# Public consultation document

# Tax Considerations for Critical Minerals Value Addition

Interested parties are invited to send their comments no later than 3 September, 2025 by e-mail to tax@iisd.org in Word format (in order to facilitate their distribution to government officials). All comments should be addressed to the IGF's Global Mining Tax Initiative. Please note that all comments on this public consultation document will be made publicly available. Comments submitted in the name of a collective "grouping" or "coalition," or by any person submitting comments on behalf of another person or group of persons, should identify all enterprises or individuals who are members of that collective group, or the person(s) on whose behalf the commentator(s) are acting.

INTERGOVERNMENTAL FORUM
on Mining, Minerals, Metals and
Sustainable Development

# Tax Considerations for Critical Minerals Value Addition

## DRAFT FOR PUBLIC CONSULTATION


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**Tax Considerations for Critical Minerals Value Addition**

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Photo: iStock

# Executive Summary

## Background

This report examines the opportunities and challenges for resource-rich developing countries to develop downstream processing and manufacturing in the mining value chain. Focusing on a selection of critical minerals vital for electric vehicles, batteries, and renewable energy technologies, it investigates two key questions. First, what specific fiscal (and non-fiscal) conditions enable critical minerals resource owners to optimize the balance between revenues from producing the mineral and the benefits from processing and refining the mineral further down the value chain, in-country? Second, what tax and other related measures have countries adopted to increase in-country value across the mining value chain? This report considers these questions, taking into account the factors that have helped or hindered previous attempts to increase domestic value lock-in in resource-rich countries. It emphasizes the potential tax policy choices related to the opportunities presented by critical minerals in the energy and digital transition and suggests simplified approaches to making these tax policy choices.

Six countries—Argentina, Australia, Chile, Indonesia, Zambia, and Zimbabwe—highlight varied approaches to using tax incentives for in-country mining value addition. Fiscal tools, including production-based incentives (e.g., reducing royalty rates from 5% on copper ores and concentrates, to 2% on copper cathodes), cost-based measures (e.g., accelerated depreciation), and profit-based incentives (e.g., tax holidays), show mixed results. The analysis notes that policies focused on tax incentives alone are insufficient without foundational enablers—with trade-offs such as potentially reduced short-term revenue balanced against potential long-term industrial gains.

## Primary Enabling Conditions

Primary enabling conditions to incentivize mineral value addition, such as legal, regulatory, and institutional stability; reliable infrastructure; and absorptive domestic market capacity, are critical for mining value addition success. For example, if a project is loss-making before tax, tax reductions will not make it profitable. By contrast, improvements in primary enablers could determine whether a project is profitable, before or after tax. Stable frameworks attract investment. Infrastructure such as affordable energy for processing and transport networks for market access, underpins viability. Domestic market capacity drives demand for processed goods (e.g., copper wire), though export potential can be important where local markets are weak, provided transport infrastructure exists.

## Secondary Enabling Conditions

Secondary enablers—fiscal instruments such as production- and cost-based incentives—complement primary conditions. Royalty adjustments (e.g., higher rates on ores and concentrates and lower rates on refined products) encourage processing, as modelled in copper scenarios, while cost-based tools, such as tax credits, can reduce upfront capital burdens, enhancing cash flow for significant smelting or refining investments. These measures—applied in countries such as Indonesia and Chile—can serve to enhance mining value addition when primary conditions are met. However, they can also risk revenue losses if not carefully calibrated.

## Practical Considerations for Making Tax Policy Choices

Tax policy choices to incentivize mining value addition must account for a country's stage along the mining value chain and possible trade-offs. Measures—such as export restrictions—may benefit countries more advanced in terms of the primary enabling conditions but may deter investment in countries without infrastructure. Incentives, such as tax credits, support early-stage processing, but may not spur refining.

Economic modelling is essential to balance upstream revenue (e.g., royalties on copper concentrates) against downstream potential (e.g., copper anodes and cathodes, as well as other multiplier effects from such investments).

## Policy Options and Concluding Recommendations

Policy-makers should consider applying the following measures, depending on where they are along the mining value chain.

1. A clear articulation of a critical minerals strategy that establishes a baseline of information.
2. A comprehensive assessment of domestic manufacturing uses for the critical minerals.
3. A consistent and uniform approach to designing tax enablers, relying objectively on economic and financial modelling of mining processing and refining projects.
4. The creation of a private sector-managed infrastructure fund, dedicated to providing funding for relevant and necessary infrastructure for the successful establishment of processing and refining capacity (primary enablers).
5. Fostering regional cooperation to optimize comparative advantages, such as would enable the transfer of ores and concentrates from one country to another for processing and refining, so long as the enabling conditions hold.

Success requires integrating these options with primary and secondary enablers, balancing immediate fiscal needs with long-term industrial goals. This approach can position resource-rich nations as key players in global supply chains, while fostering sustainable development.

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# 1.0 Introduction

## 1.1 Background and Objective

**The increasing demand for critical minerals,[1] particularly driven by the energy and digital transition, has resulted in, among other developments, a "resurgent increase in interest of mineral-rich countries in processing activities that capture value further down the mining value chain"** (Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development [IGF], 2024).

This increased interest in mineral processing for enhancing downstream value and contributing to various industrial supply chains is not new, particularly among mineral-rich developing countries. Mineral processing occurred in African countries, through metalworking using copper, iron, gold, and tin in furnaces and forges made by metalworkers from 1000 BCE (Mavhunga, 2023). During the 1550s, in Mexico, miners developed the amalgamation process consisting of refining large quantities of low-grade silver ore. Also, in Peru, indigenous peoples smelted their ores in clay furnaces (Duke University, official website). In Southeast Asia, copper-base metallurgy works (Pigott & Pryce, 2022) were found in the last part of the Holocene epoch.[2]

More recently, initiatives such as the Africa Mining Vision (AMV) articulated intentions for "down-stream linkages into mineral beneficiation and manufacturing" and for "sidestream linkages into infrastructure (power, logistics, communications, water)" (African Union, 2009). The underlying objectives of establishing such initiatives included assisting countries in developing a sustainable mining industry, as well as the development of a sound minerals industrial sector able to support their socio-economic growth, with the intended ultimate outcome of increased financial benefit to all stakeholders.

Country leaders have been sending strong messages to investors signalling their governments' interest in developing their downstream mineral sectors to improve worker skills, create jobs, and reduce project costs. For example, the government of Tanzania planned to restrict the granting of licences to investors who lack comprehensive plans for the value addition of minerals within the country (The Citizen, 2024).

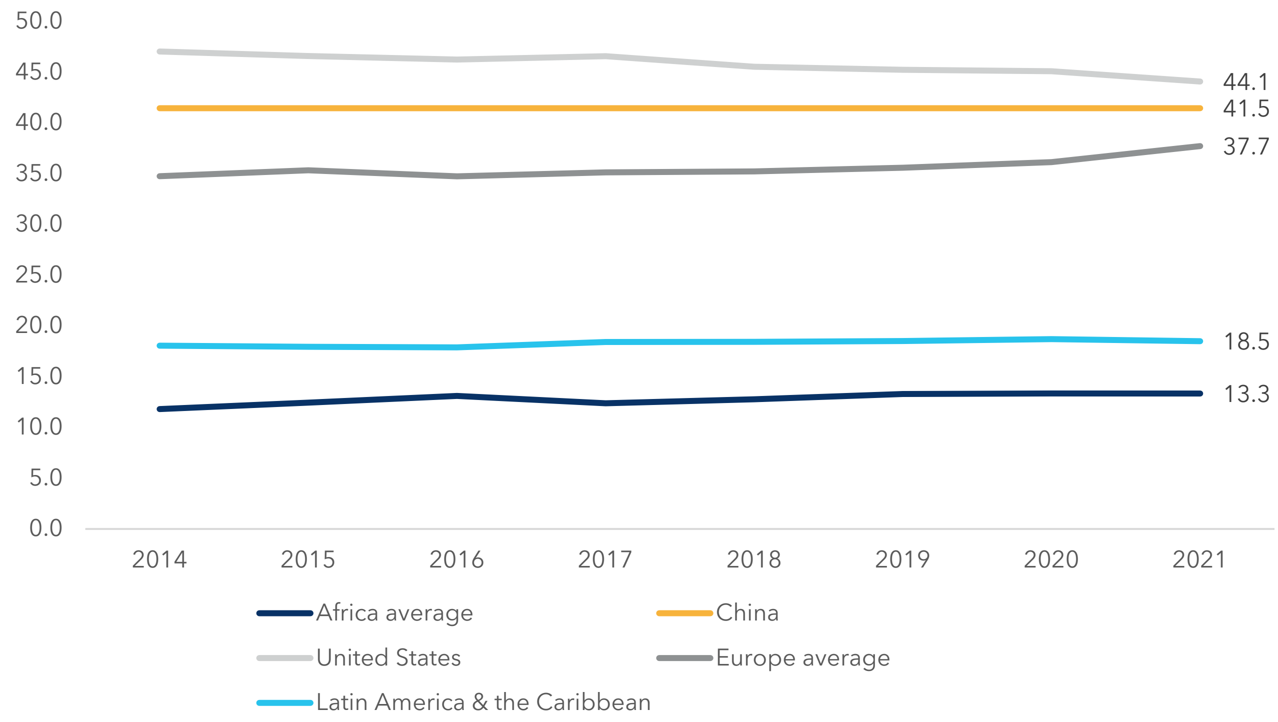
**However, such initiatives have not obtained the intended results, particularly in developing countries** due to, for example, failure to effectively develop critical minerals into vertically integrated and horizontal industrial activities; inability to sufficiently address environmental, economic, social, and health impacts of mineral operations; and an

[1] Defined as the "raw materials – minerals and metals – that are necessary for renewable energy, clean technology, and our transition to a more sustainable, low-carbon future." See IGF, (2022), *Critical Minerals: a primer*.
[2] Britannica, referring to the last 11,700 years of the Earth's history.

inability to access and use research, development, and technological information (Diallo, 2016).

This is further demonstrated in comparatively low levels of manufacturing, as measured, for example, in manufacturing value-added (Figure 1). The United Nations Industrial Development Organization (UNIDO) measures the medium- and high-tech manufacturing value-added statistic as a proportion of value added by medium- and high-tech industries relative to local manufacturing value added. This measure reflects the economic contribution of the sectors which are characterized by higher technological intensity and productivity. It is considered an essential way to assess industrial development and innovation within an economy, indicating a shift toward more advanced manufacturing practices.

**Figure 1. Medium- and high-tech manufacturing value added (% of GDP)**




Source: [UNIDO, Competitive Industrial Performance (CIP) database.]

Figure 1 shows China, Europe, and the United States averaging between 38% and 45%, while African and Latin America and the Caribbean (LAC) countries average below 20%. This underscores the manufacturing lag in developing regions, despite their resource-richness, and evidences their reliance on primary commodity exports rather than manufacturing.

**Governments with large mineral resources are increasingly more interested in the economic and social benefits that can be obtained further down the value chain.** The aim is not only to develop industrial capacity further downstream but also increase the possibility of integrating all the sections of the value chain into wider supply chains in the energy and technology transition, such as those for electric vehicles (EV), battery manufacturing, or solar photovoltaic.

**There is a plethora of literature on ways in which these countries can lock-in value from the extraction of their mineral resources beyond just the export of raw ores or concentrates.** These range from the use of fiscal and non-fiscal incentives to attract investment, to considering regional coordination for the establishment of a processing capacity at industrial scale.

**However, the concentration and dominance of processing capacity** (International Energy Agency [IEA], 2023) **for several of these critical minerals located in a handful of countries** such as China, Russia, Chile, Indonesia, Japan, Finland, Canada, Argentina, Malaysia, and Estonia, partly explains the limited success of previous policy attempts to increase mineral value addition in other resource-rich countries.

**Countries have attempted, over the years, to use a range of fiscal and non-fiscal measures to incentivize or disincentivize behaviour in the hope of increasing activity further down the mining value chain.** These measures have had differing levels of success depending on factors such as mineral resource availability and quality, volatility of commodity prices, transportation, energy availability, workforce capabilities, technology, international and national investments, the capacity of the tax authorities and mining regulatory institutions to strengthen and enforce the minerals legal system, and geopolitics.

**Tax incentives could be, and have been, applied to develop mineral industrialization further down the value chain.** These incentives have included guaranteeing fiscal stability for entities participating in projects or tax credits for the use of new technology, tax breaks, accelerated depreciation, export and import tax rules to favour national manufactured products, exemptions from customs duties for tools and equipment needed in downstream businesses, value-added tax reimbursements, reduction of withholding tax rates for the in-country use of technical assistance, financial costs and/or dividend payments from contractors, international banking institutions, and international project partners.

Mandatory quasi-fiscal policies can be—and have been—considered for inclusion in formal agreements and additional ones incorporated by governments during the life of the projects. Such policies have consisted of assuming contractually agreed expenses, such as for capacity-building programs for the workers and communities, health, roads, schools, and housing investments for resettling of communities that once lived near the operational areas, or any other types or payments or obligations.

**The anticipated growth in demand for critical minerals, on account of the crucial role they will play in the energy and digital technology transitions, offers an industrial**

**development opportunity for countries seeking to review their mining sector value chains for development and for financial benefit.** This is because:

a) Higher volumes of demand for processed minerals could allow new entrants to the market, where existing producers cannot meet new levels of demand without seeing their costs rise;
b) Higher prices can make midstream and downstream mineral processing projects commercially viable that were not before;
c) Governments can use higher rents from mining to support the development of mineral-based industries. This can be done either by using increased fiscal revenues to provide public support (e.g., public spending / tax incentives), or, in some cases, by obliging mining companies to use their rents to fund these activities.

Mineral-producing countries could, therefore—depending on the economic and commercial viability of the project—have more impetus to negotiate fiscal terms in a way that promotes mineral-based industries by using performance-based incentives to increase processing capacity. Governments could implement a comprehensive review of their fiscal terms, segmented by stages of the value chain, so that tax and non-tax incentives are applied particularly to downstream and manufacturing activities, while maintaining royalty revenues from the upstream or exploitation phase (IGF, 2024).

**Achieving this, in a manner that improves on the limited successes of the past, will require consideration of two key questions**:

1. What specific fiscal (and non-fiscal) conditions enable critical minerals resource owners to optimize the balance between revenues from producing the mineral, and the financial and economic benefits from processing and refining the mineral further down the value chain, in-country?
2. What tax and other related measures have been adopted by countries to increase in-country value across the mining value chain?

This report considers these questions, taking into account the factors that have helped or hindered previous attempts to increase domestic value lock-in in resource-rich countries. The emphasis is on what policy choices could be made regarding the opportunities provided to them from critical minerals in the energy and digital transition.

## 1.2 Who Is This Report For?

The report is primarily intended for government policy-makers of resource-rich, developing countries who are responsible for developing tax instruments to incentivize domestic investment in the processing and/or refining stages of the critical mineral value chain. It offers a practical basis for policy-makers to identify the economic conditions that enable increased mining processing capacity and therefore help them determine their country-specific fiscal policy choices accordingly.

## 1.3 What Gap Does This Report Fill?

This report introduces a practical distinction between primary and secondary conditions for mining sector value addition to succeed and offers examples of how tax instruments can be more effectively utilized in this pursuit. The absence of this level of practical consideration is one of several reasons for the limited success of previous attempts to increase domestic mining sector processing capacity in resource-rich countries.

## 1.4 Scope and Limitations

**The focus of this report is on mineral processing and refining capacity, acknowledging that while an increasing number of countries can process ores and export as concentrate, many lack the higher value-adding capabilities in smelting and/or refining**. This part of the mining value chain is the focal point of this report. The research focuses primarily on critical minerals and the energy transition, recognizing—and not seeking to duplicate—previous work that has been done on a broader and more general range of minerals.

**It also focuses on a limited selection of critical minerals, in recognition of the diversity of value chain activities for different minerals that would necessarily imply different policy choices and strategies**. Three critical minerals have been considered, namely: copper, lithium, and nickel; given the important linkages they have to the energy and digital technology transition and to the industrial policy considerations that have historically dominated the mining value addition discourse.

**Furthermore, the scope of this report does not include the various supply chains for the critical minerals considered, given the numerous permutations and combinations of these chains and at one or multiple stages of the value chain**. There are several possibilities for copper, for example, across renewable energy systems and technologies, EVs, and power grids. This report focuses on the financial benefit sharing conditions that would enable not only domestic value lock-in but also readiness for integrating into relevant supply chains.

**Several examples are featured in the report, focusing on a selection of countries at various stages of development and with different approaches to mineral processing regulation**. Six countries (two each from Africa, Asia, and Latin America) have been selected for this exercise.

### Table 1. Selected countries

| | | | Selected critical minerals | | |
|---|---|---|---|---|---|
| **#** | **Countries selected** | | **Copper** | **Lithium** | **Nickel** |
| 1 | Africa | Zambia | Yes | No | Yes |
| 2 | | Zimbabwe | Yes | Yes | Yes |
| 3 | Asia & the Pacific | Australia | Yes | Yes | Yes |
| 4 | | Indonesia | Yes | No | Yes |
| 5 | Latin America | Argentina | Yes | Yes | Yes |
| 6 | | Chile | Yes | Yes | No |

The countries have been selected according to how far along the value chain they have progressed with the minerals considered. For copper, for example, Zimbabwe is yet to develop capabilities in comminution, beneficiation and concentration, processing, refining, and manufacturing. At the other end of the selection are Australia and Zambia, with capabilities all the way through to manufacturing wire (Zambia), sheets, rods, etc. The same approach has been applied to the lithium and nickel value chains. For example, Chile and Indonesia are considered to have more processing capabilities for lithium carbonates, chloride, and hydroxides than Zimbabwe, which also has the minerals. In a similar vein, Australia is considered to have significantly higher manufacturing capability for the extraction and processing of nickel, than the other countries considered.

This framing helps in considering the tax policy choices that countries could make to enhance the financial benefits from expanding their capabilities across the value chain. The route taken by Zimbabwe for copper, for example, will differ significantly from Zambia, which already has demonstrable capabilities in processing copper anodes.

The report is based on desk research, focusing on a review of the existing literature, as well as on existing fiscal policies and regulations aimed at promoting in-country mineral value addition.

By examining the role of fiscal policy measures and practices in promoting value addition along the mining value chain for critical minerals, this report is expected to contribute practical policy choices to the long-running debate about harnessing the potential of critical minerals for sustainable development in resource-rich countries.

# 2.0 Economic Considerations Across the Mining Value Chain for the Selected Critical Minerals

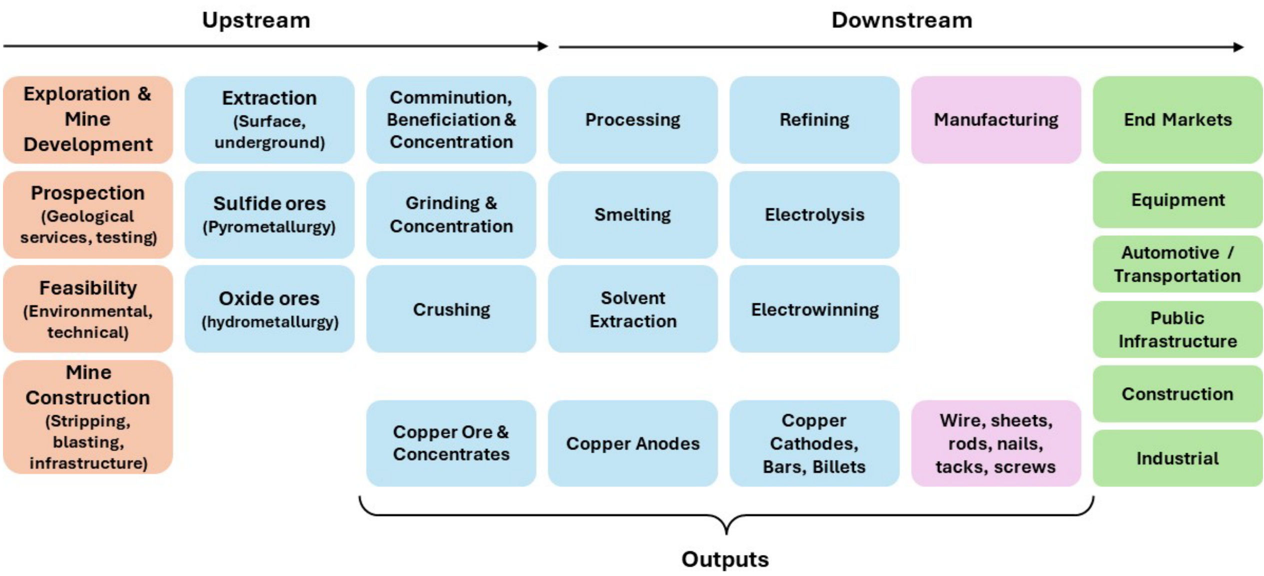
This section examines the economic considerations at various stages of the mining value chain for selected critical minerals, namely copper, lithium, and nickel. By mapping the upstream and downstream activities of each mineral, the section highlights where value is created and the differing financial benefit-sharing mechanisms available at the extraction, processing, and manufacturing stages. It further discusses the fiscal and economic dynamics influencing policy choices for resource-rich countries seeking to incentivize domestic mining value addition and reap financial benefits from it.

## 2.1 Copper

Copper reserves increased by over 40% in the last decade, reflecting an increase in exploration activities due to growing demand (U.S. Geological Survey, several years). The major copper producing countries are Chile, Peru, China, and the Democratic Republic of the Congo (DRC). Some key challenges in global copper supply include peaking production of existing mines due, in large part, to declining ore quality and reserves exhaustion; difficulty in substitution as a high performer metal for electrical uses; decreasing quality of copper ore which could increase costs of production, emissions, and tailing quantities; and operational mines exhibiting high levels of water and environmental pressures (Crux Investor, 2024).

Figure 2 illustrates the typical value chain for copper, highlighting the main activities that have revenue and cost implications for project profitability.

**Figure 2. The copper value chain**



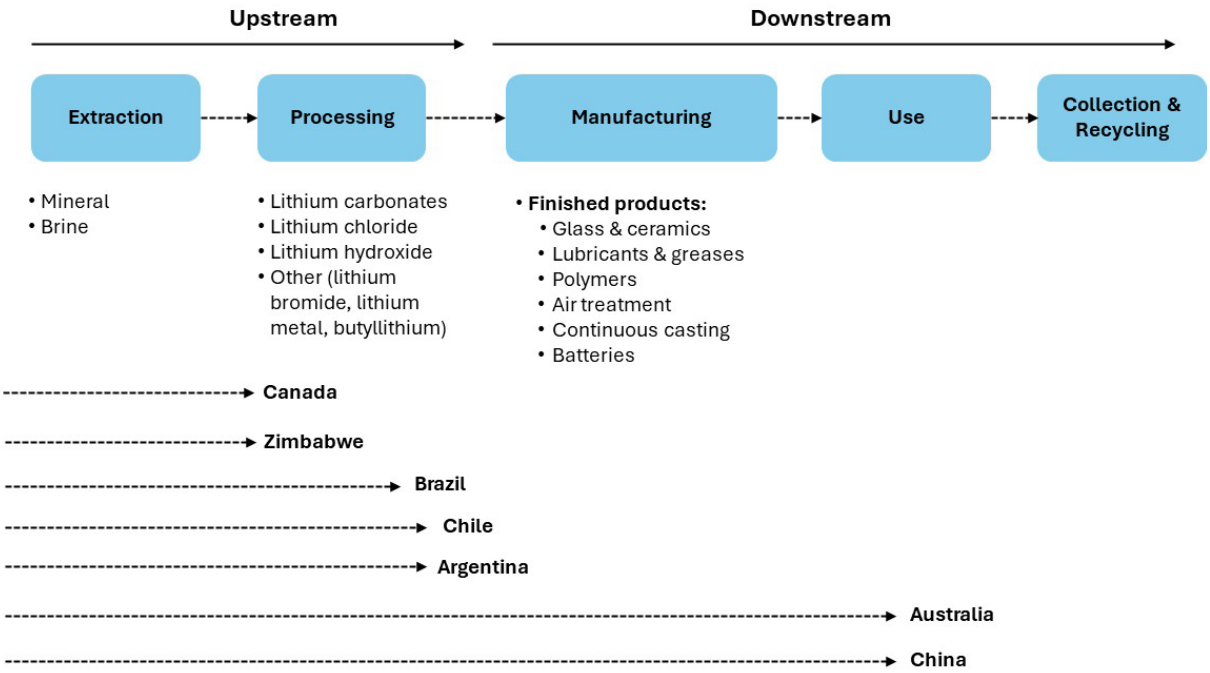

Source: Adapted from Bamber & Fernandez-Stark (2021), "Innovation and competitiveness in the copper mining global value chain: developing local suppliers in Peru," Inter-American Development Bank, Discussion Paper No. 855.

Figure 2 distinguishes between upstream and downstream activities. Upstream activities include exploration and mine development, extraction, beneficiation, and concentration (the latter two also considered as 'midstream'). Downstream activities include processing, refining, manufacturing, and then delivery to the end markets. The typical cost considerations for the mining rights holder include costs of prospection, conducting technical and commercial feasibility studies, site construction, extraction of the ore, grinding and concentration, and crushing.

## 2.2 Lithium

Lithium is one of the fastest growing minerals for the energy transition globally. Australia, Chile, China, and Argentina are the main producers, accounting for 96% of global output (Taquiri et al., 2024). In the LAC region, the vast majority of lithium reserves are in the form of brine deposits, such as in Chile, while deposits in Australia and China are mainly in the form of hard rock minerals. The extraction and processing of lithium can be complex, and the manufacturing processes for finished products—lithium-ion batteries in particular—are concentrated in a few industrial locations. Most of the aforementioned large lithium producers do not have processing capabilities, as is shown in the value chain diagram below.

**Figure 3. Lithium value chain**




Source: Adapted from Matos et al., (2020), "Material System Analysis of five battery related minerals: Cobalt, Lithium, Manganese, Natural Graphite, Nickel," Technical Report.

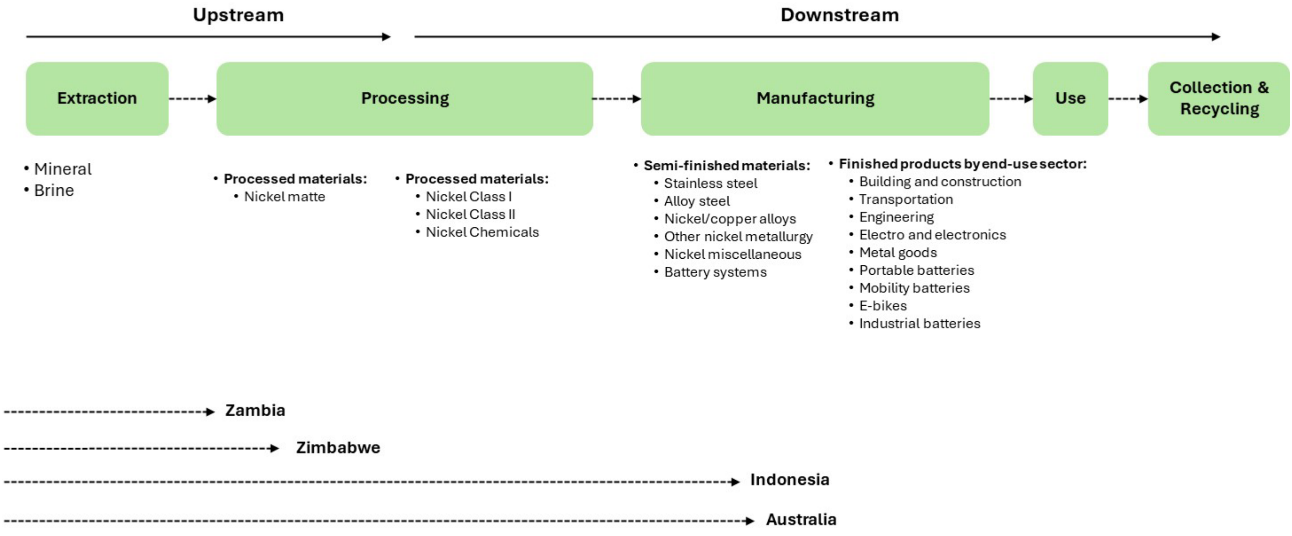
The arrows indicate the extent to which each country has advanced along the lithium value chain. For example, Chile, with the largest proven reserves, extracts lithium brine and processes lithium hydroxide largely for export.

The upstream and downstream considerations are similar to copper, in that additional economic value can be extracted further down the value chain, such as through the manufacturing of EVs, batteries, and other finished products, as highlighted in Figure 3. However—as is the case with copper—the financial benefit-sharing opportunities available to the lithium-rich country do not enjoy the special fiscal treatments as would obtain upstream. It is important to note that undertaking these activities does not necessary capture economic value—it may destroy value if the cost of production is greater than the value of what is produced. However, if there are substantial positive externalities, e.g., if the industry will become competitive over time, then it can be worth it to develop industries that are—at least initially—loss-making.

## 2.3 Nickel

Indonesia, Philippines, Russia, and Canada are the largest producers of nickel worldwide, accounting for 71% of total production. The primary drivers of nickel demand are stainless steel production and EV batteries. Figure 4 outlines the typical nickel value chain.

### Figure 4. Nickel value chain




Source: Adapted from Matos et al., (2020), "Material System Analysis of five battery related minerals: Cobalt, Lithium, Manganese, Natural Graphite, Nickel," Technical Report.

Nickel is a crucial component in stainless steel production, enhancing its corrosion resistance and durability. It is also used in alloys for high-temperature applications, such as jet engines and gas turbines.

As Figure 4 shows, value is created at multiple stages of the nickel value chain, from extraction to end-use applications. At the extraction phase, nickel ore is extracted and can be sold either in rock form or brine, depending on the geological nature and location of the deposit. Further value can be generated by converting raw ore into concentrates and then into refined nickel products, which serve as critical inputs for industrial manufacturing. Even more value can be extracted by producing alloys and other materials from these refined products. At the downstream end, the construction, automotive, and aerospace industries derive significant value from nickel-containing products.

The selected countries in the figure are at various stages of the value chain, with Australia and Indonesia furthest down the chain based on observations of exports of such products as nickel alloys and other nickel metallurgy.[3] There are recorded export volumes of certain products in the manufacturing stage of the value chain from Argentina, but not in volumes as large as those from Australia and Indonesia. There is evidence of nickel processing in Zimbabwe up to the processing of nickel chemicals, although the sole primary nickel mine operating in the country was placed under administration in May 2024.[4] Zambia's nickel processing capabilities include the production of nickel mattes.

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[3] Based on export data from the UN Comtrade Database.
[4] The Trojan mine is 70%-owned by Zimbabwe's government. See Reuters, May 2 2024, "Zimbabwe's sole nickel mine placed under administration."

## 2.4 Typical Sources of Value to the Resource-Rich Country

For resource-rich countries, their typical financial benefits have traditionally come from activities during the upstream stage of the value chain. The extracted copper, lithium, or nickel is sold by the mining rights holder, typically either as ore or concentrate (as is the case for copper and nickel), and the resource owner—i.e., the state—receives its value or share of the financial benefits from the sale through the imposition of a combination of royalties and taxes. These financial benefits—all else being equal—flow directly to the resource-rich country typically in the form of revenue to the government and can then be redirected towards government spending, savings, and investment programs.

The financial benefit sharing profile for the processing and refining stages differs from the extraction phase particularly in terms of cost and profitability. The direct financial benefits that accrue to the resource-rich country in the processing, refining, and manufacturing stages typically come from taxes paid by the operators of the smelters, refiners, and various manufacturing plants, as would be the case for any other manufacturing or industrial process. This is in addition to other benefits such as wages and salaries, taxes paid by employees, and service providers. The sunk costs and economies of scale featured at the extraction stage result in significant economic rent from which the resource owner can benefit through royalties and taxes. Such economic rent advantages at the extraction stage do not typically occur at the processing and refining stages due to several factors—including significantly higher share of operating costs, process complexity, variability in ore grade, complicated logistics, and low processing fees (particularly in times of global or regional copper smelting or refining overcapacity, for example).[5] Also, supply in the extraction stage is limited by geology, while countries without the minerals in question can also enter the latter stages of the value chain, which often increases competition.[6] These are important considerations to bear in mind when determining tax policy choices to incentivize in-country mining value addition.

For these resource-rich countries looking to encourage investment in these phases of the value chain, there are several enabling conditions that must be met. These include tax and non-tax conditions, and they are discussed in section 3 of this report.

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[5] For example, there was a drop in copper smelter conversion fees due in large part to smelter overcapacity. See Reuters, December 16, 2024: "Bleak times for copper smelters as conversion fees slump."

[6] Although mineral processing is highly concentrated for several minerals (and, in some cases, market concentration is greater than for mining), countries that dominate processing cannot leverage this to the same level of rents because it would be easier for other producers to increase their supply in response than with mining, because of the geological limits on mineral supply (Baumol & Lee, 1991). In some cases, mining can also be contestable, especially when there are large-scale producers that can readily expand production. Examples include expansion of Guinea's bauxite production in response to Indonesia's ban on raw bauxite exports in 2014, and development of Brazil's iron ore export capacity in response to Australia's introduction of a price floor in 1973 (Baskaran, 2024; Hurst, 2015).

# 3.0 Enabling Conditions to Incentivize Mineral Value-Addition

This section considers the conditions that enable domestic mining value chains to develop beyond extraction and beneficiation. A review of the literature and some of the country-level measures that have been undertaken over the years suggest that **the enablers can be categorized into non-tax policy enablers and tax policy enablers.[7]**

## 3.1 Non-Tax Policy Enablers

Before considering the fiscal tools that could incentivize mineral value addition, there are several non-tax conditions that are of great significance. It can be argued that the absence of pre-tax commercial viability nullifies the value of whatever tax policy enablers may follow.

It can also be argued that such absences explain the limited success of previous mining value addition efforts—such as the AMV at national implementation stage—or why, despite growing evidence of processing and refining activity in many resource-rich countries (see, for example, Figure 14 in IGF, 2024*a*), there has not been a significant increase in smelting and refining capacity for several of these minerals compared to countries where such activities occur at large scale. The absence of these conditions can severely undermine the effectiveness of fiscal incentives, such as tax breaks, subsidies, or tariffs designed to encourage domestic processing and/or refining.

Even with tax incentives, the absence of *primary* conditions, such as a clear strategy, adequate infrastructure, or absorptive domestic market capacity for the various stages of the refined critical mineral, can make it difficult to attract risk capital. This could imply that the cost of introducing the tax incentives for promoting value addition might outweigh the benefits. It is not clear that the practical distinction between *primary* (non-tax policy) and *secondary* (tax policy instruments) conditions is systematically reflected in the design and implementation of tax policy aimed at domestic mining value addition in general, and critical minerals value addition in particular. This section categorizes five *primary* conditions for one or a combination of tax policy instruments to positively incentivize domestic processing or refining of critical minerals.[8]

- Clear critical minerals policy or strategy
- Stable regulatory and institutional framework
- Reliable infrastructure

[7] "Tax policy enablers" refer to tax incentives, usually calculated as expenditures in the budget.
[8] Note that the implicit assumption is that the resource is available in sufficient commercially extractible quantities so that processing facilities can earn back the cost of their establishment before the resources are depleted. Also, this list does not include other broader enablers such as an overall industrial strategy.

- Absorptive domestic capacity for the refined critical mineral
- Availability of funds for investment in downstream processing

### 3.1.1 Is There a Clear National Policy or Strategy?

Clear articulation of purpose for the development of critical minerals is an important *primary* consideration. It is argued that once countries have gone through the exercise of understanding and defining what criticality means to them in terms of their mineral endowments, and having mapped these resources, an important next step is to clearly define priorities for the development of these critical minerals in strategic form (IGF, 2024b). These priorities will be influenced by key drivers such as value addition, domestic and regional supply chains, higher revenues from the critical minerals, and strategic positioning (either as suppliers of choice or investors of choice, or both) (ibid).

**Box 1. Examples of policy measures and strategies taken by countries to promote domestic or regional minerals value addition (Niri et al., 2024)**

**Australia**

Australia's Critical Minerals Strategy aims to develop its critical minerals sector, focusing on resilient supply chains and skilled workforce training to meet demand for battery and renewable technology components, such as lithium and rare earths. It includes incentives such as the AUD 4 billion Critical Minerals Facility for loans and AUD 1 billion from the National Reconstruction Fund for processing projects.

**Canada**

Canada's Critical Minerals Strategy aims to enhance competitiveness and capacity across the battery supply chain, from extraction to manufacturing, while linking to renewable technologies such as solar and energy storage. It seeks to attract investors by promoting a sustainable, integrated approach to battery production for electric vehicles and clean energy systems. The strategy includes incentives and partnerships to bolster the domestic industry and meet global demand.

**Chile**

Chile's National Mining Policy 2050 aims to boost value addition in mining for energy and technology transitions, leveraging copper and lithium for batteries and other renewable energy technologies. It targets downstream industries and innovation, with incentives such as increased research and development funding, and support for 250 supplier firms to export USD 4 billion by 2050.

The European Union (EU) and Chile signed a memorandum of understanding in July 2023 to develop a strategic partnership on sustainable raw materials value chains, which includes the creation of local processing, manufacturing, and recycling centres (European Commission, 2023).

In addition, the country created the electric vehicle initiative, a multi-governmental policy forum dedicated to speeding up the introduction and adoption of EVs internationally (Bastida et al., 2023).

**Regional cooperation between DRC and Zambia**

In October 2023, the EU, the DRC, and Zambia agreed to develop a raw materials value chain and better rail transportation in Africa. The United States also committed to assist in upgrading infrastructure along the Lobito Corridor, linking central Africa to the Atlantic coast, to transport critical minerals for producing EVs. This includes adding hundreds of kilometres of new railway track from Zambia's Copperbelt Province to an existing line in Angola (Jalasi et al., 2024).

In April 2022, Zambia and the DRC signed an agreement to contract an EVs battery factory in Lubumbashi, supported by the United States (Pickles, 2023).

**United Kingdom**

The United Kingdom's Critical Minerals Intelligence Centre (CMIC)—established in July 2022 and led by the British Geological Survey, with support from the Department for Business and Trade—aims to enhance the UK's resilience in critical mineral supply chains, which is vital for the energy and technology transitions. The CMIC is tasked with analyzing and forecasting global supply and demand dynamics of critical mineral value chains and providing data-driven insights to support UK industry needs.

These policies or strategies set out national and regional goals for downstream development actions for mineral beneficiation and manufacturing, and for horizontal linkages into transportation, energy, communications, and water infrastructure.

### 3.1.2 Are There Stable Legal, Regulatory, and Institutional Mandates?

It is argued that stable legal and regulatory environments would attract investment in critical minerals value addition. A well-defined, consistent, and transparent regulatory framework is typically a positive step toward attracting risk capital. Countries have made various reform efforts over the years, with the objective of incentivizing investment further down the mining value chain. In addition, stable policies can also be important in attracting investment, by reducing the risk to investors that changing policies will undermine the profitability of their project.

**Box 2. Examples of regulatory provisions incentivizing mining value addition**

**Australia**

Australia passed into law the Future Made in Australia (Production Tax Credits and Other Measures) Bill, 2024 to amend the Income Tax Assessment Act 1936, the Income Tax Assessment Act 1997, and the Tax Administration Act 1953, to establish several legislation-backed tax incentives. These incentives include a critical minerals production tax incentive for mineral processing activities (Government of Australia, 2024).

**Indonesia**

Another example is Indonesia's establishment of, and subsequent amendments to, its Mineral and Coal Mining Law ("Minerba," amended in 2022 – Constitutional Court of the Republic of Indonesia), which established an obligation to undertake domestic processing and refining to enhance mineral value-addition. It is important to note that although the legislation has remained in place, some of Indonesia's policies on value addition have been quite variable, such as export restrictions.

**Namibia**

Namibia signed a memorandum of understanding with the EU in 2022 on sustainable value chains for critical raw materials, which included developing refining capacity. To this end, the government has committed to removing legal and administrative constraints to ensure a conducive business environment (Pickles, 2023).

**Chile**

The strategic partnership on sustainable raw materials value chains created in 2023 by the EU and the government of Chile includes the obligation to develop value-added local content, processing, manufacturing, and recycling centres, including for the mining sector. In the signed memorandum of understanding, there was a commitment for produced outputs to be exported to Europe, as well as to the internal Chilean market (Pickles, ibid).

**Zimbabwe**

The Base Minerals Export Control's Statutory Instrument #57 of 2023, CAP. 21:05, includes certain conditions on the processing and export of lithium. Such legal instruments incorporate new, specific definitions regarding lithium, including what qualifies as beneficiated and unbeneficiated lithium (Government of Zimbabwe, 2023).

Section 3 includes amendments limiting beneficiated and unbeneficiated lithium exports if certain conditions are not met, including the price used that shall not be lower than that set by the Minerals Marketing Corporation of Zimbabwe.

### 3.1.3 Is There Reliable Infrastructure?

Infrastructure development plays a crucial role in enabling mineral value addition, particularly by facilitating the movement of the minerals from mine gate to markets where value would be realized, for storage, for providing energy for the processing and refining process, and for environmental management.

- **For providing energy**: A stable and affordable (preferably grid-connected due to cost and scale efficiency) energy supply is essential for mineral processing operations, which are typically energy-intensive. This includes electricity for crushing, grinding, smelting, and refining processes. On average, bauxite refining, for example, typically requires over 3,000 kWh per tonne of refined product. This amount of energy can power three to four households in parts of sub-Saharan Africa for a year. This amount is approximately 4,700 kWh per tonne for cobalt (Bosse et al., 2025). For projects of this nature, grid-connected power supply not only has to be available, but it also has to be available at comparatively cheaper electricity tariffs.

- **For transport and market access**: Well-developed roads, railways, and ports facilitate the transportation of raw minerals from mining sites to processing facilities and export terminals. This reduces logistics costs and ensures timely delivery. A robust transportation network connects mining regions to domestic and international markets, enabling the export of value-added mineral products.

- **For environmental management**: Adequate water supply is crucial for mining operations, especially in arid regions, and effective water treatment and wastewater management systems are important aspects of regulatory compliance and minimization of environmental impact. In Chile, for example, lithium brine extraction in the Atacama Desert has faced challenges due to water scarcity, prompting investments in desalination plants to support processing capacity (Chaudary, 2025).

These conditions are essential for creating a more favourable environment for mineral value addition, enhancing investment attractiveness, and strengthening resource-rich countries position in the global supply chain for their critical minerals.

An example of government intervention is the case of Australia's Newcastle iron beneficiation plant development. It was located with good proximity to cheap energy sources, a primary market, labour, port facilities to receive ore inputs, and was characterized by affordable transportation costs. The plant was operational for more than 80 years and, in addition, the government established partnerships with steel manufacturers and the iron ore sector as a co-investor in supporting infrastructure availability (IGF, 2018).

**Developing mineral processing industries and supporting infrastructure in parallel**

In some cases, investors are willing to build or upgrade the infrastructure they need for their mineral processing plants to be viable. Examples include the construction of the desalination plants to provide adequate water for lithium brine extraction in Chile (see above) and China State Power Investment Corp's commitment to invest in both an alumina-producing facility and a power plant to serve it in Guinea (Ecofin Agency, 2025). Yet to attract such infrastructure investment, host countries must ensure that the business environment for both mineral processing and infrastructure are sufficiently attractive.

### 3.1.4 Is There Absorptive Domestic Market Capacity?

The availability and size of the domestic market for semi-finished and finished products of the processed minerals play an important role in the extent of mineral value-addition that can occur in-country.

Using copper as an example, the availability of manufacturing capacity for finished products, such as copper wire, sheets, rods, nails, and screws (see Figure 2) could influence the prospect of developing other capabilities higher up the value chain, such as refining to produce copper cathodes, bars, and billets.

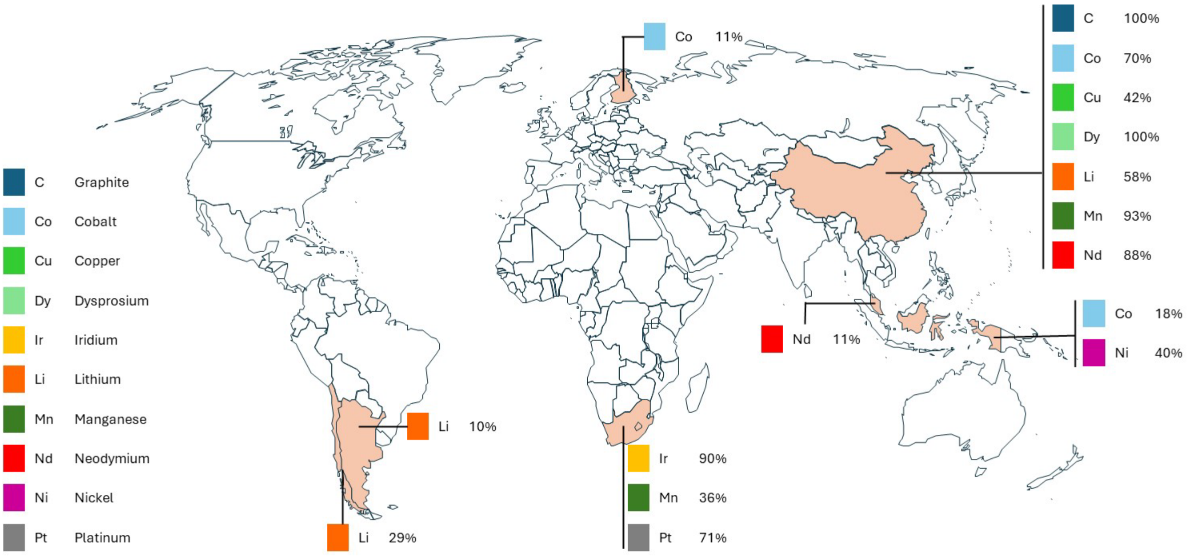
The absence of such domestic manufacturing capacity does not necessarily diminish the value of enhancing the copper mining value chain up to the refining stage, as the aforementioned refined outputs can be sold abroad at competitive prices, depending on their quality. The enabling conditions for producing refined metals for export include proximity to markets, transport, and market access infrastructure such as port facilities.

The same approach can be applied to nickel, using the semi-finished and finished products as highlighted in Figure 4. The nickel value chain can be developed to the processing stage where nickel class I (at least 98.8% nickel), class II (containing less than 98.8% nickel and typically comprising of nickel pig iron and ferronickel), and class III (aluminium alloys) outputs can be produced (Nickel28). These can then be used for the manufacturing of the semi-finished or finished products, either domestically or abroad, depending on the ability to meet the other policy and non-fiscal enablers.

### 3.1.5 Is Funding Readily Available and Accessible?

The concentration of critical mineral processing capacity in a few countries shows, among other things, that it is not typical for mining exploration and production investments to include—or be accompanied by—processing and refining capacity investments in the same location. While mineral processing occurs in many resource-rich jurisdictions, large-scale capabilities are concentrated in a few countries, and supply chains are typically mostly built around these larger-scale facilities. Figure 5 shows a handful of locations where significant processing and refining capacities reside for a small selection of 10 critical minerals.

**Figure 5. High concentration of large-scale critical mineral refining capacity in very few countries for selected minerals**




Source: IGF (2024), "Financial Benefit-Sharing Issues for Critical Minerals: Challenges and opportunities for producing countries," pp 17. Adapted from IRENA, 2023, "Geopolitics of the Energy Transition: Critical Materials," pp 40.[9]

In addition to—and commonly as a result of—the enablers discussed in this section, securing finance (including the necessary steps to ensure the project is bankable) is also an important factor to consider. Access to finance and credit can facilitate investment in mining value-addition projects, such as smelting facilities and refineries. These projects typically require substantial upfront investment in infrastructure, equipment, and technology, and can often take years to become operational and generate returns. These returns, often determined as net smelter returns or refining margins, tend to require high economies of scale to be profitable.

Some governments are getting directly involved in this regard—for example, through specialized intervention funds. The purpose of such funds is to provide capital that contributes to de-risking the investment in the processing or refining capacity for minerals identified as critical, either for industrial development or for their role in the energy and technology transition.

An example is Australia—despite being one of the world's biggest producers of raw battery minerals, it has a modest share of the global markets for processed minerals. The

[9] It is important to note that while there is mineral processing capacity in many resource-rich countries, there are also some countries with significant capability for smelting and refining minerals, such as copper—as is the case in DRC, Egypt, South Africa, and Zambia (see, for example, Bosse et al., 2025, pp 423).

government's Critical Minerals Strategy has key actions to develop their critical downstream and manufacturing capabilities that include (Australian Government, 2023):

- The use of the Northern Australia Infrastructure Facility (NAIF) to support the growth of the critical minerals sector, particularly downstream processing by requesting NAIF to earmark AUS 500 million to support projects.
- The establishment of the National Reconstruction Fund Corporation, which includes AUS 1 billion for value-add in resources and AUS 3 billion for renewables and low emissions technologies.

An approach not yet mainstreamed, particularly for resource-rich, developing countries, is to set aside such intervention funds using a proportion of revenues from traditional mining revenue sources (e.g., royalties or corporate income tax (CIT) from mining operations). Such an approach (including the Australian example of using intervention funds) would need to be justified on several grounds, which include: the opportunity cost of other uses for which these funds can be deployed, such as healthcare, education, and defence spending; and finding an objective means for determining which critical minerals warrant intervention. Also, such domestic funding may not be necessary if foreign investment can be attracted.

## 3.2 Tax Policy Enablers

This report argues that non-tax conditions are the primary enablers for mining value addition to succeed. Tax policy enablers are argued to be *secondary* conditions, insofar as resource-rich and revenue-dependent, developing countries are concerned. This is because the impact of the absence of these *primary* conditions cannot be mitigated using fiscal levers alone.

Several fiscal instruments have been applied to various degrees by countries to incentivize investment in in-country processing and refining of minerals. Some prominent examples include[10] production-based incentives, cost-based incentives, and profit-based incentives.

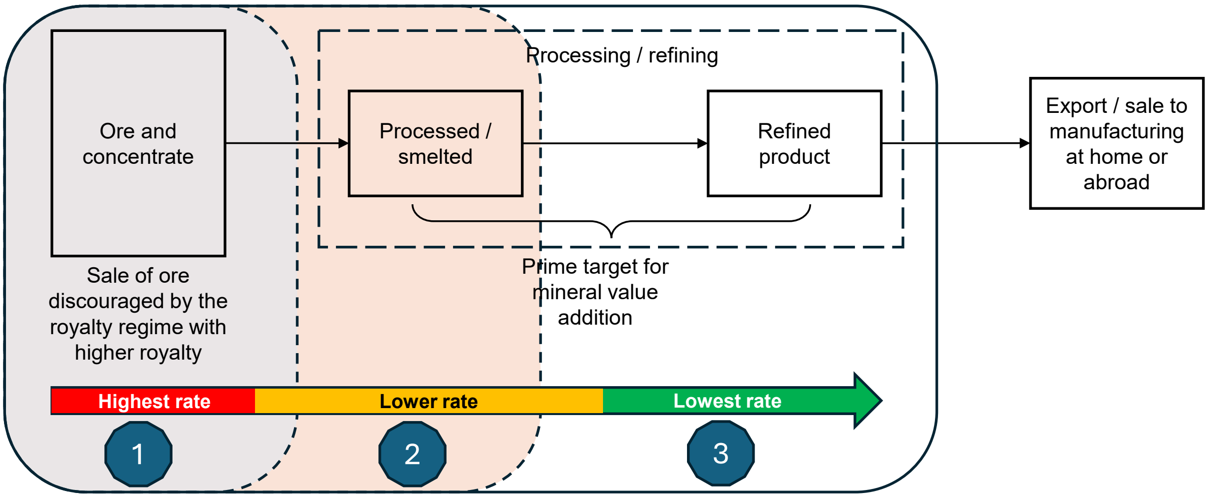
Other factors play an enabling role, ranging from the capacity of the tax administration to effectively implement the tax mandate, to the alignment of the tax system with international norms. These factors are not considered further in this report.

[10] IGF, in cooperation with the Organisation for Economic Co-operation and Development (OECD), published a comprehensive report on tax incentives in mining in 2018. It considers a range of tax incentives, including income tax holidays, withholding tax relief, cost-based incentives, export processing zones, import duty relief, royalty-based incentives, and stabilization of fiscal incentives. It also offers eight recommendations to help governments make informed decisions regarding policy choices. See Readhead, 2018.

### 3.2.1 Production-Based Incentives

Variable royalty rate adjustments connected to processing and production thresholds can be used by countries as a fiscal tool to incentivize mining value addition. The typical approach employed is to influence behaviour by imposing higher royalty rates on ores and concentrates and levying lower royalty rates on the (usually) more valuable processed and refined minerals and metals. This is illustrated in Figure 6.

**Figure 6. Illustration of a production-based mining value addition incentive**




Source: Authors.

Figure 6 shows three possible areas where the royalty can be imposed. What typically obtains is the imposition of royalties (either fixed or variable) in the upstream mining lifecycle—that is, the period that culminates in the production of the ores and concentrates, as indicated in group 1 in Figure 6. The strategy of royalty-based incentives to discourage producing ores and concentrates and encourage further processing and refining would then be to lower the royalty rate for stage 2 (processing/smelting) and reduce it even further for stage 3 (refining).

**Box 3. Examples of royalty-based mining incentives**

**Australia**

In South Australia, the royalty rate for mineral ores and concentrates is 5% and the rate for refined mineral products is 3.5% of the value of the minerals (Government of South Australia).

The royalty rates, as published by the government, are as follows:

- Refined mineral products – 3.5% of the value of the minerals
- Mineral ores and concentrates – 5.0% of the value of the minerals
- Industrial minerals – 3.5% of the value of the mineral
- Minerals mined for a prescribed purpose – 3.5% of the value of the minerals
- Extractive minerals – AUD 0.52 per tonne (as prescribed in the Mining Regulations)

In February 2024—in the wake of declining prices—the Western Australian government announced support for the nickel industry by offering royalty relief to become a global battery minerals processing hub. The royalty incentive consists of a 50% royalty rebate for local producers when the average nickel prices are lower than $20,000 per tonne within a quarter. The royalty incentive program started in March 2024 and is available for a period of 18 months, and repayable over the following 24 months.

**Mongolia**

Mongolia imposes the following royalty rates on copper (OECD, 2024):

- For copper ores and concentrates: between 11% and 30%, depending on different copper price bands
- For copper mattes, billets of refined copper, base alloys, and copper wire: between 1% and 5%, depending on different price bands
- For copper plates, sheets, and strip: between 1% and 5%, depending on different price bands

The significant difference in royalty rates is designed to discourage the export of copper ores and concentrates and incentivize the processing and refining of copper in-country.

**South Africa**

In South Africa, royalty rates vary based on whether a mineral is refined or not. The royalty rate on refined minerals ranges from 0.5% to 5%, compared to higher royalty rates for unrefined minerals, from 0.5% to 7%.

Paragraph 2 (i) of the Guide for Completion for Mineral and Petroleum Resources (South African Revenue Service, 2024) states:

> i) *The rates for the Mineral and Petroleum Resource Royalties are determined according to a formula stipulated in subsections (1) and (2) of section 4 of the Mineral and Petroleum Resources Royalties Act, 2008. The rates differentiate between the refined and unrefined conditions of the extracted resources, and the current range of rates are as follows:*
>
> *i. For refined mineral resources: a minimum of 0.5% to a maximum of 5%.*
> *ii. For unrefined mineral resources: a minimum of 0.5% to a maximum of 7%.*
>
> *The first and second schedules of the Mineral and Petroleum Resources Royalty Act, 2008 specify the minerals and refined and unrefined conditions respectively. For example, Cobalt is considered refined once processed into cobalt metal or cobalt sulphate, 99.5% refined; and the unrefined condition for copper is defined as between 20% to 30% Cu.*

Offering royalty discounts apply further down the value chain increases the chances for mining projects to be integrated up to the stage where the discount is offered. It is not typical—particularly for mining operations in resource-rich countries—to also include large-scale smelting and/or refining. However, it is possible for the latter stages to be ring-fenced with the extraction and production such that the investor could potentially benefit from the deferral of royalty or tax obligations if they invest in value addition activities further down the value chain.

From a financial benefit-sharing perspective and other than the primary conditions discussed, there are other considerations to bear in mind regarding the use of production-based incentives to encourage investment further down the value chain. First, is that such investment (e.g. refinery or smelter) may prove economically unviable. This could be because the capital costs are too high to achieve a positive net present value (NPV) and a rate of return is higher than the cost of capital; or because the ore and concentrate grades of the mineral are not of justifiable quality for such an investment; or the ore and concentrate volumes are not significant enough for the economies of scale such a capital-intensive project might require. Offering production-based incentives, such as the examples outlined in Box 3, means that the government is potentially trading revenues it would have received from stages 1 and 2 for a potentially unviable project, if the project gets built at all. Second, is the increased risk of base erosion and profit shifting (BEPS) along the value chain beyond stages 1 and 2. There are already significant transfer pricing risks at the exploration and production end of the value chain (stage 1 in Figure 6), such as undervaluing the mineral, overpricing services, overvaluing intra-group financing interest rates, etc.[11] For resource-rich countries—particularly developing countries with limited tax policy and administrative capacity—these risks could be magnified by the necessary integration that would come with linking the production-based incentives with a more integrated mining value chain.

### 3.2.2 Cost-Based Incentives

Cost-based incentives typically target the capital expenditure component of the project's cost profile; the aim being to reduce the burden on the taxpayer for the significant upfront capital expenditure on equipment, such as heavy machinery or processing plants. They include investment allowances, investment tax credits, accelerated depreciation, and the allowance to carry-forward losses (IGF, 2018).

Some countries have offered cost-based incentives, typically in the form of capital allowances for investors who demonstrate investment in in-country processing and refining of these minerals. They are typically first expressed as policy positions (such as

[11] For readers unfamiliar with the risks, features, tax implications, and mitigating strategies as they apply to mining operations, IGF and the OECD have done extensive work in this regard and produced several reports regarding a wide range of BEPS risks. See OECD and IGF Global Mining Tax Initiative for more information.

the Australian Critical Minerals Strategy 2023 – 2030) and then given legislative or regulatory force for implementation (such as the Creating Helpful Incentives to Produce Semiconductors Act, 2022 – CHIPS Act). Country examples are shown in Box 4.

**Box 4. Examples of cost-based incentives for critical minerals value addition**

**Australia**

In May 2024, the Australian government introduced a 10% production tax credit for companies that build processing facilities for critical minerals. This incentive would apply to nickel, lithium, vanadium, cobalt, graphite, and rare earths beneficiation (Australian Government, 2024).

The Future Made in Australia (Production Tax Credits and Other Measures) Act, 2025 (Government of Australia, 2025) amends the Income Tax Assessment Act, 1997, to add that:

> *Companies may be entitled to a refundable tax offset for expenditure incurred in carrying on processing activities at facilities in Australia that substantially transform feedstock containing critical minerals into purer or more refined forms of the critical minerals that are chemically distinct from the feedstock.*
>
> *This offset is designed to support the growth of these processing activities in Australia.*
>
> *One of the requirements for entitlement to the tax offset is for a company to hold a registration certificate for these processing activities and for the Australian facilities where the activities are to be carried on. The Industry Secretary will decide whether to issue the certificates. A registration can be in force for 10 income years during the period starting on 1 July 2027 and ending on 30 June 2040.*
>
> *The amount of the tax offset is 10% of the company's expenditure 9 on these processing activities.*

Processing activity is defined in the Act as an activity that "involves transforming a feedstock containing a critical mineral through extractive and metallurgical processing into a purer or more refined form of the critical mineral that is chemically distinct from the feedstock."

**United States**

Another example of cost-based incentives used for mining value addition is the U.S. Advanced Manufacturing Investment Credit, established by the CHIPS Act. It is available to manufacturers of semiconductors and semiconductor manufacturing equipment.

The Internal Revenue Service (IRS) states:

> *The tax credit is equal to 25% of the qualified investment for the taxable year with respect to an advanced manufacturing facility of an eligible taxpayer. An advanced manufacturing facility is a facility whose primary purpose is the manufacturing of semiconductors or semiconductor manufacturing equipment. Qualified investment means the basis of any qualified property placed in service by the taxpayer that is part of an advanced manufacturing facility.* (IRS)

Section 48D-1(b) states:

> *(b) Determination of credit. Subject to any applicable sections of the Code that may limit the credit determined under section 48D, the section 48D credit for any taxable year of an eligible taxpayer with respect to any advanced manufacturing facility is an amount equal to 25 percent of the taxpayer's qualified investment for the taxable year with respect to that advanced manufacturing facility. A section 48D credit is available only with respect to qualified property*

> *that a taxpayer places in service after December 31, 2022, and, for any qualified property the construction of which began prior to January 1, 2023, only to the extent of the basis of that property attributable to the construction, reconstruction, or erection of that property occurring after August 9, 2022. Under section 48D(e), no section 48D credit is allowed to a taxpayer for placing qualified property in service in any taxable year if the beginning of construction of that qualified property as determined under § 1.48D-5 begins after December 31, 2026 (the date specified in section 48D(e)).*

It is understood that this credit will apply to U.S. downstream solar, wind, battery industries, and clean energy technologies using critical minerals obtained from the most economical source including other countries besides the United States.

**Zambia**

Zambia provides a 50% capital allowance on the cost of supplies and plant equipment used exclusively for mineral processing. This incentive is designed to encourage investment in the mining and mineral processing sector by allowing companies to recover a portion of their capital expenditure through tax deductions. Whilst not clearly specified in the Income Tax Act, the Zambia Revenue Authority (ZRA) outlines this incentive in their Tax Incentives booklet which contains 10 specific incentives for mining:

"*9. Capital allowances at 50% of the cost of implements, plant or machinery used exclusively for mineral processing.*" (ZRA)

When properly designed, they can enable taxpayers to recoup their investments faster and defer their tax obligations to later stages of project life. While a useful fiscal tool, particularly as an incentivizing instrument in the manufacturing sector, cost-based incentives carry a risk of increasing pressure on tax administrators to ensure that capital expenditures have not been unduly inflated by the investor to maximize tax benefit. For example, this may manifest through related party transactions, and through exporting fully depreciated assets to claim further deductions in other mining jurisdictions.

### 3.2.3 Profit-Based Incentives

Profit-based incentives apply the use of such tools as income tax relief and withholding tax relief, focusing primarily on the ability of the investor to retain more of its realized income. For upstream mining operations, there are several risks in the application of such tools (see IGF, 2018, for more detailed discussion on the risks and recommendations). These risks include high grading to bring forward higher-grade mineral production before the expiry of a tax holiday period, and abusive transfer pricing practices. The introduction of minimum taxes on the global income of multinational enterprises (MNEs) by headquarter jurisdictions has further reduced the tax benefit of profit-based incentives to investors (see IISD (2023), IISD and ISLP (2023), and IISD (2024) for detailed discussion on the implications of the Global Minimum Tax on MNEs and the extractive industries).

**Box 5. Examples of tax holidays granted for mining processing and refining**

**Indonesia**

Indonesia applies a range of income tax holidays for numerous activities and industries which include mineral processing and refining. These are outlined in regulations 130/PMK.010/2020 and PMK 69 of October 2024 (Indonesian Ministry of Finance).

The regulation (130/PMK.010/2020) provides tax holidays and reductions for companies classified under "Pioneer Industries," which include:

- Upstream base metals industry: This encompasses both iron steel and non-steel sectors, with or without integrated derivatives.
- Oil and gas refining industry: Applicable to operations with or without integrated derivatives.
- Organic basic chemical industry: Covers industries sourcing from oil, natural gas, coal, or agricultural products, with or without integrated derivatives.
- Inorganic basic chemical industry: Includes industries with or without integrated derivatives.

To qualify for these incentives, companies must meet specific criteria, such as:

- having the status of an Indonesian legal entity
- making a new investment with a minimum value of IDR 100 billion (approximately USD 6.1 million)
- committing to start realizing the investment plan no later than one year after the issuance of the decision letter on the CIT reduction

The incentives offered under 130/PMK.010/2020, include:

- Tax holiday: For investments valued at a minimum of IDR 500 billion (USD 6.1 million), companies can receive a 100% reduction in CIT for a period ranging from 5 to 20 years, depending on the investment amount. After this period, a 50% tax reduction is granted for the next 2 years.
- Mini-tax holiday: For investments between IDR 100 billion (approximately USD 30.6 million) and IDR 500 billion (USD 30.6 million), companies are eligible for a 50% reduction in CIT for 5 to 20 years, followed by a 25% reduction for the subsequent 2 years.

This regulation was updated in October 2024 (PMK 69) to include a domestic minimum additional tax in line with the OECD's global minimum tax standards which ensures an effective tax rate of at least 15%. The tax reduction thresholds as defined in regulation 130/PMK.010/2020 would still remain, but PMK-69 emphasizes the need for proposals for CIT reductions to be submitted by December 31, 2025, to qualify for these benefits.

Also, in February 2024, the Government of Indonesia announced new tax incentives to encourage the production and sale of EVs. The new rules eliminate luxury tax on EVs for the 2024 fiscal year and import tax up to the end of 2025. In addition, the tax incentives lower value-added tax (VAT) from 11% to 1% for EV buyers until the end of 2024 (Strangio, 2024).

**Democratic Republic of the Congo** (DRC, Ministry of Planning, National Investment Promotion Agency)

Companies investing in facilities (e.g., refineries or battery precursor plants) can access significant incentives under the Investment Code (Law No. 004/2002), managed by the National Agency for the Promotion of Investment. They are eligible for exemptions from customs duties and taxes on equipment imports, such as machinery needed for cobalt processing, for a period of 3 to 5 years, depending on the economic region. This provision aims to reduce upfront costs for investors and encourage local processing, although a 2% administrative fee and VAT must be paid initially and later reimbursed. The duration of these exemptions varies by region. In Economic Region A (Kinshasa), the exemption lasts 3 years, perhaps reflecting comparatively more advanced infrastructure. Economic Region B (including mining hubs such as Lubumbashi and Kolwezi) offers 4 years, while Economic Region C (covering the less developed areas) provides 5 years. These longer tax holidays in underdeveloped regions are outlined in Article 15 of the Code.

**Zambia**

The standard CIT rate is 30% but is 15% for manufactured goods made from copper cathodes to promote value addition and the growth of local industries.[12] Depreciation within the CIT system is a non-allowable deduction. However, the taxpayer can claim "capital allowances" on fixed assets. Companies operating in the electricity generation, mineral processing, manufacturing, and tourism, can claim a wear and tear allowance of 50% (Kalikeka & Nsenduluka, 2023).

Other tax policy enablers are summarized in Table 2.

**Table 2. Summary of mining tax incentives and behavioural responses**

| Tax incentive | Behavioural response | Potential impact on government revenues |
|---|---|---|
| **Taxes on income** | | |
| Income tax holidays | Investors may increase income during the tax-free period by speeding up production and shifting profits offshore | Significant revenue loss due to untaxed profits during the holiday period; reduced future revenue from depleted ore reserves |
| Withholding tax relief | Investors may increase interest expenses and charges for administrative services paid to foreign affiliates in low-tax jurisdictions | Reduced revenue from profit shifting via inflated related-party payments, eroding the tax base |
| Cost-based incentives (e.g., accelerated depreciation, investment allowances, tax credits, longer loss carry-forward) | Investors may inflate capital expenditure, engage in "gold plating," deduct costs twice, or export depreciated assets to claim further deductions elsewhere | Revenue loss from overstated deductions; potential double deductions increase forgone revenue; cycling assets may further erode tax base |
| **Taxes on imports and exports** | | |
| Export processing zones (EPZs) | Investors may reduce taxable income by selling mineral production at below-market | Significant revenue loss from profit shifting to EPZs; additional |

12 Tax specialists have warned that that the differentiated tax rates could produce distortions, avoidance behaviours, and revenue leakages within the tax collection process, as the lower CIT rate could be perceived as a permanent tax holiday, eroding the overall CIT system.

| **Tax incentive** | **Behavioural response** | **Potential impact on government revenues** |
|---|---|---|
| | rates to related-party smelters in EPZs with lower tax rates | costs from EPZ infrastructure and subsidies |
| Import duty relief | Investors may inflate costs of machinery and equipment purchased from related parties to increase deductible expenses | Reduced revenue from overstated deductions; loss of import duty revenue, potentially encouraging over-invoicing |
| **Taxes on production** | | |
| Royalty-based incentives (e.g., royalty holidays, sliding-scale royalties) | Investors may shift revenues into tax-free periods by speeding up production or adopt tax planning to avoid higher royalty brackets (e.g., under-pricing sales) | Revenue loss during royalty holidays; under-pricing in sliding-scale royalties reduces royalty income; increased administrative complexity |
| **Other incentives** | | |
| Stabilization of fiscal incentives | No specific behavioural response, but locks in other incentives' adverse impacts, preventing corrections to revenue losses | Magnified revenue losses from locked-in incentives; restricted ability to adapt to commodity price changes or implement anti-abuse measures, e.g., BEPS reforms |

Source: Adapted from IGF-OECD, 2018.

The main conclusions from previous work on tax incentives in mining (as summarized in Table 2), are that:

- Governments should use financial modelling to assess the costs and investment impacts of tax incentives, accounting for behavioural responses and the combined revenue effects of multiple incentives.
- Tax incentives that create parallel domestic fiscal regimes should be avoided to prevent abusive transfer pricing, particularly when applied unevenly across the mining value chain.
- Harmful incentives such as tax holidays—which encourage profit shifting and are ill-suited for mining's long-term, location-specific investments—should be replaced with efficient alternatives such as accelerated depreciation or investment allowances.
- Eligible mining expenditures for cost-based incentives must be clearly defined, including rules for carrying forward expenses, to enhance project profitability.
- Incentives reducing taxes on outbound payments require caution to mitigate profit shifting through inflated related-party transactions. Similarly, incentives creating sharp rate changes, such as sliding-scale royalties or tax holidays, should be avoided to prevent underpricing or deferred sales.

- Regular annual reviews and sunset clauses are essential to limit the costs of poorly designed incentive programs.
- Governments should invest in building expertise in mining tax policy and administration to support informed decision-making, particularly in commercial and financial modelling.

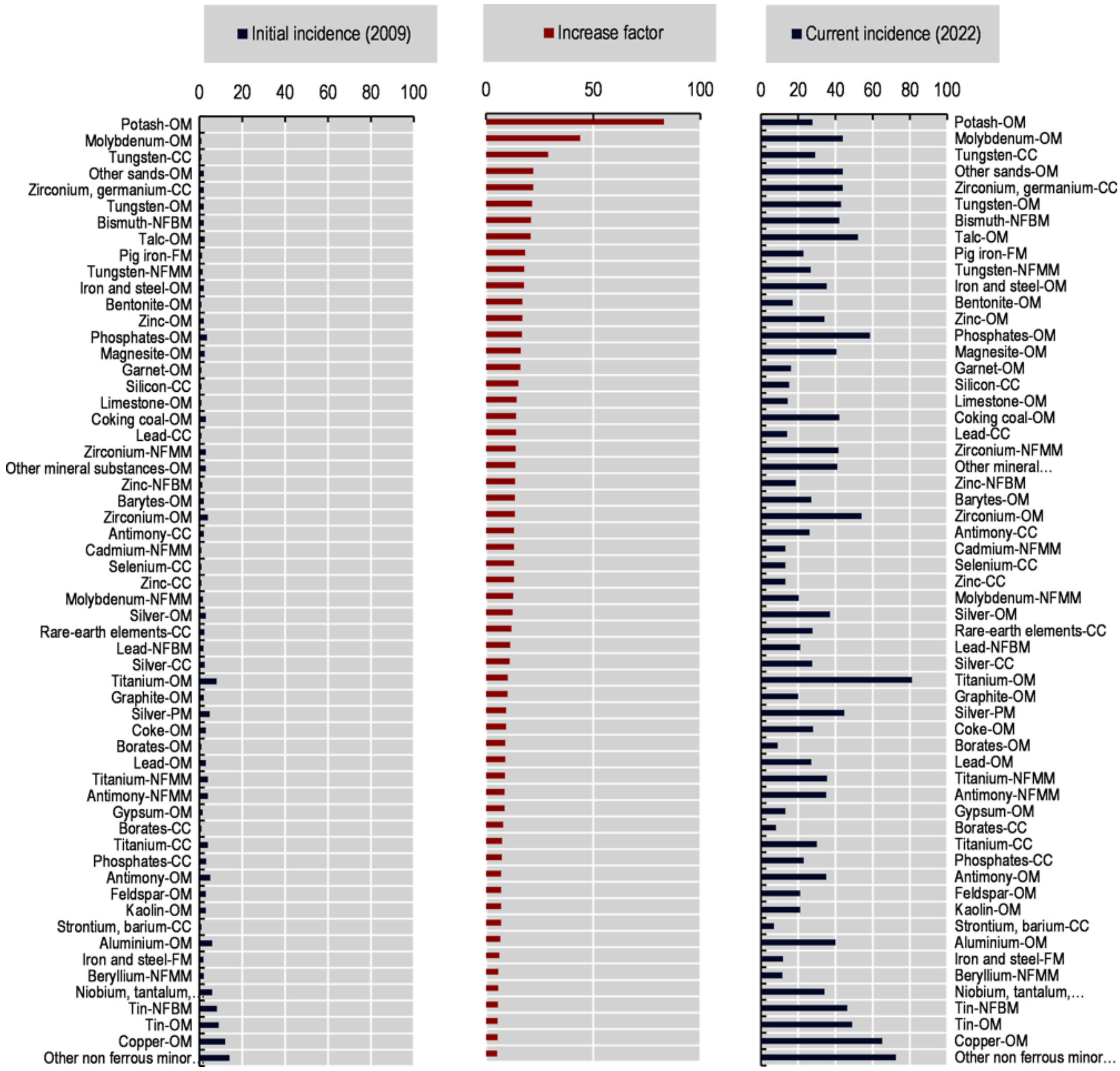
## 3.2.4 Other Policy Enablers

### 3.2.4.1 Export Restrictions

An often-used policy to incentivize mining value addition is the restriction of exports. This is done through several strategies including outright bans on exporting the mineral ore and/or concentrate or other metallurgical forms of the commodity, or the use of export taxes to achieve the same effect. It has been observed that restrictions on the export of critical minerals have increased more than five-fold over the last decade, such that roughly 10% of the global value of critical raw material exports face at least one export restriction strategy. The top six countries that implemented export restrictions between 2009 and 2020 were China, India, Vietnam, Russia, Argentina, and Kazakhstan for minerals essential for the energy transition (Khan, 2023).

The incidence of export restrictions on industrial raw materials increased five-fold between 2009 and 2022 (OECD, 2024). The top minerals that were subject to export restrictions in this period included copper, iron, molybdenum, titanium, and zirconium, representing nearly half of total export restrictions for that period (Perry et al., 2024). Figure 7 illustrates the extent of use of various forms of export restrictions on specific minerals.

**Figure 7. Sharp increase in export restrictions**




Source: OECD, (2024) "Inventory of Export Restrictions on Industrial Raw Materials 2024."

Some of the critical minerals that were subject to significant increases in the use of export restrictions include bismuth, molybdenum, tungsten and rare earth elements. Copper, graphite, and titanium were also subject to increases in export restrictions, as Figure 7 highlights.

The nature of the export restrictions during this period comprised of export prohibition (42% of the observed occurrences), export taxes (29%), more prohibitive licensing requirements (25%), and other measures including export quotas (4%).

The essence of such export restrictions—in addition to being often used as a political tool in trade disputes—is to incentivize more domestic processing and refining. The impact of this approach has been mixed. For example, in Zimbabwe, there was an export ban on chromium ore in 2011, the expectation being that the more valuable ferrochromium would be produced domestically as a result. The outcome was a decrease in the price of Zimbabwean chromium ore, a modest increase in chromium ore sold to domestic ferrochromium producers, and a significant decrease in overall chromium production due to the absence of export destinations (Perry et al., 2024). Zimbabwe currently applies an export restriction on unbeneficiated mineral ores—lithium in particular—under the Base Minerals Export Control (Unbeneficiated Base Mineral Ores) (Amendment) Order, 2023. The specific provisions are outlined in Box 6.

**Box 6. Zimbabwe's export restriction provisions for lithium**

*"Schedule (Section 3 (2)) – Pre-export Mining, Storage, Transportation, Sale and Processing of Lithium Bearing Ores*

*1.No individual or entity having a right to mine for lithium bearing ores under the Mines and Minerals Act [Chapter 21:05] (in this Schedule referred to as a "lithium miner") may –*

*(a) mine such ores directly or indirectly for export unless it–*

*(i) processes the lithium or lithium bearing ores at an Approved Processing Plant (APP) owned or controlled by it; or*

*(ii) sells the lithium or lithium bearing ores to any individual or entity owning or controlling an APP for processing at that APP;*

*(b) store such ores except at –*

*(i) the mining location where the ores are mined; or*

*(ii) at the site of an APP;*

*(c) transport such ores –*

*(i) except under a lithium movement permit issued under paragraph 3(b); or*

*(ii) under a lithium movement permit, except to an APP*

*2. No individual or entity may buy lithium bearing ores form a lithium miner or any other person–*

*(a) except under a Lithium Ore Purchase License (LOPL) issued under paragraph 3(c); or*

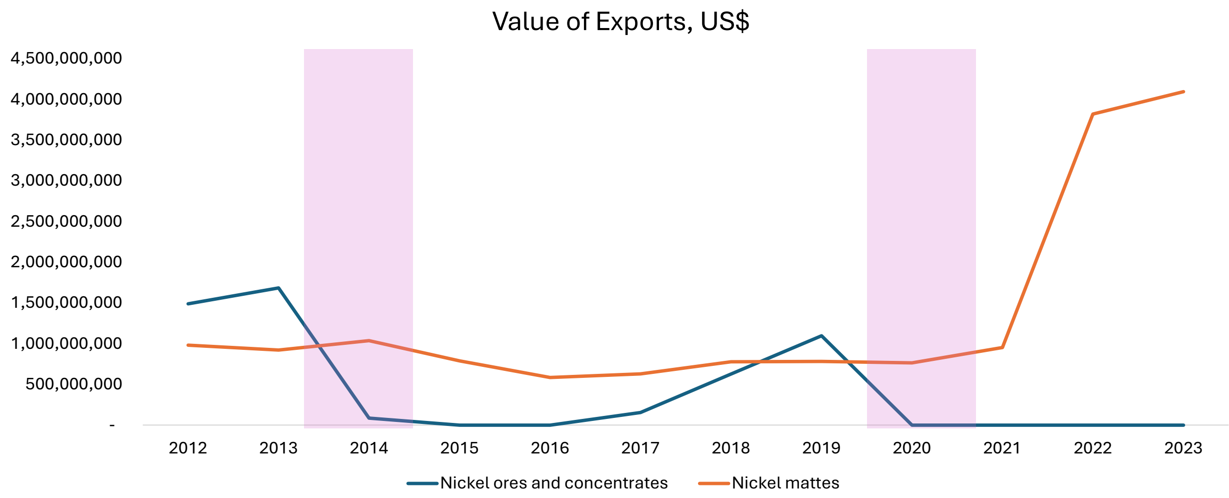
*(b) obtain a Lithium Ore Purchase License (LOPL) unless he, she or it owns or controls an APP."*

The Government of Namibia banned the export of unprocessed lithium and other critical minerals to boost revenues from the increasing demand for clean energy products, such as batteries for EVs (Reuters, 2023). Indonesia has export restrictions on nickel. Nickel ore cannot be exported from Indonesia unless processed. The objective of this policy is to "strengthen domestic processing facilities, bring back the added value of nickel's supply chain to the Indonesian economy and spur job creation and economic development in Indonesia" (IEA, 2024).

Chilean law considers lithium a strategic resource that can only be developed by the state or by private companies in association with the government. Chile also imposes limits on lithium brine extraction, and companies are required to sell 25% of their output locally at below-market prices, to producers that commit to developing the lithium value chain. As of the time of publication, the 25% percent requirement has not yet been applied due to an absence of offers to produce lithium-related products in the country (Bastida et al., 2023).

In Indonesia, the export of nickel ores and concentrates was banned in 2014, with some exceptions, and then more progressively in 2020 (Guberman et al., 2024). The objective was to increase the processing of ores and concentrates into more valuable nickel products such as nickel matte. The outcome was an initial decline of existing production of nickel mattes, which had already been in production before the ban, between 2015 and 2020. However, following the reimplementation of the ban in 2020, after a previous lapse in enforcement, production of nickel matte significantly increased, as is shown in Figure 8.

**Figure 8. Nickel exports from Indonesia**




Source: Adapted from the UN Comtrade Database, several years.

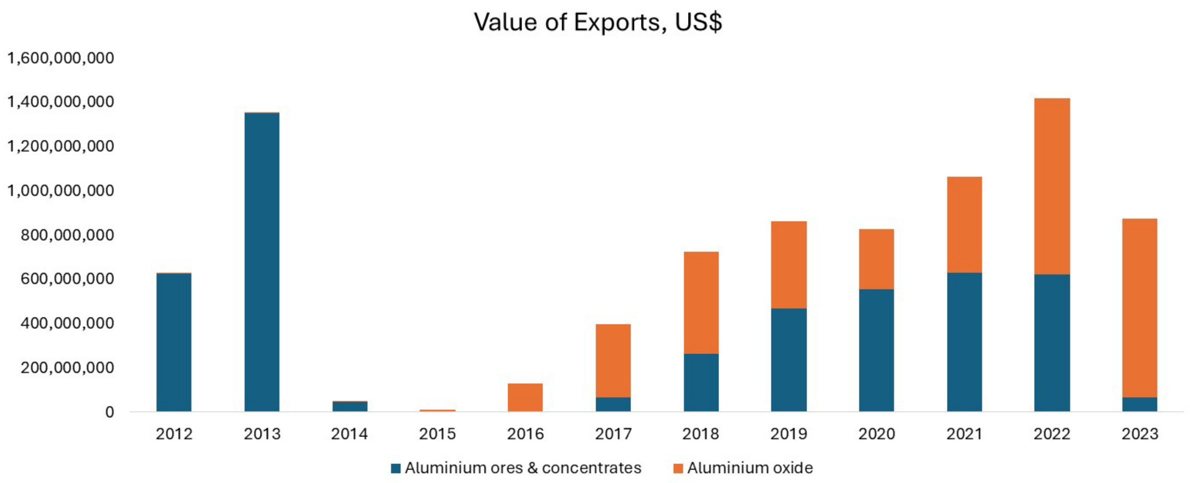
While the observed export values suggest that the export ban appears to have worked in Indonesia, it was also found that some of the nickel ores and concentrates were smuggled to China (Guberman et al., ibid). It is also useful to note that Indonesia's infrastructure and supply base is significantly larger and more mature than Zimbabwe's and has likely played a role in enabling this export ban strategy in the former and possibly hindering the strategy in the latter.[13] For example, in the 10-year period from 2013 to 2022, Indonesia

[13] It is also useful to note that a key contributing factor was the fact that Chinese smelters had configured their facilities to suit Indonesia's high-grade nickel ore and would have found it costly to reconfigure. See NRGI (2021).

added 16,700 MW of electricity generation capacity. This is 60 times the 280 MW Zimbabwe added over the same period.[14] A key cost component of the mining processing and refining stages of the value chain is grid-connected electricity. As discussed in section 2.2.2, this is a primary condition that must be met.

Restrictions on bauxite in Indonesia have had mixed results, as Figure 9 shows. It does however highlight an upward trend in processed outputs over the 10-year period between 2015 and 2023. Following the enforcement of the ban on raw mineral exports in 2014, there was a 95% drop in bauxite production from 55.7 million tonnes in 2013 to 2.6 million tonnes in 2014 (Baskaran, 2024).

**Figure 9. Aluminium exports from Indonesia**




Source: Adapted from the UN Comtrade Database, several years.

This was followed by a shift to other sources of bauxite, demonstrated most clearly by the increase in Guinean bauxite output, resulting in Guinea becoming the largest producer of bauxite after Australia, in 2023 (Baskaran, ibid). The Indonesian government attempted to relax the restrictions in 2017 and, as Figure 9 shows, there was an increase in aluminium oxide exports, along with ores and concentrates.

This report argues that past copper-related export bans implemented in Zambia were contributing factors that led to the decrease in the production of processed and raw minerals, rather than boosting local value addition. In Zambia, such measures proved to be foreign investment deterrents, as they negatively impacted exploration efforts and mineral plant processing capacity, which incentivized companies to look for substitute markets (IMF, 2024).

[14] Calculated using data available from https://countryeconomy.com/energy-and-environment/electricity-generation/zimbabwe, and https://countryeconomy.com/energy-and-environment/electricity-generation/indonesia.

In recognition of the challenges inherent in the export restriction strategy, the Zambian government has initiated a strategic shift. The primary objective is to enhance the domestic value addition of copper prior to export. This involves incentivizing foreign investment in processing facilities and forging partnerships with regional stakeholders to cultivate a robust copper value chain within the Southern African Development Community (Mumba, 2024).

Strategies to achieve this include the scaling up of trade missions to expose exporters to international markets, product quality enhancements, encouraging partnerships and joint ventures, enhancing identification of new export products, and developing export readiness of companies.

**Box 7. Example of export taxes on selected minerals**

**Zimbabwe**

For unbenefited lithium: export tax of 5% of the gross fair market value (Government of Zimbabwe, 2025, Section 12B of the VAT Act).

#### 3.2.4.2 Special Economic Zones

The use of special economic zones (SEZ)—a delimited area within a country where the rules for conducting business are different from the rest of the country, if the same business were to be conducted (World Bank, 2017)—for mining value addition promotion is not uncommon. The typical features of fiscal incentives provided in SEZs include, but are not limited to, customs duty relief and tax incentives such as tax holidays, tax exemptions, lower tax rates, income tax credits, etc. (IISD, 2024). The broad aim of these zones is to attract investment to targeted sectors, therefore, potentially shifting economies from raw material exports to higher-value processed goods. They encourage the development of downstream industries such as mineral processing and manufacturing. Governments often use them to leverage natural resource wealth and integrate into global value chains, while retaining economic benefits locally.

**Box 8. Special economic zones**

**Indonesia**

The Morowali Industrial Park (IMIP) in Central Sulawesi is an SEZ focused on nickel processing and refining. Established in 2013 as a collaboration between Indonesian and Chinese investors, this SEZ hosts smelters and refineries that convert raw nickel ore into high-value products like nickel pig iron and stainless steel, as well as nickel sulphate for EV batteries (Nickel Industries).

One of the primary incentives is tax holidays and reductions. Companies operating within IMIP benefit from significant tax exemptions, including CIT holidays of up to 20 years, depending on the investment size and sector, as part of Indonesia's SEZ incentives under Law No. 39 of 2009 and subsequent regulations such as Government Regulation No. 96 of 2021. For example, investments in metal processing, such as nickel smelting and refining, qualify for these extended tax breaks to encourage downstream industries. Additionally, there are reductions or exemptions on VAT and luxury goods tax for equipment and materials imported into the zone, lowering initial setup costs for facilities such as smelters and refineries.

Another critical incentive is customs and import duty exemptions. Firms in IMIP are exempt from import duties on machinery, raw materials, and capital goods needed for production, provided these are not available domestically.

**DRC and Zambia transboundary SEZ**

Another example is the collaboration between the DRC and Zambia to develop an EV battery value chain through a transboundary SEZ. The SEZ focuses on converting (mainly) cobalt to produce battery precursors, batteries, and eventually supporting an ecosystem for the production of EVs. This partnership seeks to transform the region into a hub for green energy technologies, creating jobs and strengthening regional economic integration (UNECA, 2022).

# 4. Making the Policy Choice: Practical considerations

This section examines policy choices countries can adopt to increase in-country value across the mining value chain, focusing on fiscal tools, their trade-offs, and contextual factors influencing the ultimate outcome of domestic mining value enhancement.

Historically, countries have oscillated between protectionist measures (e.g., export restrictions) and market-friendly incentives (e.g., tax credits). Figure 7 in Section 3.2.4.1 showed a sharp rise in export restrictions from 2009 to 2022, reflecting a preference for coercive policies to force domestic processing. Yet, as seen in Indonesia's nickel and bauxite export restrictions, outcomes can vary widely based on enabling conditions like infrastructure, market access and market power.

A one-size-fits-all approach is inadequate; policy choices must be adapted to the country's position along the mining value chain, its ability to ensure the primary policy enablers, and a clearly articulated critical minerals strategy.

Table 3 summarizes the tax policy choices (based on the tax policy enabler categories identified in section 3.2) in the context of their potential applicability across the mining value chain, potential benefits, and trade-offs.

### Table 3. Tax policy choice options across the mining value chain

| Mining value addition policy/incentive | More appropriate for… | | | | | Potential benefit | Possible trade-offs |
|---|---|---|---|---|---|---|---|
| | Exploration stage | Production stage | Processing stage | Refining stage | Manufacturing | | |
| Production-based policy choice | | ✓ | ✓ | | | Encourages investment due to benefits from reduced tax burden (through lower royalty rates for processing/refining)<br>Could lead to higher long-term tax revenue from refined minerals and supporting industries | Lower upstream revenues due to lower royalty rates to encourage processing and refining might not be matched or surpassed by gains in higher value metals or the employment benefits from added refining capacity<br>Complexity in implementation and monitoring? |
| Cost-based tax policy choice | | | | ✓ | ✓ | Incentive to invest due to benefits from incidence of tax burden (e.g., faster return on investment, improved cash flow, risk mitigation in volatile markets particularly during periods of low revenue)<br>Benefits linked to forward linkages e.g., increased industrial output | Higher administrative complexity in tracking costs (e.g., accelerated depreciation)<br>Potential reduction in short-term tax revenue due to deferred tax obligations<br>Tax avoidance risks linked to cost inflation |
| Profit-based tax policy choice | | | | ✓ | ✓ | Incentive to invest due to benefits from reduced tax burden (early profit retention, potential for reinvesting retained profits, increasing project viability) | If integrated with exploration and production (upstream) project, trade-off in income tax revenue from upstream operations, particularly in periods of high prices<br>High-grading mineral extraction to extract higher-quality metals before the expiration of the tax holiday period<br>Higher risk of abusive transfer pricing practices |

| Mining value addition policy/incentive | More appropriate for… | | | | | Potential benefit | Possible trade-offs |
|---|---|---|---|---|---|---|---|
| | **Exploration stage** | **Production stage** | **Processing stage** | **Refining stage** | **Manufacturing** | | |
| Export restrictions[15] | | ✓ | | | | Higher value metals from processing or refining<br>Increased tax revenue from higher value minerals<br>Benefits linked to forward linkages e.g., employment, increased industrial output | Could deter investment in exploration and production e.g., bauxite in Indonesia<br>Could result in reduced export volumes and foreign exchange earnings |

Source: Authors.

Policy-makers will have to determine the suitability of their tax policy choices in the context of their unique country circumstances, which would hopefully have been clearly articulated in their critical minerals strategies, as well as their industrial policies.

There are trade-offs, for example, in choosing a production-based approach to incentivize mining value addition. An implication of taking this approach is that the potential revenues from the exploration and production stages are—by virtue of lower royalty rates, as is the case in the Australian, Mongolian, and South African examples in section 3.2.1—sacrificed for potentially higher revenues in higher-value products further down the value chain. On the upside, this approach could incentivize investment in smelters and refineries, such that the higher-value products not only yield more tax revenue for the state but also create multiplier effects beyond the narrow domestic revenue concerns typically addressed by the ministry of mines and the dedicated units within the ministry of finance and revenue authorities overseeing the mining sector. On the downside, this approach risks incentivizing projects that might never be commercially viable on their own, therefore costing the government revenues that it would otherwise have made from the upstream operations stage.

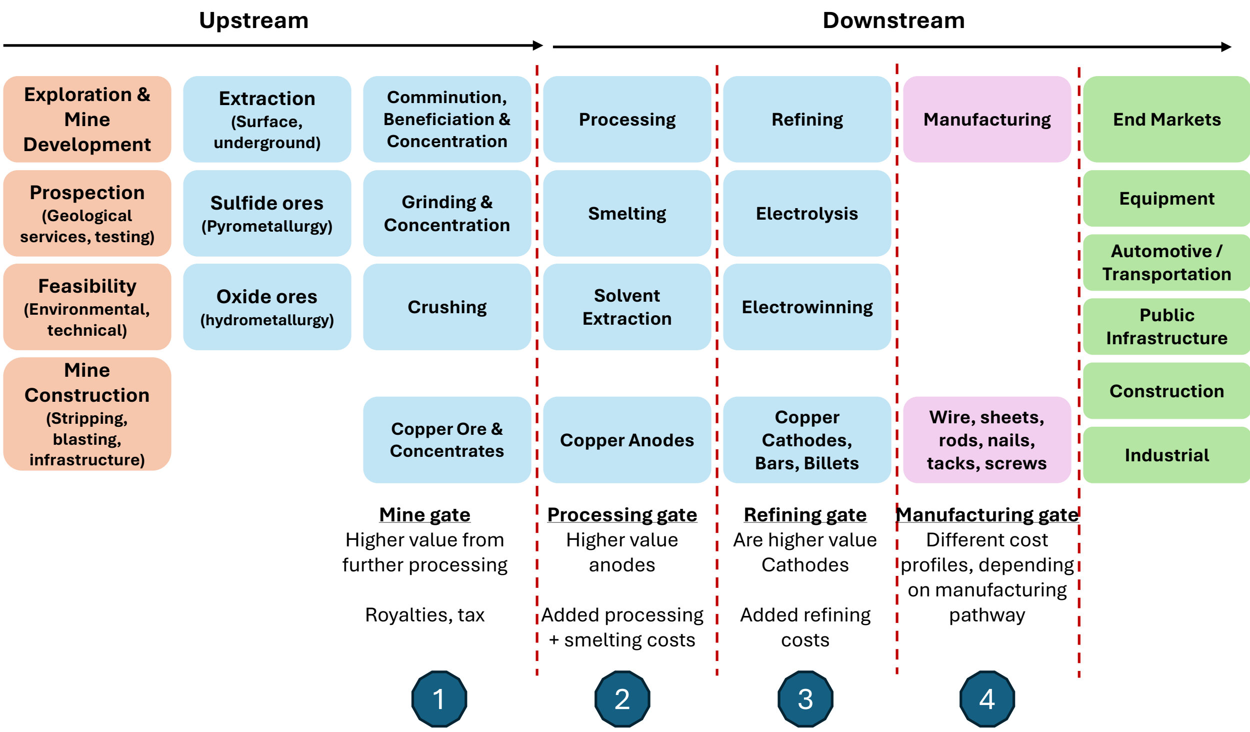
[15] Some governments might also extend the export restrictions to the processing and refining stages to incentivize downstream value addition.

## 4.1 Assessing the Conditions for the Policy Choice

Assuming that the primary enablers, as highlighted in section 3.1, are (or can be) met, the secondary enablers would then serve as strong complementary tools for incentivizing value addition beyond the mine gate. An important policy consideration is the trade-off between the timing and value of revenues that may accrue to the government at each stage of the value chain.

Figure 10 illustrates these potential trade-offs using the copper mining value chain.

### Figure 10. Sequencing and value of revenues in the copper mining value chain




Source: Adapted from Bamber & Fernandez-Stark (2021), "Innovation and competitiveness in the copper mining global value chain: developing local suppliers in Peru," Inter-American Development Bank, Discussion Paper No. 855.

As is shown in Figure 10, the main sources of value occur in four stages, namely:

- at the mine gate, from the sale of copper ore and concentrates (stage 1),
- after some processing, typically involving the use of a smelter, from the sale of blister copper made as anodes (stage 2),
- after a refining process, from the sale of copper cathodes (stage 3), and
- through various manufacturing processes, resulting in the making and sale of final products such as wires, sheets, rods, and nails (stage 4).

At stage 1, the full upstream lifecycle of exploration, development, and production of copper is reached, the copper ore is ground, and the copper concentration increased. This enhances the value of the copper that is sold. Copper is a commonly traded commodity and has readily available prices for concentrates in various markets.[16] Typically, the revenue generated from the sale of the ores and/or concentrates forms the basis on which the fiscal terms are determined. A royalty is charged on the revenues and—subject to the costs incurred and the treatment of such costs for tax purposes—a tax is typically imposed on the profits once these costs are recovered. Countries like Argentina and Chile can be considered to operate mostly at this stage, i.e., the bulk of the copper mining activity conducted in these countries typically results in the production of copper ore and concentrate for export and/or sale.

At stage 2, the produced ores and concentrates undergo further processing, typically involving a smelting process and extraction of impurities in order to increase quality. The product of this process commands a higher value than the concentrates from stage 1 but also incurs a higher cost through the introduction of a smelter and its attendant capital and operating costs. Zambia is an example of a country with facilities that operate at this stage.

At stage 3, copper cathodes are produced from a refining process, resulting in higher value products for export and/or sale. Countries like Australia and Indonesia have copper mining operations operating at large scale that reach this stage of the value chain. Zambia also exports copper cathodes. The cost profile at this stage includes the cost of refining and other processes such as electrolysis and electrowinning.

At stage 4, the copper cathodes serve as input material for different manufacturing processes, ranging from the manufacturing of copper wires to tacks and screws. These manufactured goods get used in other manufacturing or industrial processes and sectors that include equipment, transportation, public infrastructure, and construction. Moreover, many supply chains are both supplied by and feed into manufacturing processes at this stage, linking them to other sectors. These processes typically do not have the features that justify the imposition of mining royalties and other taxes that are typical for the extractive sector (mining royalties in particular). Any tax enablers limited to the extractive sector would therefore focus on the first three stages.

A policy choice would then have to be made to determine which tax instruments could—in combination with the primary enablers—incentivize investment to expand the value addition process beyond the mine gate for the ores and concentrates. This policy choice would almost certainly mean foregoing some upstream revenue with the expectation that such loss in revenue will be offset by gains from higher-value products.

[16] See IGF-OECD (2023) for a practical guide to determining the price of minerals, where examples are provided for minerals with readily available prices, such as copper (p. 26).

To illustrate the kinds of policy choices available, a simplified and generalized hypothetical table is shown below (Table 4) that constructs a revenue and profit profile of a mining project at different stages of the value chain, similar to the copper illustration above (i.e., mined ore/concentrate, processed, and refined stages).

**Table 4. Mining revenue and profit illustration**[17]

| | **Stage 1** | **Stage 2** | **Stage 3** |
|---|---|---|---|
| | **Concentrate** | **Processed** | **Refined** |
| Mineral price (USD per metric ton) | 6,000 | 7,500 | 9,000 |
| Volumes produced (metric tons)[18] | 10,000 | 10,000 | 10,000 |
| Total cost (USD per metric ton) | 3,500 | 4,500 | 5,500 |
| Total cost (USD – volumes produced X total cost) | 35,000,000 | 45,000,000 | 55,000,000 |
| Gross revenue (USD – price X volumes produced) | 60,000,000 | 75,000,000 | 90,000,000 |
| Royalty rate (percentage) | 5% | 5% | 5% |
| Royalty (USD – royalty rate X gross revenue) | 3,000,000 | 3,750,000 | 4,500,000 |
| | | | |
| Net revenue (gross revenue *less* royalty) | 57,000,000 | 71,250,000 | 85,500,000 |
| | | | |
| Gross profit (net revenue *less* total cost) | 22,000,000 | 26,250,000 | 30,500,000 |
| | | | |
| Income tax rate (percentage) | 25% | 25% | 25% |
| Income tax amount (income tax rate X gross profit) | 5,500,000 | 6,562,500 | 7,625,000 |
| | | | |
| Aggregate profit (gross profit *less* income tax) | 16,500,000 | 19,687,500 | 22,875,000 |
| | | | |
| Financial benefit to government (royalty + income tax) | 8,500,000 | 10,312,500 | 12,125,000 |

[17] The prices, volumes, costs, and royalties used are for illustrative purposes only, and do not reflect current prices or scales. They are used in this exercise to demonstrate the different values in each stage of the value chain. The illustration also assumed stages 2 and 3 to be commercially viable. It is also important to note that the royalty is typically charged on the value of the mineral extracted and not on the final product. However, some jurisdictions encourage or mandate downstream processing within the country and may tie royalties to the value of the processed product to incentivize value addition, such as through offering lower rates for in-country processing. Examples have been shown in Box 3 at section 3.2 of this report.

[18] It is important to note that the volumes are only constant if referring to the copper contained in these products. Otherwise, the total weight of concentrate is typically higher than the weight of the high purity copper cathode.

This illustration focuses on two areas where direct extractive sector-related policy choices can make an impact, namely the royalty rate and the total costs. The income tax rate is excluded from the spectrum of policy choices because it is assumed that this rate is generally applicable across all sectors beyond mining.[19]

The government applying these fiscal instruments can directly change the royalty rate and can influence the way in which the costs can be recovered, through cost-based incentives such as accelerated depreciation for the copper smelting or refining plant, or the immediate expensing of capital costs incurred for these plants.

To this end, and in keeping with the examples of enablers considered in section 3, several policy choices can be made:

- Production-based choices, which focus on lowering the royalty rates to stimulate investment in smelting and refining.
- Cost-based choices, which include capital allowances such as accelerated depreciation for smelting and refining equipment.
- Profit-based choices, which include tax credits on CIT and withholding taxes.
- Prohibitive choices, which include export bans or limitations on volumes exported.

**Production-Based Choice**

The royalty rate used in Table 4 is arbitrarily lowered to 3% if the mineral is smelted in-country, and 2% if further refined. Assuming investors process the copper and take advantage of the lower royalty rate of 3%, and that all the ores and concentrates are used for this purpose, the government will forego the USD 8.5 million in financial benefits that it could have earned from exporting the ores, in exchange for USD 9.2 million from incentivizing the processing of the mineral. If the mineral is refined and the 2% royalty is applied, the financial benefit to the government is USD 10.1 million, assuming there are no tax avoidance risks realised. This is illustrated in Table 5.

[19] IGF, in cooperation with the OECD, published a comprehensive report on tax incentives in mining in 2018. It considers a range of tax incentives including income tax holidays, withholding tax relief, cost-based incentives, export processing zones, import duty relief, royalty-based incentives, and stabilization of fiscal incentives. It also offers eight recommendations to help governments make informed decisions regarding policy choices. See Readhead, 2018.

**Table 5. Mining revenue and profit illustration: Varied royalty scenario**

| | **Stage 1** | **Stage 2** | **Stage 3** |
|---|---|---|---|
| | **Concentrate** | **Processed** | **Refined** |
| Mineral price (USD per metric ton) | 6,000 | 7,500 | 9,000 |
| Volumes produced (metric tons) | 10,000 | 10,000 | 10,000 |
| Total cost (USD per metric ton) | 3,500 | 4,500 | 5,500 |
| Total cost (USD – volumes produced X total cost) | 35,000,000 | 45,000,000 | 55,000,000 |
| Gross revenue (USD – price X volumes produced) | 60,000,000 | 75,000,000 | 90,000,000 |
| Royalty rate (percentage) | 5% | 3% | 2% |
| Royalty (USD – royalty rate X gross revenue) | 3,000,000 | 2,250,000 | 1,800,000 |
| | | | |
| Net revenue (gross revenue *less* royalty) | 57,000,000 | 72,750,000 | 88,200,000 |
| | | | |
| Gross profit (net revenue *less* total cost) | 22,000,000 | 27,750,000 | 33,200,000 |
| | | | |
| Income tax rate (percentage) | 25% | 25% | 25% |
| Income tax amount (income tax rate X gross profit) | 5,500,000 | 6,937,500 | 8,300,000 |
| | | | |
| Aggregate profit (gross profit *less* income tax) | 16,500,000 | 20,812,500 | 24,900,000 |
| | | | |
| Financial benefit to government (royalty + income tax) | 8,500,000 | 9,187,500 | 10,100,000 |

In the above scenario, lowering the royalty rate to incentivize investment in further mineral processing and refining, results in higher financial benefit to the state than if ores and concentrates were extracted and exported without further value addition.

The trade-off with this approach (i.e., production-based incentives) is that the revenue that would have immediately accrued to the state once the ore and/or concentrate is produced, is sacrificed for potentially less profitable refining activity. The value of the products of this process is potentially subject to price volatility and the costs associated with processing and refining. An illustration of this scenario is shown in Table 6, where the total costs in stage 3 are increased by 25%.

**Table 6. Mining revenue and profit illustration: High-refining cost scenario**

| | **Stage 1** | **Stage 2** | **Stage 3** |
|---|---|---|---|
| | **Concentrate** | **Processed** | **Refined** |
| Mineral price (USD per metric ton) | 6,000 | 7,500 | 9,000 |
| Volumes produced (metric tons) | 10,000 | 10,000 | 10,000 |
| Total cost (USD per metric ton) | 3,500 | 4,500 | *6,875* |
| Total cost (USD – volumes produced X total cost) | 35,000,000 | 45,000,000 | *68,750,000* |
| Gross revenue (USD – price X volumes produced) | 60,000,000 | 75,000,000 | 90,000,000 |
| Royalty rate (percentage) | 5% | 3% | 2% |
| Royalty (USD – royalty rate X gross revenue) | 3,000,000 | 2,250,000 | 1,800,000 |
| Net revenue (gross revenue *less* royalty) | 57,000,000 | 72,750,000 | 88,200,000 |
| Gross profit (net revenue *less* total cost) | 22,000,000 | 27,750,000 | *19,450,000* |
| Income tax rate (percentage) | 25% | 25% | 25% |
| Income tax amount (income tax rate X gross profit) | 5,500,000 | 6,937,500 | *4,862,500* |
| Net profit (gross profit *less* income tax) | 16,500,000 | 20,812,500 | *14,587,500* |
| Financial benefit to government (royalty + income tax) | 8,500,000 | 9,187,500 | *6,662,500* |

In this scenario, lowering the royalty rate to incentivize refining results in a lower financial benefit to the government, than would have been the case if the ores and concentrates were exported at stage 1.

### Cost-Based Choice

The incidence of taxation in the period immediately following the start of production can have a significant impact on the pace at which the investor recoups their investment, as well as the ability of the investor to service debt, particularly if debt financing has been used to fund the smelting or refining project.

Cost-based incentives, such as accelerated depreciation or longer carry forward of losses, would not necessarily change the level of fiscal burden—but it will affect the timing of cash flows. Such timing can prove attractive to the investor, depending on a range of factors, including the amount, tenor, and interest rate on debt it can secure for the project, as well as the rate of return such incentives, when calculated, can achieve compared to the investor's thresholds. Also, the effect of deferring tax to later stages in project life can prove critical for projects in the initial years when capital requirements are at their most acute (IGF-OECD, 2018).

The scenario used in this section does not show a time series for the various entry points of costs and revenues, so it is not possible to illustrate the incidence of the tax burdens when they occur. However, it can be assumed, for the purpose of this exercise, that cost-based incentives such as accelerated depreciation and investment tax credits have been introduced such that the overall costs do not change, but their timing of occurrence does. This affects the investor's cost recovery and internal rate of return such that investment decisions can be positively incentivized. In this scenario, applying the production-based incentive will be unnecessary if the smelting or refining project is economically viable on its own.

**Prohibitive Choice**

Based on Table 4, applying a ban on the export of ores and concentrates will deny the government USD 8.5 million in financial benefits, but potentially produce higher revenues from the export or sale of processed products (USD 10.3 million). If the restriction also includes a ban on the export of copper anodes, this potential benefit could increase to USD 12.2 million (assuming such risks as the risk of smuggling are not realised).

Conversely, if the costs of getting to stage 3 increases by 25%, as illustrated in Table 6, the immediate trade-off in this scenario is the difference between the financial benefit the government would have made from producing and exporting ore and concentrate and the financial benefits from stage 3 (USD 8.5 million – USD 6.7 million = USD 1.8 million).

It is important to note that these policy choices must be informed by a robust understanding of project economics, guided by information typically provided in feasibility studies and detailed discounted cashflow (DCF) models, and should be subject to independent government verification. This can also be done proactively at policy planning level by conducting independent assessments to ascertain the viability of projects and the impact of policy choices such as those illustrated above (production-based, cost-based, prohibitive). This exercise is important to determine the correct fiscal tools that should neither deter investors nor unnecessarily deny financial benefit to the government.

If it is established—given the presence of primary enablers—that an integrated copper exploration, production, smelting, and refining project is commercially viable based on the size of the reserves and other technical considerations (Barr et al., 2005),[20] such

[20] A study was conducted in 2005 to demonstrate the economic viability of on-site processing of copper compared to the sale of copper concentrates.

prohibitive measures can be applied especially in scenarios where pre-tax commerciality is established. Also, it may not be necessary to introduce other incentives such as lower royalties or capital allowances for smelting and refining equipment.

## 4.2 Estimating the Tax Policy Choice

It is important to reiterate that deciding the policy approach must be based on rigorous analysis that considers the cost and revenue profiles of the projects at all stages of the value chain. This should, ideally, be done using financial models prepared using DCF analysis. While such analysis is typically required from the investors during the licensing process in the form of bankable feasibility studies, consideration should be given to government officials conducting such analysis independently, or to reviewing such feasibility studies rigorously.

While specific country contexts and overall industrial policies may differ—and there will be no hard-and-fast-rule to follow—a general but important principle would be for a resource-rich country to avoid choices that would lead to lower financial (and broader economic) benefits to the state than it would have otherwise gained from the exports at stage 1.

**Box 9. Estimating the tax policy choice for mining value addition**

**In general:**

Estimated tax revenues from integrated processed or refined minerals/metals (stages 1, 2, and 3) should exceed estimated tax (and royalty) revenues from ore/concentrate production (stage 1). Important parameters to take into account in assessments of expected economic and fiscal benefits include: the price of the refined product, the cost per tonne of establishing and operating processing and refining plants, net smelter returns, treatment and refining charges, transportation costs for alternative refining and smelting options, and the attendant transfer pricing risks that typically apply to mining operations. This should also apply to standalone facilities that are intended to pull in ores and concentrates from different mines to achieve economies of scale.

**For production-based incentives:**

For production-based incentives, particularly variable royalties, estimated tax revenues from integrated processing or refining (stages 1, 2, and 3) must also exceed estimated tax revenues from ore/concentrate production (stage 1) using the royalty rates that would be applied if there were no processing or refining.

**For cost-based and profit-based incentives:**

The economic viability of the integrated processing or refining project (stages 1, 2, and 3) should be demonstrably independent from the viability of the exploration and production project (stage 1), and not solely dependent on a cost-based or profit-based incentive for the entirety of the project lifespan. This is important, given that the use of profit-based incentives has historically tended to be inefficient and ineffective for mining operations, particularly at stage 1. Therefore, the project must be able to demonstrate independent economic viability. Consideration can be given to integrating the cost-based incentives across the value chain if doing so yields a higher internal rate of return than investments in either project would without the incentive.

**For export restrictions:**

With this tax policy choice, the emphasis on—and perhaps the absolute requirement of—primary conditions is more pronounced in this regard. For the tax policy choice (e.g., the use of export taxes as described in section 3.2.4.1), the estimated economic and fiscal benefits from stages 1, 2, and 3 must exceed the economic and fiscal benefits from stage 1.

## 4.3 Calculating the Costs and Benefits of the Policy Choice

Calculating the costs and benefits of the tax policy choice can be done by assessing the key economic parameters from the rigorous financial modelling exercise highlighted in section 4.2. It will entail determining, in particular, the net present value (NPV), internal rate of return (IRR), real payback period, and other parameters highlighted in Box 8, for stages 1, 2, and 3. These calculations will be done individually and then combined. The steps to consider in carrying out such calculations are outlined in the Box 10.

**Box 10. Calculating the costs and benefits of the policy choice**

**Base case:**

Estimate the revenues (royalty and taxes) from the exploration and production of ore and concentrate (base case, working assumption being that the financial model is built). Estimate the NPV, IRR, payback period of government revenues, and all other relevant ratios e.g., investment cover (A)

Estimate the revenues, NPV, IRR, etc., of government revenues from the processing or refining plant separately (B)

Do the same for an integrated project incorporating stages 1, 2, and 3 (C)

**Incentives scenario:**

Estimate the revenues, NPV, IRR, etc., of government revenues from the integrated project (stages 1, 2, and 3), based on the incentive(s) offered (D)

Estimate the revenues, NPV, IRR, etc., of government revenues from the processing or refining plant separately, based on the incentive(s) offered (E)

Estimate the targeted wider benefits from establishing the processing facility (such as employment, specific industrial and manufacturing multipliers, etc.), and wider economic costs (such as environmental damage, impact of higher labour costs on other sectors, etc.). Estimate their NPV, IRR, etc. (F)

**Benefit determination:**

Determine the difference between (C) and (A)

Determine the difference between (D) and (C)

**Decision conditions:**

If (C) – (A) is greater than 0, there is merit in having an integrated project that, in the base case, does not require tax incentives.

*What this means: The project has been determined to be economically viable without tax incentives.*

If the overall project NPV for (B) is positive, the IRR is above the required hurdle rate, and all other indicators suggest project economic viability, the project can be carried on independently without the need to offer a tax incentive.

*What this means: The project has been determined to be economically viable without tax incentives.*

If (D) – (C) (or (D) + (E) – (C)) is greater than 0, and If (C) – (A) is greater than 0, the mining tax incentive can be offered.

*What this means: If the financial benefit to the government from the incentivized integrated scenario exceeds the financial benefit to the government in the base case, a mining tax incentive can be offered. This could be because the project is marginally profitable, and the application of an incentive would make the project more attractive. Another example could be that there may be adjacent or support industries, or other development projects that might (when combined with either a new mine or a new beneficiation plant) result in a better economic case.*

If (D) – (C) (or (D) + (E) – (C)) is greater than 0, but (C) – (A) is less than 0, the condition for offering the mining tax incentive should include (D) – (A) being greater than zero.

*What this means: If the financial benefit to the government from the incentivized integrated scenario exceeds the financial benefit to the government in the base case, but the base case integrated project is only viable with the tax incentive, a mining tax incentive can be offered provided that the financial benefit from the incentivized integrated scenario also exceeds the financial benefit from the standalone project in stage 1 (i.e., (A)) and is efficient (i.e., at the lowest possible cost to the government; see IGF-OECD, 2018). Ideally, the incentive should be the minimum level necessary to induce investment in the targeted project.*

The Natural Resource Governance Institute's (NRGI) March 2025 paper, *Refining the Strategy: The Economics of Lithium Value Addition in Ghana*, provides a useful case study that underscores the importance of rigorous cost-benefit analysis similar to the above illustration. The paper highlights that Ghana's ambition to refine lithium domestically faces significant challenges, including limited feedstock access, high operational costs compared to global competitors such as China, and an oversupplied global refining market. NRGI's modelling estimates that a Ghanaian refinery could result in at least USD 500 million in lost government revenue due to the need to purchase lithium concentrate at below-market prices for the refinery to break even. It would also only generate about 200 direct jobs and offer uncertain broader economic benefits. These findings, coupled with potential environmental and social costs, reinforce the need for thorough impact analysis considering economic, fiscal, environmental and social effects.

**Box 11. Summary of key messages from the NRGI (2025) paper**

**Economic feasibility challenges**: Ghana's ambition to refine lithium domestically must be grounded in a rigorous cost-benefit analysis, considering the global market outlook and economic viability. Current conditions suggest limited economic benefits due to high costs and market dynamics dominated by China.

**Global market constraints**: China controls 93% to 94% of global spodumene refining capacity, benefitting from technical expertise, lower costs, and significant government support. Excess refining capacity in China and uncertain demand growth for lithium chemicals outside of China pose significant challenges for a Ghanaian refinery.

**High costs and limited feedstock**: A Ghanaian refinery would face high capital and operating costs, estimated at USD 20,000 per tonne per year (t/y) and USD 3,700/t respectively, compared to China's USD 7,000/t/y and USD 3,000/t. Limited access to feedstock, primarily from the Ewoyaa mine, further constrains viability unless additional lithium discoveries are made or imports are secured.

**Financial implications**: Modelling indicates that a refinery would need to purchase spodumene concentrate at below-market prices to break even, leading to a government revenue loss of at least USD 500 million in a medium-price scenario if reliant on Ewoyaa's reserves, or USD 300 million over a 20-year operation, compared to exporting unrefined concentrate.

**Limited economic benefits**: A refinery is unlikely to create more than 200 direct jobs, with uncertain stimulus for other sectors. Opportunity costs are significant, as USD 500 million exceeds Ghana's 2024 budget for basic education, potentially diverting resources from other developmental priorities.

**Environmental and social risks**: Refining could consume water equivalent to the annual usage of 90,000 Ghanaians and produce byproducts like sodium sulphate, posing environmental risks if not managed properly. These impacts could outweigh the limited economic gains.

**Recommended approach**: A "mine-and-monitor" strategy is advised, focusing on starting Ewoyaa mine operations, supporting further lithium exploration, and monitoring global market conditions, such as a potential USD 3,000/t premium for non-Chinese lithium chemicals, which could make refining viable.

**Strategic considerations**: If pursuing refining, Ghana should replicate proven Chinese designs, develop reagent production capacity, and strategize byproduct use (e.g., in cement). Managing long-term offtake agreements is crucial to retain flexibility for future refining opportunities.

# 5. Conclusion

As observed throughout this report, tax and non-tax incentives and fiscal policies alone are not sufficient to promote mineral value addition in countries. Mining tax incentives are, in effect, secondary—albeit complementary—to the more significant primary enablers, outlined in section 3.1 of this report.

The countries considered in this study have taken various paths, depending on their unique circumstances, to advance in-country critical minerals downstream value addition.

Policy-makers should consider applying the following measures, depending on where they are along the mining value chain.

1. A clear articulation of a critical minerals strategy that establishes a baseline of information, including: a detailed understanding of the feasibility of processing and refining based on the quality and volume of ore to be produced; and an understanding of processing and refining costs for each critical mineral. This is in addition to strengthened domestic value addition policies and enabling legislative and regulatory frameworks.

2. A comprehensive assessment of domestic manufacturing uses for the critical minerals, in addition to mapping the procurement needs of the supply chains for these manufacturing uses, and an honest assessment of domestic market readiness for such manufacturing uses.

3. A consistent and uniform approach to designing tax enablers, relying objectively on economic and financial modelling of mining processing and refining projects. This includes strict adherence to the assessment, estimation, and cost and benefit determination of the policy choice criteria similar to the considerations discussed in section 4 of this report.

4. The creation of a transparently managed infrastructure fund, dedicated to funding relevant and necessary infrastructure for the establishment of processing and refining capacity (primary enablers).

5. Fostering regional cooperation to optimize comparative advantages, such as enabling the transfer of ores and concentrates from one country to another for processing and refining, and for refined products to serve as feedstock for other industrial and manufacturing uses within the region. Such efforts should ensure that benefits of regionalising value addition are fairly shared between collaborating countries; or that countries giving up opportunities to add value are compensated in a different way, e.g., by being granted market access for their exports of other products and services.

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