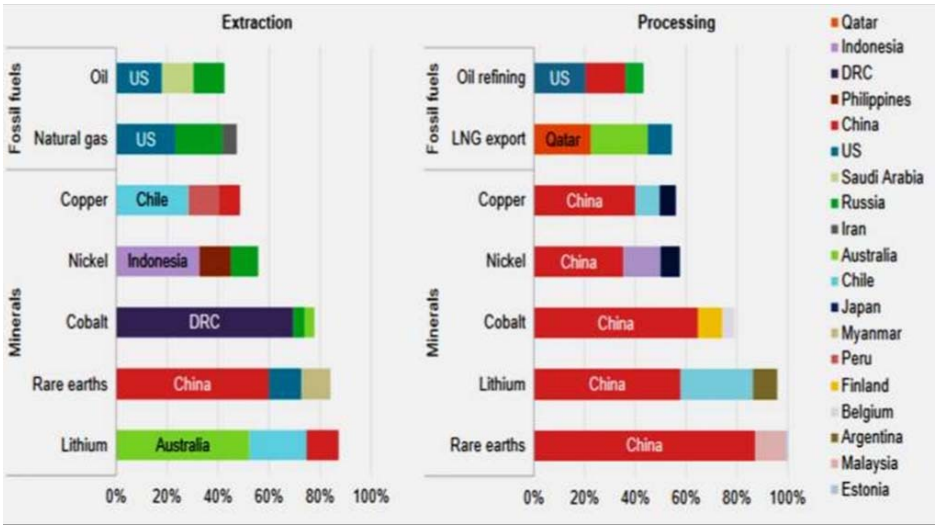
Driven by strong demand, the supply of metals can, in turn, affect the course of the energy transition, as the price of metals is a determining factor in the competitiveness of industrial equipment (see Figure 1).

Figure no. 1 Critical minerals pose new energy security challenges



Source: International Energy Agency (IEA)

Figure no. 2 Main countries on the critical minerals market



Source: International Energy Agency (IEA)

There are several risks to consider. Firstly, the value chains are more complex than those for fossil fuels, and the markets are not very transparent and can be highly volatile. Secondly, the number of producing countries is small. For lithium, cobalt and rare earths, the top three producers control more than three-quarters of world production. Some countries even have a quasi-monopolistic position, notably South Africa in the case of platinum and the DRC in the case of cobalt, while China accounts for 60% of rare earth production.

In addition, there are several geographies to be distinguished: reserves or resources, operating mines and refineries or smelters. The geography of refining is particularly concentrated, mainly because of the role played by China. China's share of nickel refining is 35%. It accounts for between 50% and 70% of lithium and cobalt refining, and 90% of rare earth refining (see Figure 2).

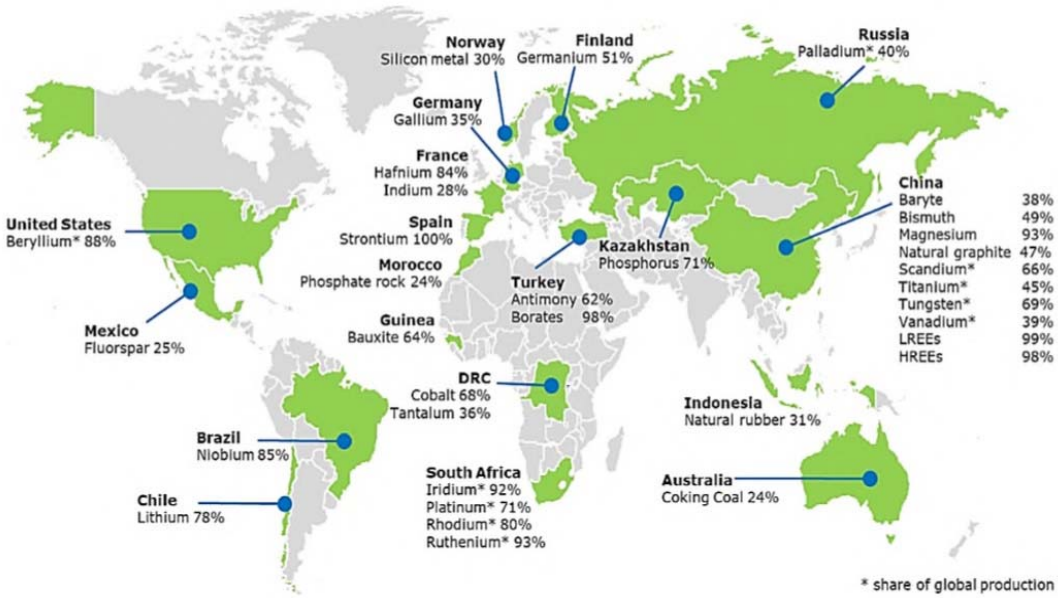
4.2. Analysis of critical raw materials and legislation at EU level

The history of rare earths is a European one. It began in Sweden in 1787, when the Swedish amateur mineralogist (and artillery lieutenant) - Carl Axel Arrhenius - discovered a black mineral in the Ytterby quarries north of Stockholm (used to develop porcelain).

At this moment, the EU depends on only one country for certain critical raw materials (Figure 3):

- China supplies 100% of EU purchases of heavy rare earths
- Turkey supplies 98% of the EU's boron purchases
- South Africa provides 71% of EU platinum imports.

Figure no. 3 Countries accounting for the largest share of EU supplies of critical metals



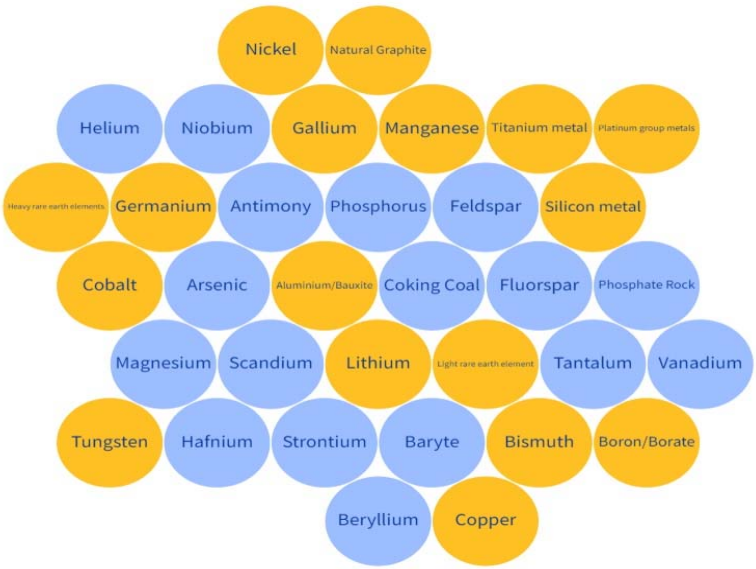
Source: (European Commission, 2020)

In the case of the EU, the regularly updated list of critical metals is used in the negotiation of trade agreements and in defining research and innovation programmes. In particular, the EU urges its partners to refrain from any measures aimed at restricting exports of metals. It was in this context that the EU lodged several complaints with the WTO against China (in 2012, 2014 and 2016), criticising the country for imposing export taxes on certain metals, or for securing long-term supplies from third countries, notably for cobalt , to the benefit of its refining industry. (Lepesant, 2021)

The EU is also pursuing a dialogue with Japan and the United States, while strategic partnerships could emerge with neighbouring countries, particularly in the Western Balkans (Serbia for borates and Albania for platinum).

The Council adopted this year, in March, a regulation establishing a framework with the aim of safeguarding the supply of essential raw materials in the long term at the European level: "Critical Raw Materials Regulation". The final text identifies two lists of materials (34 critical and 17 strategic) that are essential for the green and digital transitions as well as for the defence and space industries (Figure 4).

Figure no. 4 Critical raw materials



Source: (European Council, 2024)

The regulation on critical raw materials identifies, in terms of annual consumption of raw materials, 3 benchmarks to be met: 10% to be extracted locally; 40% to be processed in the EU and 25% have recycled materials as a source of origin.

To facilitate the development of strategic projects, Member States will create single points of contact at the relevant administrative level and at the appropriate stage of the critical raw materials value chain. Extraction projects will receive permits within 27 months and recycling and processing projects should receive permits within 15 months, with limited exceptions designed to ensure meaningful collaboration with local communities affected by projects and adequate environmental impact assessment in complex cases. Large companies producing strategic technologies (i.e. battery, hydrogen or renewable energy producers) will carry out a risk assessment of their supply chains to identify vulnerabilities.

The European Commission has adopted, also, the "Circular Economy Action Plan" to help modernise the economy by exploiting opportunities at national and European level, with priority for six strategic areas: raw materials, batteries, active pharmaceutical ingredients, hydrogen, semiconductors, cloud and high-tech.

In Europe, are recycled over 50% of metals like iron, zinc and platinum, covering 25% of the EU's consumption, but the recycling rate is low or even derisory for several other metals. In the case of batteries, the recycling rate for cobalt is 32%, but lithium is rarely recovered. The difficulty lies in the design of the batteries and the risks of explosion and fire associated with their treatment at the end of their life. Recycling equipment is also economically difficult because the quantities are small and the metals are integrated with other materials. Faced with the challenges posed in terms of security of supply and the sustainability of the energy transition, the EU has fleshed out its legislation, particularly in the battery sector, in order to increase Europe's autonomy.

There is now a trend at European level for mineral resource deposits to be declared of public, local, regional, national or European importance, with regulations in place to protect research and exploitation. European climate and energy policy requires a large amount of metals and minerals for its strategic technologies and in this respect, capacity must be increased for all stages of the raw materials value chain, i.e. mining, recycling and extraction from ore, refining and transformation, according to the European Parliament resolution of 25 November 2020 on a "New industrial strategy for Europe".

On the part of the European Union, a proposal for a regulation in favour of a storage solution was published on 16 March 2023 "Establishing a framework to ensure secure and sustainable supplies of critical raw materials" (European Commission 2023). Through this text, the Commission envisages a mapping of stocks and supply flows currently managed by public and private players in the European Union, in order to gain sufficient visibility to put in place a proactive policy of coordination between Member States.

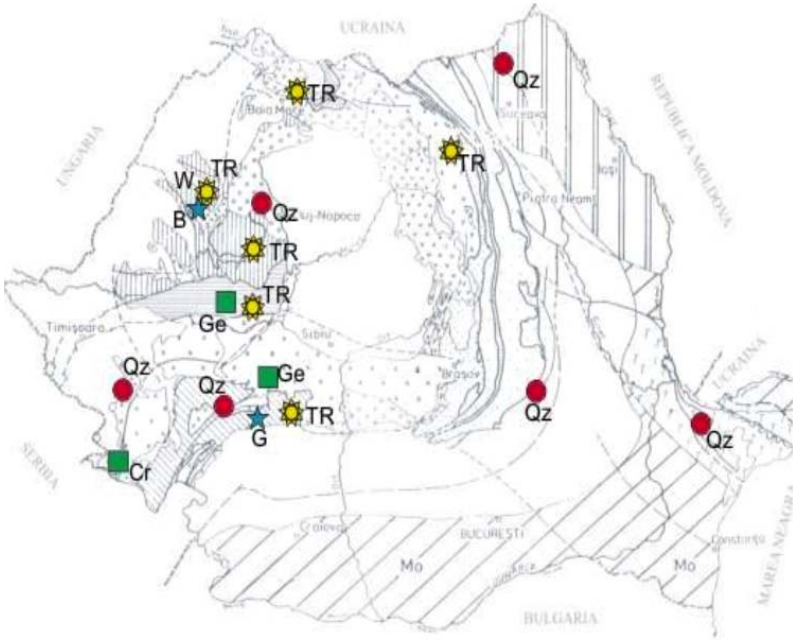
The development of regulation in Europe is also in line with the issues raised by international organisations (OECD, World Bank, IEA) to understand the criticality of minerals. Europe recently participated in the friend-shoring trend through the Critical Raw Mineral Club initiative. This initiative duplicates that of the United States, in which Europe also participates.

The European Union has a range of options here, which are not mutually exclusive: improving traceability, developing extraction activities on its own soil, identifying alternative resources and recycling. However, social acceptance, environmental risks and profitability are all challenges. While mining activity is enjoying a revival in northern European countries that could facilitate the establishment of industrial clusters for battery production, the environmental challenges cannot be overlooked. In this context, recycling appears promising.

4.3. Analysis at the Romanian level

A SWOT analysis in "National strategy for non-energy mineral resources, horizon 2035" shows that there are indications of critical material existence in our country:

Figure no. 5 Critical material resources in Romania



Source: (Ministry of Economy, 2023)

In our country there are opportunities, some with good exploitation potential, but there are also geologically unexplored reserves. Thus, quartz sands and graphite belong to the category of economically important non-metallic resources with known geological reserves and exploitation possibilities. Economically important non-metallic resources with unknown geological reserves include boron and phosphorus minerals. Further, the category of economically very important metal resources with unknown geological reserves and moderate potential includes chromium, magnesium, germanium and tellurium. In the category of economically important metal resources, with unassessed geological reserves and moderate potential: stibium (antimony), wolfram (tungsten) and rare earths (TR). There are relatively low prospects of discovering resources of cobalt, indium,

niobium, gallium, platinum group minerals. An offshore map of National Agency for Mineral Resources (ANMR) showing the presence of manganese and rare earths also in the Black Sea.

The priorities of "National strategy for non-energy mineral resources, horizon 2035" are: geological research, inventory and evaluation of critical raw materials, advanced exploitation and processing of non-energy mineral resources, environmental restoration and socio-economic regeneration, exploitation of secondary resources from tailings ponds and tailing ponds, use of geothermal waters.

The general objectives of this Strategy have been established:

- the institutional and legislative framework on non-energy mineral resources to be harmonized
- for sustainable development, non-energy mineral resources are used responsibly in the interest of the country
- financial support in the field of industrial research, innovation and development of this group of resources.

5. Conclusions

Critical minerals are essential to many strategic industries in economy, such as agriculture, manufacturing, artificial intelligence, clean technologies, electric vehicles, energy and much more. They are essential to our daily lives and are vital components of the global energy transition, including the production of wind turbines, batteries for electric vehicles, solar panels and semiconductors.

We have to continue to strengthen the supply of critical minerals and promote innovation and sustainable practices within the minerals value chains. The actions must support economic growth and develop a more inclusive and highly skilled workforce, while advancing and reinforcing our leading environmental, social and governance standards:

Secure access to raw materials as far as possible by reducing dependence on imports and encouraging the development of the circular economy and local alternatives. The aim is to reuse or recycle mine tailings or goods components by giving them a second life.

We have to ensure the availability of components for tomorrow's industries by doubling Romanian production capacity and industrial innovation.

Master new digital technologies to develop sovereign solutions in agriculture, health and industry. Develop skills in the industries of the future by training young people and creating centres of excellence. Support the emergence and industrialisation of start-ups.

The mineral and energy resources of the subsoil represent a national heritage that must be harnessed in a sustainable way, as it is the basis for the socio-economic development of the country.

The exploitation of mineral resources requires the reactivation of the mining and processing industry (processing, concentration, metallurgy). It is imperative that the exploitation of mineral resources is carried out in a sustainable manner, without the use of technological procedures and highly toxic substances (e.g. sodium cyanide), which would endanger the environment, human communities, archaeological and historical remains and the natural landscape in the mining area. If, for the exploitation of certain mineral resources, it will be necessary to resort to foreign companies, the association/cooperation or concession agreements should provide for considerably higher profit shares for the Romanian State than those accepted for the Rosia Montana project (possibly with the application of production sharing agreement principles).

6. References

- Chalmin, P. and Jégourel, Y., 2023. *Cyclope les marchés mondiaux 2023 : „Les cavaliers de l'Apocalypse"*. Paris: Economica Publishing House.
- European Commission, 2020. *Circular economy action plan*. Brussels. [online] Available at: https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en [Accessed 15 June 2024].
- European Commission, 2020. *Study on the EU's list on critical raw materials*. Brussels. [online] Available at: https://op.europa.eu/en/publication-detail/-/publication/c0d5292a-ee54-11ea-991b-01aa75ed71a1/language-en [Accessed 15 June 2024].

- European Commission, 2023. *Establishing a framework to ensure secure and sustainable supplies of critical raw materials*. Brussels. [online] Available at: https://www.europarl.europa.eu/doceo/document/TA-9-2023-0325_EN.html [Accessed 15 June 2024].
- European Commission, 2023. *Study on the Critical Raw Materials for the EU 2023*. Brussels. [online]. Available at: https://single-market-economy.ec.europa.eu/publications/study-critical-raw-materials-eu-2023-final-report_en [Accessed 15 June 2024].
- European Council, 2024. *An EU critical raw materials act for the future of EU supply chains.* [online] Available at: https://www.consilium.europa.eu/en/infographics/critical-raw-materials/ [Accessed 15 June 2024].
- European Parliament, 2020. *New Industrial Strategy for Europe*. Brussels. [online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0102 [Accessed 15 June 2024].
- International Energy Agency (IEA), 2022. *Strategic and Critical Materials Stock Piling Act*. iea.org. october 31. [online] Available at: https://www.iea.org/policies/15534-strategic-and-critical-materials-stock-piling-act [Accessed 15 June 2024].
- Lepesant G., 2021. *Le rôle des métaux critiques dans la transition énergétique: défis et stratégies.* [online] Office franco-allemand pour la transition énergétique. [online] Available at: https://shs.hal.science/halshs-03364934 [Accessed 15 June 2024].
- Ministry of Economy, 2023. *National strategy for non-energy mineral resources, horizon 2035*, Bucharest. [online] Available at: https://commission.europa.eu/system/files/2023-11/ROMANIA%20-%20DRAFT%20UPDATED%20NECP%202021-2030.pdf [Accessed 15 June 2024].