



No Time to Waste: Governing Cobalt Amid the Energy Transition

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Contents

KEY MESSAGES.....	3
SUMMARY	4
INTRODUCTION.....	6
1 DIFFERENCES BETWEEN COBALT AND MAJOR METALS	8
1.1 Cobalt as a by-product.....	8
1.2 Small production values	9
1.3 Precarious demand.....	9
1.4 Geographic concentration and geopolitical significance	12
1.5 Market immaturity and integration.....	15
1.6 Price volatility.....	16
2 POLICIES FOR COBALT MINING AND PROCESSING DURING THE ENERGY TRANSITION	18
2.1 Licensing and exploration.....	20
2.2 Taxation	23
2.3 Value addition: processing and links to the economy.....	26
2.4 Environmental protection.....	33
2.5 Promoting sustainable conditions for workers and communities	34
2.6 International and regional policies.....	38
CONCLUSION	40
REFERENCES	41

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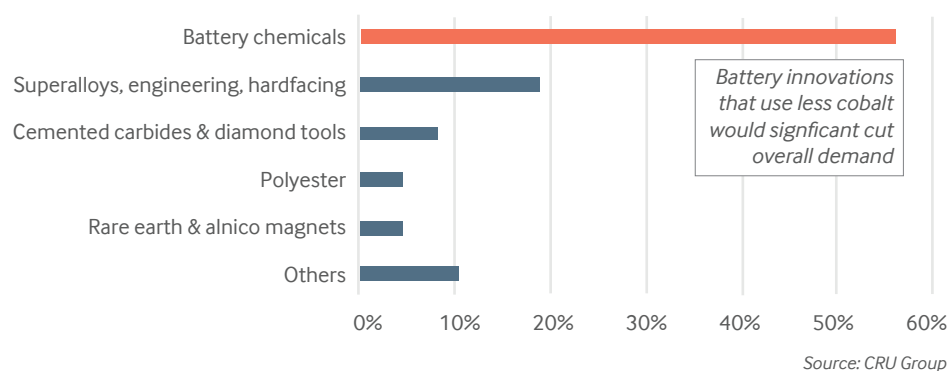
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Key messages

- *Poor governance is limiting the value of cobalt for mining countries.* Mineral-rich countries such as the Democratic Republic of Congo (DRC) are not adequately leveraging cobalt, copper and other minerals and metals to improve the lives of citizens. Without a substantial change in approach, countries will miss the opportunities brought by demand for commodities needed for green technology.
- *Cobalt's role in the energy transition depends on better governance.* Cobalt is currently a critical input to batteries for electric vehicles and energy storage, demand for which is rising as energy markets transition away from fossil fuels. However, known reserves of cobalt are limited predominantly to the DRC, which is a risky place to operate given its poor record on corruption, taxation, license security and the welfare of artisanal miners. These constraints may limit mining investment, and harm both the local environment and communities. Consequently, battery manufacturers are seeking to use less cobalt. By improving the security of supply and reducing the harms from mining, authorities in the DRC could lengthen cobalt's future in the battery industry and strengthen the opportunity cobalt presents for the country.
- *Improving governance does not require new or specialized policies.* Most policy principles that apply to other metals also apply to cobalt. Governments and activists should urgently focus on strengthening transparency, accountability and the practical implementation of existing policy principles. The biggest challenge is the weak uptake of known good practices including around licensing, taxation and anticorruption.
- *Some unique traits of the cobalt industry make it harder for governments to manage cobalt accountably.* These include the immaturity of the market and increasingly integrated supply chains which make price reporting opaque. The intense geopolitical focus on cobalt supply will also test governments. Governments need extra support and resources to address these issues.
- *Governments are focusing on adding value to their mineral production by developing processing and other downstream industries.* While governments will likely derive most value from mining itself and related supplier activities, "value addition" may bring some ancillary benefits. To achieve their goals, governments require clear, consistent and credible policies. Most could also cooperate with neighboring states, since few countries can securely supply all battery minerals on their own.

Cobalt consumption by end use in 2020 (percentage of total consumption)



Summary

The continued rise in cobalt demand could earn countries billions of dollars and kick-start new industries in countries dominated by resource extraction. However, these countries face obstacles. How should their governments manage cobalt mining industries? Frameworks like the Natural Resource Charter provide principles of good governance that apply to major metals like copper, iron and gold; most of these also apply to cobalt. But there are some differences that warrant a reconsideration of some policies.

Differences between cobalt and major metals	Policy implication cobalt producing countries
Cobalt is usually a by-product. For most mines, the value of the major metal—not the value of cobalt—determines investment decisions.	Policies aimed at attracting investment must work for the major metal as much as the by-product.
Cobalt has so far provided governments with smaller revenues than major metals. Even the world’s dominant producer, the Democratic Republic of Congo (DRC), earns more from copper than cobalt.	Cobalt revenues alone are unlikely to fund economic development. While exploiting cobalt do not ignore the value of major metals.
Companies along the supply chain are increasingly integrated, which means little cobalt is traded on the open market, and it is difficult to determine the market price for tax purposes.	Effective taxation and royalty collection require reliable verification of the value of mined cobalt. Be prepared to dedicate expertise and funding to verification.
Over half of all cobalt goes to the battery industry. A single industry buying so much of the global supply means that cobalt demand is precarious. Market analysts project large increases in demand for cobalt from electric vehicle makers—but this demand is uncertain and may not last beyond the next decade.	Do not wait to improve cobalt governance. Policies designed to extract value from cobalt should not be decades in the making.
In the past, the cobalt market has experienced dramatic volatility. Furthermore, forecasts of high demand do not automatically mean high prices since high prices can spur new supply.	Do not set policies assuming the currently high prices will last.

For the most part, the standard principles of mining governance apply to cobalt: for example, governments should combat corruption, build regulatory capacity and protect communities. But governments might wish to reconsider their approach to the following policy areas:

Fighting corruption. The fast pace of dealmaking and pressure for companies and countries to gain secure sources of production in the cobalt sector carries high corruption risks that must be met with effective preventative measures and enforcement efforts.

Licensing. Providing data for companies to reassess old geological surveys may reveal previously overlooked resources. Governments should also be ready to license projects that were previously unviable.

Taxation. A sliding royalty—the rate of which automatically adjusts to a price change— on cobalt production may help manage price volatility. In addition, unreliable price reporting makes verifying cobalt values for tax purposes difficult. Collecting reliable data on prices and pushing for international price transparency will help combat tax-base erosion tactics by companies.

Value addition. A clear, credible and consistent long-term policy direction instills confidence in companies to invest in industries downstream from cobalt mining. Governments also need to provide reliable transport, energy and skilled labor. Because one country does not have all the required metals to manufacture electric vehicle batteries, it is also important to think regionally and work closely with neighbors.

Environmental protection. While cobalt mining appears no more harmful than other mining, higher demand could encourage further expansion of mines into environmentally sensitive areas. This could lead to more rapid deforestation. Governments should apply the World Bank's forest-smart mining practices, improve licensing management and manage artisanal miners.

Artisanal mining. Managing artisanal mining both protects artisanal miners' rights and the producing country's ability to sell cobalt on the global market. Governments should follow international standards for managing artisanal mining, trace and audit supply chains, and formalize artisanal mining labor markets.

International and regional policies. Governments can coordinate with neighboring countries on policies to share geological data, develop business and customs regulations to facilitate cross-border supply chains, and develop partnerships with a wide range of consumer economies, including China and others.

Cobalt might not stay critical for long. Mining countries can capture value as miners dig and process the metal, and perhaps develop more industry along battery supply chains. However, this opportunity might not last long enough to finance decades of development in low- and middle-income countries. Improving governance now will help attract investment and capture value quickly before time is up.

Introduction

Cobalt is critical.¹ Along with other critical minerals, cobalt has important economic uses and currently few viable substitutes, yet its supply faces a high risk of disruption. Manufacturers of batteries for electric vehicles (EVs)—a market that has grown from virtually nothing in 2010 to producing 2.3 million vehicles in 2020, 3.2 percent of the global vehicle market²—want the metal. EV sales—and likewise, cobalt demand—could grow a lot more. Bloomberg New Energy Finance (BloombergNEF) under its relatively pessimistic scenario forecasts that by 2025, EVs will comprise 16 percent of all new passenger vehicle sales. By 2040, the vast majority of sales will be EVs.³

Further, depending on the speed of the global energy transition, cobalt demand could grow by 143 to 370 percent from 2020 to 2040.⁴ In comparison, from 2000 to 2020, cobalt production grew by 320 percent, while copper production grew by 1,415 percent.⁵ A future growth of 370 percent therefore seems reasonable. However, when considered in absolute terms and bearing in mind that all metals are nonrenewable, which means adding 22 more mines the size of Kamoto, currently the world’s largest cobalt-producing mine.⁶

Cobalt’s criticality makes it geopolitical. Mining, processing and consuming countries form allegiances and rivalries to secure the supply of this metal. The Democratic Republic of Congo (DRC)—where almost 70 percent of the world’s cobalt is mined⁷—and China—which processes most of it—are at the center of these maneuvers. Conversely, the United States and the European Union both want a cheap and steady supply of cobalt to ensure EVs replace their countries’ fleet of vehicles running on petrol and diesel and hope their companies can also benefit from this new vital market.

Cobalt can fund economic development. The rise in price meant that in 2019, by value, a third of DRC’s exports were of cobalt. Consequently, the DRC government

1 Although this criticality is not the same as the criticality of oil and gas. Disrupted gas supplies mean near instant effects for consumers—cold houses in winter or power cuts. Disrupted cobalt supplies, which contribute to a stock of batteries in EVs, do not have the same instant effect. Manufacturers can delay production, and consumers, after purchasing a car, do not need another one for a decade. Jim Krane and Robert Idel, “More Transitions, Less Risk: How Renewable Energy Reduces Risks from Mining, Trade and Political Dependence,” *Energy Research and Social Science* 82 (2021). <https://doi.org/10.1016/j.erss.2021.102311>.

2 “Global Electric Car Sales by Key Markets, 2010-2020,” International Energy Agency (IEA), last modified 2 December 2020, www.iea.org/data-and-statistics/charts/global-electric-car-sales-by-key-markets-2015-2020.

3 BloombergNEF, *The Cost of Producing Battery Precursors in the DRC (2021)*, assets.bbhub.io/professional/sites/24/BNEF-The-Cost-of-Producing-Battery-Precursors-in-the-DRC_FINAL.pdf.

4 The IEA forecasts total cobalt demand growth from all industries from 2020 to 2040 could be 143 percent under the IEA’s Stated Policy Scenario and 370 percent under its Sustainable Development Scenario, which assumes a faster energy transition. The IEA forecast demand from ‘clean energy technology’ industries could be between 6 to 30 times higher than current demand. Within this the agency suggests demand from clean energy industries would comprise up to 60 to 70 percent of total cobalt demand, up from below 20 percent today. IEA, *The Role of Critical Minerals in Clean Energy Transitions (2021): 7-8, 148*, www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions. A World Bank report forecasts that growth in demand from ‘energy technologies’ only could be 450 percent between 2018 and 2050. Kirsten Hund, Daniele La Porta, Thao P. Fabregas, Tim Laing, and John Drexhage, *Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition (World Bank, 2020): 73*, pubdocs.worldbank.org/en/961711588875536384/Minerals-for-Climate-Action-The-Mineral-Intensity-of-the-Clean-Energy-Transition.pdf.

5 Authors’ calculation from U.S. Geological Survey, *Mineral Commodity Summaries: Cobalt (2021)*, pubs.usgs.gov/periodicals/mcs2021/mcs2021-cobalt.pdf and U.S. Geological Survey, *Mineral Commodity Summaries: Cobalt (2001)*, s3-us-west-2.amazonaws.com/prd-wret/assets/palladium/production/mineral-pubs/cobalt/210302.pdf.

6 Authors’ calculations using data from S&P Capital IQ.

7 Using production of cobalt concentrates and intermediates in 2019. U.S. Geological Survey, *Mineral Commodity Summaries: Cobalt*.

declared cobalt to be a “strategic mineral,” raising its royalty on cobalt to benefit more from the higher demand.⁸ DRC is now developing new policies to govern its cobalt mining.

Yet, cobalt may not remain critical for decades to come. EV buyers, battery manufacturers and miners fear the high prices and disrupted supply, as well as human right abuses, environmental destruction, corruption, and political risk. As with other critical minerals, industries are seeking to use less of the metal. The time available for the DRC and other countries to benefit from mining the metal may be short-lived.

Given this impermanence and cobalt’s criticality, proper governance is important both for people in mining countries and for humanity to meet the Paris Climate Agreement. This report aims to help governments and their advisors in mining countries, such as the DRC, derive value from mining cobalt, develop industry along the battery-supply chains and address a host of problems from human rights abuses to corruption.

The report is also for policy-makers working to ensure that the world delivers enough cobalt in time for the global energy transition. Cobalt delivery starts with understanding how countries like the DRC and potentially new suppliers govern their mining industries. It requires understanding how to balance steady supply for the world and economic development for the people in these countries.

Since so much cobalt comes from the DRC, most of the examples and the discussion in this report is focused on the DRC. However, the report also addresses the smaller countries—such as the Philippines, Cuba, Papua New Guinea, Zambia and Angola—that mine some cobalt or that with rising prices may discover and develop much larger deposits.

In the next section, we describe the six differences between cobalt and major metals such as copper. We then use these differences to suggest how resource governance principles—as expressed in NRGi’s Natural Resource Charter—might adapt when applied to cobalt.⁹

8 See, e.g., BBC News, “Le Cobalt Substance Stratégique en RDC,” 4 December 2018, www.bbc.com/afrique/region-46440013; NS Energy, *Profiling the World’s Eight Largest Cobalt-Producing Countries*, 22 February 2021, www.nenergybusiness.com/features/top-cobalt-producing-countries.

9 A commonly used set of principles for the mining industry itself is the International Council on Mining and Metals, “Mining Principles,” www.icmm.com/en-gb/about-us/member-requirements/mining-principles.

1. Differences between cobalt and major metals

Six differences between cobalt and major metals such as copper and iron influence how governments manage cobalt mining and processing. For each we discuss the policy implications and whether these differences are permanent or temporary.

1.1 COBALT AS A BY-PRODUCT

Cobalt is usually found in ore alongside other metals like copper, nickel and platinum group metals.¹⁰ Since miners must extract the whole ore rather than individual elements within the ore, miners decide whether to extract based on the total value of the metals in the ore. In cobalt ores, the “grade,” or proportion, of cobalt in the ore is usually much lower than the grades of the “major metals” such as copper and nickel (Table 1). Even in mines in the DRC, where grades are highest, the gross sales revenue from cobalt earned in 2020 was at most a quarter of the revenue from copper (the only exception is the Etoile mine in Haut-Katanga province).¹¹ In this sense, cobalt is usually a by-product in the mining of another metal. Cobalt makes extracting an ore body more profitable, but the factors that companies traditionally look for are the major metal’s grade, mass, and accessibility.

Table 1. Grades in main cobalt mining regions¹²

Ore type	Region ¹³	Major metal grades (%)	Cobalt grades (%)
Copper and cobalt	African Copper Belt	3	0.3 and 0.8
Nickel and cobalt sulphides	Canada, Russia, Western Australia	2 to 3	0.1 and 0.14
Nickel and cobalt laterites	Brazil, Madagascar, Papua New Guinea, Philippines, Indonesia	1.1 to 1.25	0.06 and 0.1

This means that, among other things, the supply of cobalt can be constrained when the price of copper or nickel is too low to justify developing the mine. Therefore, mines—particularly outside the DRC where grades are lower—might not increase supply in response to sustained high cobalt prices.

However, the fluctuating cobalt price changes the economic importance of the metal within the ore body. Recently, alongside a large rise in the copper price, the price of

10 Most cobalt is found alongside copper, about a third of global cobalt supply is found in nickel ores, and only between 0.2 percent and 9 percent of cobalt comes from platinum-group-metal ores. Estimates vary based on year and method of study. CRU Group; Patricia Alves Dias, Darina Blagoeva, C. Pavel, and N. Arvanitidis, “Cobalt: Demand-Supply Balances in the Transition to Electric Mobility,” *JRC Science for Policy Report (2018)*: 30; Elsa Olivetti, Gerbrand Ceder, Gabrielle Gaustad and Xinkai Fui, “Lithium-ion Battery Supply Chain Considerations: Analysis of Potential Bottlenecks in Critical Metals,” *Joule* 1 (2017): 234.

11 Authors’ calculations using Banque Centrale du Congo, *Condensé Hebdomadaire D’informations Statistiques (2021)*, www.bcc.cd/downloads/pub/condinfostat/Cond_Info_stat_07_21.pdf.

12 Source for major metal and cobalt grades: CRU. Olivetti et al. (2017): 234–235 suggest: nickel laterites: 1.3 percent–2.5 percent Ni, 0.05 percent–0.15 percent Co; nickel sulphides: 1.5 percent–3 percent Ni, 0.05 percent–0.10 percent Co; copper-cobalt ores in African Copperbelt: 3 percent Cu, 0.3 percent Co.

13 Copper and cobalt (African Copper Belt: DRC Katanga Province and Zambia with possible outliers in Tanzania and Uganda); nickel and cobalt sulphides (Canada: Sudbury Basin, Manitoba and Voisey’s Bay; Russia: Norilsk, Siberia and Kola Region; Western Australia); nickel and cobalt laterites (Australia, Brazil, Cuba, New Caledonia, Madagascar, Papua New Guinea, Philippines and Indonesia).

cobalt has risen too. With the cobalt price \$50,000 per ton in 2021, and the copper price at \$9,000 per ton (see section 1.6 for price charts), the value of cobalt in some mines—such as the open-pit Mutanda mine in the Katanga province of DRC—is higher than the value of the copper, making cobalt the primary metal in the ore body. If the current differential between copper and cobalt prices were to persist, then cobalt would remain a significant decision factor.

Conversely, while large-scale mining traditionally treats cobalt as a by-product, artisanal miners have been able to switch focus between extracting cobalt and extracting the major metal as the relative value of the two metals change. This has enabled artisanal miners in the DRC to essentially act as swing producers. The rise in the cobalt price in 2018 encouraged a surge in cobalt extraction by these miners.

1.2 SMALL PRODUCTION VALUES

It is important to put the rise in the value of cobalt in perspective. Currently, both globally and in the DRC, the value of copper produced each year far exceeds the value of cobalt. The price of cobalt has risen significantly—in July 2021, it was double its value five years ago. But the price of copper too has risen—almost three-fold over the same period. More importantly, humanity produced 140,000 tons of cobalt in 2020, compared with 20 million tons of copper.¹⁴ Globally, the value of this copper production (using 2020 prices) is 28 times more than the value of cobalt production.¹⁵ Even in the DRC, the value of copper produced in 2020 was twice times the value of cobalt. Using prices of the two metals for 2021, the ratio is similar.¹⁶

While agencies like the World Bank and International Energy Agency (IEA) forecast increasing cobalt demand to meet the Paris climate goal, the value of global cobalt production in 2040 under the IEA's Sustainable Development Scenario would still be only a tenth of the value of copper forecasted to be in demand under the same scenario.¹⁷ Indeed, in terms of physical amounts, more copper is required to make a lithium-ion battery than cobalt.¹⁸ Barring a substantial discovery of cobalt or much higher cobalt prices relative to other metals, the major metals like copper and nickel will generate most economic benefits for countries, not cobalt.

1.3 PRECARIOUS DEMAND

More than half of the world's cobalt goes into batteries¹⁹ (See Figure 1). Growing demand for EVs has caused the recent rise in consumption and led to the IEA and World Bank's estimates of future growth.

However, having just one industry buying much of the global cobalt supply makes cobalt demand precarious. In comparison, the largest consumer of copper—the construction industry—consumes only about a third of total copper produced, and

14 U.S. Geological Survey, *Mineral Commodity Summaries: Cobalt*; and U.S. Geological Survey, *Mineral Commodity Summaries: Copper* (2021), pubs.usgs.gov/periodicals/mcs2021/mcs2021-copper.pdf.

15 U.S. Geological Survey and S&P Capital IQ.

16 Authors' calculation using Banque Centrale du Congo, *Condensé Hebdomadaire D'informations Statistiques*.

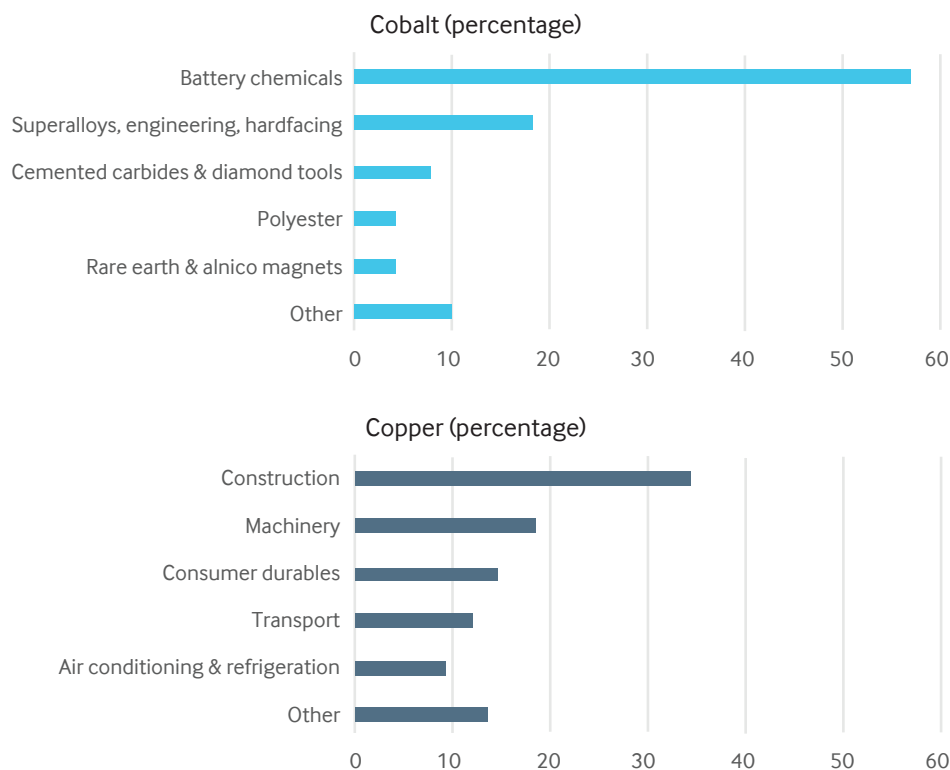
17 Assuming average prices for 2021 for both cobalt and copper. IEA forecasted copper demand to grow from 24 million tons in 2020 to 33 million tons in 2040 under the Sustainable Development Scenario. "Total Copper Demand by Sector and Scenario, 2020-2040," International Energy Agency, last updated 5 May 2021, www.iea.org/data-and-statistics/charts/total-copper-demand-by-sector-and-scenario-2020-2040.

18 BloombergNEF, *The Cost of Producing Battery Precursors in the DRC*, 15.

19 In 2020, 57 percent of cobalt went to the battery industry. Mostly as cobalt chemicals. Conversely, the main use of cobalt metal is in magnets, nickel-based alloys and materials for tools. Cobalt Institute, 'State of the Cobalt Market' Report (2021), www.cobaltinstitute.org/wp-content/uploads/2021/05/CobaltInstitute_Market_Report_2020_1.pdf.

construction itself is a highly diversified and mature industry, which is not subject to the same sudden demand changes as the battery-chemical industry.

Figure 1. Cobalt and copper consumption by end use in 2020²⁰



The criticality of cobalt—and perhaps the growing awareness of human rights, security, and environmental problems in the Congo—are driving battery and vehicle companies to use less cobalt.²¹

If battery manufacturers switch from lithium nickel-manganese-cobalt (NMC) batteries—the dominant battery chemistry in use in EVs today—to other battery types, cobalt consumption could fall significantly.²² The new nickel-intensive designs—such as the “NMC 811” design that use a ratio by weight of nickel, manganese and cobalt of 8:1:1—use around three quarters less cobalt and are able to store more energy and at a lower cost than earlier battery designs.²³

Manufacturers might eventually remove cobalt entirely. The current industry consensus is that use of a lithium-iron-phosphate (LFP) battery in EVs will grow significantly in the next five years.²⁴ In China, LFP batteries in Chinese passenger EVs increased from 10 percent of all EVs in 2019 to 29 percent in 2020.²⁵ Many electric

20 CRU Group via research support to NRGi.

21 See, e.g., Fred Lambert, “Tesla Secures New Cobalt Deal as it Phases Out the Controversial Mineral,” *Electrek*, 16 June 2020, electrek.co/2020/06/16/tesla-secures-cobalt-deal-controversial-material.

22 Yangtao Liu et al., “Current and Future Lithium-Ion Battery Manufacturing,” *iScience* 24, no. 4 (23 April 2021): 102332, doi.org/10.1016/j.isci.2021.102332; Matthew Farmer, “Is This the Golden Age of Battery Innovation?” *PowerTechnology*, 12 April 2021, www.power-technology.com/features/is-this-the-golden-age-of-battery-innovation.

23 Yangtao Liu et al., “Current and Future Lithium-Ion Battery Manufacturing,” *iScience* 24, no. 4 (23 April 2021): 102332, doi.org/10.1016/j.isci.2021.102332; Matthew Farmer, “Is This the Golden Age of Battery Innovation?” *PowerTechnology*, 12 April 2021, www.power-technology.com/features/is-this-the-golden-age-of-battery-innovation.

24 CRU Group.

25 Yu and Sapporo (2021).

buses already use LFP batteries. The cost of the iron and phosphate is currently much lower than cobalt. Although of course, criticality is dynamic, and the phosphate market might be the next concern for the battery industry.

S&P Global forecasts that without these alternatives gaining traction, cobalt demand from passenger EVs will increase from 25,000 tons in 2020 to 46,000 in 2021 and 85,000 in 2025.²⁶ But the growing market share of these batteries could severely affect cobalt demand by 2025 onward. Furthermore, depending on the price of cobalt, efforts could accelerate to commercialize more experimental designs such as solid-state batteries, the NMC 370 lithium-ion battery design (no cobalt) and hydrogen cells for heavy-duty transport.²⁷

A key factor therefore is the price that rationalizes usage. The more expensive cobalt becomes, the less industries will want to use it, reducing demand and limiting a further price rise. At the same time, a high cobalt price might prompt new mines to open and encourage more exploration. Although, as we argue in section 1.1, for those mines in which cobalt is the by-product, this is unlikely to happen as much as it does in other metal markets.

While these factors are eroding demand for cobalt, they are unlikely to eliminate it entirely, especially considering the anticipated surge in demand for electromobility. Three factors might maintain cobalt demand. First, a huge expansion in all EV types would mean that even with batteries that use less cobalt, total cobalt demand would remain high. Second, a complete switch to LFP is currently unlikely given that the performance of the LFP battery does not match that of the NMC battery. Third, most vehicle production schedules have at least a 10-year life cycle from design to production. With EVs, the battery and its control electronics are specific to the vehicle design, so once an EV is designed, it is expensive to change battery types. This will probably slow the entrance of other battery types into the market. For example, BloombergNEF forecasts NMC 622 and NMC 811 batteries to be commonly used in passenger vehicles in Europe this decade, although this use declines with new low-cobalt battery types gaining large shares of the market by 2030.²⁸

Another limit on the cobalt boom is that the energy transition is primarily about changing a stock, not about supplying a flow.²⁹ Once the stock of vehicles is transitioned, there is less need for more minerals at the same quantity. Lithium-ion batteries are expected to last between 10 to 20 years, depending on how they are used.³⁰ So vehicle owners will only need to replace them every decade or two. Some of this replacement may come from recycling. There are also growing attempts to recycle batteries, although recycling is not expected to account for a large share of batteries. The remaining would come from new batteries.

This differs from the economics of oil and the internal combustion engine in which a steady flow of oil is required to keep cars moving. This means the transition for mining countries is a one-shot game—a large shot that might play out over the next decade or two, given net-zero goals of 2050 or 2060 for regions like China and the European Union—but still not one to be wasted.

26 Aline Soares, Alice Yu, Jason Sapporo, Mitzi Sumangil, and Ronald Cecil, "Green Energy Revolution—Boost for Industrial Metals Demand," *S&P Capital IQ (2021)*, www.spglobal.com/marketintelligence/en/news-insights/research/green-energy-revolution-boost-for-industrial-metals-demand.

27 Yu and Sapporo (2021).

28 BloombergNEF, *The Cost of Producing Battery Precursors in the DRC*.

29 Jim Krane and Robert Idel, "More Transitions, Less Risk: How Renewable Energy Reduces Risks from Mining, Trade and Political Dependence."

30 "All About Electric Car Batteries," EDF, accessed 1 December 2021, www.edfenergy.com/electric-cars/batteries

It is therefore difficult to predict the future of cobalt, but the risk that demand collapses is real. It has happened with other minerals. One is saltpeter, a source of nitrogen before the discovery of a technique to synthesize nitrogen. This discovery reduced saltpeter's value, ending the key role that nitrates had played in the Chilean economy, at the time the dominant producer.³¹

Without an assured future for cobalt past the next decade, it is risky for a government to implement policy that spans decades. For example, for a country wanting to expand its cobalt production or develop downstream industries, it is worth noting that the typical mine takes 14 to 16 years from discovery to full production.³² Governments would do well to consider demand scenarios for the next 10 to 20 years.

1.4 GEOGRAPHIC CONCENTRATION AND GEOPOLITICAL SIGNIFICANCE

The cobalt market involves relatively few countries and companies. This concentration creates significant geopolitical and investment risks for governments of both cobalt-consuming and cobalt-producing countries, as well as companies along the supply chain. Two countries dominate the market. The DRC produces 68 percent of the global production of cobalt ore, concentrate and intermediate (Table 2).³³ This puts tremendous market power in the hands of the Congolese state and poses significant risk for consumers—in comparison, the Organisation of Petroleum Exporters (OPEC) only controlled 50 percent of the oil market even in its heyday in the 1970s.³⁴

Table 2. Cobalt reserves by country, 2020³⁵

Country	Reserves (thousand tons)	World share
DRC	3,600	50.7 %
Australia	1,400	19.7 %
Cuba	500	7.0 %
Philippines	260	3.7 %
Russia	250	3.5 %
Canada	220	3.1 %
Madagascar	100	1.4 %
China	80	1.1 %
Papua New Guinea	51	0.7 %
United States	53	0.7 %
South Africa	40	0.6 %
Morocco	14	0.2 %
Other countries	560	7.9 %
Total	7,100	100 %

31 Manuel Bastias Saavedra, "Nitrate," 1914-1918-Online International Encyclopedia of the First World War (Bavarian State Library, 8 October 2014), encyclopedia.1914-1918-online.net/article/nitrate/2014-10-08.

32 Although this might change. Currently, Chinese investment in both the DRC and the Indonesian projects is reducing the timescale of development. Once approved, at least one Indonesian high-pressure-acid-leach project could come onstream within three to four years. This contrasts markedly from earlier high-pressure-acid-leach projects, such as Murrin Murrin and Vale New Caledonia, which have taken over 10 years to reach consistent production levels.

33 U.S. Geological Survey data for 2020 show that Australia substantially increased its share of global cobalt production. U.S. Geological Survey, "Cobalt."

34 "Market Share within OPEC," *WTRG Economics*, accessed 19 October 2021, www.wtrg.com/opecshare.html.

35 Authors' calculations based on U.S. Geological Survey, "Cobalt" 2.

However, the DRC's market power is tempered by having to sell to predominantly one buyer. China refines and consumes about half of the world's cobalt. (See Table 4 and Table 5; note the different years, so totals are not similar.) Even within the DRC, production is concentrated further. In 2020, four mines (Kamoto, Tenke Fungurume, Metalkol RTR and Etoile) produced 41 percent of global cobalt.³⁶

Table 3. Average cobalt production by country, 2015–2019³⁷

Country	Production (tons of cobalt equivalent)	World share
DRC	85,255	60.92 %
Russia	8,700	6.22 %
China	6,757	4.83 %
Canada	6,287	4.49 %
Australia	5,354	3.83 %
Cuba	5,243	3.75 %
Philippines	3,690	2.64 %
Madagascar	3,275	2.34 %
Papua New Guinea	2,838	2.03 %
Zambia	2,788	1.99 %
New Caledonia	2,433	1.74 %
Morocco	1,986	1.42 %
Finland	1,902	1.36 %
South Africa	1,112	0.79 %
Brazil	762	0.54 %
United States	614	0.44 %
Zimbabwe	403	0.29 %
Indonesia	350	0.25 %
Botswana	119	0.09 %
Vietnam	82	0.06 %
Total	139,952	100%

Table 4. Cobalt refining by country, 2017³⁸

Region	Refining (tons)	World share
China	100,000	53.7%
Finland	16,500	8.9%
Zambia	9,600	5.2%
DRC	9,050	4.9%
Canada	9,020	4.8%
Russia	7,520	4.0%
Australia	6,700	3.6%
Madagascar	5,600	3.0%
Other countries	22,130	11.9%
Total	186,120	100%

36 Authors' analysis based on S&P Capital IQ.

37 "Data Section, Chapter 6.4," *World Mining Data*, last accessed 19 October 2021, www.world-mining-data.info/?World_Mining_Data__Data_Section.

38 Garside, "Cobalt Refinery Capacity by Major Countries."

Table 5. Cobalt consumption by region, 2020³⁹

Region	Consumption (tons)	World share
China	65,718	50.1%
Rest of Asia	37,325	28.4%
North America	13,898	10.6%
Western Europe	10,501	8.0%
South America	1,289	1.0%
Eastern Europe	1,274	1.0%
CIS	983	0.7%
Africa	284	0.2%
Total	131,272	100%

This concentration means that disputes, expropriations, labor unrest or operational or environmental crisis in just a few mines across the world can eliminate a large share of supply. For example, in 2019 Glencore shut down Mutanda (which had accounted for 19 percent of global supply), citing high costs, low cobalt prices and high taxes.⁴⁰

Furthermore, Chinese battery manufacturers' reliance on cobalt has prompted Chinese companies to invest in cobalt mines. Such as Tenke Fungurume, Deziwa, Ruashi and Kisanfu. Globally, Chinese companies own shares in mines that produce 12 percent of global cobalt ore and concentrate, and 22 percent of cobalt intermediate production. With this ownership concentrated in Africa.⁴¹ Chinese companies control at least 41 percent, and perhaps up to 50 percent, of Africa's industrial cobalt production.⁴²

Barring a major crisis, the DRC could remain dominant for a while. Across the world, there are more than 120 new nickel and copper projects that could yield cobalt. However, the most credible and substantial projects are situated in the DRC and Indonesia.⁴³ And Indonesia's new projects are unlikely to make the country a significant producer.

In the longer term, however—over 16 years, given the average time to develop a mine—exploration might yield mining developments outside the DRC. Recent exploration has both substantially increased and been mostly outside the DRC.⁴⁴ This will eventually yield new viable cobalt projects, which could be widely distributed. For example, significant cobalt resources could be found in manganese nodules and

39 CRU Group.

40 S&P Capital IQ; Sophia Kalantzakos, "The Race for Critical Minerals in an Era of Geopolitical Realignments," *The International Spectator* 55, no. 3 (2 July 2020): 1–16, doi.org/10.1080/03932729.2020.1786926.

41 In most cases, Chinese investors partially own mines with other investors. The study records the Chinese proportion of a mine's production relative to the ownership share, rather than recording with the total production from the mine of any Chinese part-ownership, or only production from mines fully owned by Chinese entities. Andrew Gulley, Erin McCullough, and Kim Shedd, "China's Domestic and Foreign Influence in the Global Cobalt Supply Chain," *Resources Policy* 62 (2019): 320.

42 This does not include the cobalt from artisanal miners bought by Chinese traders. Magnus Ericsson, Olof Lof, and Anton Lof, "Chinese Control over African and Global Mining – Past, Present and Future," *Mineral Economics* 33 (2020): 153–181.

43 Specific projects include the following: In DRC: Boss Mining expansion; Deziwa Phase 2, owned by CNMC; Mutanda re-opening, owned by Glencore; RTR Phase 2, owned by ERG; Tenke Fungurume, development of sulphide ore, owned by CMOC, Mutoshi owned by Chemaf who will supply Trafigura; Comide. In Indonesia: PT Antam; Sorowako, PT Halmahera Persada Lygend; PT QMB New Energy Materials; Huayue Nickel & Cobalt. Source: CRU International.

44 Adjusted for inflation, exploration spending between 2018 and 2020 was almost double the total exploration spending across the eight-year period from 2010 (the first year for which S&P has data) to 2017. While 70 percent of the exploration spending during the last three years has been outside the DRC. Authors' calculations using S&P Capital IQ.

cobalt-rich crusts on the seabed,⁴⁵ although extraction of these resources may never occur due to the high environmental and technological risks. Furthermore, a 2020 study found cobalt-bearing deposits in 25 countries in Europe alone.⁴⁶ Also, the African Development Bank believes the current cobalt deposits found in Africa could be the “tip of the iceberg.” Botswana shows potential for stratiform-type copper deposits like the Zambian Copperbelt, and the Katanga Copperbelt has recently been found to extend into Angola.⁴⁷

1.5 MARKET IMMATURITY AND INTEGRATION

Cobalt prices are less transparent than prices of major metals. The London Metal Exchange (LME), the exchange on which most metal trades are made, publishes daily prices for cobalt metal and copper cathodes. The Metal Bulletin from FastMarkets is another reporter. However, governments face two main challenges when using these price reports.

First, most countries export cobalt hydroxide and other intermediates. There is no quoted price or otherwise-standardized price for cobalt hydroxide, but this intermediate is the most frequently traded substance by miners. This makes it challenging for governments to verify whether the prices at which companies report their sales reflect fair market value, thereby impeding effective tax administration. There is also no quoted price for copper intermediates, but far more final stage copper (cathode) is sold by mining companies, so the problem is less severe.

Second, the cobalt market is concentrated and vertically integrated—only a few companies operate in some parts of the value chain, and companies increasingly operate across links in the chain. Only a few companies trade cobalt with other companies, which means there are few deals made out in the open, and so few prices are published. Furthermore, many companies that trade cobalt have not responded to public pressure to be transparent about their trades or broader commercial dealings. Such opacity is one reason the scandal involving DRC assets purchases by Glencore, the Israeli businessman Dan Gertler and the Kazakh bank Eurasian Resources Group was not uncovered sooner.⁴⁸ As of 2019, a handful of Chinese companies exist: eight of the 14 largest cobalt miners in the DRC are now partly or wholly Chinese-owned, accounting for almost half of the country’s output.⁴⁹ Because of the DRC’s dominant position, the Congolese state-owned enterprise Gécamines is also important.

The subsequent links in the supply chain are also concentrated in a small number of companies, with most refining taking place in China and the production of battery cathodes and anodes dominated by a small group of players. All of this makes it harder for tax authorities to assess whether the prices that companies declare for exported cobalt are accurate.

45 John F. Slack, Bryn E. Kimball, and Kim B. Shedd, “Cobalt,” Chapter F of *Critical Mineral Resource of the United States—Economics and Environmental Geology and Prospects for Future Supply* (U.S. Geological Survey, 2017).

46 S. Horn, A. G. Gunn, E. Petavratzi, R. A. Shaw, P. Eilu, T. Törmänen, T. Bjerkgård, et al., “Cobalt Resources in Europe and the Potential for New Discoveries,” *Ore Geology Reviews* 130 (2021): 103915, doi.org/10.1016/j.oregeorev.2020.103915.

47 African Development Bank, *Lithium-Cobalt Value Chain Analysis for Mineral Based Industrialization in Africa* (2021): 12, www.afdb.org/en/documents/lithium-cobalt-value-chain-analysis-mineral-based-industrialization-africa.

48 Patrick Keefe, “Buried Secrets: How an Israeli Billionaire Wrested Control of One of Africa’s Biggest Prizes,” *The New Yorker*, 8 July 2013.

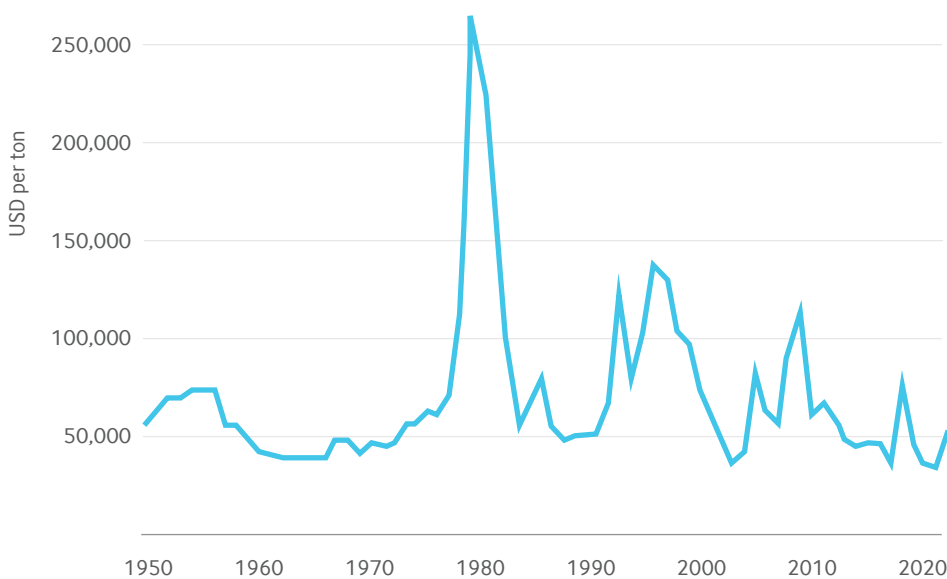
49 Luca Maiotti and Benjamin Katz, *Interconnected Supply Chains: A Comprehensive Look at Due Diligence Challenges and Opportunities Sourcing Cobalt and Copper from the Democratic Republic of the Congo*, Organisation for Economic Co-operation and Development (OECD, 2019): 14, mneguidelines.oecd.org/interconnected-supply-chains-a-comprehensive-look-at-due-diligence-challenges-and-opportunities-sourcing-cobalt-and-copper-from-the-drc.htm.

None of these factors are permanent, however. As the cobalt market matures and reporting becomes more accurate, if companies break up and the market becomes more diverse, cobalt prices may become more widely reported and reliable. For example, the cobalt futures market is expanding. In addition to LME, another commodity exchange—the Chicago Mercantile Exchange—is creating its own cobalt futures.⁵⁰

1.6 PRICE VOLATILITY

The cobalt market has been turbulent in the last few years. The price of cobalt increased three-fold between 2016 (the end of a multiyear downward and relatively stable trend in the price) and 2018. The price then fell with equal severity as the supply from mines reacting to the previous boom came online. The price then rose again, this time by a quarter from the end of 2020 to July 2021 (the time of writing). This is not the first such boom-and-bust cycle in the cobalt market as Figure 2 shows.

Figure 2. Cobalt prices from 1950 to 2021⁵¹



However, both in nominal terms and after adjusting for inflation, even today’s high price of around \$50,000 per ton is low relative to cobalt prices in the past. After adjusting for inflation, the price of cobalt appears to be on a gradual long-run decline, as too is copper.

Figure 3 compares the index values of copper, cobalt and nickel prices over the last 65 years. Copper is a volatile commodity that wrecks havoc on economies in countries like Zambia and Chile, which depend on exporting the metal. But the price of cobalt is even more volatile.⁵² Furthermore, the prices of the major metals copper and nickel rise and fall in tandem; in fact they move with the global economic cycle. The cobalt price so far has not.⁵³ This fact provides an opportunity for governments to apply sliding royalties (see section 2.2 on taxation).

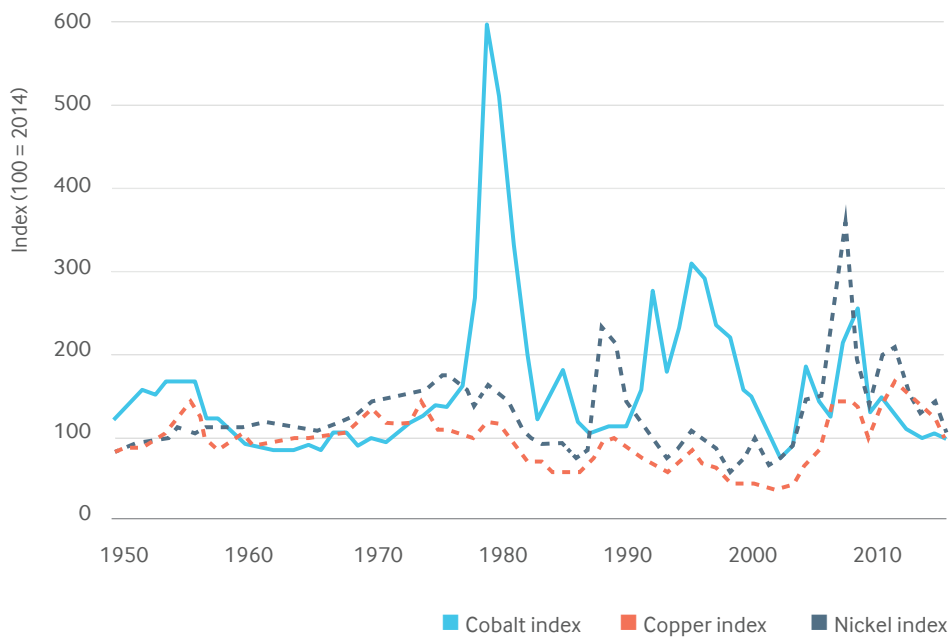
50 “Cobalt Metal (Fastmarkets) Futures: A New Way to Manage Cobalt Price Risk,” CEM Group, last accessed 19 October 2021, www.cmegroup.com/trading/metals/other/cobalt-metal-fastmarkets-futures.html.

51 S&P Capital IQ; Sven Renner and Friedrich Wellmer, “Volatility Drivers on the Metal Market and Exposure of Producing Countries,” *Mineral Economics* (2019), doi.org/10.1007/s13563-019-00200-8.

52 Measured by the coefficient of variation (the standard deviation of the series of prices divided by the mean of the series), cobalt price is more volatile than the major metals like copper, lead, zinc and nickel. Authors’ calculations using U.S. Geological Survey data.

53 The correlation between nickel and copper (0.7) is much closer than between either copper and cobalt (0.3), or nickel and cobalt (0.3).

Figure 3. Price indices for cobalt, copper and nickel between 1950 and 2015⁵⁴



Sudden surges in the cobalt price will challenge policy-makers if they do not also anticipate a subsequent collapse in the price. The resulting excitement and hope for a long period of high prices may encourage long-term policies that require a sustained price to work. The spike from 2016 to 2018 excited the industry and mining country governments. Consequently, at least three cobalt-producing countries—DRC, Madagascar and Zambia—increased royalty rates on cobalt. However, the price fell back as quickly as it had risen and recently rose yet again.⁵⁵ This left mining industries with royalty rates designed for high prices but having to operate under much lower prices (see section 2.2).

54 S&P Capital IQ; Sven Renner and Friedrich Wellmer, “Volatility Drivers on the Metal Market and Exposure of Producing Countries,” and authors’ calculations.

55 This drop was in response to Chinese cathode manufacturers stopping their stockpiling of cobalt, and to a smaller extent, a rise in artisanal mining from the DRC (although this rise in artisanal production is unlikely to happen again). Source: CRU International.

2. Policies for cobalt mining and processing during the energy transition

Most government policies for mining do not differ by mineral type. For example, the profit made by a company mining a copper-cobalt ore cannot be distinguished between the two metals. Corporate income taxes, applied to this profit, are thus not specifically applied to cobalt. Similarly, except for specific cobalt processing, the mine’s environmental damage comes from mining the ore; it is difficult to separately account for the damage caused by the copper and by the cobalt. For the most part therefore, the mining governance principles expressed in the Natural Resource Charter apply to cobalt.

The rising demand for and the criticality of cobalt makes following these principles ever more important. However, few countries are following these principles. According to the 2021 Resource Governance Index, seven out of the 13 countries examined govern their mining industry “poorly” or “weakly.” Mining governance in the DRC is the worst among all the countries.

Table 6. 2021 Resource Governance Index scores for countries with mining industries⁵⁶

	DRC	Myanmar	Morocco	Tunisia	Uganda	Tanzania	Mexico	Guinea	Ghana	Mongolia	Colombia	Peru	Senegal
Overall score	36	38	49	50	55	58	59	62	69	70	75	75	75
VALUE REALIZATION	65	48	40	48	52	60	60	80	83	61	75	76	70
Licensing (subcomponent)	68	20	14	71	46	66	49	77	66	61	69	64	56
Taxation (subcomponent)	69	59	39	54	72	85	85	77	82	85	78	86	89
Local impact (subcomponent)	67	60	43	33	38	46	46	83	100	53	79	79	67
State-owned enterprises (subcomponent)	55	54	64	36	.	41	.	82	.	44	.	.	68
REVENUE MANAGEMENT	26	30	40	35	63	60	56	71	54	71	83	78	80
ENABLING ENVIRONMENT	17	37	68	67	50	53	62	35	71	78	68	72	75

At the same time, the differences between cobalt and major metals described so far suggest that governments might need to treat cobalt mining differently in some important respects, as discussed in this section. We start from the general principles of the Natural Resource Charter and then describe different applications to cobalt mining. The section follows the order of the chain of policy decisions a government usually makes in managing a mining sector:

- 1 Licensing and exploration
- 2 Taxation
- 3 Value addition
- 4 Artisanal mining
- 5 Geopolitics

56 NGRI, 2021 Resource Governance Index, resourcegovernanceindex.org.

The general principles relating to the two other policy areas—state ownership and revenue management—we found to be almost entirely applicable to cobalt and so do not cover them here. See the Natural Resource Charter for more information on these general principles.

Box 1. The 12 precepts of the Natural Resource Charter

- Resource management should secure the greatest benefit for citizens through an inclusive and comprehensive national strategy, clear legal framework and competent institutions.
- Resource governance requires decision-makers to be accountable to an informed public.
- The government should encourage efficient exploration and production operations and allocate rights transparently.
- Tax regimes and contractual terms should enable the government to realize the full value of its resources consistent with attracting necessary investment and should be robust to changing circumstances.
- The government should pursue opportunities for local benefits, and account for, mitigate and offset the environmental and social costs of resource extraction projects.
- Nationally owned companies should be held accountable, with well-defined mandates and an objective of commercial efficiency.
- The government should invest revenues to achieve optimal and equitable outcomes, for current and future generations.
- The government should smooth domestic spending of revenues to account for revenue volatility.
- The government should use revenues as an opportunity to increase the efficiency of public spending at the national and subnational levels.
- The government should facilitate private sector investments to diversify the economy and to engage in the extractive industry.
- Companies should commit to the highest environmental, social and human rights standards, and to sustainable development.
- Governments and international organizations should promote an upward harmonization of standards to support sustainable development.

Corruption can affect all aspects of the government decision chain. Although corruption is a major issue in mining more broadly, three factors make it particularly problematic for cobalt: the opacity and immaturity of global markets, dominance of a small number of commercial players, and concentration of resources in one of the most corrupt countries in the world according to World Governance Indicators.⁵⁷ Cobalt has been at the center of some of the highest-profile corruption scandals in the world in recent years, and anticorruption authorities in the United States, United Kingdom and Switzerland have investigated allegations of bribery and favor-trading among major Western companies, middlemen and Congolese authorities.⁵⁸

57 For “control of corruption,” the World Bank ranks the DRC in the third percentile in the world. Performance is similar for “rule of law,” “regulatory quality,” and “government effectiveness.” The one relative bright spot is “voice and accountability,” where the country is in the 14th percentile. “Worldwide Governance Indicators,” World Bank, last accessed 20 October 2021, info.worldbank.org/governance/wgi.

58 Will Fitzgibbon, “U.S. Sanctions Mining Magnate Accused of Corruption in the Congo, Reversing Trump-Era Move,” *International Consortium of Investigative Journalists*, 10 March 2021, www.icij.org/investigations/paradise-papers/us-sanctions-mining-magnate-accused-of-corruption-in-the-congo-reversing-trump-era-move; Michael Kavanagh, “U.K. Fraud Unit Finds Alleged Bribe Network Behind Cobalt Hub,” *Bloomberg*, 14 July 2021, www.bloomberg.com/news/articles/2021-07-15/u-k-fraud-unit-finds-bribe-network-behind-world-s-cobalt-hub; Zandi Shabalala and Helen Reid, “Swiss Prosecutors Launch Glencore Criminal Probe Over Congo,” *Reuters*, 19 June 2020, www.reuters.com/article/us-glencore-investigation-switzerland/swiss-prosecutors-launch-glencore-criminal-probe-over-congo-idUSKBN23Q2VW.

Preventing corruption requires implementing controls, such as transparency, due diligence requirements and conflict of interest restrictions, some of which are detailed below. But it also requires political allies and resourced and effective accountability actors (e.g., the courts, tax authorities, investigative journalists) that are protected and operate without political interference. Without this progress, other policies to maximize the value of cobalt to the country, such as through tax reform or processing efforts, will not deliver returns to citizens.

In places like the DRC, a large and growing gap exists between the quality of laws written and the implementation of those rules.⁵⁹ The Resource Governance Index, which measures the transparency and strength of accountability of institutions governing the mining industry, shows that the DRC government does not openly allocate licenses, disclose all contracts, or publish environmental and social impact studies.⁶⁰

This opacity allows corruption to thrive, prevents the Congolese people from benefitting from cobalt mining and shortens the years in which they could benefit. It is relatively easy to set a royalty rate at 10 percent, but how much a company pays can depend as much on their accounting as on how close they are with tax collectors. Alternatively, officials may enforce the rules in an overzealous or predatory manner and snarl up processes in tax courts for years.⁶¹ Companies want to operate in the DRC when the price is high enough for them to stomach the risk, but a sustained slump reduces their appetite.⁶²

2.1 LICENSING AND EXPLORATION

Natural Resource Charter, Precept 3. The government should encourage efficient exploration and production operations and allocate rights transparently.

- Verify jurisdiction over areas to be licensed for exploration
- Build and maintain a good understanding of the resource base
- Secure property rights and decide on areas to open for exploration
- Select an appropriate method to allocate rights

The high cobalt price changes the geological attractiveness of mining areas. Areas surveyed in the past might be explored again as companies look for new deposits. Resources already discovered but lying undeveloped because they had not previously been profitable to mine might now become viable. Even tailings with low grades of cobalt become more attractive for companies to process.

59 NRG, *Resource Governance Index: From Legal Reform to Implementation in sub-Saharan Africa* (2018), resourcegovernance.org/sites/default/files/documents/rgi-from-legal-reform-to-implementation-sub-saharan-africa.pdf; NRG, 2021 *Resource Governance Index: Democratic Republic of Congo* (2021), resourcegovernance.org/analysis-tools/publications/2021-resource-governance-index-drc-mining; Amir Shafaie, Moses Kulaba, and Kaisa Toroskainen, "Politics are Holding Back Implementation of Extractive Sector Transparency Rules," (NRG, 2021), resourcegovernance.org/blog/politics-are-holding-back-implementation-extractive-sector-transparency-rules.

60 NRG, 2021 *Resource Governance Index: Democratic Republic of Congo*.

61 For examples like these on corruption in taxation, see Alexandra Gilles, Sebastian Sahla, Matthieu Salomon, and Tom Shipley, "Step 4 Research Guide: Revenue Collection," in *Diagnosing Corruption in the Extractive Sector: A Tool for Research and Action* (NRG, 2021), resourcegovernance.org/sites/default/files/documents/step_4_research_guide_revenue_collection.pdf.

62 The DRC, along with Indonesia and Papua New Guinea, are in the bottom 10 countries for investment attractiveness, according to the Fraser Institute. Jairo Yunis and Elmira Aliakbari, *Annual Survey of Mining Companies 2020* (Fraser Institute, 2021), www.fraserinstitute.org/studies/annual-survey-of-mining-companies-2020.

Even in the DRC, while much of the land has been licensed, relatively little exploration has occurred. Perhaps 50 percent of the Copperbelt remains unexplored.⁶³ High prices, lower political risk and better geological data sharing could unlock more cobalt from this area. However, for this to work, the existing corruption around asset transfers needs to be tackled.

For most countries other than the DRC, these factors mean that governments can:

Provide geological data to explorers to help new finds. A government can provide data from previous geological surveys. Data sharing—about cobalt and the metals it accompanies—could extend to a regional level given that discoveries across the border from a country make discoveries within its borders more likely.⁶⁴

Be ready to manage licensing and transfer processes to provide mineral development licenses to companies. Countries with unlicensed geography with mineral potential need to invest in building the capacity to conduct license rounds, manage geological data and attract companies. Even where most of the prospective mining territory has been licensed out already, the pace of change in the cobalt sector may create opportunities. If companies are selling their stakes, to the extent that existing laws allow for it, governments could seize the moment to exert more control—such as by approving new project partners and gaining assurances of integrity (e.g., avoiding a repeat of Gertler-Gécamines scandal that led to the government losing an estimated \$1.36 billion of revenues).⁶⁵

Better control over mine shutdowns. Government influence over production scheduling decisions poses a complex challenge. Political interference in a company's operational decisions can impede commercial planning and open the door for new forms of corruption. Accordingly, laws and contracts tend to limit the government's power to control production. Given the concentration of production in just a few mines, however, company decisions on when to shut down or pause production have a huge effect on the market price and on government revenue. In the DRC, Glencore's decision to shut down Mutanda led to a fall in government revenue. Such power also gives mining companies enormous leverage over the state. This has motivated some Congolese actors to call for greater government control over when a mine is able to shut down. Governments like the DRC might wish to explore mechanisms to narrow the scope of justification for shutdowns, including via contract terms or legislation, or by empowering state-owned enterprises to play their commercial roles more effectively. All such steps come with trade-offs, but given the challenges of concentration in the cobalt sector, they warrant further discussion.

Enhance anticorruption measures to ensure that licenses are awarded to competent and well-governed companies. These could include:

- Require license applicants and holders to disclose their beneficial owners.⁶⁶
- Define which officials and politically exposed persons cannot hold interests in assets because doing so would create a conflict of interest and establish a plan for screening for violations.

63 Carl-Johan Karlsson, "The DRC's Unparalleled Resource Potential," *Global Business Reports* (2020), www.gbreports.com/article/the-drcs-unparalleled-resource-potential.

64 African Development Bank, *Lithium-Cobalt Value Chain Analysis for Mineral Based Industrialization in Africa*, 12.

65 "United States Sanctions Human Rights Abusers and Corrupt Actors Across the Globe," U.S. Department of the Treasury, 21 December 2017, home.treasury.gov/news/press-releases/sm0243. For an in-depth discussion of the corruption risks inherent in cobalt supply chains, see *Resource Matters, See No Evil, Speak No Evil - Poorly Managed Corruption Risks in the Cobalt Supply Chain* (2019). resourcematters.org/wp-content/uploads/2019/04/ResourceMatters-SeeNoEvil-CobaltCorruptionRisks-Apr-2019.pdf

66 A requirement already in the Extractive Industry Transparency Initiative Standard.

- Conduct due diligence by screening applicants, including their personnel and beneficial owners, against integrity metrics, including whether they have adequate internal anticorruption systems, past involvement in corruption, and potential political connections or conflicts of interest.
- Ensure all license-holders have the expertise to execute the relevant activities or serve a clear commercial purpose, including minority partners. If there is a local content program, publish prequalification standards including integrity measures, and avoid assigning local partners to companies.
- Adopt the latest transparency standards (the EITI Standard, in most cases), especially about disclosing license processes, applicants, recipients, and the full text of all licenses and contracts.
- Limit discretionary licensing decisions and political influence, such as by using competitive tenders whenever appropriate; standardizing, automating and publicizing the licensing process; adopting robust and transparent qualification criteria; and involving oversight actors in the process. The standard practice in the DRC is for the state company Gécamines to assign licenses to corporate entities and then sell shares of these entities to actual mining companies. This is despite the Mining Code requiring competitive tenders.⁶⁷
- Reduce the use of business development agents and intermediaries by applicant companies, such as by automating application procedures, meeting only with company representatives, and removing any formal or informal agent requirements.
- Enforce local antibribery laws and investigate parties implicated in foreign antibribery cases.

These principles are as important for the DRC as for any other country. While the DRC has the basic elements in place for a “satisfactory” governance licensing process according to the latest Resource Governance Index, in practice significant problems exist. Licensing is not done openly, nor are contracts consistently disclosed. On the Worldwide Governance Indicators for “rule of law” and “control of corruption” the country scored respectively just five and six out of 100.⁶⁸

Poor governance in the past has reduced the DRC government’s ability to respond as well as other governments. Geological data has already been sold off.⁶⁹ Most of the available land for licensing has already been sold.⁷⁰ Similarly, while the Mining Registry controls all granting and withdrawal of mining licenses, Gécamines regularly usurps its power and is the de facto gatekeeper, making proper management of licenses difficult.⁷¹

67 Jean Pierre Okenda Lohese and Descartes Mponge Malasi, *Politique et Pratiques de la RDC en Matière de Transparence des Licences et Contrats du Secteur Extractif* (NRGI, 2021), resourcegovernance.org/sites/default/files/documents/politique_et_pratiques_de_la_rdc_en_matiere_de_transparence_des_licences_et_contrats_0.pdf.

68 “Democratic Republic of Congo,” *Resource Governance Index* (NRGI, 2021), resourcegovernanceindex.org/country-profiles/COD/mining?years=2021.

69 Interview with Lies Caesens and Jean Pierre Okenda from Resource Matters, 22 September 2021.

70 Interview with Lies Caesens and Jean Pierre Okenda.

71 Carter Center, *A State Affair: Privatizing Congo’s Copper Sector* (2017), www.cartercenter.org/resources/pdfs/news/peace_publications/democracy/congo-report-carter-center-nov-2017.pdf.

2.2 TAXATION

Natural Resource Charter, Precept 4. Tax regimes and contractual terms should enable the government to realize the full value of its resources consistent with attracting necessary investment and should be robust to changing circumstances.

- Consider the function, not the form, of the tax regime
- Use royalties
- Consider how to tax income and rent
- Avoid tax incentives and simplify tax regimes
- Avoid using state equity to increase government returns
- Establish transparency, stability, and robustness
- Ensure competent tax administration and implement tax avoidance rules

The rise and fall in cobalt prices may have challenged some governments and companies. After the price rose between 2016 and 2017, the government of DRC increased the royalty rate from 2 percent to 3.5 percent and then to 10 percent as part of a major revision to the country’s Mining Code. Some other governments also raised royalties on cobalt (see Table 7), but soon after, the cobalt price fell again. None of these governments subsequently reduced the rates to match the drop in price. Miners in the DRC then faced the highest royalty rate on cobalt in the world, and, based on analysis in 2018 comparing the DRC to six other leading mining countries, the highest average effective tax rate overall.⁷² However, the actual taxes companies paid may have been much lower due to various tax planning measures that companies employ. The fact that royalties comprise such a large share of the DRC’s overall mining tax regime makes it highly regressive—the tax burden as a proportion of company profits rises when the price falls.

We next discuss whether high royalty rates are sensible and whether an alternative type—a sliding royalty—might be effective.

Table 7. Royalty rates on cobalt around the world

Country	Old rate	New rate
DRC ⁷³	2%	10%
Madagascar ⁷⁴	2%	4%
Zambia ⁷⁵	5%	8%
Western Australia	2.5% in metallic form, 5% as concentrate, 7.5% as ore.	Same
New South Wales (Australia) ⁷⁶	4%	Same

72 The other countries were Chile, Indonesia, Papua New Guinea, Peru, Western Australia and Zambia. “Democratic Republic of Congo Mining Code Tax Analysis 2018,” NRGi, accessed 2 July 2021, www.resourcedata.org/dataset/democratic-republic-of-congo-mining-code-tax-analysis-2018.

73 In 2018. While the rate on copper (the largest value metal) rose from 2 percent to 3.5 percent. Sascha-Lee Solomons, “New DRC Mining Code Comes into Effect, Still a Cause for Concern,” *Miningreview.com*, 8 June 2018, www.miningreview.com/battery-metals/new-drc-mining-code-effect-still-cause-concern.

74 In November 2019.

75 It continued to levy a sliding royalty on copper ranging from 5.5 percent to 10 percent, dependent on the LME copper price. “Mineral Royalty,” Zambia Revenue Authority, accessed July 2021, www.zra.org.zm/wp-content/uploads/2020/01/Mineral-Royalty.pdf.

76 “Royalty Rates,” New South Wales Government, accessed July 2021, www.resourcesandgeoscience.nsw.gov.au/miners-and-explorers/enforcement/royalties/royalty-rates.

2.2.1 Benefits of reducing the royalty rate

Heavy and regressive tax regimes deter investment. Surveys suggest this effect is strongest for exploration investment since once a deposit is found an investor cannot choose to develop it in another country.⁷⁷ While sound in theory, it is difficult to demonstrate this effect empirically. Exploration budgets of companies in the DRC targeting cobalt and copper fell by 40 percent after the rise in the royalty rate, which anecdotally suggests that investors were deterred.⁷⁸ But while the royalty must have been a factor in these decisions it is difficult to know to what extent or what the optimal royalty rate would have been. Other related factors were also problematic, including uncertainty around whether the new mining code's fiscal terms would even be applied.⁷⁹ Box 2 demonstrates why it is so difficult to understand the effect of a royalty increase. The royalty rate hike certainly has not stopped all investment in the country: no company that was already operating has actually left the country since the rise, CMOG just announced a \$2.5 billion investment in Tenke Fungurume, Eurasian Resources Group's Metalkol mine will increase production, and Glencore's Mutanda will restart.

Box 2. Effect of increasing the cobalt royalty rate to 10 percent in the DRC

In 2018, the DRC government increased the cobalt royalty from 2 to 10 percent. Soon after, the price of cobalt fell by more than half. Officially reported production fell by 29 percent, and the Glencore-owned Mutanda mine closed.

Explanations for this include:

- The price fell at the same time as the royalty rose.
- Glencore claimed it shut Mutanda due to the higher royalty charge.
- Major mines like Glencore's Mutanda mine started to stockpile production in the country and then stopped extracting. This might have been an attempt to create a shortage in the market to increase prices, and investors certainly pressured the government to agree to better fiscal terms.⁸¹
- The decline in official production might have been due to unrecorded mining and smuggling, perhaps to avoid the royalty, which was not recorded in official production statistics. Despite the official 29 percent decline in production, other countries' imports from DRC declined by less than 3 percent. Even so, a shift to unrecorded production would have reduced government-collected revenues, so this remains a valid concern.⁸²
- Most of the oxide reserves in the Copperbelt have been mined, and companies struggled to develop the sulphide reserves to continue production.

This shows that multiple factors are at play whenever a government increases taxes. No doubt the royalty rate contributed to a drop in production and the mine shutdown, but it is difficult to know how much.

A second effect is "high grading." Miners high grade when they extract only high-grade ores and leave lower-grade ores, to avoid paying royalties on tons of low-value ore. For the DRC, many mines are open pit but with dwindling resources, companies must develop underground mines to continue. These are usually more costly, so a

77 Jairo Yunis and Elmira Aliakbari, *Annual Survey of Mining Companies*, 2020.

78 Authors' calculations based on S&P Capital IQ.

79 Thomas Lassourd and Jean Pierre Okenda, *Is the Democratic Republic of Congo's New Mining Fiscal Regime up to the Task?* (NRGI, 2018), resourcegovernance.org/blog/democratic-republic-congo-new-mining-fiscal-regime-task; African Business, "Mining amid Regime Change in the DRC," 14 February 2019, african.business/2019/02/energy-resources/drcongo-mining-felix-tshisekedi-and-regime-change.

80 Thomas Lassourd and Jean Pierre Okenda, *Is the Democratic Republic of Congo's New Mining Fiscal Regime up to the Task?*

81 Authors' analysis, based on net weight of imports of cobalt products. "UN Comtrade Database," United Nations, accessed 2 July 2021, comtrade.un.org/data.

high royalty rate may deter mine expansion plans. A royalty has a direct effect on this decision because it does not vary with the cost of extracting each ton of ore.

By increasing the cost for EV batteries, a high royalty rate might eventually cause manufacturers to use less cobalt. For an NMC 811 battery, the current design using the least amount of cobalt, doubling the cobalt price from \$50,000 per ton increases the cost of the overall battery pack (including both the battery cell and casing) by 6 percent.⁸² (So with battery designs using more cobalt, the effect is greater.) Therefore, a 10 percent royalty effectively increases the battery pack cost by 0.6 percent. Assuming a battery manufacturer makes a gross profit margin of 20 percent, a 10 percent royalty on cobalt reduces the profit margin by three percent. This is significant given that EV prices are approaching parity with internal combustion engine vehicles, and battery and EV manufacturers can gain significant market share from relatively small price reductions.

2.2.2 Benefits of keeping the royalty rate high

On the other hand, for mines producing cobalt as a by-product, raising the royalty rate on this minor metal has a smaller effect on company profits than a similar increase in the rate on the major metal. A government can tax cobalt more without destroying project viability.⁸³ Although this also means the revenue generated is relatively small.

Demand for cobalt may be temporary, so governments need to capture as much value from cobalt sales as possible while demand is high. A higher royalty rate might indeed deter investment in the long term, but if in cobalt demand is likely to erode anyway, worry that a high royalty will reduce expected fiscal revenues is less of a concern.

The DRC's relative market power means that whatever effect the higher royalty has on the eventual price of cobalt, there are few alternative sources in the short term. For a while at least, the government can levy a high royalty and not worry about a lot of cobalt buyers getting the metal from other countries.

2.2.3 A middle way: Benefits of a sliding royalty rate

Governments, including in the DRC, might benefit from a middle way. Rather than change the royalty rate unpredictably, which investors have long said makes a country less attractive,⁸⁴ and is often delayed in response to the price rise, a sliding royalty might be better.

An increasing number of governments have levied sliding royalties on their mining industries. A sliding royalty is a royalty for which the rate changes with respect to a change in some chosen variable. Often this is the metal price.⁸⁵ For example, the Mauritanian sliding gold royalty rate ranges from 4 to 6.5 percent; each rate is triggered as the international price of gold rises above an established threshold.

Charging a sliding royalty on a major metal can be challenging because mining costs typically rise and fall with metal prices in general.⁸⁶ This results in a price rise, triggering a royalty rise but also a cost rise, meaning the company is paying a higher royalty from potentially less profit. If wrongly calibrated, a sliding royalty might deter investors. But because cobalt is usually mined as a by-product, investment is less

82 BloombergNEF, *The Cost of Producing Battery Precursors in the DRC*, 31

83 Lassourd and Okenda, *Is the Democratic Republic of Congo's New Mining Fiscal Regime up to the Task?*

84 Jairo Yunis and Elmira Aliakbari, *Annual Survey of Mining Companies, 2020*.

85 We found sliding mineral royalties of this kind in Côte d'Ivoire, Bolivia, Burkina Faso, Mauritania, Zambia, Queensland, Guinea, Kyrgyzstan, Myanmar, Mongolia, Niger, South Africa, Chile, Peru and Nevada in the United States levy sliding royalties using different designs. Thomas Lassourd and David Manley, "Sliding Scale Royalties" in *The Future of Resource Taxation*, International Governmental Forum for Mining and Minerals and Africa Tax Administration Forum (2022, forthcoming).

86 Thomas Lassourd and David Manley, "Sliding Scale Royalties"

price-sensitive to this metal, and in turn less sensitive to the royalty rate on cobalt. Changes to the prices of mining inputs, from tires to engineers, also generally reflect the rise and fall in the demand for major metals, not necessarily cobalt. These two facts give governments an opportunity to apply a sliding royalty to cobalt that they might not have with some other major metals.

2.2.4 Challenges in measuring the value of cobalt for taxation

The lack of reliable price reporting for cobalt (see section 1) makes it difficult for tax authorities to verify whether companies are paying the correct amount of tax. Merely taking the international reported prices for cobalt is not sufficient since actual prices traded, even on an arms-length basis, may be far from these reported prices, and the substance traded is unlikely to be cobalt metal (the commodity priced by the Metal Bulletin and LME) but rather cobalt hydroxide.

Furthermore, contaminants reduce the value of cobalt, but cobalt prices do not clearly reflect the cost of removing them. Battery manufacturers require almost pure cobalt, and charge penalties to cobalt processors for any extra elements contaminating the cobalt hydroxide. These penalties are negotiated on an individual basis and can increase variation in cobalt prices; it is therefore difficult for tax authorities to judge whether prices for cobalt traded between related companies have been artificially reduced to decrease taxes due.

The tight integration of the cobalt market not only reduces open trades of cobalt, thus reducing public reports of prices, but it also allows for transfer pricing abuses. A mining subsidiary in the DRC exporting its cobalt hydroxide to a processing plant subsidiary owned by the same company in China or a tax haven might under-report the value of the cobalt hydroxide if it allows the company to pay less tax in the DRC.

This integration also means that as companies buy other companies along the chain, the resulting transfer in assets might attract capital gains tax. Authorities have traditionally struggled to monitor and verify that a transfer has legally taken place for the purposes of taxation and to verify the capital gain. Difficulties in verifying the values of cobalt in reserves only adds to the challenge.⁸⁷

2.3 VALUE ADDITION: PROCESSING AND LINKS TO THE ECONOMY

Natural Resource Charter, Precept 10. Whether the government should promote domestic participation in downstream industries depends principally on weighing any savings on transportation to and from a foreign refinery, and other potential benefits, against potential downsides to state support for the domestic downstream industry. These include:

- The opportunity cost of public funds used in highly-capital intensive processing plants
- Dependence on imported skills and equipment

Potentially limited job creation relative to other industries

For mining countries, “adding value” to minerals means developing industries along the value chain of that mineral. This can mean not only industries downstream, but

87 United Nations, “Chapter 4: Indirect Transfer of Assets,” in *United Nations Handbook on Selected Issues for Taxation of the Extractive Industries by Developing Countries*, Economic and Social Affairs (New York: United Nations, 2017): 125–216, www.un.org/esa/ffd/wp-content/uploads/2018/05/Extractives-Handbook_2017.pdf; Perrine Toledano, John Bush, and Jacky Mandelbaum, “Designing a Legal Regime to Capture Capital Gains Tax on Indirect Transfers of Mineral and Petroleum Rights: A Practical Guide” (International Senior Lawyers’ Project and Columbia Center on Sustainable Investment, October 2017): 27, scholarship.law.columbia.edu/cgi/viewcontent.cgi?article=1012&context=sustainable_investment_staffpubs.

industries that supply the mining industry. Many governments aim to add value to minerals, as they hope that this helps industrialize their economies and diversify their economies, having seen now-industrialized countries seemingly industrialize this way. Governments often see that failing to add value to their exports is a lost opportunity—once the metal is gone, it is gone. Sometimes companies “add value” to metal concentrates without specific policies requiring them to do so, merely to reduce onward transport costs—in these cases they have done it to increase profits. It is less common for industries further along the value chain to develop in mining countries. In thinking about value addition policies, it is therefore useful to keep in mind what makes commercial sense and what does not, and what factors might change this commerciality.

The principles of value addition policies applicable to other metals apply equally to cobalt. However, many governments with critical mineral reserves show significant interest in ensuring their economies participate in battery value chains. Understanding how governments can encourage companies operating along the value chain to establish themselves in their countries is becoming important.

2.3.1 Cobalt value chain

Figure 4 shows the cobalt value chain from ore and concentrate all the way to EV assembly. This chain is shortening with some stages integrating under one company (see also section 2.2).

Figure 4. Cobalt value chain

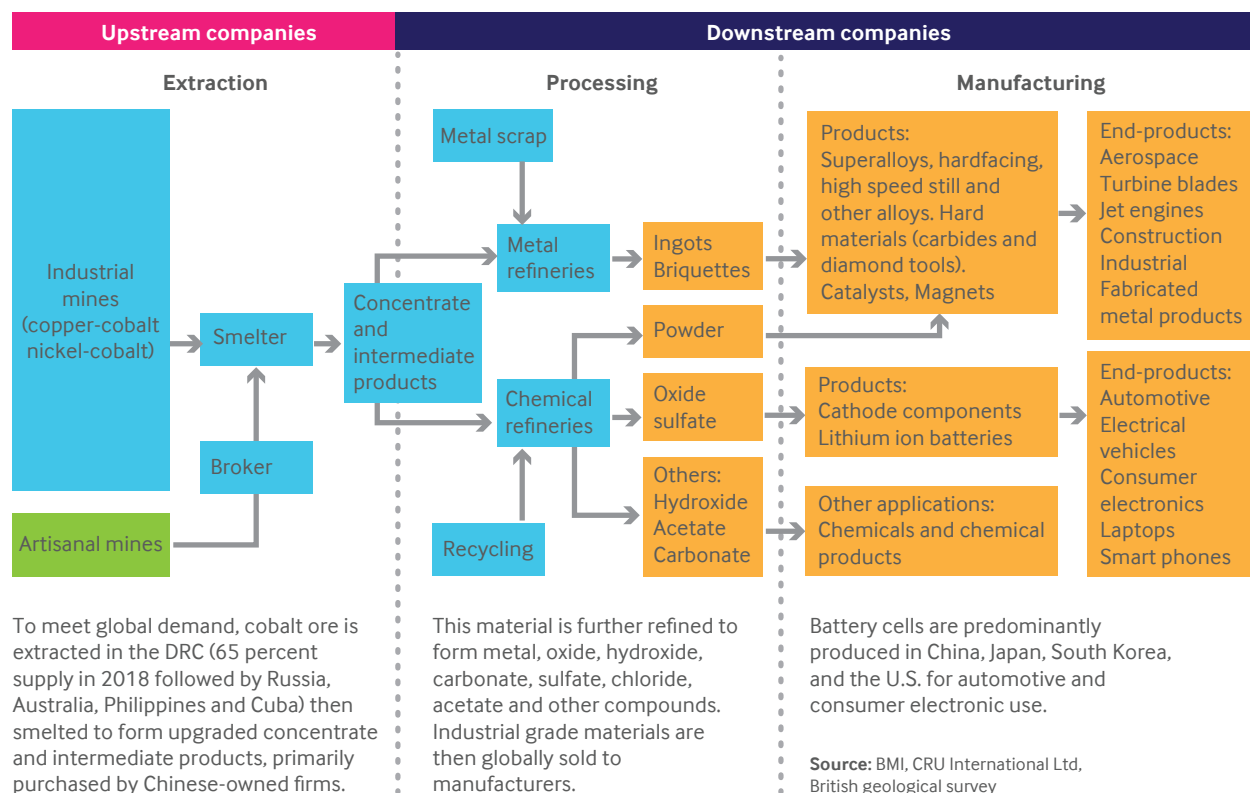


Table 8. Cobalt-to-electric vehicle value chain and production proportions in countries

Value chain link	Approximate production proportion in countries
Cobalt ore and concentrate	Only 0.5 percent of cobalt is exported as ore and concentrate. Almost all mining industries, including in the DRC, go further than this stage.
Cobalt hydroxide, oxide or matte (intermediates)	The DRC produced 68 percent of the world's cobalt in 2020, ⁸⁸ of which 94 percent is in the form of hydroxide or oxide. ⁸⁹ In 2016, China produced 11 percent of world's hydroxide or oxide. ⁹⁰
Cobalt sulphate/chemical (refining) ⁹¹	50 percent from China in 2016. ⁹² See Table 4 for top 10 refining countries.
Battery precursor (also requires nickel and manganese sulphates)	Concentrated in China.
Battery cathode	66 percent from China in 2019. ⁹³
Battery assembly	73 percent from China in 2019. ⁹⁴
Electric vehicles	43 percent from China in 2016. ⁹⁵

Aside from Australia, which exports concentrates containing cobalt to China, mining operations commonly process cobalt concentrate into either cobalt hydroxide or mattes near the site of extraction. Companies in the DRC mostly process copper-cobalt concentrate to produce cobalt hydroxide, which reduces the weight for transport. Some Congolese mines that are near plants in Zambia export concentrate across the border, where it is processed into cobalt hydroxide and exported overseas.

While the DRC has successfully “added value” in this way, soon companies will have to invest in more processing plants. In the next 10 to 15 years, miners are set to deplete most of the oxide reserves that lie close to the surface, and to continue production of cobalt hydroxide/oxide/matte they will need to gradually dig into the hybrid and sulfide reserves. The mining industry will have to invest in pyrometallurgy to treat sulfide ores and sustain or increase output capacity.

While most battery manufacturers have demanded cobalt sulphate, commonly produced from cobalt hydroxide, an alternative to add value down the chain is to process cobalt as cobalt metal, usually supplied as briquettes.⁹⁶ Typically, battery cathode manufacturers prefer to use cobalt hydroxide as it is easier to convert into sulphate. However, cobalt metal can be stored for longer. Given the long transport times and the need for storage to address disruptions, a growing market for cobalt metal presents an opportunity for mining countries.⁹⁷ In addition, a substantial

88 U.S. Geological Survey, “Cobalt.”

89 Using the total value of exports from 2016 to 2020. “U.N. Comtrade Database,” United Nations.

90 Andrew Gulley, Erin McCullough, and Kim Shedd, “China’s domestic and foreign influence in the global cobalt supply chain,” *Resources Policy* 62 (2019): 317-323.

91 Includes metal, metal powders, oxides and other simple chemical compounds.

92 Gulley, McCullough and Shedd, “China’s Domestic and Foreign Influence in the Global Cobalt Supply chain.” Another source provides a close result of 53 percent in 2017: “Cobalt Refinery Capacity by Major Countries,” M. Garside, Statista, 27 July 2021, www.statista.com/statistics/339798/annual-cobalt-refinery-capacity-by-country.

93 Mining.com Editor, “Chart: China’s Grip on Battery Metals Supply Chain,” *Mining.com*, 7 May 2020, www.mining.com/chart-chinas-grip-on-battery-metals-supply-chain.

94 Mining.com Editor, “Chart: China’s Grip on Battery Metals Supply Chain.”

95 Patrick Hertzke, Nicolai Müller, and Stephanie Schenk, “China’s Electric-Vehicle Market Plugs In,” *McKinsey Quarterly*, 6 July 2017, www.mckinsey.com/featured-insights/china/chinas-electric-vehicle-market-plugs-in.

96 Nick Popovic, Glencore at “Panel: Country Focus: The Democratic Republic of Congo” part of the FT Mining Summit 2021: Enabling the Energy Transition (London), 7 October 2021.

97 Charlotte Radford and Susan Zou, “Cobalt Sulfate Producers Buy Metal Again After Market Reaches ‘Inflection Point,’” *Fastmarkets*, 19 August 2020, insights.fastmarkets.com/new-energy/cobalt-sulfate-producers-buy-metal-again-after-market-reaches-inflection-point.

reduction in weight would mean that lower transport costs could more than offset the adding processing cost.⁹⁸ However, the energy intensity the major constraint in making cobalt metal is the energy intensity. For the DRC this means addressing chronic power shortage, likely by sorting out its large hydropower potential.

It is much less common for a mining country to go on to process its own cobalt to produce sulphates and other cobalt chemicals. Table 9 shows that China refined 54 percent of the world's cobalt production in 2019. This may partly be due to the difficulties of transporting cobalt sulphates, which mean locating plants near consumers becomes important. However, cobalt mining countries like Zambia, the DRC and Madagascar did refine some cobalt, which together amounted to 9 percent of the global total.

Table 9. Cobalt refining capacity in 2019⁹⁹

Country	Refining capacity (tons)
China	150,000
Finland	16,500
Zambia	9,600
Canada	8,020
Russia	7,520
Australia	6,700
Congo (Kinshasa)	6,050
Madagascar	5,600
Japan	5,500
Norway	5,200
Others	15,580
Total	236,000

One option that is emerging is to process cobalt sulphate close to the mine site, and then locate a battery precursor plant nearby. Unlike the cobalt sulphate, precursor material is more easily transportable. A precursor plant in the DRC could export to a cathode plant in China. There are difficulties to this, however. The precursor plant requires a secure supply of the other metals required in the battery cathode design—nickel and manganese sulphates, a reliable energy supply, and a skilled workforce.¹⁰⁰

2.3.2 Success factors for developing downstream cobalt-processing industries

Countries in which industries downstream from mining have developed have benefited from the following factors:

Success factor 1. Proximity to downstream customers and other chemical-processing companies

Proximity matters for three reasons. First, cobalt sulphate degrades over time and in transport. Since most demand for processed cobalt comes from China, cobalt-producing countries such as Indonesia that are close to end consumers, who currently are mostly in China, have an advantage.

98 Nick Popovic, Glencore at "Panel: Country Focus: The Democratic Republic of Congo."

99 U.S. Geological Survey notes that this includes standby capacity. Refinery products include cobalt metal, metal powders, oxides, and (or) salts. U.S. Geological Survey, "Minerals Yearbook – Cobalt: 2019 Tables-Only Release," prd-wret.s3.us-west-2.amazonaws.com/assets/palladium/production/atoms/files/myb1-2019-cobal-adv.xlsx.

100 BloombergNEF, *The Cost of Producing Battery Precursors in the DRC*.

Second, proximity to precursor plants matters because they require almost pure cobalt sulphate, with exact specifications. Specialized processing companies have performed best when located near their customers so they can more easily coordinate, fulfil “just-in-time” orders and quickly provide samples.

Proximity to other chemical processing companies helps. Providing near pure cobalt is particularly challenging for cobalt from the African Copperbelt—while this region’s cobalt contains high cobalt grades, it also usually has many impurities. In principle, these impurities could be removed in the mining country, one way for Zambia and the DRC to add value to their cobalt product. However, this is most effectively done within a cluster of other chemical processing industries, as processing plants make much of their profit from selling the impurities, which are themselves highly valued but not always easily transportable.

Success factor 2. Low freight and trade costs

Time spent at borders and ports are problematic in many developing countries, making trade costs 75 percent higher than in high-income countries.¹⁰¹ This makes meeting processing times tricky, requires weeks of costly storage, during which time the cobalt sulphate would erode.

Success factor 3. Cheap and reliable energy supply

Processing cobalt at almost any stage of the value chain consumes a lot of electricity. Yet some developing countries such as the DRC are both short of energy and have unreliable power grids.¹⁰² In the DRC, large-scale mines in the southeast of the country receive only around half of the required power from the grid, relying for the rest on diesel generators which are both expensive and polluting.¹⁰³ Unfortunately, there is little hope for change in the near term. The DRC is planning the new Inga III large-scale hydroelectric dam, but most of its electricity is to be exported to South Africa; and the broader Grand Inga dam project within which it sits (which would generate even more energy) is long delayed.¹⁰⁴ Conversely, in the longer term, by deriving most of its energy from hydroelectric dams, the DRC can market its processed cobalt as low emission products.

2.3.3 Tools for government action when success factors are missing

While supplying cheap and reliable energy is possible, some of these success factors are difficult for countries to replicate. Countries can also suffer a coordination problem. Companies could all decide to invest and develop an industrial cluster, benefiting from each other proximities, but no one company wants to invest without guarantees that the others do so too. How then does a country attract the first chemical business without the cluster?

101 Authors’ calculations based on estimates in the ESCAP-World Bank Trade costs Database. We compare mean trade costs for trading between country pairs where either the importing or exporting country is developing (i.e., non-high income using the World Bank classification) or African versus mean trade costs for country pairs where both countries are high-income. For country classifications, see “World Bank Country and Lending Groups,” World Bank, accessed 13 July 2021, datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups.

102 “Getting Electricity,” World Bank, Doing Business, accessed 25 May 2021, www.doingbusiness.org/en/data/explore-topics/getting-electricity.

103 “Congo Delays Ban on Copper and Cobalt Exports Due to Power Shortage,” *Mining Technology*, 12 January 2016, www.mining-technology.com/news/newscongo-delays-ban-copper-cobalt-exports-due-power-shortage-4783695.

104 Pauline Bax and Michael Kavanagh, “China Dominates Bid for Africa’s Largest Dam in New Pact,” *Bloomberg Green*, 7 August 2020, www.bloomberg.com/news/articles/2020-08-07/chinese-firms-dominate-bid-to-build-congo-s-inga-dam-in-new-pact.

Success is possible, however. In Indonesia and Papua New Guinea, companies have developed pressure acid leach projects to process nickel cobalt laterites. Companies such as Tesla and LG—a South Korean battery manufacturer—are also considering developing EVs and batteries in Indonesia.¹⁰⁵

Here are three policies that countries have used to develop industries downstream from their mining. Their success rests of the credibility of the government to see the policy through despite costs in the short term.

Tool 1. Export bans or duties

The most common policy has been bans or custom duties on the export of unprocessed minerals. Both the DRC and Indonesia used export bans on the export of concentrates and eventually got companies to process this concentrate in-country. However, the process took many years, worked only for some metals and not others, and created additional costs that could have been avoided. If a government does want to impose an export ban or duty, they should have the following characteristics:

Targeted. Indonesia started with banning the export of all unprocessed minerals, but officials later realized that processing some minerals—nickel-cobalt laterites—was closer to being viable than others—copper. This meant that copper miners were severely impacted without reasonable means to respond to the ban.

In the DRC, while the policy eventually resulted in more processing at home, the path to this result was indirect and slow—taking eight years so far. The government banned the export of copper concentrate, cobalt hydroxides and carbonates, and some other metals. The government then issued waivers to companies, as they did not respond as hoped. It was unclear whether the government wanted to target copper or cobalt, and whether to focus on pushing companies to process copper-cobalt concentrate or refine cobalt hydroxide further. Now the policy seems to be coalescing around ensuring that all concentrate is processed into intermediates (hydroxides, oxides or mattes) and focusing on the further processing of copper. The new government appears to recognize that cobalt hydroxide is widely traded and adding further value in country does not currently make sense. However, the government has not made a clear policy statement on what exactly it wants to achieve with its policies in this area.

Being clear about the target of the ban—both in terms of metal and stage of processing—helps. A ban on a metal that cannot feasibly be processed in the country forces the government to lift the ban and damages its credibility. Rather than a blanket ban on many metals and stages of processing, it might be best to start with targeted bans that require companies to conduct just one more stage of the value chain in the mining country and expand from there.

Consistent. Both the DRC and Indonesia imposed export bans, then waived them, re-imposed them, and so on. This instability meant that for a long time, companies did not believe that the government would stick to its policy, so the bans provided few incentives to invest in downstream facilities.

Forewarned. Bans given with enough warning allow companies to adjust in time and limit excuses when the ban does come into play. The various bans on the sale of new internal combustion engine vehicles in European countries has meant that one in nine

¹⁰⁵ Bernadette Christina, "Indonesia Says \$9.8 Billion EV Battery MOU Agreed with LG Energy Solution," Reuters, 30 December 2020, www.reuters.com/article/us-indonesia-electric-vehicles-idUSKBN2940AW.

new cars sold in 2020 were electric, despite the bans only coming into force in 2030 or 2035.¹⁰⁶

Use of market power. If the mining country depends on a single importing client, the export ban is more difficult to impose, especially if the importing client can source its needs somewhere else. For cobalt, the DRC's market share is matched by China's market demand share. It is not obvious who will be pressured to give in first: DRC to cancel the ban, in case Chinese demand drastically reduces; or China, in case they are completely dependent on DRC's cobalt. DRC's export ban therefore has more chance of success if demand from other regions increases.

A government should also be confident that opportunities to mine cobalt elsewhere are sufficiently scarce that companies will still invest even if they are obliged to process domestically at additional cost. Indonesia's contrasting experiences with its export bans on raw nickel (where it held significant market power, and the ban encouraged downstream processing as a result) versus its experience with a raw bauxite export ban (where downstream companies were easily able to switch to other sources of supply) are a case in point.¹⁰⁷ Of course, if the conditions are attractive enough for the country to impose a ban on unprocessed exports and still attract investment, the government may prefer to instead change the fiscal regime to raise more tax revenues.

Less expensive than the alternative. If, after imposing a ban, companies would rather cut production or investment rather than develop downstream activities, then a ban would also not work. There is a risk that companies may lose money by adding further value in the mining country, specifically when processing cobalt hydroxide into cobalt sulphate (unless they are part of an integrated firm and can sell to their own counterparts). As the process of producing battery cathodes becomes more integrated, the market for "third-party" cobalt sulphate is becoming increasingly volatile caused by the fluctuations in inventories further up the chain of battery manufacture, so that battery-grade cobalt sulphate can sometimes be priced lower than cobalt hydroxide (which is a lower value-added product). Currently Chinese prices for battery-grade cobalt sulphate are quoted at \$6,000 per ton of 20.5 percent cobalt material, which is below the current price of cobalt contained in crude cobalt hydroxide.¹⁰⁸

To impose an export ban, therefore, governments should be confident that cobalt mining companies are making enough post-tax profits to absorb the additional cost of processing in country, and that any cut to production or future investment as a result will be outweighed by the benefits of having more processing in country.

Tool 2. Subsidies and other investment incentives

Some governments focus on supporting an "anchor business," which then attracts other firms, whose presence in turn attracts still more firms. Focusing on a single anchor business can be cheaper than supporting a whole industry.

The challenge is in finding a business that will establish operations at a scale that attracts other firms. It should ideally require service companies and other inputs, and that can attract more investment to supply them. Indonesia appears to have found such an anchor business in the form of Tesla.

106 Kate Abnett, "Electric Car Sales Surge as Europe's Climate Targets Bite," Reuters, 29 June 2021, www.reuters.com/business/sustainable-business/electric-car-sales-surge-europes-climate-targets-bite-2021-06-29.

107 Lebdioui and Bilek, "Do Forward Linkages Reduce or Worsen Dependency," NRGI, 13–14, 16–17, resourcegovernance.org/sites/default/files/documents/do-forward-linkages-reduce-or-worsen-dependency-in-the-extractive-sector.pdf.

108 CRU International.

As with export bans, credibility matters to avoid a coordination problem. Other companies need to believe that the anchor business will stay in the country for a long time and buy inputs from companies within the country. Likewise, no amount of subsidies is likely to be enough to convince an anchor business to invest unless it thinks that a viable cluster will develop around it. The anchor business must believe that the government policy will work and there will be enough low-cost suppliers for its business, along with reliable electricity, labor, and transport networks, and so on. These do not have to be in place before the anchor business invests, but the belief that they will be someday is necessary. Therefore, in addition to supporting an anchor business, governments that want to follow this route also need a credible, long-term plan to support a viable cluster.

In addition, governments can address some success factors—particularly costs to export to downstream markets and access to electricity—directly, by investing in infrastructure or cutting red tape.

Tool 3. Long-term and stable government direction

As noted above, a government’s approach to encourage cobalt processing is more likely to succeed if it declares a long-term, stable and credible direction. Having a clear “roadmap” maintains confidence by helping businesses understand each policy step; it also helps businesses to anticipate policies and adapt their business strategies to take advantage of resulting opportunities.

Sustainable value addition also requires building capacity for long-term competitiveness. This might be through intra-industry dialogue to share information on quality requirements, research and specialized skill accumulation. The gradual development of technology and skills from working in the downstream industry enables local firms to meet the demand for increasingly sophisticated inputs and services, as well as develop capabilities that can serve other sectors.¹⁰⁹

2.4 ENVIRONMENTAL PROTECTION

Precept 5. The government should pursue opportunities for local benefits, and account for, mitigate and offset the environmental and social costs of resource extraction projects.

- Involve the local community in decision-making and assessment
- Establish and define ownership rights
- Measure and mitigate the negative effects of extraction
- Take opportunities to develop local benefits from extraction
- Communicate with members of local government and strengthen their capacity

Although mining cobalt does not produce very different environmental effects to mining other metals, some of the largest sources of cobalt are in environmentally sensitive areas (for example, in the forests of the Congolese basin). One of the most important effects is deforestation.

The exposure of new tracts of forest to mining activity presents the largest environmental risk. This is because, for the most part, miners cause the destruction of forests, not directly through clearing space for mines, but indirectly, by building roads to the mines. Roads provide easier and cheaper access for loggers and their machines,

109 Amir Lebdioui, “Local Content in Extractive Industries: Evidence and Lessons from Chile’s Copper Sector and Malaysia’s Petroleum Sector,” *The Extractive Industries and Society*, 7, no. 2 (2020): 341–352, <https://doi.org/10.1016/j.exis.2019.05.001>.

and the means to haul logs to markets.¹¹⁰ In the DRC, most large-scale mines are in areas where forests have already been cleared. So continued mining of or development in these “brownfield” sites is relatively low-risk for forests. However, continued demand for cobalt would likely encourage renewed exploration and expansion into “greenfield” areas, in the DRC and elsewhere.

While large-scale mining is currently confined primarily to more lightly forested areas of the DRC, artisanal miners operate in more pristine forests. Artisanal mines can also result in deforestation—from undermining and disturbing tree roots, to establishing logging camps that turn into larger population centers in previously sparsely populated forest regions.¹¹¹ Rising metal prices cause new waves of deforestation here, too. For example, the spike in coltan prices in 2002 led to a rush of artisanal mining in Kahuzi-Biega National Park in eastern DRC.¹¹²

The World Bank’s Forest-Smart Mining approach, part of its wider Climate-Smart Mining Initiative, details practices to reduce impacts on forests while allowing mining activities that are necessary to supply an energy transition.¹¹³ For its part, the DRC government in late 2021 announced a ban on all illegal log exports and a review of contracts with logging companies. Since 2020, the Direction de Reboisement et Horticulture has been tasked with restoring the country’s forest. It aims to plant one billion trees by 2023 and has plans for various agroforestry projects on 1,800 hectares.¹¹⁴ However, the DRC has tried similar initiatives—including a moratorium on new logging licenses—before, with little apparent reduction in the rate of deforestation.¹¹⁵

Creating viable alternatives for artisanal miners is also important. This means identifying alternative mining sites that are rich in minerals and accessible to markets, and located outside of environmentally sensitive areas. This in turn requires governments to use geological and geographical data, and effectively monitor where artisanal miners operate.¹¹⁶

2.5 PROMOTING SUSTAINABLE CONDITIONS FOR WORKERS AND COMMUNITIES

Natural Resource Charter, Precept 5. “... The government should seek to formalize and regulate the industry, to mitigate the negatives of artisanal mining while preserving or improving the poverty-alleviating benefits. To achieve this, the government may consider cooperatives and other community-based solutions, while also encouraging the overall diversification of the economy in order to create larger opportunities for poverty reduction.”

110 Laura Sonter, Diego Herrera, Damian Barrett, Gillian Galford, Chris Moran, and Britaldo Soares-Filho. “Mining Drives Extensive Deforestation in the Brazilian Amazon,” *Nature Communications*, 8 (2017): 1013, [10.1038/s41467-017-00557-w](https://doi.org/10.1038/s41467-017-00557-w).

111 Kirsten Hund and Carole Megevand, *Deforestation Trends in the Congo Basin Reconciling Economic Growth and Forest Protection* (World Bank, 2013).

112 World Bank, *Forest-Smart Mining: Identifying Good and Bad Practices and Policy Responses for Artisanal & Small-Scale Mining in Forest Landscapes* (2019): 64, elibrary.worldbank.org/doi/pdf/10.1596/32026.

113 World Bank, *Forest-Smart Mining: Identifying Good and Bad Practices and Policy Responses for Artisanal & Small-Scale Mining in Forest Landscapes*; and Sian Bradley, Mining’s Impacts on Forests, Chatham House (2020), www.chathamhouse.org/2020/10/minings-impacts-forests/4-forest-smart-approaches.

114 Yara Rizk, “DRC to Crackdown on Illegal Forestry, After Taking a Tough Stance on Mining,” *The Africa Report*, 10 November, 2021, www.theafricareport.com/143171/drc-to-crackdown-on-illegal-forestry-after-taking-a-tough-stance-on-mining.

115 Chatham House, *Illegal Logging in the Democratic Republic of the Congo* (2014), www.chathamhouse.org/sites/default/files/home/chatham/public_html/sites/default/files/20140400LoggingDRCLawson.pdf.

116 World Bank, *Forest-Smart Mining: Identifying Good and Bad Practices and Policy Responses for Artisanal and Small-Scale Mining in Forest Landscapes*.

Mining can come at a heavy human cost, and mines in DRC and other producer countries have been associated with child labor, dangerous working conditions, conflict and local environmental damage. The cobalt industry has drawn scrutiny from Congolese and international advocates for human rights abuses that clash with the narrative of clean progress that the EV industry promotes. This has spillover effects on global consumer markets. EV manufacturers selling to mostly climate-conscious consumers worry about the impact of these concerns on their businesses, which accelerates the drive to use less cobalt in their batteries. While far from being the only type of mining in which human rights are abused and environments destroyed, the perception among particularly Western observers is that these issues are a reason to avoid buying cobalt.¹¹⁷

Various organizations have created standards to reduce the negative impacts that mining can have on mine workers and neighboring communities.¹¹⁸ Yet two challenges hinder the effective implementation of these standards:¹¹⁹

- *Challenge 1:* A lack of coordinated action, accountability and access to information across the supply chain hinders sustainability efforts.
 - Response: Thoroughly document and disseminate a complete picture of what the supply chain constitutes and create stronger mechanisms for neutral and reliable information sharing.
 - Response: Proactively communicate the full picture of the EV battery supply chain, not just react to specific stories based on negative incidents.
 - Response: Leverage automakers' experience and capacity in traceability and sustainability.
- *Challenge 2:* Inadequate coordination and data-sharing across multiple supply chain standards limit adherence.
 - Response: Define and categorize existing standards to develop essential criteria, facilitate comparison and equivalency, and streamline adherence.
 - Response: Create new incentives for compliance with agreed standards.
 - Response: Develop data and data-sharing protocols to facilitate adherence.

The challenges of managing the local impacts of cobalt are like broader challenges across mining projects generally. As in other elements of this paper, the heavy concentration of cobalt assets in the DRC means that the governance challenges facing the Congo have broader repercussions across the global industry. One challenge is enhancing practices for managing industrial mining alongside artisanal mining and setting policies to support good governance in both spaces. Artisanal mining, or informal mining contributes 15 to 20 percent of global mineral production.¹²⁰ In the

117 Fred Lambert, "Tesla Secures New Cobalt Deal as it Phases Out the Controversial Mineral," *Electrek*, 16 June 2020, electrek.co/2020/06/16/tesla-secures-cobalt-deal-controversial-material.

118 OECD Due Diligence Framework, LME Responsible Sourcing Requirements, Global Battery Alliance Battery Passport, Initiative for Responsible Mining Assurance Standard for Responsible Mining, Responsible Minerals Initiative's Responsible Minerals Assurance Process.

119 Ethan N. Elkind, Patrick R. P. Heller, and Ted Lamm, *Sustainable Drive Sustainable Supply: Priorities to Improve the Electric Vehicle Battery Supply Chain (Berkeley Law and NREGI, 2020)*, resourcegovernance.org/sites/default/files/documents/sustainable-drive-sustainable-supply-priorities-to-improve-the-electric-vehicle-battery-supply-chain.pdf.

120 Abbi Buxton, *Responding to the Challenges of Artisanal and Small-Scale Mining: How Can Knowledge Networks Help?* (International Institute for Environment and Development, 2013), pubs.iied.org/16532iied.

DRC, a fifth of cobalt is mined by artisanal miners.¹²¹ At least 40 million people work in artisanal mining worldwide;¹²² in the DRC, where 90 percent of mining labor is artisanal, 60 percent of households in the Congolese copper belt rely on mining for their livelihoods.¹²³

With respect to the battery industry, better management of artisanal mining is important because not only does a large amount of cobalt come from these miners, but they act as “swing producers.” They often switch between mining copper and cobalt in response to the changing prices of the two metals. When the cobalt price is high enough, artisanal miners supply more cobalt to traders. The surge in artisanal cobalt was one reason for the price crash in 2018. Although their ability to continue to play this role may diminish as reserves available to artisanal miners deplete.¹²⁴

Despite the efforts of some companies to portray industrial (large-scale) mining and artisanal mining as completely distinct, the boundaries between the two are permeable, and both types of mining need reform. Large-scale miners often source product from artisans, and product from both is frequently intermingled at trading depots. Artisanal mining often takes place within the concession areas owned by large-scale miners.¹²⁵ It is therefore important to reform large-scale and artisanal mining practices together. It is also necessary to recognize that not all mineral production categorized as “artisanal” is the same; artisanal operations are characterized by varying degrees of formalization.¹²⁶

Many of the international efforts that have arisen focus on tracing the sources of cobalt or formalizing artisanal production. Despite the proliferation of these standards and procedures, many artisanal miners and community residents report that they have not been meaningfully consulted in decisions around the future of mining.¹²⁷ More broadly, Congolese stakeholders such as the *Congo N’est Pas à Vendre* coalition and international actors including the OECD are pushing back on simplistic narratives that frame artisanal mining as inherently dangerous and corrupt and industrial mining as fundamentally “cleaner.”¹²⁸

The standard policy response is formalization, although this means different things in different countries. According to the DRC mining code, formalization implies two things: 1) working in an artisanal zone established by the authorities, and 2) working in a legally registered cooperative.

However, despite years of trying to formalize artisanal mining, governments in the DRC have hardly progressed. The current government hopes to change that via a state-owned *Entreprise Générale du Cobalt* (EGC), which it established in 2019.

121 Andy Holme, “Cobalt, Congo and a mass artisanal mining experiment,” *Reuters*, 13 May 2021, www.reuters.com/business/energy/cobalt-congo-mass-artisanal-mining-experiment-andy-home-2021-05-13/.

122 World Bank, *2019 State of the Artisanal and Small-Scale Mining Sector* (Washington, D.C.: World Bank, 2019), vii, www.pactworld.org/state%20of%20asm.

123 Benjamin Faber, Benjamin Krause, and Raúl Sanchez de la Sierra, *Artisanal Mining, Livelihoods and Child Labor in the Cobalt Supply Chain of the Democratic Republic of Congo* (University of California, Berkeley Center for Effective Global Action, 2017), cega.berkeley.edu/assets/cega_research_projects/179/CEGA_Report_v2.pdf.

124 CRU Group.

125 Maiotti and Katz, *Interconnected Supply Chains*.

126 *Ibid.*

127 Emmanuel Umpula, Abbi Buxton, and Brendan Schwartz, *Islands of Responsibility? Corporate Sourcing of Artisanal Cobalt in the Democratic Republic of Congo* (International Institute for Environment and Development and Afrewatch, 2021), pubs.iied.org/20436iied.

128 Le Congo N’est Pas à Vendre, “DR Congo Stands to Lose \$3.71 Billion in Mining Deals with Dan Gertler,” 12 May 2021, www.corruptiontue.org/dossiers/dossier/dr-congo-stands-to-lose-3-71-billion-in-mining-deals-with-dan-gertler; Maiotti and Katz, *Interconnected Supply Chains*.

2.5.1 DRC's new effort to protect and formalize artisanal miners: *Entreprise Générale du Cobalt*

ECG is a subsidiary of the giant state-owned mining and commodity trading company Gécamines—with monopoly power to purchase and market artisanal cobalt. EGC has two objectives—formalization and price control—framed by the Gécamines' chairman in lofty terms: “We are going to eliminate child labor, we are going to eliminate labor by pregnant women, and we are going to eliminate fraud in this sector so that the cobalt . . . will be responsible cobalt.”¹²⁹ However, without addressing longstanding governance challenges at Gécamines achieving these goals will be difficult.

Formalization

ECG intends to respond to both the worries over human rights violations in artisanal mining and the detriment to DRC's brand among international buyers of cobalt. It proposes to do this by formalizing artisanal cobalt mining, by designating zones where such mining is allowed, and making artisanal mining illegal on all other land.

This will be challenging. There may not be sufficient area of good mining land that could absorb more than 100,000 artisanal miners. Most of the designated supply zones are remote and have fewer minerals than other mining areas; artisanal miners may continue mining private mining concessions close to their homes.¹³⁰ Moreover, artisanal miners may bribe officials to continue their activities.¹³¹ ECG formalization will have to operate alongside schemes already run by the private sector, some of which have been successful in improving working conditions for artisanal miners.

Price control

ECG's second objective is to increase cobalt revenues for the government and artisanal miners by buying their cobalt at a higher price and selling it on. Currently, the prices artisanal miners receive is probably lower than the price formal miners get, and less predictable.¹³² To this end, EGC intends becoming the sole buyer and exporter of artisanal cobalt in the DRC. To help market the metal, EGC will use the commodity trading firm Trafigura, although it might use other traders too in the future. In essence, EGC intends to act as a ‘marketing board’ for the country's artisanally mined cobalt. To afford to purchase cobalt from artisanal miners at a higher price, it hopes to use its market power to raise global cobalt prices; the company would be the fourth largest cobalt supplier in the world.¹³³

However, if ECG can get a better price for the cobalt it exports, which is not guaranteed, it is not clear who will benefit. Will EGC pass the gain on to artisanal miners, or to the government? Keep it for itself, or distribute it to Trafigura? Both the company and the government will need to clearly and transparently prioritize who

129 Andy Home, “Congo's Move to Control Artisanal is Double-Edged,” *Reuters*, February 9, 2020.

130 Brian Ziswa, “Cobalt, Sustainability: DRC Launches Monopoly over Cobalt ASM to Improve ESG Credentials,” *Roskill*, 8 April 2021, roskill.com/news/cobalt-sustainability-drc-launches-monopoly-over-cobalt-asm-to-improve-esg-credentials.

131 In 2013 (the latest data year), over half of Congolese firms were requested to pay a bribe, according to the World Bank, while corruption among law enforcement and security services policing the sector is common. Filipe Calvão, Catherine Erica Alexina McDonald, and Matthieu Bolay, “Cobalt Mining and the Corporate Outsourcing of Responsibility in the Democratic Republic of Congo,” *The Extractive Industries and Society*, 17 February 2021, doi.org/10.1016/j.exis.2021.02.004; World Bank, Enterprise Surveys, “Bribery Incidence (% of Firms Experiencing at Least One Bribe Payment Request) – Congo, Dem. Rep.,” The World Bank, accessed 14 May 2021, data.worldbank.org/indicator/IC.FRM.BRIB.ZS?locations=CD.

132 Calvão, McDonald, and Bolay, “Cobalt Mining.”; Benjamin Jones, *The Electric Vehicle Revolution: Economic and Policy Implications for Natural Resource Exporters in Developing Countries*, 158th ed., vol. 2020, WIDER Working Paper (UNU-WIDER, 2020), doi.org/10.35188/UNU-WIDER/2020/915-0; Chloe Brown et al., “Investigating the Potential of Radar Interferometry for Monitoring Rural Artisanal Cobalt Mines in the Democratic Republic of the Congo,” *Sustainability* 12, no. 23 (January 2020): 9834, doi.org/10.3390/su12239834.

133 Brown et al., “Investigating the Potential of Radar Interferometry.” Ziswa, “Cobalt, Sustainability.”

gets a share, and manage the deal with Trafigura. Marketing boards have had only mixed success in the extractive sector.¹³⁴ In the past, commodity marketing boards have often forced small-scale producers to accept a lower price for their output than they would get if they sold their produce on the open market.¹³⁵ This has particularly been the case where the sector is made up of by small producers with limited political influence.¹³⁶ Some governments have argued that profits retained by marketing boards help fund national development, this is often not the case.

2.6 INTERNATIONAL AND REGIONAL POLICIES

The criticality of cobalt has quickly elicited international cooperation among consumer countries—such as the European Union—and between consumer countries and mining countries—such as the United States, Australian and Canadian Critical Minerals Mapping Initiative.¹³⁷ The European Union is developing deals with non-EU countries to secure supplies of critical minerals.¹³⁸ The criticality of cobalt gives producer countries power—they can use it to gain concessions, improve their international relations or use tools such as export taxes to raise the price of exported metals. Conversely, consumer countries might wish to support producer countries to improve mining sector governance. Which can both help to raise the value producer countries get from their mining industry and reduces risks for investors to exploration and develop new resources.

Unlike the European Union, African countries do not yet coordinate in supplying critical minerals. Mining countries in Africa, perhaps led by the DRC, could play a traditional role of a supplier of raw critical minerals as individual countries. Or they might coordinate—through the African Union or other regional bodies—to improve the governance and investment attractiveness of their mining sector, and perhaps to develop regional supply chains. Such coordination might mutually benefit groups like the European Union, the United States and other major consumers who want to create alternative supply chains beyond China’s jurisdiction.¹³⁹

Another area for coordination is in developing regional value chains. Given the small size of industry in most developing countries, it is highly unlikely that a country can develop more than a small element of a supply chain alone. But coordinated across an entire region, such as southern Africa, some industrial clusters might flourish. Regional bodies like Southern African Development Community and initiatives like the Continental Free Trade Area have an important role to play here.

Finally, governments like that in the DRC can improve how they operate with Chinese companies and government contacts. Politicians and citizens in countries like DRC may score political points by criticizing Chinese companies, but this can be

134 Jones, *The Electric Vehicle Revolution*.

135 Robert H. Bates, *Markets and States in Tropical Africa: The Political Basis of Agricultural Policies* (Berkeley: University of California Press, 2005). Cited in Daron Acemoglu and James Robinson, “Patronage or Programmatic Politics?” *Why Nations Fail: The Origins of Power, Prosperity, and Poverty* (blog), 25 October 2012, whynationsfail.com/blog/2012/10/25/patronage-or-programmatic-politics.html. Thembumenzi Dlamini, Mangaliso Mohammed, and Thabo Sacolo, “Assessing the Impact of National Marketing Boards on Consumers and Producers’ Welfare” (Swaziland Economic Policy Analysis and Research Centre, November 2017), media.africaportal.org/documents/National-Marketing-Boards.pdf.

136 Daron Acemoglu, Simon Johnson, and James A. Robinson, “Institutions as a Fundamental Cause of Long-Run Growth,” in *Handbook of Economic Growth*, eds. Philippe Agion and Steven Durlauf (North Holland: Elsevier, 2005), 385–472.

137 “Critical Cooperation: How Australia, Canada and the United States are Working Together to Support Critical Mineral Discovery,” U.S. Geological Survey, 16 October 2020, www.usgs.gov/news/critical-cooperation-how-australia-canada-and-united-states-are-working-together-support

138 “Raw Materials Diplomacy,” European Commission, 5 July 2016, ec.europa.eu/growth/sectors/raw-materials/specific-interest/international-aspects_en.

139 African Development Bank, 12.

counterproductive in the longer term—putting Chinese companies on the defensive and triggering an existing inclination to stop or cut down communication. Instead, Chinese companies operate more responsibly and transparently when host-country laws are strong, clear and well-enforced.¹⁴⁰

Conversely, Chinese companies operating within mining countries might wish to step outside their familiar government and company meetings to engage with stakeholders including CSOs, journalists and impacted communities, while recognizing that these conversations can be uncomfortable and unfamiliar to many Chinese diplomats and company executives.

140 Xiaoxue Weng and Lila Buckley (eds.), *Chinese Businesses in Africa: Perspectives on Corporate Social Responsibility and the Role of Chinese Government Policies* (International Institute for Environment and Development, 2016), pubs.iied.org/17581IIED.html.

Conclusion

To benefit from the rise in cobalt values, better governance is needed. Cobalt mining governance should mostly follow the principles advised for other metals like copper, as detailed in frameworks such as the Natural Resource Charter. These include principles on licensing, taxation, revenue management and accountability. Although for many countries and particularly in the DRC, there is a significant gap between principles and practice.

However, the few differences between cobalt and major metals mean some elements of cobalt governance might be examined separately. These include being a minor metal—a by-product of major metal mining processes—with few industrial uses in immature markets that are subject to significant innovation and demand collapse.

The concentration of cobalt production in the DRC substantially increases risks for miners and cobalt buyers. Just four mines in the DRC account for 41 percent of production. Problems for these four mines and the stability of the DRC are therefore a significant concern for battery producers. Unless global production can rise significantly, cobalt costs could severely limit EV sales and slow the pace of the energy transition. For this reason, battery producers are using less cobalt. Improving governance might help reduce these supply risks and prolong the life of the cobalt market. Good both for mining countries and the pace of the energy transition. But this should not mean pandering to investors. Rather it means governing mining so that the long-term Congolese interests are upheld.

This is no easy task, but two specific policies that can reduce political risk and help long-term interests of people in mining countries are:

- Levying a sliding royalty on cobalt to ensure that a government receives more income when the cobalt price rises but provides relief to companies when the price falls.
- Establishing success factors for downstream cobalt processing, such as reliable energy; regional cooperation; and a clear, credible and consistent long-term policy direction that provides confidence to companies to invest.

As well as policies, one primary goal of governments must be to address corruption and the wide gap between statements of intent and actual change. Governments must apply a variety of measures including the disclosing contracts, tightening controls around mining licenses, and resourcing agencies to monitor behavior, for example, of mining and logging activity in environmentally sensitive areas.

The future for cobalt and for countries that mine it could be rosy or risky. DRC and perhaps smaller producers can capture value as their miners dig and process the metal. However, this opportunity is not large enough and might not be around long enough to finance decades of development in cobalt-producing countries. Improving governance now will help attract investment and capture value before time is up. Cobalt might not stay critical for long.

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