CENTRE FOR ECONOMIC POLICY RESEARCH

CEPR

October 2025

Escaping the critical minerals curse

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THE RACE FOR CRITICAL MINERALS

A race is raging among the superpowers over critical minerals in developing countries to power the simultaneous energy and digital transitions that the world is experiencing. The extraordinary growth in demand for critical minerals is putting upward pressure on prices and stimulating new critical mineral discoveries around the world. In developing countries, the new bonanza from critical minerals presents opportunities but also important risks. In this Policy Insight, we argue that absent governance system shifts, developing countries risk facing a 'critical minerals curse'.

Today's race to secure critical minerals by the economic superpowers is far from new – it stems from a long-standing and fundamental asymmetry between advanced economies and developing economies. Developing economies are less industrialised and tend to consume fewer minerals than they produce. This situation lends itself to influence over these minerals by foreign economic powers, where the latter also enjoy advances in technology and military might. When this happens, one can speak of a 'grab for minerals'.

Competition among 19th century European empires for copper, tin, rubber, timber, diamonds, and gold was the trigger for what was known as the 'scramble' for Africa's resources. The advance of steam engine navigation made access to, and transport of, these resources much easier for these empires. The resources were essential to powering industrial revolutions, and people in the colonies where they were located faced expropriation and were subjected to various forms of forced labour, including to extract the resources. As a result, former colonies inherited a complex history and bad institutions, which they – including many in Africa – continue to grapple with.

A 2001 article by the three 2024 Nobel Laureates, Daron Acemoglu, Simon Johnson, and James Robinson, exploits how Europeans colonised large parts of the globe to illustrate how institutions are shaped by the history of extractive activities. Importantly, the article also provides evidence of the persistence of the effects of these extractive institutions on economic prosperity today. This echoes the work on institutions by the 1994 Nobel Laureate Douglas North, who renewed interest in economic history using quantitative methods to explain economic and institutional change. In this Policy Insight, we highlight the importance of institutions for developing countries to navigate the advent of critical minerals resulting from the economic superpowers race echoing the 19th century race by European empires.

1 We thank Ali Ached, Ugo Panizza, Gregoire Rota-Graziosi, and Noé van Hulst for helpful suggestions and comments.

A telling historical example of the complex history of developing countries is the Democratic Republic of Congo (DRC), illustrated prominently in the 2012 book, *Why Nations Fail*, authored by two of the 2024 Nobel Laureates (James Robinson and Daron Acemoglu). Once known as the Belgian Congo, the DRC experienced a cruel form of colonisation as the de facto personal property of King Leopold II of Belgium. The DRC's post-independence era was plagued by direct interventions by foreign powers and autocratic rulers. This history helps explain the DRC's deficient institutions, the persistent low level of trust among citizens, and distrust between the citizenry and the government.

Nowadays, the DRC is touted as the 'new Saudi Arabia of critical minerals'.[2] The DRC is the repository of the world's largest reserves of critical minerals such as cobalt, copper, and lithium. Indeed, the DRC holds around 70% and 60% of the world's cobalt and lithium reserves, respectively, as well significant deposits of nickel and uranium, which are used in energy generation and batteries for electric vehicles. But the abundance of these minerals has not improved the lives of the citizens in one of the poorest countries in the world. Indeed, the DRC encapsulates the seemingly insurmountable and intertwined challenges posed by critical minerals. These challenges are tied to geopolitics, conflicts (both internal and external), the environment, as well as economic and social dimensions.

Fast forward to today, and the race for natural resources to power the simultaneous energy and digital transitions is raging among the economic superpowers, with China in lead position. In principle, this renewed interest by superpowers in minerals in developing countries should mean the latter will receive windfalls. Historically, however, developing countries have had difficulties managing bonanzas from the export of natural resources. Here, we highlight the dualism of institutions required for developing countries to navigate the phenomenon. Specifically, we argue that the difficulty for mineral-rich developing countries lies in the balancing act between two different types of institutions, namely, outward-facing and inward-facing institutions.

DEMAND AND SUPPLY OF CRITICAL MINERALS

While the energy and digital transitions both rely on technologies that require critical minerals, the clean energy transition is most prominently associated with the intensive use of these minerals. Technologies including wind turbines, solar PVs, electricity networks, electric vehicles, and nuclear power require minerals such as copper, lithium, nickel, silicon, cobalt, rare earth elements, and uranium. Demand for these minerals is expected to grow quickly as the energy transition gathers pace.

In the face of this growth in demand, the limited supply of critical minerals has put upward pressure on their prices (although the increase in prices has receded for certain minerals, especially energy minerals).

Forecasts suggest that demand for minerals for clean energy technologies will rise least four-fold by 2040 to meet climate goals, with particularly high growth for minerals needed for electric vehicles (IEA, 2021). Graphite, nickel, lithium, and rare earth minerals are expected to witness explosive demand as a result of policy changes to meet climate goals. However, recent setbacks to the global climate consensus cast uncertainty over future demand for energy-related critical minerals. That said, in their most recent update, the IEA (2025) forecast that demand for critical minerals will continue to grow strongly in 2025. Despite this rapid growth in demand, major supply increases – led by China, Indonesia, and the DRC – caused a glut which pushed prices down, especially for battery metals. Current investment decisions will likely take account of significant market and economic uncertainties, even though future demand growth is expected to be strong. Supply is expected to catch up demand by 2035, but concerns remain, especially for copper.

2 See https://www.energy.gov/cmm/what-are-critical-materials-and-critical-minerals

We argue that the bonanza from the exploitation in developing countries creates both opportunities but also important risks, especially for the developing countries.

GEOGRAPHY OF MINERAL MINING AND PROCESSING

The production of critical minerals is relatively scattered. The salient issue is where the residual production of critical minerals net of domestic consumption (i.e., exports), especially of raw critical minerals, is concentrated. The production of critical minerals is highly prevalent in the major economic blocs, namely, China, the United States, and European Union. These blocs typically consume more of what they produce, making them dependent on exporters of raw critical minerals. Australia, Russia, Kazakhstan, DRC, Mozambique, Chile, South Africa, and Zimbabwe, as well as many others, are important exporters of raw critical minerals and are thus courted by the superpowers, which are striving to ensure secure supplies of such minerals.

The geography of mining versus processing of critical minerals is telling. China dominates the processing of copper, nickel, cobalt, rare earths, and lithium, but China only dominates in the production of rare earths, while Chile and Peru dominate in the production of copper, Indonesia dominates in the production of nickel, DRC dominates in the production of cobalt, and Australia and Chile dominate in the production of lithium. It is mind-boggling that China is the dominant producer in the world economy of offshore wind, onshore wind, solar, and electrical vehicles, and has 40-45% global shares in the production of fuel cell trucks, heat pumps, and electrolysers (Leruth et al., 2022).

According to the IEA (2025), the supply of critical minerals, especially in refining and processing, has become less diversified, and diversification of refining supply chains is stalling. This raises risks to energy security. Although mining is still less concentrated than refining, it shows a similar trend. Export restrictions and security risks are proliferating.

ECONOMIC SECURITY AND VALUE CHAINS

Many developing countries attempt to maximise the value of their raw critical minerals by setting up cartels. In response to the unfair share they believed they received from the exploitation of these minerals, developing countries historically have set up producer cartels, such as the Organization of the Petroleum Exporting Countries (OPEC). While these cartels may get higher prices for these critical minerals and add revenue to government coffers, in practice advanced economies eventually find alternative suppliers (for example, non-OPEC producers) or develop alternative products (such as synthetic palm oil or shale oil). Moving up the value chain would be a better route, but that too has proven difficult. The risk of cartelisation is another source of concern for major economic powers dependent on exports from developing countries. The uneven distribution of production of critical minerals is, however, likely to diffuse as elevated prices steer exploration investment efforts and eventually lead to more discoveries (Arezki et al., 2019). A case in point is lithium, the price of which has fallen after fears over scarcity in the face of extraordinary growth in demand.

ENVIRONMENTAL HAZARDS

The ramping up of mining activities around critical minerals has severe environmental, health, and social consequences. Mining activities can cause irreversible damages to the environment and are also a significant source of emissions of greenhouse gases, undermining climate goals. Mining of critical minerals is intensive in the use of water and can also contaminate water, especially where standards and controls are weak. Also, in places where labour standards are weak, including in the DRC, working conditions can be very harsh and child labour is rampant. Still, the DRC has become the darling of the United States and the European Union despite huge governance challenges, thanks to the DRC negotiating contracts away from China.

The risk of environmental damage is exacerbated by the 'not in my backyard' (NIMBY) politics of the industrialised countries which consume these critical minerals abundantly. There is ample room here for international corporations, especially those headquartered in industrialised countries, to step up their efforts and adhere to their home standards to avoid environmental and health disasters in the most vulnerable countries where these minerals are extracted. If not confronted, these environmental degradations will leave people behind for decades in developing countries where the minerals are extracted.

DANGER TO DEMOCRACY AND THE POTENTIAL MINERAL CURSE

The new geopolitical environment in which mineral-rich developing countries have become the centre of attention of major powers is likely to slow down, or even reverse, democratisation in many of these developing countries. This is because 'geopolitical rents' for leaders aligning with superpowers are now back. That does not augur well for citizens and for the prospects of improved economic governance in those developing countries.

Leaders of countries like the DRC have been courted simultaneously by China and the United States, despite a poor track record in terms of governance and human rights abuses. The bonanza from critical minerals is, however, not necessarily good news. Traditionally, developing countries have not managed the proceeds from the exploitation of their natural resources well, with dire consequences for their citizens. The new geopolitical environment may make things worse.

Indeed, the track record of developing countries in managing their natural resources has been so subpar so that the term 'resource curse' was coined to describe the paradox of countries rich in natural resources performing worse than countries that are resource-poor (e.g., van der Ploeg, 2011). The macro-institutional consequences of traditional resources offer lessons in what to avoid when managing booms in critical materials.

One challenge traditionally emphasised in the literature is rent-seeking, whereby natural resources increase the return to state capture, potentially leading to inefficient policy choices in the absence of strong political institutions. Tornell and Lane (1999) describe a 'voracity effect' in which a terms-of-trade windfall leads to state capture by powerful groups. Robinson et al. (2014) provide a similar model in which incentives for state capture increase with exports of natural resources. Ross (2012) provides evidence of rent-seeking in the oil industry.

Another challenge is the so-called 'Dutch disease', whereby a natural resource discovery or price appreciation is accompanied by an overvalued real exchange rate, which in turn shrinks the non-resource export sector and typically depresses growth prospects. Eastwood and Venables (1982) show how, in the standard neoclassical model, an oil discovery will lead to an appreciation of the real exchange rate, operating through an increase in the relative price of non-tradeables.[3] Torvik (2001) shows that the Dutch disease can be avoided in a more sophisticated model by allowing for learning-by-doing in the non-tradable sector and knowledge spillovers from the non-tradable to the tradable sector. Arezki and Ismail (2013) present mixed empirical evidence in favour of the Dutch disease.

DUALISM OF INSTITUTIONS

Unfortunately, worsening rule of law and quality of institutions tends to be part of the resource curse too. On the other hand, Mehlum et al. (2006) show that good institutions, unsurprisingly, moderate the natural resource curse. But which ones? There are two key areas:

3 Arezki et al. (2017) document evidence of the 'anticipation effect' on the current account stemming from news shocks in the form of oil and gas discoveries.

- The policies and institutions that govern the opening of the natural resource sector to attract investment and hence generate revenues for the state (*outward-facing institutions*).
- The quality of redistributive institutions that govern how the proceeds from the exploitation of these resources are used to benefit people, including in terms of human capital (*inward-facing institutions*).

The difficulty for developing countries rich in minerals lies in the balancing act between these outward-facing and inward-facing institutions (Arezki et al., 2019).

In practice, countries rich in critical minerals get their fair share of revenues from extraction by multinational corporations. This starts with transparent mining contracts and by strengthening local governments' capacities to negotiate fair contracts with multinationals. Improved transparency and mining contracts will help producer countries to redistribute the proceeds to citizens to ensure economic justice. The governments of resource-rich countries should also pursue local content policy by localising the processing of critical minerals. A telling example is the case of Botswana, which acquired a 15% stake in the world biggest diamond miner, DeBeers, that helped lock in local diamond-cutting activities.

Beyond these economic considerations, countries rich in critical minerals coveted by the superpowers often experience both internal and external conflicts. A case in point is the DRC, which has long faced massive violence and crime in mineral-rich provinces such as Katanga and North Kivu, fuelled by neighbours including Rwanda and Uganda. The advances of Rwanda-backed M23 rebels in eastern Congo is alarming for the DRC and could fuel a major continental conflict. The Trump administration is actively pushing for a peace deal between the DRC and Rwanda to end the violence, which appears to be contingent upon the two countries each signing a bilateral economic agreement with the United States involving mineral extraction and processing. The United States has of course pursued a similar strategy when demanding that Ukraine sign an agreement to hand over part of its mineral wealth.

The weak enforcement of environmental and social standards in many mineral-rich countries is also very concerning. A global debate is raging over boycotts of critical minerals emanating from zones of conflict and forced labour. These boycotts alone are unlikely to sway governments in mineral-rich countries to do right by their citizens, but multinational corporations and foreign governments may be more susceptible to change.

POLICY PRESCRIPTIONS

As the rivalry between the economic superpowers over access to critical minerals continues to intensify, these multifaceted challenges may grow insurmountable. This should not deter the governments and the citizenry in mineral-rich countries from defending their interests by building and reinforcing their social and economic institutions.

Regulation at the national level has often failed to address issues of over-exploitation of natural resources as well as displacement, environment degradation, and risk to biodiversity, which are often best managed by local communities. The work of the late Elinor Ostrom (2009) shed important light on the design of self-organised user communities to achieve sustainability in the exploitation of natural resources, which can be salient for getting the governance of critical material booms right.

Various existing international initiatives have focused mainly on transparency – for example, the Extractive Industry Transparency Initiative (EITI). The development of environmental, social, and corporate governance (ESG) norms has roots in the socially responsible investing movement that began in the 1970s. It is unclear, however, whether and how such norms could be enforced, especially considering their voluntary nature. One encouraging sign is that consumers in advanced economies appear to be changing their behaviour with respect to the environment. But investor behaviour, especially in developing countries, may not be so amenable to change. The challenge with all these international initiatives is the difficulty in translating them into the right context and fostering ownership, especially at the local and national levels.

Critical minerals also pose new challenges to developing economies, including technological uncertainty and geopolitical tensions affecting demand. A telling example is lithium, which is used to make batteries. While lithium-ion batteries remain the norm, a myriad of potential alternatives technologies are being developed, including sodium-based batteries (Vu, 2025). This rapid technological evolution is driven by the usual market size effect but also importantly by concerns about economic security. From the perspective of the economic superpowers, there are concerns about the security of supply from politically unstable countries such as the DRC. In addition, there are geopolitical tensions between economic superpowers that could disrupt supply chains. China controls the supply of lithium iron phosphate cells, which essentially makes other economic superpowers dependent on it. Such technological uncertainty, coupled with geopolitical tensions, affects critical minerals and their potential obsolescence in important ways. This situation stands in sharp contrast with conventional minerals – for example, the risk of obsolescence might lead to more rapid depletion of reserves.

From the perspective of developing economies, potential obsolescence could have major economic consequences, from the drying out of exports of critical minerals to the disruption of investments, leading to sunk costs. This calls for more fiscal prudence and the design of extraction and sale contracts to ensure adequate risk-sharing between multinational corporations and governments in developing economies. To do so, developing economies should consider longer-term contracts similar to the 'take-or-pay' contracts for natural gas, which require purchasers to pay for a contractually specified minimum quantity of output, even if delivery is not taken.

Long-term contracting alone will not suffice to deal with the inflexibility stemming from fluctuations in supply and demand. Contingent claim contracts exist, but they are difficult to administer. To mitigate these hazards, parties will therefore wish to choose contract terms that minimise the need for costly adjudication while maintaining incentives for appropriate adaptation (Crocker and Masten, 1988). Masten and Crocker (1985) examine the incidence of take-or-pay provisions in contracts between natural gas producers and pipelines from this perspective. The main reason for such provisions is to avoid repeated bargaining in transactions by specifying the future terms of trade in a long-term contract at the outset of the relationship. The authors also provide theoretical and empirical evidence that obligations contained in contracts written in unregulated environments allow efficient adaptation to changing circumstances in long-term contractual relationships.

In the context of critical minerals, longer-term contracts help reduce the uncertainty stemming from perceived political instability and geopolitical tensions. In a nutshell, the contract reduces the incentive to engage in costly and hazardous outcome-linked R&D to innovate away from, say, existing lithium battery technology. This is because without such longer-term contracts, a higher bidder (say, China) could sway the supplier of critical minerals such as the DRC away from, say, Europe. Long-term access to lithium would also allow Europe to catch up with China in existing processing technology. In other words, the proposal is to steer away from runway R&D spending and industrial policy that might turn out to be inefficient. Longer-term contracts reduce 'inefficient' R&D by reducing uncertainty vis-a-vis suppliers of critical minerals and the dominance of processing powers such as China.

Failure to ensure appropriate risk-sharing could lead developing economies to speed up extraction.[4] This would lower prices of critical minerals and potentially also erode fiscal discipline and degrade the environment. These unintended consequences stemming from demand uncertainty are akin to the so-called 'green paradox', whereby the announcement of a future carbon tax or a sufficiently fast-rising carbon tax encourages fossil fuel owners to extract reserves more aggressively, thus exacerbating global warming.[5]

CONCLUSION

To escape a new curse of critical minerals, developing and advanced economies need to build a new model of international governance that accounts for interdependencies related to peace and stability, global health, and environmental and climate issues in a world increasingly organised into blocs. If externalities are to be internalised, a new international mode of governance will need to effectively deliver technology transfers from advanced to developing economies to provide the tools to address the threat of climate change and meet climate goals, including by moving value chains of critical minerals. Such international governance should also promote effective access to international capital markets through, for example, green bonds, nature bonds, or blue bonds instead of opaque resource-backed loans. Developing countries also need to shift their domestic governance to ensure that foreign direct investment delivers on local content, environmental protection, and jobs to address rising discontent in communities where mining or other extractive industries operate. Critical minerals also pose new challenges to developing economies, including technological uncertainty and geopolitical tensions affecting demand. This calls for more fiscal prudence and the design of extraction and sale contracts to ensure adequate risk-sharing between multinationals and governments in developing economies.

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5 See van der Ploeg and Withagen (2015) for a review of the green paradox.

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