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Leveraging Copper for Economic Transformation

Policy choices for value addition in Zambia

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Leveraging Copper for Economic Transformation: Policy choices for value addition in Zambia

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Executive Summary

Copper is central to Zambia's economy. The country is the world's 10th-largest copper producer, and copper accounted for around 60% of export revenues in 2023. Yet, the country's heavy reliance on mining exposes Zambia to well-known risks: slower growth, limited diversification, weak job creation, and heightened vulnerability to external shocks.

Against this backdrop, deeper participation in the copper value chain—through processing and manufacturing—offers a potential pathway to strengthen resilience and domestic linkages. Still, value addition is not automatic. Its benefits depend on careful sequencing, competitiveness, and the ability to address binding constraints while proactively managing social and environmental costs.

Global demand for copper is expected to remain strong, driven by electrification, renewable energy, infrastructure investment, digitalization, and the rise of artificial intelligence. Most projections point to persistent supply shortfalls into the mid-2030s. Zambia is therefore well placed to expand its role in copper value chains. The country already smelts around two thirds of its mined copper and refines around 30% into copper cathodes, while only about 1% is transformed into copper-based products, primarily copper wiring.

Processing and manufacturing can substantially increase the gross market value of copper exports. Price comparisons across the value chain indicate that smelting, refining, and selected downstream products—such as refined copper tube or pipe fittings and stranded wire, cables, and plaited bands—command significantly higher unit prices compared to concentrates. But higher prices do not necessarily translate into higher domestic value added. Value added depends on production costs, energy use, imported inputs, scale, skills, and the share of activity retained domestically. For policy-makers, this distinction is crucial: price signals indicate revenue potential, but they are an incomplete guide for industrial strategy.

Trade diagnostics converge on a clear finding: as Zambia seeks to triple its copper production by 2031, expanding smelting and refining offers the most realistic near-term foundation for value addition ahead of more downstream activities. Analyses by the International Trade Centre (ITC) and the Observatory of Economic Complexity (OEC) identify smelted copper anodes and refined cathodes as Zambia's most feasible and scalable export expansion opportunities. Under favourable conditions, these activities could increase annual exports by up to USD 3.7 billion by 2030. In contrast, opportunities in copper-based manufacturing are more limited in the short term and generally smaller in scale.

This does not imply that downstream manufacturing should be excluded from Zambia's strategy. Rather, it underscores the importance of both sequencing and addressing current binding constraints to industrial development. Economic complexity analysis suggests that step-by-step diversification—building on existing capabilities while investing in future ones—is more effective than attempting to leap directly into highly complex products. In Zambia's case, downstream opportunities are more likely to emerge where manufacturing is anchored in domestic and regional demand, particularly for copper-intensive products linked to electrification, energy systems, construction, and infrastructure. These sectors reflect structural needs in Zambia and the wider region, offering a more realistic entry point than competing in globally saturated manufacturing segments.

In the long term, it is estimated that Zambia could increase its copper-based export revenues several fold if expanded processing is successfully combined with manufacturing. These gains are conditional on addressing foundational constraints, such as unreliable and insufficient electricity supply, limited access to affordable finance, shortages of skilled labour, insufficient feedstock for fabricators, high trade and logistics costs, and intense international competition that compresses margins.

Environmental and social considerations are integral to the value-addition agenda. Mining and processing pose risks related to emissions, water use, waste, and community impacts. At the same time, Zambia's low-carbon electricity mix represents a strategic advantage as global buyers increasingly prioritize sustainability. Managing these risks proactively is a social and environmental imperative, as well as a competitiveness issue.

Zambia has adopted a range of policies aimed at promoting value addition across the copper sector, including strategies on mining, industrial development, energy, skills, trade, and local content. While responsibilities are clearly assigned across government, policy effectiveness is weakened by gaps in implementation, limited coordination across institutions, and the absence of a consolidated action plan linking industrial ambitions to enabling conditions.

Strategic Policy Directions

First, Zambia should adopt a sequenced and multi-pronged approach to copper value addition. In the near term, policy should focus on consolidating and improving the efficiency of midstream processing. While most copper produced in Zambia is already smelted domestically, refining capacity could be expanded and better aligned with industrial objectives. At the same time, the foundations for downstream development—skills, energy, logistics, and institutional capacity—need to be strengthened.

However, current market realities need to be addressed. At present, Zambia's economic and trade structures are not well aligned with domestic industrialization ambitions. Most midstream outputs are exported under existing commercial and trading arrangements, limiting access to feedstock for domestic manufacturers whose capabilities are still emerging. Without reforms to offtake arrangements, logistics, and market access, downstream manufacturing will struggle to emerge, regardless of industrial intent.

Diversifying markets is therefore critical. International markets will remain central to Zambia's copper economy and export earnings, but regional opportunities are underutilized. Demand across Africa—particularly for copper-intensive products linked to electrification, energy systems, construction, and infrastructure—is growing rapidly, yet Zambia currently exports only a limited share of its copper to neighbouring markets. Strengthening regional market access would support downstream manufacturing, reduce exposure to external shocks, and anchor value addition in demand that is structurally aligned with Zambia's development needs.

Second, addressing binding constraints is a priority. They need to be complemented with incentives to support industrial development. Reliable and affordable electricity is the most critical bottleneck and should be treated as an immediate policy focus through accelerated investment in generation, greater regulatory flexibility for industry-dedicated and off-grid solutions, and credible tariff reform.

Third, access to finance—particularly for small and medium-sized enterprises—should be strengthened by expanding credit availability rather than relying solely on capital market deepening. Improved implementation of the movable collateral framework, targeted use of development finance to de-risk lending, and mobilization of domestic and diaspora savings can all support this access. Trade facilitation and logistics reforms should be viewed as core industrial policy instruments for a landlocked copper economy.

Fourth, the effectiveness of Zambia's value-addition strategy will depend on policy coherence, data, and execution capacity. Industrial ambitions must be aligned with energy planning, trade policy, skills development, and environmental and social safeguards through formal coordination mechanisms across government. Strengthening the state's ability to measure and analyze value added—rather than relying on export prices alone—would support more informed prioritization and accountability. A clear, credible implementation pathway, grounded in realistic sequencing and continuous engagement with the private sector, will be more decisive for success than the breadth of policy instruments deployed.

Implications for International Partners

Technical and financial partners can play a catalytic role by aligning technical support and finance with Zambia's sequenced approach to copper value addition and broader national development priorities. **In the short and medium terms, support should focus on strengthening competitiveness** in copper processing—particularly smelting and refining—while building the foundations for more advanced manufacturing over time. This work includes targeted investment in industrial capabilities, technology transfer, and skills development.

Investment in reliable, low-carbon electricity and enabling infrastructure should be a central pillar of external support, given the high cost of capital and its decisive role in unlocking value addition across the copper value chain and the wider economy. Development partners are also well placed to de-risk private investment through blended finance, guarantees, and investments in energy, logistics, and processing infrastructure, helping to crowd in capital and address persistent investor bias against African markets.

Support for regional trade corridors and logistics, including the Lobito Corridor, can significantly improve Zambia's market access, provided such investments are accompanied by customs harmonization, digital trade facilitation, and coordinated corridor governance.

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Acronyms

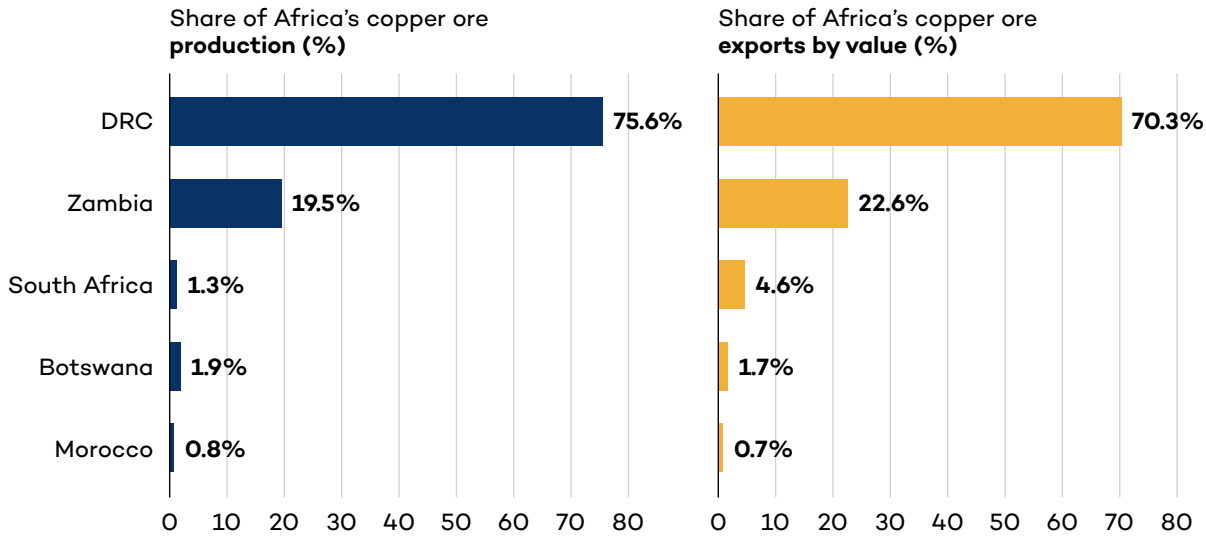
3MT	3 Million Tonnes strategy
AfCFTA	African Continental Free Trade Area
AfDB	African Development Bank
AI	artificial intelligence
ASM	artisanal and small-scale mining
DRC	Democratic Republic of the Congo
ECA	Economic Commission for Africa
FTA	free trade area
HS	Harmonized System
IGF	Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development
IMF	International Monetary Fund
IRP	Integrated Resource Plan
ITC	International Trade Centre
Mt	million tonnes
MOU	Memorandum of Understanding
MFEZ	Multi-Facility Economic Zone
MRCA	Minerals Regulation Commission Act
OEC	Observatory of Economic Complexity
OECD	Organisation for Economic Co-operation and Development
SADC	Southern African Development Community
SEZ	Special Economic Zone
TVET	Technical and Vocational Education and Training
USGS	U.S. Geological Survey

1.0 Introduction

Zambia is an important copper producer. In 2023, the country produced around 3% of the global mine output of copper. This makes it the 10th-largest copper producer in the world, after Chile, the Democratic Republic of the Congo (DRC), Peru, China, the United States, Indonesia, Russia, Mexico, and Australia. Zambia also produces 0.7% of the global output of refined copper (Idoine et al., 2025).

In Africa, Zambia was the second-largest copper producer, after the DRC in 2023, accounting for 19.5% of Africa's ore production and 22.6% of the continent's export value (African Development Bank [AfDB] & Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development [IGF], 2025).

FIGURE 1. The top five African producers' share of copper production and exports in 2023



Source: AfDB & IGF, 2025.

Copper contributes an estimated 15% of the country's GDP (Ninan Dulvy et al., 2025). Government revenues from mining, dominated by copper, accounted for 10.7% of total

government revenue in 2023 (UNU-WIDER, 2025). Around 2.3% of jobs in Zambia were in the mining and quarrying sector in the same year (Zambia Statistics Agency, 2024). Moreover, copper and copper-based products accounted for 60% of Zambia's foreign exchange earnings from the export of goods and services in 2023 (United Nations, n.d.; World Bank, n.d.).[1] The economy is therefore considered "resource dependent" according to the International Monetary Fund (IMF, 2012).

Resource dependency carries a number of risks, including slower economic growth and greater exposure to economic shocks (Dauvin & Guerreiro, 2017; Davis, 2022). In response, mineral-producing countries are actively seeking to leverage rising mineral demand and intensifying geopolitical competition to diversify their economies, strengthen resilience, and capture greater domestic value from their resources. One of the primary policy responses has been to strengthen domestic mineral processing and manufacturing capabilities, shifting value creation closer to the source of extraction and reducing reliance on the export of raw minerals.

For Zambia, extending economic activity beyond mining and further along the copper value chain can offer a potential route to diversification, provided the right enabling conditions are in place[2] (Lebdioui & Bilek, 2021). When aligned with competitiveness, infrastructure, and skills development, copper-based industrialization can support manufacturing growth, job creation, and fiscal revenues, contributing to more resilient economic structures and, over time, to poverty reduction (Haraguchi et al., 2017; Karahasan, 2023).

The analysis in this study indicates that Zambia could derive significant economic benefits from expanding activities along the copper value chain. Section 2 clarifies what "value addition" means in the context of minerals. Section 3 analyzes Zambia's copper value chain and current levels of value addition and identifies new opportunities. Section 4 assesses the conditions required to realize these opportunities, including the environmental and social risks involved. The final section of the report reviews Zambia's policy and regulatory landscape, setting out recommendations to enhance benefits and manage related risks.

[1] We consider copper at various stages of refinement, as well as manufactured articles of copper and copper-based chemicals. This includes the following Harmonized System (HS) codes: 2603, 282550, 262030, 282741, 283325, 74, 85441, and 854420. Zambia did not record exports of products under HS code 282741 in 2024 (United Nations, n.d.). The HS is an international system developed by the World Customs Organization to classify products traded internationally.

[2] Developing midstream/downstream activities is more likely to diversify the economy away from extractives to the extent that (a) said activities are commercially viable without government subsidies or protection from competition, (b) the producing country has a high degree of market power in the extractive commodities in question, and (c) the midstream/downstream activities being developed source non-extractive inputs from the local economy (Lebdioui & Bilek, 2021).

2.0 What Is Value Addition?

Value addition is a core economic concept that measures the new value created through productive activity within an economy. In its most widely accepted definition, value added is calculated as the difference between the value of the output produced and the intermediate inputs used in production. This concept underpins national accounting systems and forms the basis for measuring GDP, which is calculated as the sum of value added across all sectors of the economy plus all taxes, less subsidies on products (see Annex A for definitions and methodologies).

In the context of minerals, value addition is widely seen as a potential pathway toward structural transformation away from commodity dependence, rather than an end in itself. It refers to the increase in domestic value created from a mineral resource across its life cycle—from extraction to processing, use, and reuse—after accounting for capital intensity, imported inputs, and external dependencies. Unlike many manufacturing sectors, mineral value chains are strongly shaped by geology, scale economies, energy requirements, and global market structures, which fundamentally influence where value can be created and captured.

From a narrow economic perspective, mineral value addition is often equated with moving downstream along the value chain through activities such as processing, refining, fabrication, and manufacturing. However, international experience shows that downstream processing does not automatically result in higher domestic value added. Many processing activities are capital- and energy-intensive and rely heavily on imported technology, inputs, and expertise. Where enabling conditions such as affordable and reliable energy, adequate infrastructure, skills, and access to markets are not in place, the net domestic value created by downstream activities can be limited. In some cases, this value can be outweighed by economic and fiscal costs.

For mineral-producing economies such as Zambia, value addition therefore needs to be assessed not only by the type of activity performed, but by the extent to which that activity increases domestic income, capabilities, and linkages. This includes wages paid to domestic workers, fiscal revenues accruing to the state, profits retained or reinvested locally, and the development of competitive domestic suppliers and services. Importantly, value creation in the minerals sector extends well beyond the physical transformation of ore. Significant and often more employment-intensive value can be generated through upstream and adjacent activities such as geological services, construction and engineering, maintenance, logistics,

environmental management, digital services, and, over time, recycling and circular-economy activities. These activities can anchor more diversified and resilient local economies, generating stronger learning effects than heavy processing alone.

While economic value added provides a necessary foundation for assessing copper value addition, it is not sufficient to capture copper's full contribution to sustainable development. To be truly transformative, value addition must be understood as a multi-dimensional concept that also encompasses social outcomes and environmental resilience.

The social dimension of value addition refers to how well copper-related activities translate into meaningful human development outcomes. This includes creating quality employment across the value chain; developing technical, managerial, and entrepreneurial skills; and strengthening domestic enterprises capable of participating competitively in mineral-related activities. In mining regions, the distribution of benefits matters as much as their aggregate size. Value-addition strategies that fail to improve livelihoods, support inclusive local development, and expand opportunities for women and historically marginalized groups risk undermining social cohesion and long-term project viability. Social value is maximized when communities are not only beneficiaries of mining activities but also active participants in decision-making processes through consultation, transparency, and accountability mechanisms.

The environmental dimension of value addition recognizes that mining is inherently disruptive, but that sustainable value creation depends on minimizing harm while maximizing efficiency and long-term ecological outcomes. In the context of copper, environmental value is not created by extracting or processing greater volumes, but by reducing the environmental footprint per tonne produced and aligning production with climate and environmental objectives. This includes decarbonizing energy use, improving resource efficiency, strengthening water and waste management, protecting biodiversity, and ensuring effective rehabilitation of ecosystems. As global demand for copper is increasingly driven by clean-energy transitions, environmental performance has become a critical determinant of long-term competitiveness and market access. The social and environmental dimensions are considered in Section 5.2.

Taken together, these dimensions underscore a central policy insight: value addition that is narrowly focused on economic upgrading can create new risks if social and environmental dimensions are not addressed in parallel. Poorly designed strategies can deepen inequalities, strain ecosystems, and undermine resilience even as headline economic indicators improve. A robust approach to copper value addition therefore requires balancing economic viability with social inclusion and environmental stewardship, ensuring that gains from copper translate into durable, inclusive, and sustainable development outcomes for Zambia.

3.0 Mapping the Copper Value Chain

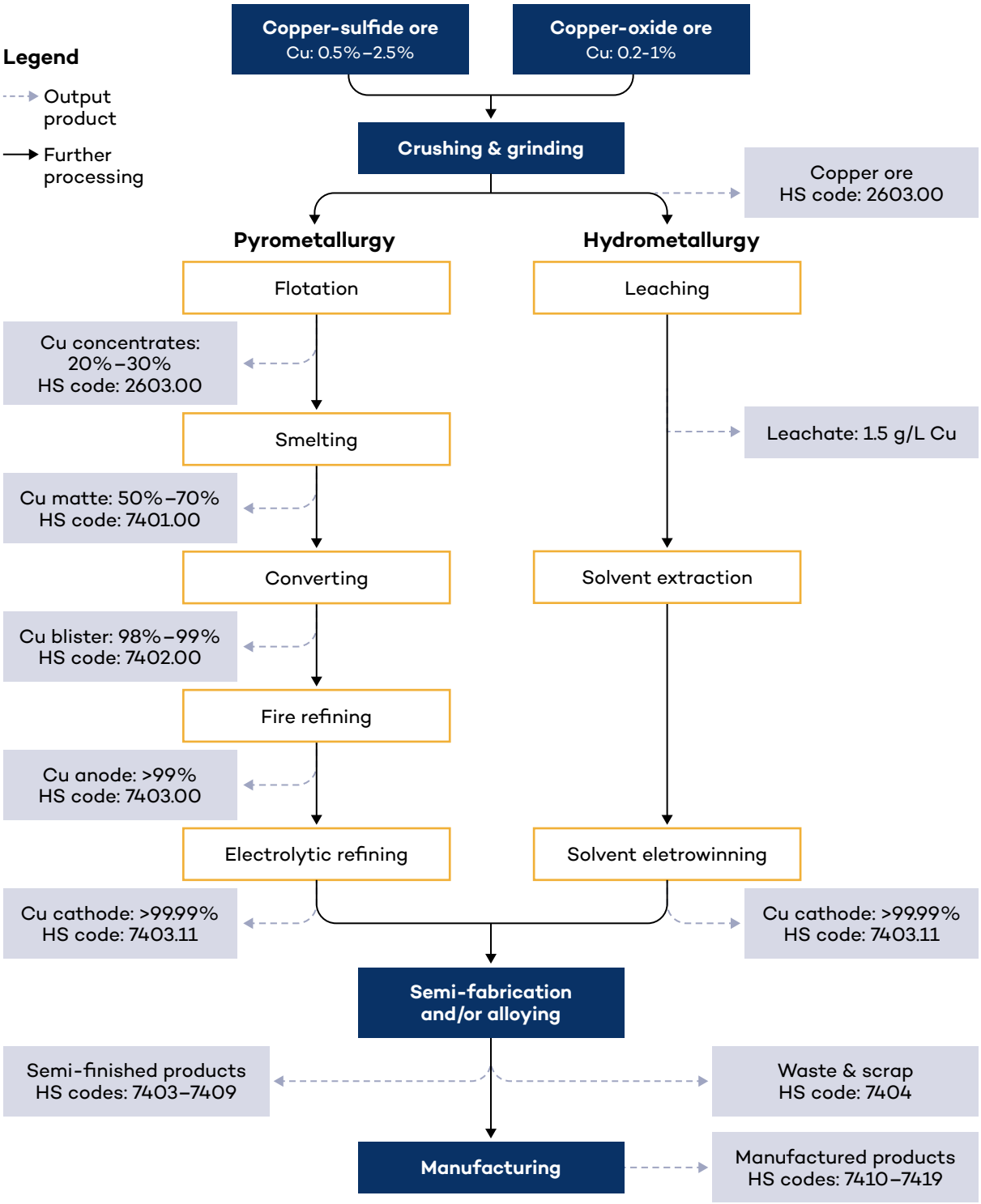
3.1 Explaining the Copper Supply Value Chain

Copper occurs naturally in the Earth's crust in various forms (International Copper Study Group, 2025). The two main types of copper ore extracted—sulphides and oxides—both exist in the Central African Copperbelt region, where Zambia is located (Igor Azeuda Ndonfack et al., 2025). Small amounts of copper can also be found in the earth in a metallic state (AfDB & IGF, 2025).

Copper ore is a host metal for other elements, notably cobalt (60% of which comes from copper mining), as well as gold, lead, zinc, molybdenum, selenium, and tellurium (AfDB & IGF, 2025). Due to increased demand and risk of supply disruptions, many countries have added copper to their critical minerals lists.

Figure 2 illustrates a simplified copper value chain.

FIGURE 2. Simplified copper supply value chain



Source: Based on AfDB & IGF, 2025.

3.1.2 Copper Beneficiation

The first stage of the transformation of copper ores is crushing and grinding. The ensuing process varies according to the types of ores mined. Sulphide ores, which lie at a deeper depth, are generally processed by flotation, followed by smelting and conversion to blister

copper (approx. 98%–99%), and then refined via electrorefining into cathode copper (AfDB & IGF, 2025; Cujba & Lazăr, 2024).

By contrast, oxide ores, which are found closer to the surface, are refined through hydrometallurgy (leaching, solvent extraction, and electrowinning) to produce copper cathode (AfDB & IGF, 2025; Cujba & Lazăr, 2024). In some cases, sulphides "are oxidized through bio-oxidation or roasting and then processed via hydrometallurgy" (AfDB & IGF, 2025).

Once copper cathode is obtained, it is used to make semi-finished products such as rods, wires, sheets, tubes, and/or alloyed with metals like zinc (to make brass), tin (to make bronze), or nickel (for cupronickel).

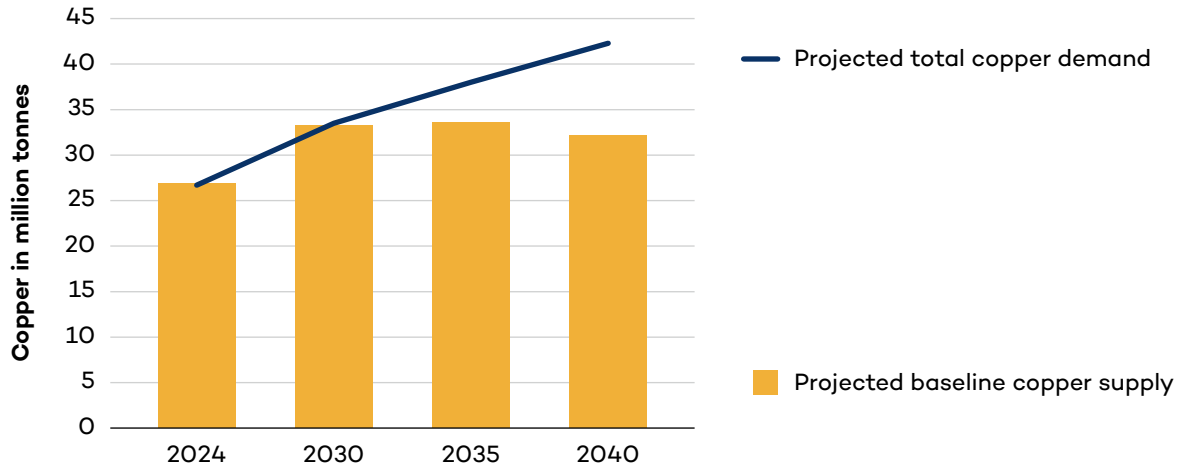
Further downstream, these alloys are used in critical applications, such as infrastructure. energy systems, power infrastructure, electric wiring, transportation, consumer electronics, automotives, and renewable energy solutions (AfDB & IGF, 2025).

Copper can also be recycled at different stages of the value chain. Current recycling supplies remain relatively limited, however, and are estimated to account for 28%–32% of global copper supply (AfDB & IGF, 2025).

3.1.3 The Future of Copper Supply and Demand

Copper demand is expected to increase in the coming decades, driven by electrification, the transition to renewable energy, digitalization, and the rise of artificial intelligence (AI) (Yergin et al., 2026). BMI and S&P forecast a shortfall in copper supply until the mid-2030s or 2040, respectively; S&P considers that the shortfall could reach over one third of current supply (Hodgson, 2026; Yergin et al., 2026). If these projections are correct, there will be space in the market to absorb additional refined copper output.

FIGURE 3. Copper supply and demand projections, 2024–2040



Source: Yergin et al., 2026.

In addition, governments are competing to secure access to copper, due to concerns that geopolitical tensions will leave them without adequate supply (Hargreaves, 2026). This is particularly important given copper's role in technologies used in AI and defence. These

demand trends, combined with supply disruptions, have pushed the copper price to an all-time high of USD 13,000 per tonne (Benchmark Mineral Intelligence Limited, 2026).

3.2 The Copper Value Chain in Zambia

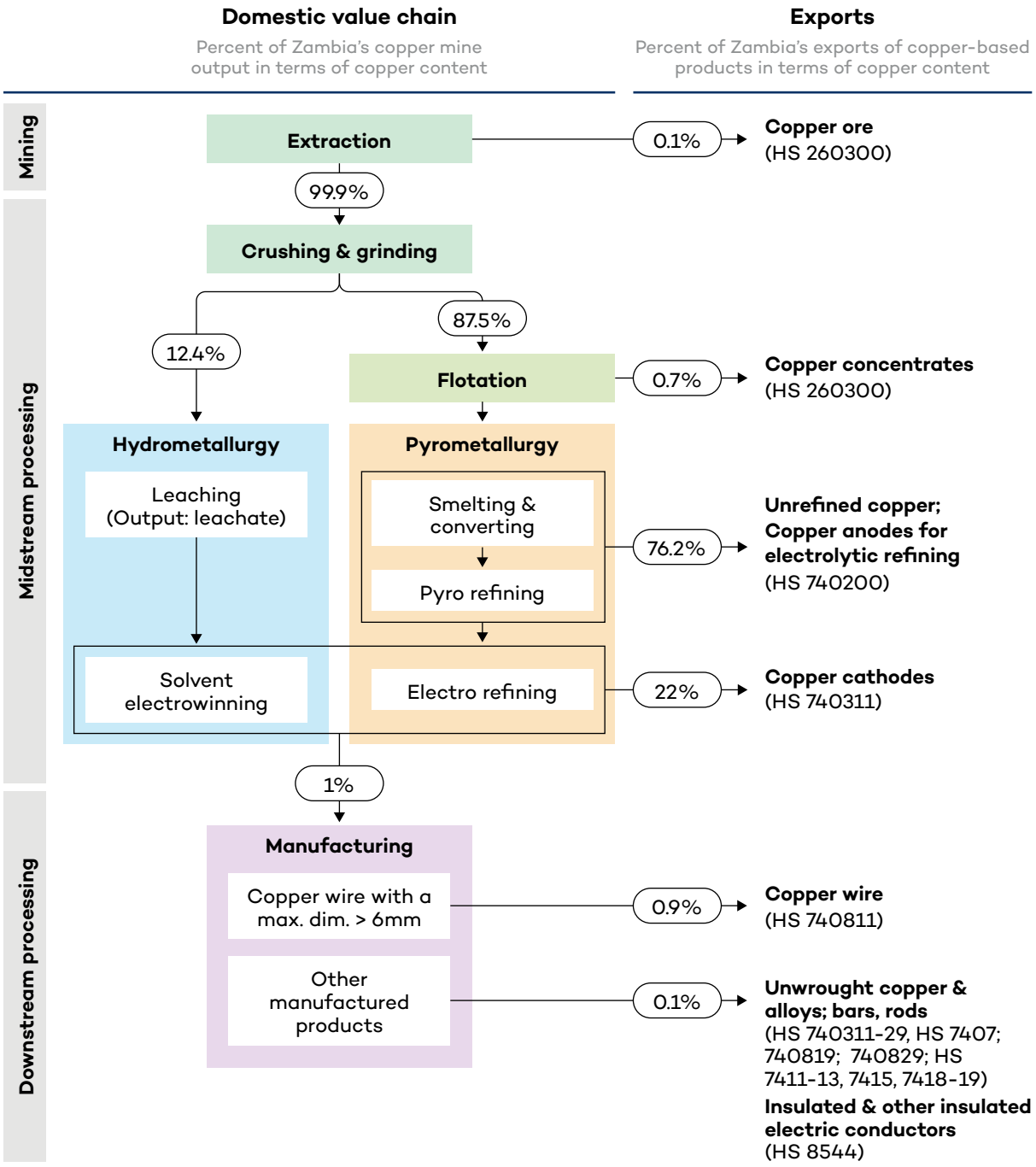
In 2023, Zambia mined approximately 800,000 tonnes of copper (metal content), equivalent to 3% of global output, from both sulphide and oxide ores. The country has ambitions to triple its production to 3 million tonnes by 2031 (Ministry of Mines and Mineral Development, 2024).

Small-scale mining contributes meaningfully to this output, accounting for an estimated 9% of total production, based on data for the first 6 months of 2025 (Zambia Monitor Contributor, 2025).

In 2025, Zambia had 28 active mining projects and 10 operating smelters and refineries (AfDB & IGF, 2025). Both hydrometallurgical and pyrometallurgical processes are used in Zambia, as well as biohydrometallurgy (the use of micro-organisms to improve the dissolution of metals from ore).

Figure 4 offers a simplified visualization of Zambia's domestic copper value-addition landscape. It shows that 99.9% of Zambia's copper is smelted and refined in-country, and only 0.1% of Zambia's copper leaves the country in the form of copper ores (authors' calculations based on Idoine et al., 2025; U.S. Geological Survey [USGS], 2025).

FIGURE 4. Simplified visualization of the domestic value chain and share of exports, 2023



Source: authors' elaboration based on AfDB & IGF, 2025; Idoine et al., 2025; ITC, 2025c; USGS, 2025; United Nations, n.d.

Zambia has developed substantial midstream beneficiation capacity. As illustrated in Figure 4, in 2023, nearly all copper mined domestically was processed further within the country: only around 0.7% was exported at the concentrate stage, while 76.2% was smelted and converted into anodes and blister copper, and a further 22% was refined into high-purity cathodes.

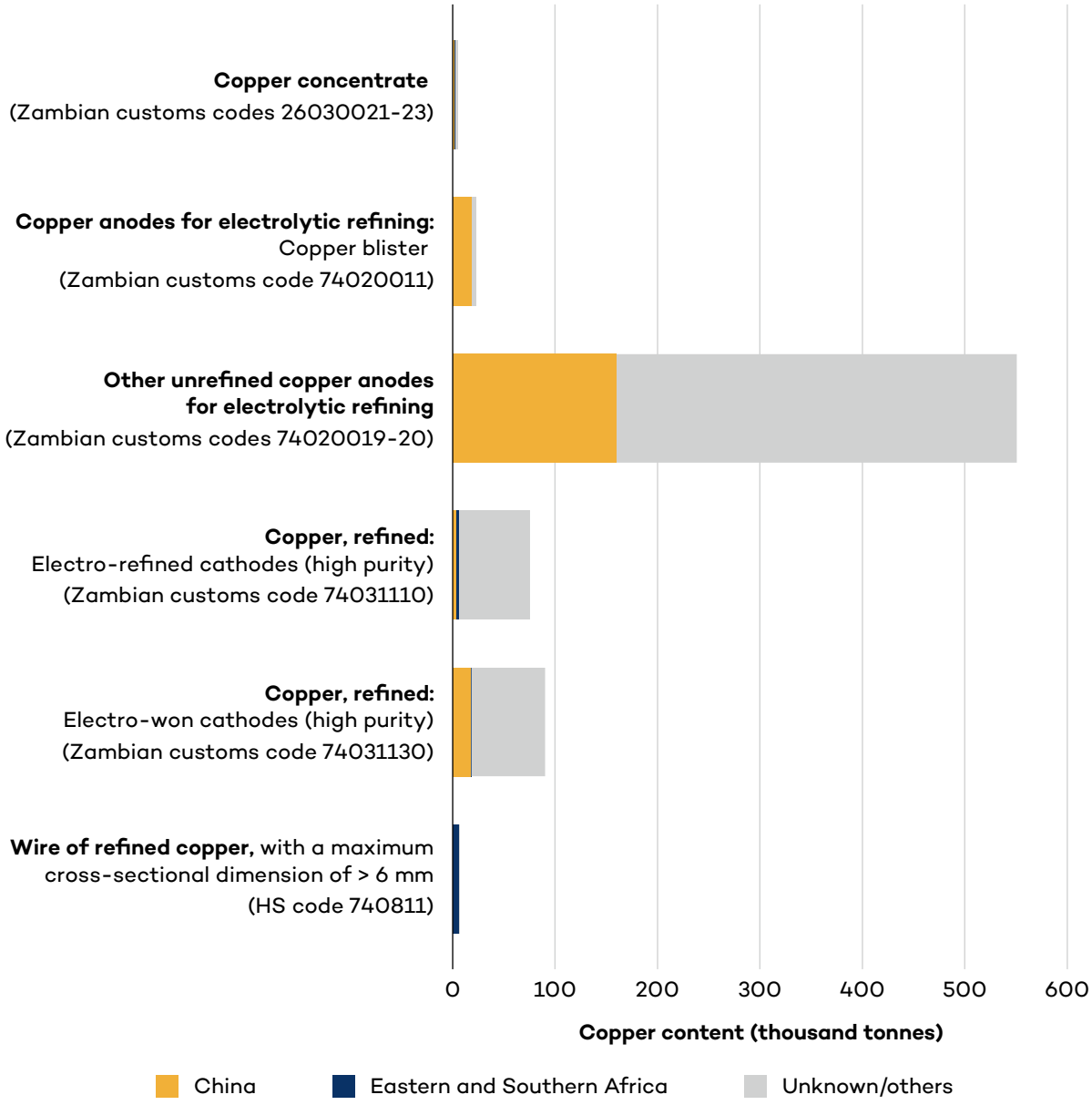
However, this processing depth does not translate into downstream integration. Almost all beneficiated copper exits the country after smelting or refining, and only about 1% is absorbed by domestic manufacturing. Although this highlights a significant gap between midstream processing and downstream value addition, Zambia has a modest but established downstream fabrication base. For instance, a small number of firms, including the formerly state-owned company Metal Fabricators of Zambia Plc., fabricate refined copper and alloys (Metal Fabricators of Zambia Plc, 2024; authors' analysis based on ITC, 2025b; United Nations, n.d.). Some examples of domestically manufactured products include the following (authors' analysis based on International Trade Centre, 2025b; Neelkanth Cables, n.d.; United Nations, n.d.):

- insulated electrical wiring, including coaxial cable and other copper cables
- bars, rods, and profiles of refined copper
- bars, rods, and profiles of copper alloys (excluding such articles of copper-zinc base alloys [brass])
- tubes and pipes
- copper tube or pipe fittings (e.g., couplings, elbows, sleeves)
- copper alloy tubes or pipe fittings (e.g., couplings, elbows, sleeves)
- stranded wire, cables, plaited bands, and similar products
- nails, tacks, drawing pins, staples, and similar articles (excluding staples in strips)
- washers (including spring washers and spring lock washers)
- screws, bolts, nuts, and similar articles – threaded (other than screw hooks, ring- and eyebolts, lag screws, plugs, bungs, and similar products, with screw thread)
- screw hooks, screw rings, and similar products – threaded (excluding standard screws and bolts and nuts)
- copper sanitary ware and parts thereof (excluding cans, boxes, and similar containers and fittings)
- other copper-based articles.

Total exports from downstream manufacturing accounted for only 1% of total copper exports from Zambia in 2023.

Figure 5 summarizes Zambia's direction of exports by copper content.

FIGURE 5. Zambia's exports of copper-based products by destination, 2023



Source: Authors' analysis of AfDB & IGF, 2025; UN, n.d.

Trade statistics highlight an important observation regarding the destination of Zambia's copper exports. A significant share of the country's copper exports is recorded as destined for commodity trading hubs such as Singapore and Switzerland. These destinations largely reflect "paper trade" rather than physical trade flows. Copper does not physically enter these jurisdictions but is instead sold on paper to trading arms or subsidiaries, which then resell the material to consumers elsewhere. This structure is closely linked to the ownership structure of large firms (such as Glencore) that control extraction, trading, and downstream sales through affiliated entities.

When partner countries' import data are used, excluding paper transactions and reflecting physical delivery, China emerges as the main destination for Zambia's copper. In 2023, China accounted for 58% copper exports by value, based on trading partners data (UN, n.d.).

This trading structure has important implications for value addition and economic governance. While vertically integrated trading arrangements can reduce transaction costs and improve market access, they also shift price-setting power, margins, and strategic decision making outside Zambia. This can limit the country's ability to capture value beyond processing, complicate transfer pricing oversight, and reduce transparency over final markets and prices. It also creates exposure to concentration risk, as Zambia's copper revenues become closely tied to a small number of end markets and corporate trading networks. As Zambia seeks to deepen value addition and strengthen economic resilience, these ownership and trading structures represent both a constraint and a source of risk that policy-makers will need to actively manage.

3.2.1 Revenue Potential Along the Copper Value Chain: What prices do and do not reveal

Zambia could substantially increase its export revenues by processing copper further along the value chain. However, assessing the scale and nature of these gains requires careful interpretation of what "value addition" means in practice.

As defined in Section 2, value addition refers to the incremental economic value created through production after accounting for the cost of intermediate inputs. It is measured at the firm level and reflects the contribution of labour, capital, technology, and services—not simply the market price of outputs. Because firm-level cost data are rarely available, especially across multiple stages of global value chains, this section uses export prices per tonne of copper content as a proxy for potential revenue generation, rather than as a direct measure of value added.

BOX 1. CRITICAL POLICY CAUTION: PRICE IS NOT THE SAME AS VALUE ADDED

Higher export prices should not be interpreted as higher value added. **Price-based comparisons capture gross revenue,** not the net economic value retained domestically. Activities associated with high prices may also involve higher costs, including capital investment, energy, imported inputs, transportation, logistics, and the cost of labour.

As a result, the stage of the copper value chain with the highest price per tonne is not necessarily the stage that delivers the greatest domestic value added, employment, or fiscal returns. For policy-makers, price is therefore a useful indicator of revenue potential, but an incomplete guide for value-addition strategy.

Policy decisions on which segments of the copper value chain to prioritize should be informed by a broader assessment of production costs, access to energy and feedstock, economies of scale, skills requirements, environmental and social impacts, and the share of value captured domestically. Without this broader lens, there is a risk of promoting activities that appear attractive on a price basis but deliver limited net benefits once constraints and costs are taken into account.

Against this backdrop, Table 1 illustrates how the market value of copper changes across different stages of processing and manufacturing, expressed as the average export price per cone of copper content for selected products in 2023. The table highlights potential

substantial differences in unit prices along the value chain, suggesting that processing and manufacturing increase gross export revenues per tonne of copper.

TABLE 1. Prices per tonne of copper content for different products along the copper value chain, 2023

Value chain stage	Product	Average export price per tonne of copper content (USD)	Increase in value of a tonne of copper compared to previous value chain stage (USD)
Pyrometallurgical processing			
Crushing, grinding, and flotation	Copper concentrate	4,000–6,000	Unclear
Smelting and converting	Smelted copper blister	7,700–7,800	1,700–3,800
Fire refining	Copper anodes for electrolytic refining	8,900	1,100– 1,200
Electrolytic refining	High-purity electrorefined cathodes	8,200	(700)
Hydrometallurgical processing			
Solvent extraction and electrowinning	High purity electro-won cathodes	8,500	2,500–4,500
Semi-manufacture/manufacturing			
Semi-manufacture	Semi-manufactured articles of copper (bars, rods, profiles)	11,900	3,200–3,700
	Wire of refined copper, with a maximum cross-sectional dimension of > 6 mm	8,800	300–600
	Wire of refined copper, with a maximum cross-sectional dimension of <= 6 mm	8,900	500–800
Manufacturing	Tubes and pipes of refined copper	6,000	(2,200–2,500)
	Stranded wire, cables, plaited bands and the like, of copper (excluding electrically insulated products)	15,000	3,100–6,200

Value chain stage	Product	Average export price per tonne of copper content (USD)	Increase in value of a tonne of copper compared to previous value chain stage (USD)
	Screws, bolts, nuts and similar articles, threaded, of copper (other than screw hooks, ring- and eyebolts, lag screws, plugs, bungs and the like, with screw thread)	5,000	(3,800–6,900)
	Washers, screw hooks, screw rings and the like, threaded, of copper (excluding standard screws and bolts and nuts)	1,000	(7,800–10,900)
	Sanitary ware, and parts thereof, of copper (excluding cans, boxes and similar containers of heading 7419, and fittings)	11,000	(900)–2,200
	Refined copper tube or pipe fittings (e.g., couplings, elbows, sleeves)	104,000	92,100–95,200
Chemical processing			
Chemical processing	Copper oxides and hydroxides (in bulk)	1,000	Unclear

Note: We do not include alloys or products further downstream that combine copper with other materials, as we lack the information to calculate the level of copper content and the price per kilogram.
Source: Authors' analysis based on AfDB & IGF, 2025; ITC, 2025b; United Nations, n.d.

Several patterns stand out in Table 1.

- First, midstream processing delivers largely and relatively consistent price gains. Smelting and converting can increase the price of copper (per kg of copper content) by up to USD 3,800 per tonne, almost doubling the price compared to concentrate. Refining through solvent extraction and electrowinning can more than double the price compared to concentrate.
- Second, some semi-manufactured and manufactured products command very high prices, particularly for products such as strander wire, copper tunes, or pipe fittings, which show particularly large price premiums reaching up to USD 95,200. By contrast, products such as copper wire—currently much of the focus of Zambia's downstream manufacturing—offer more modest price increases per tonne than some midstream processing activities.

- Third, higher levels of processing do not automatically translate into higher prices. Electrorefining, for example, does not appear to increase prices relative to smelted copper, and several manufactured products show lower unit prices than refined copper. This underlines that market outcomes depend on various factors, such as product type and demand from end-use markets.

Taken together, these price differentials indicate where higher export revenues may be generated along the copper value chain. At the same time, they reinforce the need for a cautious, cost-competitive, and sequenced approach to value addition, in which price signals are interpreted alongside production costs, feasibility, and domestic value retention—issues examined further in the following sections.

4.0 Key Opportunities for Increased Copper Value Addition in Zambia

Available evidence points to clear but differentiated opportunities for Zambia to expand value addition along the copper value chain. As the country is set to triple its copper production, trade diagnostics, economic complexity analysis, and sector studies broadly converge on two findings: increased midstream processing offers the most immediate and scalable opportunities, while downstream manufacturing holds longer-term potential but is constrained by current enabling conditions. The sections below synthesize these findings and draw out their policy implications.

4.1 Expansion of Midstream Mineral Processing: What the evidence shows

Multiple trade diagnostics converge on a clear finding: Given existing capabilities, infrastructure, and markets, Zambia's strongest near-term opportunities for copper value addition lie in further expanding midstream processing—specifically, smelting and refining. While most mined copper is already smelted and converted domestically, refining capacity remains more limited.

Trade diagnostics by the ITC identify smelted but unrefined copper anodes and refined copper cathodes as Zambia's largest export expansion opportunities among products it already exports. Accounting for projected supply capacity, demand growth in partner markets, and tariff liberalization under the African Continental Free Trade Area (AfCFTA), ITC estimates that Zambia could increase annual exports of smelted but unrefined copper anodes by up

to USD 2.4 billion and refined copper cathodes by up to USD 1.3 billion by 2030, compared to 2020–2024 (ITC, 2025b).[3]

Using a different methodology, the Observatory of Economic Complexity (OEC) reaches a closely aligned conclusion. Based on Zambia's existing export basket and network position in global and regional trade, the OEC ranks smelted copper anodes and other refined but unwrought copper products among those for which Zambia is best positioned to expand exports (Jun et al., 2020; Simoes & Hidalgo, 2011).

The World Bank (2025a) reinforces this assessment, finding that Zambia could increase copper-based export revenues by up to sixfold within a decade, even under its current product mix dominated by smelted and refined copper, provided key enabling conditions are addressed.

TABLE 2. Comparative summary of findings of midstream copper opportunities

Dimension	ITC	OEC	World Bank
Key conclusion	Largest export expansion opportunities are in smelted and refined copper	Zambia best positioned to expand exports of smelted anodes and refined unwrought copper	Major near-term revenue gains achievable from existing copper product mix
Analytical lens	Trade potential (supply, demand, tariffs)	Economic complexity and network position	Economy-wide competitiveness and constraints
Time horizon	Short to medium term	Short to medium term	Short to medium term
Implication for value addition	Prioritize and scale up midstream processing capacity	Deepen competitiveness in processing before downstream fabrication	Prioritize enabling conditions over product switching

Sources: ITC, 2025b; Jun et al., 2020; Simoes & Hidalgo, 2011; World Bank, 2025a.

However, it is important to highlight that expanding refining is not a purely commercial decision. As shown in Table 1, the price of refined copper is actually lower than the price of smelted copper (blister and anodes). There are, therefore, few incentives to invest in refining

[3] Increasing exports by the amounts indicated here will depend on the copper price. It could also require increased copper mine output or imports of feedstock to supply Zambia's processing industry. ITC considers that Zambia could increase its exports of copper anodes by 59% in 2030 compared to a weighted average of the last 5 years (ITC, 2026a, 2026b). The fact that the copper content contained in Zambia's exports of copper anodes already account for 80%–82% of the country's mine output and production has apparently been decreasing over the period 2020–2024 (Idoine et al., 2025; USGS, 2025) suggests that an increase of this size would require feedstock greater than the country's current copper mine output. The government's aim of increasing copper production to 3 million tonnes (Mt) per year by 2031 would facilitate this if achieved.

facilities that are capital-intensive with long payback periods, energy hungry, and technically demanding.

This suggests that further expansion of refining is most likely to be viable where it is linked to broader industrial and market strategies. Aligning refining capacity with domestic downstream demand and growing regional markets—such as for electrical conductors, construction materials, and energy infrastructure—can help improve refinery utilization rates, reduce logistics costs, and strengthen investment economics. In this context, the planned increase in copper production under Zambia's 3 Million Tonnes (3MT) strategy creates an opportunity not only to process additional ore domestically but also to better integrate refining with downstream manufacturing and regional supply chains.

This strategic logic is further reinforced by evolving geopolitics around critical minerals. Copper is listed as a critical mineral by many countries, as it is an essential input for energy transition, electrification, and industrial security. There is growing concern among major consuming economies about the high concentration of midstream copper processing and refining capacity in China. As governments and firms in the United States, the European Union, and other partners seek to diversify supply chains and "de-risk" from concentrated processing hubs, there is renewed interest in alternative locations that combine resource availability, political stability, and credible environmental and social governance.

In this context, Zambia's existing smelting base, increasing investment, low-carbon electricity mix, and ambitions to expand refining capacity position it as a potential partner in diversified copper supply chains. Recent Memorandums of Understanding (MOUs) on critical minerals cooperation with the United States and the European Union signal this interest.

Translating geopolitical intent into sustained investment will require more than upstream production growth. It will depend on Zambia's ability to offer reliable and competitive access to energy, predictable feedstock access, infrastructure to access ports, competitive logistics, and clear linkages between refining capacity and downstream or regional demand.

4.1.1 Product Complexity, Sequencing, and Enabling Conditions

While midstream expansion offers significant revenue potential, it is unlikely to drive broad-based diversification or sustained income growth alone. Smelted and refined products are relatively low-complexity products, and higher-income economies typically specialize in more complex products (Felipe et al., 2012; Simoes & Hidalgo, 2011).

At the same time, OEC analysis indicates that Zambia has limited near-term scope to move directly into high-complexity segments, which are dominated by advanced industrial economies. This does not imply a choice between midstream and downstream activities, but rather a need for deliberate sequenced upgrading anchored in realistic markets.

Midstream processing serves as a platform for downstream development by securing feedstock, building industrial skills, and lowering input costs for manufacturers. Downstream manufacturing strategies are more likely to succeed when oriented toward domestic and regional demand, particularly in copper-intensive applications linked to electrification, energy infrastructure, and construction, areas where Zambia and the wider African region face large and persistent investment gaps.

Economic complexity research suggests that a step-by-step diversification approach, grounded in existing capabilities but guided by future demand in regional energy and infrastructure markets, offers a more realistic and strategic pathway to higher-value manufacturing over time (Alshamsi et al., 2018; Growth Lab, n.d.).

The World Bank (2025a) underscores that realizing these gains depends less on product choice than on enabling conditions, notably reliable electricity supply, efficient trade logistics, and policy reforms that improve competitiveness and investment certainty. Recent power shortages that curtailed smelter output—including at the Chambishi copper smelter in 2024—illustrate the binding nature of these constraints (Luk & Mfula, 2024).

4.1.2 Import Substitution: Limited scope

Import substitution in midstream copper offers limited additional scope for copper value addition. As Table 2 shows, Zambia's imports of copper products are small and concentrated in niche items, indicating narrow domestic demand for locally produced substitutes.

Table 3 summarizes key imported copper products. Given the limited scale of domestic demand, strategies centred on replacing imports are unlikely to drive significant industrial growth. Export-oriented approaches—anchored in regional and global markets—remain more relevant.

TABLE 3. Zambia's imports of selected copper products, 2023

Copper product	Zambia's imports in 2023, USD million
Copper, refined, in the form of cathodes and sections of cathodes: Electrorefined cathodes (high purity)	0.8
Copper-tin base alloys (bronze) unwrought	0.2
Master alloys of copper (excluding phosphorus-copper compounds [copper phosphide] containing, by weight, > 15% phosphorus)	2.1

Source: Authors' analysis of United Nations, n.d.
NB: Tariff lines with imports of less than USD 100,000 are excluded.

4.2 Expansion of Copper Manufacturing: Limited near-term scope and longer-term potential

Evidence suggests that opportunities to expand copper-based manufacturing exports beyond midstream processing exist but are modest in scale. ITC estimates incremental export potential by 2029 for products Zambia already produces, including low-voltage electrical conductors (up to USD 34 million), refined copper wire (>6 mm, USD 19 million), and other refined copper products (USD 6.1 million) (ITC, 2025b). Among manufactured products, low-voltage cables stand out as a relatively stronger opportunity, ranking just behind Portland cement in unrealized export potential.

However, these opportunities are small compared to smelting and refining, and most copper manufacturers fall outside Zambia's top 10—and often top 50—export opportunities. Both ITC and OEC find that Zambia is currently better positioned to expand exports of non-copper products, such as cement or certain steel products, than most copper-based manufactured goods.

UN Trade and Development reaches a similar conclusion, identifying limited diversification potential for new copper manufacturers compared to other products, such as aluminum oxide and nickel sulphates. The most promising copper-related opportunity identified is articles made of copper—mainly tubes, pipes, and semi-fabricated products—with an estimated export potential of around USD 22 million annually, largely to markets outside the region (Freire, 2025).

By contrast, the World Bank (2025a) presents a more optimistic long-term scenario. It suggests that Zambia could increase copper-based export revenues up to tenfold within a decade if it successfully expands into higher-value semi-finished and manufactured copper products and expands its smelted and refined copper exports. These gains could be realized if constraints related to electricity supply, access to feedstock, logistics, and governance are addressed.[4] Priority opportunities include supplying regional demand for copper rods, wires, cables, transformers, and electrical equipment, and—over a longer time horizon—participation in component manufacturing for clean-energy technologies (Adewumi, 2024, cited in World Bank, 2025a). Importantly, the study also notes that larger and more immediate gains continue to come from expanding smelted and refined copper exports.

4.3 Discussion: Sequencing, constraints, and policy choice

Across ITC, OEC, UN Trade and Development, and World Bank analyses, there is strong convergence on a central conclusion: copper smelting and refining represent Zambia's most robust and immediately scalable value-addition opportunities within the copper value chain and represent key opportunities for the country to expand its exports. Downstream manufacturing offers smaller, riskier, and more conditional gains in the short term.

These analytical tools, however, have limitations. They rely on observed trade patterns and inferred capabilities and cannot fully capture policy-driven shifts such as coordinated infrastructure investment or strategic industrial targeting. International experience shows that countries can, under certain conditions, diversify beyond what data-driven models predict. Costa Rica's transition from agricultural exports to semiconductors and medical devices is a notable example of this (Reed, 2024). Consistent with this, the World Bank (2025a) remains cautiously optimistic about Zambia's longer-term prospects in more sophisticated copper-based manufacturing.

Nevertheless, binding constraints—particularly electricity availability—currently limit the feasibility of expanding copper-based manufacturing at scale. Without significant new generation capacity, further industrial expansion risks crowding out households and other productive sectors. While off-grid solutions are emerging, they remain partial and firm-specific (Ecofin Agency, 2025; ESI Africa, 2024; Jardim, 2024).

[4] Key aspects of Zambia's policies relating to the copper value chain are discussed in Section 6.

A sequenced strategy therefore appears most prudent. In the short term, policy efforts should prioritize scaling smelting and refining where capabilities and export potential already exist. In parallel, investment in electricity generation, logistics, and skills would help relax constraints over time. As these constraints ease, Zambia can pursue expansion into manufacturing, building on increased feedstock availability—particularly for regional infrastructure and electrification markets—and on increased feedstock availability and existing industrial capacity (Logan & Acheampong, 2025).

Ultimately, copper-based manufacturing should be viewed as one option within a broader industrial and export strategy, rather than an end in itself. Prioritization will need to balance export growth potential, economic complexity, feasibility, and opportunity cost. A clear long-term vision, combined with disciplined sequencing, will be essential to ensure that copper value addition contributes to durable, inclusive, and sustainable economic transformation.

5.0 Challenges for Further Copper Value Addition in Zambia

Zambia's ambition to expand copper value addition beyond mining is widely shared and well justified. However, evidence from firm surveys, analytical studies, and stakeholder consultations points to several binding constraints that will determine whether midstream and downstream value-addition efforts succeed or stall.

Many challenges are well known, but they are not equally constraining, nor can they be addressed simultaneously. Although the government has recently attempted to improve the business environment, which is expected to yield positive results (Levin Sources, 2023), difficulties remain.

This section highlights key constraints as enabling conditions necessary to spur industrial development. It also highlights the economic, social, and environmental risks that arise if value addition is pursued without addressing these constraints in a sequenced and coherent manner.

5.1 Factors Hampering Industrial Development

5.1.1 Electricity: The critical binding constraint

Electricity remains a decisive bottleneck for industrialization. In that regard, access to reliable, affordable electricity is a major obstacle to copper value addition in Zambia. Enterprise surveys and the World Bank's Doing Business data consistently identify electricity reliability as a major obstacle to firm performance and industrial expansion (Aguirre Unceta, 2021; Saggese et al., 2024; World Bank, 2025b, cited in Mulder et al., 2024).[5]

Zambia's heavy reliance on hydropower, coupled with disruption to rainfall patterns due to climate change, has led to frequent power shortages that are expected to persist (Sparkman & Tobin, 2023). At the same time, electricity tariffs set below operating costs have constrained investment in generation and grid infrastructure, although reforms are under consideration (see Section 6.5 for further details) (IMF, 2023).

[5] We thank the Enterprise Analysis Unit of the Development Economics Global Indicators Group of the World Bank for the data.

5.1.2 Finance Constraints Are Structural But Solvable With Targeted Levers

Limited access to affordable finance is a major constraint for Zambian firms, including manufacturers (Aguirre Unceta, 2021; Mulder et al., 2024). In practice, the challenge is less about the absence of financial institutions and more about high borrowing costs, limited long-term credit, and collateral constraints, particularly for small and medium-sized enterprises (Chilembo, 2021; Economic Commission for Africa [ECA], 2025).

Banks provide most of the financing in Zambia (Kaluba & Haabazoka, 2024; PwC, 2023; Simpasa, 2013).[6] While the country's banking sector remains profitable—with a return on average assets of over 5%—high interest rates suggest scope to improve credit conditions if risks are better managed and the supply of loanable funds increases (IMF, 2023; IMF African Dept, 2024).

Interest in local capital markets, including the stock exchange, remains limited, reflecting the structural constraints smaller economies face in developing deep and liquid markets (ECA, 2025; Torre & Schmukler, 2007). Given that Zambia has already implemented key foundational reforms—such as a prefunded pension system and liberalized financial flows (Meh & Schmukler, 2025)—further efforts to deepen local capital markets are unlikely to be the most effective lever for mobilizing additional finance in the near term.

Leakages further constrain domestic finance. The Government of Zambia estimates that the country is experiencing illicit financial outflows of USD 5 billion per year (ECA, 2025), equivalent to 60% of current investment (authors' calculations based on IMF African Dept, 2024; World Bank Group, n.d.). This reduces domestic liquidity.

In addition, significant domestic savings are held abroad. Bank for International Settlements data indicate that Zambian residents hold around USD 6 billion with overseas banks (around 70% of Zambia's annual gross investment) (authors' calculations based on Bank for International Settlements, 2025; IMF African Dept, 2024). The IMF projects that in 2025, Zambia will invest abroad an amount equivalent to 16% of the country's gross domestic investment (authors' calculations based on IMF African Dept, 2024). At the same time, international capital remains structurally under-allocated to sub-Saharan Africa (British International Investment, 2025; Meh & Schmukler, 2025), further constraining the pool of long-term finance available to domestic firms.

5.1.3 Feedstock and Input Availability Undermine Downstream Feasibility

Predictable access to competitively priced feedstock is a binding constraint for downstream copper fabrication and manufacturing in Zambia, as well as copper alloy production. While export opportunities exist, downstream activities cannot scale without reliable access to inputs.

For copper fabrication, firms typically prefer to use copper waste and scrap instead of refined copper because it is cheaper and reduces impurity risks (Finance and Private Sector Development Unit, Africa Region, 2011, p. 11; International Wire, 2025). However, Zambia's

[6] This can mean that stricter competition regulations would not increase efficiency; see Stiglitz, 2017.

limited industrial base constrains the availability of scrap, reducing this option in practice (Sekakela & Grynberg, 2016).

Moreover, stakeholder interviews indicate that commercial offtake agreements significantly limit domestic access to mined copper that Zambian firms can process further downstream, as the majority of cathodes are sold to foreign buyers (C. Freire, personal communication, June 25, 2025; Logan & Acheampong, 2025; World Bank, 2025a). Smaller manufacturers are particularly disadvantaged. Without the scale to commit to large volumes or long-term contracts, they face higher input costs and unreliable supply (Logan & Acheampong, 2025; Weate et al., 2024). These constraints have contributed to under-utilization of existing fabrication and cable-manufacturing capacity.

Input constraints extend beyond copper itself. Zambia does not mine key alloying metals such as zinc and tin, though it mines nickel, which can be alloyed with copper to produce cupronickel (Austrian Federal Ministry of Finance, n.d.). Its landlocked geography raises the cost of importing these inputs, further limiting the competitiveness of alloy-based products (Sekakela & Grynberg, 2016). While small-scale alloy production exists, it remains insufficient to support meaningful downstream expansion.

5.1.4 Trade Logistics and Market Access Constraints Raise Costs and Reduce Competitiveness

High international trade and logistics costs materially undermine the competitiveness of Zambia's copper exports. Transport costs for refined copper cathodes are estimated at USD 180–200 (World Bank, 2025a) per tonne, equivalent to roughly 25%–100% of the export price, significantly eroding margins (see Table 1).

These costs are compounded by long transit times—around 7 days via the Ndola–Walvis Bay corridor and up to two weeks via Durban—as well as lengthy documentary approvals (10–14 days) and repeated border checks, notably at Chirundu (World Bank, 2025a). Evidence shows that such delays and frictions can have a disproportionate negative impact on export performance, particularly for time- and cost-sensitive manufactured goods (Djankov et al., 2010).

However, high trade costs (particularly freight costs) may boost the incentive to smelt, convert, and refine copper ores and concentrates in Zambia, since they increase the benefit of reducing the weight through mineral processing before the copper is shipped internationally (Scurfield et al., 2024). Indeed, the Organisation for Economic Co-operation and Development's (OECD) estimates of the cost of shipping copper products from Zambia to China indicate that the cost of shipping copper ores and concentrates could account for 7% of export value and be up to seven times the cost per kilogram of copper content shipped compared to shipping copper anodes, or nine times the cost of shipping refined copper cathodes (AfDB & IGF, 2025; OECD, 2025; United Nations, n.d.).

Nevertheless, reducing trade costs may still support the development of copper-based industries. This is because they can help to increase investment in copper mining in Zambia by reducing the costs of importing inputs and exporting production, regardless of the level of processing. This could enable the expansion of midstream and downstream industries that use mine output as feedstock. In addition, reducing trade costs would support local manufacturing of copper products using imported inputs and the production of copper alloy

by reducing the cost of importing these inputs, given that manufacturers must import these due to difficulties obtaining them locally.

5.1.5 Demand Constraints, Low Margins, and Intense Competition

Demand constraints remain a critical limitation for copper fabrication in Zambia. Sekakela and Grynberg (2016) note that "the major source of demand for copper products is the manufacturing and construction industries" (p. 85) and that "there is insufficient demand in the [Southern African Development Community (SADC)] region" (p. 85) They further argue that "Zambia cannot competitively access long-distance markets for fabricated products" (p. 85), as competitiveness in products such as low-voltage cables is undermined by logistics constraints, including border delays and long lead times, particularly in markets such as India and East Asia where strong local production capacity exists.

Stakeholder interviews carried out in 2025 reinforce this assessment, indicating that domestic demand alone cannot sustain copper-based industries. They also highlight that demand from Zambia alone is insufficient to support viable copper fabrication and that firms are typically located close to end markets rather than to sources of raw material (Finance and Private Sector Development Unit, Africa Region, 2011).

At the same time, regional demand for copper-based products is growing, creating a more plausible market for Zambia. The World Bank is growing opportunities in neighbouring countries, and Zambia's participation in the SADC Free Trade Area (FTA)—which eliminates tariffs on most products traded with immediate neighbours—strengthens the case for a regional rather than global market strategy for copper fabrication (SADC, n.d.).[7]

5.1.6 Low Margins and Global Competition Pressure

Low and increasingly volatile margins pose a structural challenge to copper value addition in Zambia. Sekakela and Grynberg (2016) show that margins in copper beneficiation (i.e., smelting and refining) and fabrication are low, reflecting intense global competition, particularly from China. This pressure has intensified. Smelting margins reportedly turned negative in 2025 (Hodgson, 2025), underscoring the vulnerability of processing activities to global market cycles.

These margin pressures are not temporary. China's dominance in copper refining—accounting for an estimated 44% of global refinery output—has reshaped global pricing dynamics, compressing treatment and refining charges and limiting the scope for new entrants to compete on cost alone (authors' calculations based on USGS, 2025). For Zambia, this means that value addition cannot rely on scale or cost competition alone, particularly in segments where global overcapacity and state-backed investment in competing jurisdictions depress returns.

At the manufacturing stage, competition from imports further constrains profitability, mirroring broader challenges faced by Zambia's manufacturing sector (Aguirre Unceta, 2021). In this context, pursuing downstream copper activities without addressing structural cost

[7] The DRC is not a SADC FTA member. Angola is not yet a member but is preparing to join the FTA (SADC, 2025). Malawi, Tanzania, and Zimbabwe have retained duties on some products and therefore do not fully apply the FTA.

drivers—such as electricity reliability, logistics efficiency, and access to competitively priced inputs—risks locking in low-margin or loss-making activities.

5.1.7 Skills and Capabilities: A structural constraint on scaling value addition

Skills shortages represent a structural bottleneck to Zambia's copper value-addition ambitions, affecting both supply and upgrading potential. Evidence suggests that Zambia's technical and vocational education and training (TVET) system may be unable to produce a sufficient number of technicians and technologists to support the planned expansion of copper mining in line with the government's plans, which in turn constrains feedstock availability for downstream processing and manufacturing (Ninan Dulvy et al., 2025). In this sense, skills constraints limit value addition indirectly, by restricting the scale and reliability of upstream production.

At the downstream level, skills gaps are even more pronounced. Sekakela and Grynberg, (2016) identify inadequate worker skills as a key factor constraining the development of copper fabrication in Zambia. World Bank analysis reinforces this diagnosis, noting that advancing into higher-value copper processing and manufacturing requires a different and more sophisticated skills profile, particularly in areas such as process engineering, quality control, maintenance, and research and development (Ninan Dulvy et al., 2025). Without targeted investments in these capabilities, efforts to move further along the copper value chain risk remaining limited to low-value or low-margin activities.

5.1.8 Policy Coherence and Consistency: Aligning ambitions with delivery capacity

A central challenge for Zambia's copper value-addition agenda is the misalignment between industrial ambitions, enabling infrastructure, and policy implementation capacity. The country's Integrated Resource Plan (IRP) (Ministry of Energy, 2023) projects copper output reaching 3 Mt per year only by 2040, up from 800,000 tonnes currently, while government targets aim to reach that level by 2031. At the same time, the mining sector already consumes approximately 50% of available electricity, and, as noted above, overall supply is insufficient to meet current demand, let alone support rapid expansion (Saggese et al., 2024). This divergence risks undermining policy credibility and investor confidence, as industrial growth targets are not yet underpinned by realistic energy delivery pathways.

The need for adaptive and implementation-aware policy design is also evident in Zambia's legal and regulatory framework for copper value chains. For example, the National Local Content Strategy (2018–2022), while well intentioned, did not sufficiently account for domestic supply-side capacity constraints as demand increased, limiting its effectiveness. Similarly, the temporary suspension of export taxes under the Customs and Excise Act (CAP 322) in August 2025—introduced in response to concentrated stockpiles following technical disruptions at local smelters—highlights the tension between policy objectives and operational realities. While taxing concentrates can be economically justified as a tool to encourage domestic processing and job creation, persistent technical challenges at local smelters can make domestic absorption infeasible in the short term, requiring flexibility in policy application.

At the same time, policy predictability remains critical for investment. Recent efforts by the Zambian authorities to provide greater clarity and reassurance around fiscal policy appear to have contributed to renewed large-scale investment in the mining sector (ECA, 2025).

5.1.9 Summary and Priority Areas for Action

The analysis above highlights a range of challenges for Zambia to facilitate the expansion of copper-based industries beyond mining. Interviews with stakeholders in Zambia carried out in May 2025 indicate that priority areas to address could include guaranteeing predictable feedstock through local content and offtake regulations, making energy more reliable and affordable, and leveraging the Lobito Corridor to support improved trade logistics (C. Freire, personal communication, June 25, 2025) (see Section 7.3 for further discussion of the Lobito Corridor).

5.2 Environmental and Social Risks

Expanding copper mining and copper-based industries can generate substantial economic benefits, but it can also amplify environmental and social risks that, if poorly managed, undermine the development outcomes and competitiveness of the industry. Buyers and investors are increasingly attentive to environmental and social performance, making stronger safeguards not only a necessity but also a potential source of advantage (Davis & Shafaie, 2023; World Bank, 2025a).

5.2.1 Local Environmental and Social Impacts: Cumulative risks are rising

Like most governments tasked with the management of mineral resources, the Zambian government is at the crossroads of delivering on national development goals while simultaneously addressing the growing risks of climate change.

Copper mining and processing can drive land disturbance, erosion, water contamination, and air pollution, with implications for public health and local livelihoods. In the Copperbelt, artisanal copper–cobalt mining provides livelihoods for an estimated 500,000 people, but it is often associated with land degradation, erosion, and water pollution. Large-scale copper mining operations—which have a particularly high environmental footprint—carry cumulative impacts, including on biodiversity and natural ecosystems. Risks increase as ore grades decline and waste volumes rise, elevating the importance of tailings and stockpile management and post-closure liabilities.

Government therefore needs to ensure that mine waste facilities are designed, operated, and closed using site-specific risk assessments and international good practices, with monitoring throughout the mine life and after closure, including for cumulative impacts where operations cluster.

Water stress adds another layer of risk. Mines already operate in areas of high competition for water, and climate change is expected to intensify scarcity, raising the risk of conflict with other users, such as farmers and local communities. Evidence of serious local impacts—such as public health risks from air pollutants and heavy metals or reported cases of significant water pollution, as in the case of the Chambishi multi-facility economic zone (MFEZ) (E.

Lange, personal communication, November 19, 2025)—further reinforces the need for stronger safeguards.

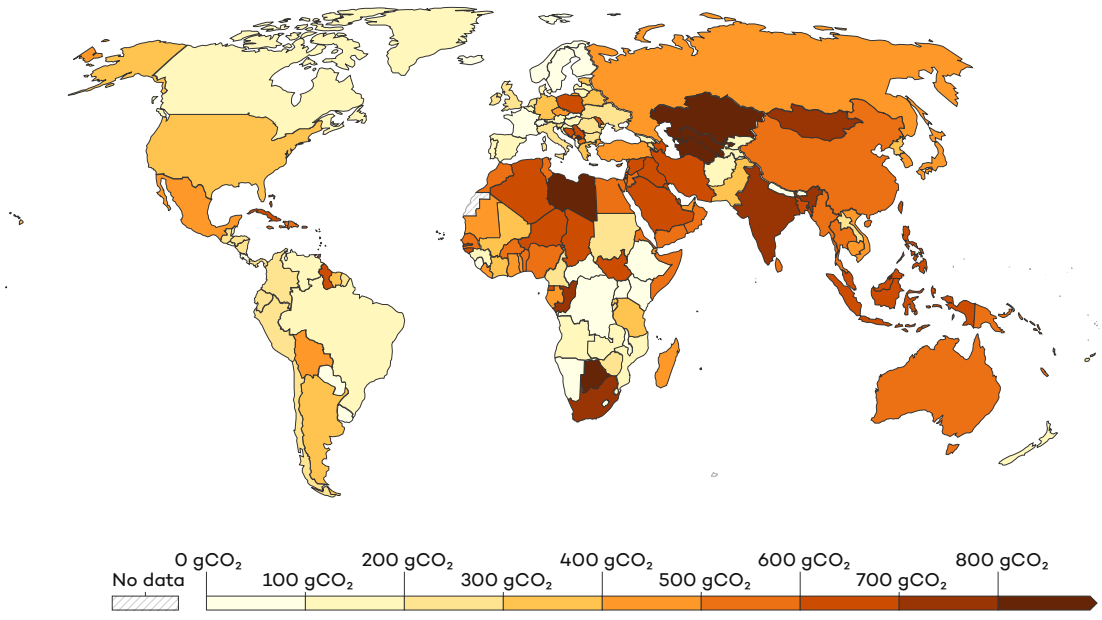
Artisanal and small-scale mining (ASM) requires a tailored regulatory approach. ASM miners often struggle to comply with environmental regulations and standards that apply to the sector. It is therefore important to adopt specific, fit-for-purpose rules, licensing, and enforceable environmental management plans. Safeguards should include water protection, biodiversity and deforestation controls, and attention to operations in High Conservation Value Areas, including requirements for mitigation plans and ecosystem service protection around communities.

Carbon Intensity and Greenhouse Gas Emissions

Copper production is among the most carbon-intensive activities in the metals sector, with emissions estimated at ~4.1 tonnes of carbon dioxide equivalent (CO_2e) per tonne of refined copper, a level twice that of steel production, which stands at about 1.9 Mt of CO_2e per tonne produced on average. Emissions intensity varies significantly by technology, scale, and feedstock, with sulphide ores refined through pyrometallurgy typically being far more carbon-intensive than oxide-ore processing routes.

Zambia is comparatively well positioned in this context. Because electricity generation is dominated by hydropower, the carbon intensity of metals production in Zambia is likely to be lower than in many competing processing jurisdictions (Figure 6). By contrast, China—the world's largest copper refiner, accounting for an estimated 44% of global refinery output—relies on a more carbon-intensive power mix, which could gradually erode its advantage in emissions-sensitive markets (Acuna & Llancas, 2024; USGS, 2025).

FIGURE 6. Emissions intensity of electricity generation by country



Source: Ember, 2025a, 2025b, with major processing by Our World in Data, 2025.

This matters strategically: Global buyers are increasingly seeking lower-emission copper as part of lower greenhouse gas emission energy supply chains, and emissions performance is becoming a factor in market access, pricing, and investment decisions (Acuna & Llancas, 2024; Chatham House, 2024; USGS, 2025).

To leverage its low-emission intensity comparative advantage, the government needs to accelerate the shift toward renewable energy sources to guarantee access to copper mining and refining operations. However, as highlighted earlier, there are nonetheless risks associated with excessive dependence on a single source of energy due to climate variability. In the case of Zambia, reliance on hydropower needs to be considered in the design of energy policies moving forward.

Carbon intensity should be treated as a core competitiveness lever in Zambia's copper value-addition strategy. This requires policies that accelerate renewable energy expansion and diversification, promote energy-efficiency improvements in mining and refining, and create enabling conditions for investment in cleaner processing technologies. Attention is needed for sulphide-ore processing via pyrometallurgy, where emissions are highest; in addition, tailored regulatory frameworks, combined with targeted support for research, development, and technology upgrading, will be essential. If managed strategically, Zambia's low-carbon electricity base can support both environmental objectives and market positioning in a rapidly decarbonizing global copper value chain.

6.0 Assessment of Zambia's Policies for Copper Value Addition

As Africa's second-largest copper producer, Zambia has historically been integrated into the global copper value chain through mining and primary refining (Idoine et al., 2025). However, new policy reforms aim to reposition the sector as a driver of industrialization and economic diversification by strengthening domestic processing capacity.

6.1 Mineral Development Policies: From mining to processing

Zambia's mineral development policies increasingly emphasize a shift from extraction to processing and beneficiation, reflecting a strategic goal of capturing more value from its vast copper resources.

The National Mineral Resources Development Policy (2022–2027) highlights the need to enhance local participation in the mining value chain and improve local value addition. It explicitly addresses industrialization imperatives, value addition, skills, and research and development, all directly relevant to the copper value chain. It aims to promote the beneficiation of minerals, including copper, through various incentives and regulatory support. The policy also highlights the importance of formalizing ASM and integrating it into the formal economy. However, the policy lacks an integrated approach to address challenges such as capacity building, access to finance, and competition with firms in Special Economic Zones (SEZs).

The National Mineral Resources Development Policy is backed by key legislation, including the Minerals Regulation Act No. 14 of 2024 and the Geological and Minerals Development Act No. 2 of 2025, with Critical Minerals Regulations under development to reinforce its goals. The policy is closely aligned with regional and continental frameworks such as the SADC, Common Market for Eastern and Southern Africa, and AfCFTA, as well as bilateral initiatives like the regional battery supply chain partnership with the DRC. Together, these frameworks aim to enhance market access, harmonize standards, and foster regional value chain development for battery components and midstream copper products.

The Minerals Regulation Commission Act (MRCA), 2024, which replaced the Mines and Minerals Development Act, 2015, introduces a more robust governance framework tailored to processing and beneficiation. It retains the requirement for processing licences while streamlining the application and approval process to encourage investment in downstream activities. The MRCA establishes an online, self-service cadastre for all exploration, mining, and processing licences, improving efficiency and transparency while reducing costs for operators. By broadly defining mineral processing to include refining and smelting, the act ties extraction directly to value addition. Meanwhile, new export permit requirements for both raw ores and processed minerals (see MRCA, art. 33) could help promote domestic beneficiation (though they also risk dampening mining investment). Together, these provisions align with Zambia's National Critical Minerals Strategy, which prioritizes local value chain development in critical minerals, including copper.

The Geological and Minerals Development Act, 2025, further strengthens this policy trajectory by institutionalizing value-addition responsibilities within the Ministry of Mines. It creates dedicated director-level positions focused on ASM and large-scale mining, each with mandates to promote beneficiation and reinvestment in processing.[8] Supporting provisions include the establishment of an accredited mineral laboratory to enhance technical capacity and quality assurance and the introduction of comprehensive local content requirements to boost Zambian participation in supply chains. These measures not only promote beneficiation but also ensure that processing is included in employment, procurement, and investment policies. Collectively, the MRCA 2024 and the Geological and Minerals Development Act, 2025, demonstrate Zambia's commitment to moving its mining sector beyond extraction, positioning value addition as a core policy priority to maximize development outcomes from its mineral resources.

The government also plans to introduce regulations for offtake agreements to guarantee adequate supply of copper for mineral processing operations in the country. It has already required some copper mines (Mopani Copper Mines and Konkola Copper Mines) to reserve 20% of their production for the local market. Yet their "low production in recent years has created local market scarcity" (R. Chabala, personal communication, December 9, 2024, cited in Logan & Acheampong, 2025).

Research indicates that difficulties enforcing contracts, fragmented permitting processes, and regulatory uncertainty all deter investment in downstream copper activities (Saggese et al., 2024).

6.2 Industrialization Policies: Value addition through diversification

Zambia's industrial policy reflects several recognized good practices, notably a strong emphasis on dialogue with the private sector, which is widely identified as a critical condition for effective industrial policy design (ECA, 2025; Rodrik & Stiglitz, 2024). Building on this foundation, Zambia's industrial strategy places value addition and diversification at the centre of efforts to reduce dependence on raw copper exports and accelerate structural transformation.

[8] As noted in Section 3.2, small-scale mining contributed around 9% of Zambia's copper production during the first half of 2025 (Zambia Monitor Contributor, 2025).

These priorities are clearly articulated in the Eighth National Development Plan (2022–2026), which explicitly prioritizes local processing and downstream product development and stronger linkages to the mining sector. The objective is not value addition for its own sake, but the creation of higher-quality employment, increased fiscal revenues, and improved competitiveness in regional and global markets.

One of the flagship tools for advancing this objective is the establishment of SEZs, designed to attract investment into manufacturing and processing activities. The Chambishi MFEZ illustrates how spatially targeted policies can support clustering of copper-based industries close to mining operations (Page & Tarp, 2020). Building on this model, the government is planning to establish an SEZ dedicated to battery electric vehicles, intended to integrate Zambia into the global clean energy and electric mobility value chains, from copper processing for electrical components to battery and vehicle manufacturing, using domestically produced copper (M. Mukando, personal communication, November 4, 2025). This initiative signals a deliberate attempt to align mineral endowments with higher-growth, technology-driven sectors with global demand.

However, policy ambition currently outpaces implementation planning. Zambia does not yet have a detailed roadmap that specifies how value-addition objectives will be realized, or how trade-offs across sectors will be managed. More critically, policies affecting key competitiveness drivers—particularly energy infrastructure—are not yet fully aligned with industrial targets. The IRP (2023) projects that copper output will not reach 3 Mt per year until 2040, while the government targets aim to reach this level by 2031 (Ministry of Mines and Mineral Development, 2022). Given that the mining sector already consumes a substantial share of available electricity, this divergence risks creating a binding constraint on beneficiation and manufacturing if energy supply expansion does not keep pace.

For industrialization policies to translate into tangible value addition, Zambia will need to move from strategy to sequenced delivery. This requires aligning industrial targets with realistic energy and infrastructure planning; clarifying priorities for allocating new power supply among mining, manufacturing, and social needs; and developing an implementation roadmap that links SEZs, energy investment, skills development, and feedstock access. Without this alignment, diversification initiatives risk remaining aspirational rather than transformative.

6.3 Local Content Policies: Value retention

Zambia's local content policies are intended to ensure that value is not only captured but retained within the Zambian economy by ensuring that mining benefits translate into wider economic opportunities. While the policy intent is clear, outcomes to date have been uneven, reflecting gaps in scope, definition, and implementation capacity.

The first major intervention, Statutory Instrument 36 of 2011 under the Citizen Economic Empowerment Act, linked preferential procurement to citizen ownership and empowerment. However, its impact on value retention was limited. The instrument was applied primarily to public sector procurement and excluded the mining industry, allowing Zambia's most strategic industry to continue relying heavily on imported inputs and foreign suppliers. This exclusion significantly constrained the policy's ability to deepen and revealed the limitations of a fragmented approach to local content.

The National Local Content Strategy (2018–2022) sought to address these shortcomings by adopting a multi-sectoral framework that extended local content objectives to mining, manufacturing, and agriculture. In the mining sector, the strategy aimed to expand opportunities for Zambian suppliers and contractors while promoting domestic processing and beneficiation. While this marked a stronger commitment to integrating local content into the copper value chain, implementation fell short, largely due to weak enforcement mechanisms and limited domestic supplier capacity. As a result, the risk of "fronting"—where foreign products are repackaged through Zambian-owned entities—remained high, undermining the policy's core objective.

In parallel, Zambia's 3MT strategy has elevated value addition within the local content agenda by explicitly linking production expansion with downstream industrialization. The strategy targets an increased output to 3 Mt per year by 2031, from its current average level of 800,000 tonnes, while prioritizing investment in domestic processing and semi-finished products (Objective 7) (Chifunda, 2025). The 3MT strategy also identified complementary measures, such Mining Indabas, international investment promotion, and improved geological and market data to attract private investment to processing activities.

As part of Zambia's strategy to capture more of the value along the copper value chain, the state-owned Industrial Development Corporation of Zambia is also involved in copper trading through a joint venture with commodity trading company Mercuria. This may allow the country to capture more value from its copper by increasing sales prices through selling at the optimal time, while ensuring that at least some of the returns from this activity go to the state.

Local content policies will only support value retention if they move beyond ambition toward clear definitions, enforceable requirements, and realistic alignment with domestic capabilities. For Zambia, this implies shifting from ownership-based and compliance-driven approaches toward capability-based local content, anchored in supplier development, predictable demand, and integration with industrial, energy, and skills policies. Without this shift, local content risks becoming a formal requirement with limited impact on genuine domestic value creation.

In October 2025, Zambia adopted the Geological and Minerals Development (Local Content) (Preference for Goods and Services in the Mining Sector) Regulations, 2025. The regulations came into force January 2026. While at the time of publication it was too early to assess the impacts of the regulations, they appear to address some of the concerns outlined in the previous paragraph. In particular, the regulations provide a clearer definition of which firms are considered to be local (Zambian citizens must hold 25% ownership). Also, the regulation requires mining companies to support the development of local suppliers.

6.4 Policies on Access to Finance: Unlocking the collateral framework

Zambia has taken an important policy step to improve access to finance by establishing a collateral registry under the Movable Property Security Interest Act, which is intended to enable firms—particularly small and medium-sized enterprises—to use movable assets as collateral for loans. In principle, this framework should reduce credit constraints for domestic suppliers and manufacturers seeking to participate in copper value chains. In practice, however, the policy instrument remains underutilized and has delivered limited impact.

Evidence suggests that the weak performance of the collateral registry reflects implementation and market failures rather than flaws in the legal framework itself. First, demand for loans secured by movable collateral remains small, reducing incentives for lenders to invest in repossession systems and risk-management processes; as a result, many banks continue to discount or reject movable assets as acceptable collateral. Second, lenders face challenges in monitoring movable collateral, creating uncertainty over asset retention and increasing perceived credit risk. Third, limited awareness and understanding of the Movable Property Security Interest Act among financial institutions, particularly regarding the use of assets without unique serial numbers, has constrained uptake (Swiss Confederation et al., 2021).

6.5 Policies on Electricity Supply to Enable Industrial Development

As highlighted already, access to reliable and affordable electricity is central to Zambia's copper value-addition ambitions, and recent policy reforms signal a growing recognition of this constraint.

The 2021 IRP, coordinated by the Ministry of Energy, provides the overarching framework for electricity system development to 2050, with a planning horizon to 2030. Developed through extensive multistakeholder consultations, the IRP adopts a least-cost approach to meeting rising demand from mining, beneficiation, and industrialization, while also supporting the objective of universal electricity access (Ministry of Energy, 2023). The IRP aligns copper production targets—reaching 3 Mt per year by 2040—with long-term power system expansion.

However, implementation remains the critical challenge. As discussed earlier, unreliable electricity supply continues to constrain firms, reflecting years of under-investment driven in part by below-cost tariffs. To address this, the Energy Regulation Board adopted a 5-year transition toward cost-reflective tariffs in 2023, while retaining lifeline tariffs to protect low-income households (Bowa, 2023; IMF, 2023). For industry, higher tariffs may be offset by gains from improved reliability, reduced downtime, and lower unit production costs, suggesting that predictability and quality of supply matter as much as price.

Several complementary reforms aim to crowd in private investment. Zambia has declared the national grid open access, allowing independent power producers to wheel electricity through ZESCO's network, and established the Office for Private Power Investment to facilitate project development. In parallel, the partially state-owned Copperbelt Energy Corporation has invested in new generation capacity, including solar projects, while the Zambia–Tanzania Interconnector is expected to improve system flexibility by enabling access to regional power pools during periods of peak demand (World Bank Group, 2025).

Off-grid and distributed energy solutions form another pillar of the policy framework. Government initiatives—led through the Off-Grid Taskforce Initiative and guided by the Rural Electrification Master Plan—aim to expand electricity access, particularly in rural areas, while encouraging private investment in mini-grids and solar systems (Government of the Republic of Zambia, 2009; Ministry of Energy, n.d.). The Energy Regulation Board has approved a flexible regulatory framework for off-grid generation, including tariff flexibility for smaller systems, which has helped catalyze recent investments (Chilembo, 2019; Ecofin Agency, 2025; ESI Africa, 2024; Jardim, 2024; Zambia Off-Grid Electricity Portal, n.d.). At the same time,

tariff approval requirements for larger mini-grids introduce regulatory risk that could slow investment if not applied predictably.

6.6 Policies in Support of Skills Development: Aligning education systems with industrial needs

Skills development is a critical enabler of Zambia's copper value-addition and industrialization agenda, and the policy framework includes several important building blocks. Zambia has an extensive network of TVET institutions and has implemented an employer skills levy since 2016 to mobilize private sector resources for training. These instruments signal recognition that workforce capabilities are central to economic transformation.

However, evidence suggests that policy intent has not yet translated into adequate skills outcomes. The World Bank identifies systemic capacity constraints in the TVET system, resulting in weak training quality and limited use of digital technologies in education (Woldetsadik et al., 2024). At the same time, parts of the training system remain poorly aligned with industry needs: some TVET programs continue to teach obsolete technologies, while university education is often described as overly academic, with insufficient practical and applied training (Mubanga et al., 2019; Mulder et al., 2024). These mismatches reduce the employability of graduates and limit the availability of technicians, technologists, and engineers needed to support mining expansion and downstream processing.

Recent policy actions point in the right direction. The government is revising TVET curricula in consultation with employers, aiming to improve relevance and responsiveness to labour-market demand (Woldetsadik et al., 2024). There is also scope to strengthen industrial attachment and apprenticeship schemes, particularly with mining companies, to ensure that both TVET and university students acquire hands-on experience with modern technologies and operating environments (E. Lange, personal communication, September 23, 2025). Such measures would help address skills bottlenecks in mining and processing, support higher copper output, and indirectly enable greater value addition by improving feedstock availability (see Section 5.1.3).

6.7 Trade Policies: Enhancing value addition through export taxes and tariffs

Zambia's trade policy framework has increasingly deployed tax and tariff instruments to promote copper value addition, though with mixed results.

On the input side, the government has taken steps to reduce costs for domestic processors. Measures such as the suspension of customs duty and surtax on imported copper cathodes, alongside zero-rating copper cathodes for value-added tax,[9] aim to improve access to feedstocks at competitive prices. These interventions respond to the reality that domestic copper manufacturers are unable to secure sufficient cathodes at affordable terms, despite Zambia producing more copper than they consume (authors' analysis based on Logan & Acheampong, 2025; USGS, 2025). While these measures reduce input costs, their

[9] However, it may also encourage fraudulent tax refund over-claiming (Kravchenko, 2018).

effectiveness remains constrained by limited processing capacity and unreliable electricity supply.

On the export side, export taxes under the Customs and Excise Act (CAP 322)—notably the 10%–15% levy on unprocessed ores and concentrates (Section 72A) (Mulenga, 2025)—are intended to discourage raw mineral exports and incentivize local beneficiation. Similarly, value-added tax incentives for capital equipment and tax-free zone provisions encourage investment in processing infrastructure. In practice, however, these measures have had limited traction. Only about 5% of copper cathodes are currently transformed into rods and cables domestically, and firms have frequently sought exemptions from export taxes, citing unreliable power supply and insufficient smelting and refining capacity as binding constraints (Representatives from Zambia Revenue Authority, personal communication, November 27, 2024, as cited from Logan & Acheampong, 2025). This experience illustrates that fiscal disincentives alone cannot induce value addition when processing is not commercially viable.

Zambia's trade policy is also shaped by its regional and international commitments, particularly the SADC Protocol on Trade. Rules of Origin, which are meant to encourage domestic transformation by granting preferential market access for goods, meet the value-addition threshold. These provisions can support upgrading into wires, rods, pipes, and finished products.

Over time, similar incentives may emerge under the AfCFTA, once negotiations on product-specific rules of origin and tariff schedules are finalized. However, Zambia's relatively high tariffs on certain copper products, such as wires and cables, risk insulating domestic producers from competition and weakening export competitiveness. The World Bank has recommended a coordinated regional tariff approach, aligned across Common Market for Eastern and Southern Africa and SADC, to support integration into regional and global value chains without undermining competitiveness.

Beyond tariffs and taxes, Zambia deploys export promotion instruments and commercial diplomacy, which evidence suggests can support export expansion (Afesorgbor, 2019; Cruz et al., 2018; ECA, 2025; Hayakawa et al., 2014; Lederman et al., 2010; Marcelin & Nanivazo, 2019). However, current approaches remain largely supply-driven. Allowing firms to actively shape trade missions and market prioritization, based on their expansion strategies, could improve effectiveness (ECA, 2025). The country has also pursued dialogue with neighbouring countries such as Zimbabwe to address barriers to trade across the countries' shared border (A. Maliti et al., personal communication, November 20, 2025).

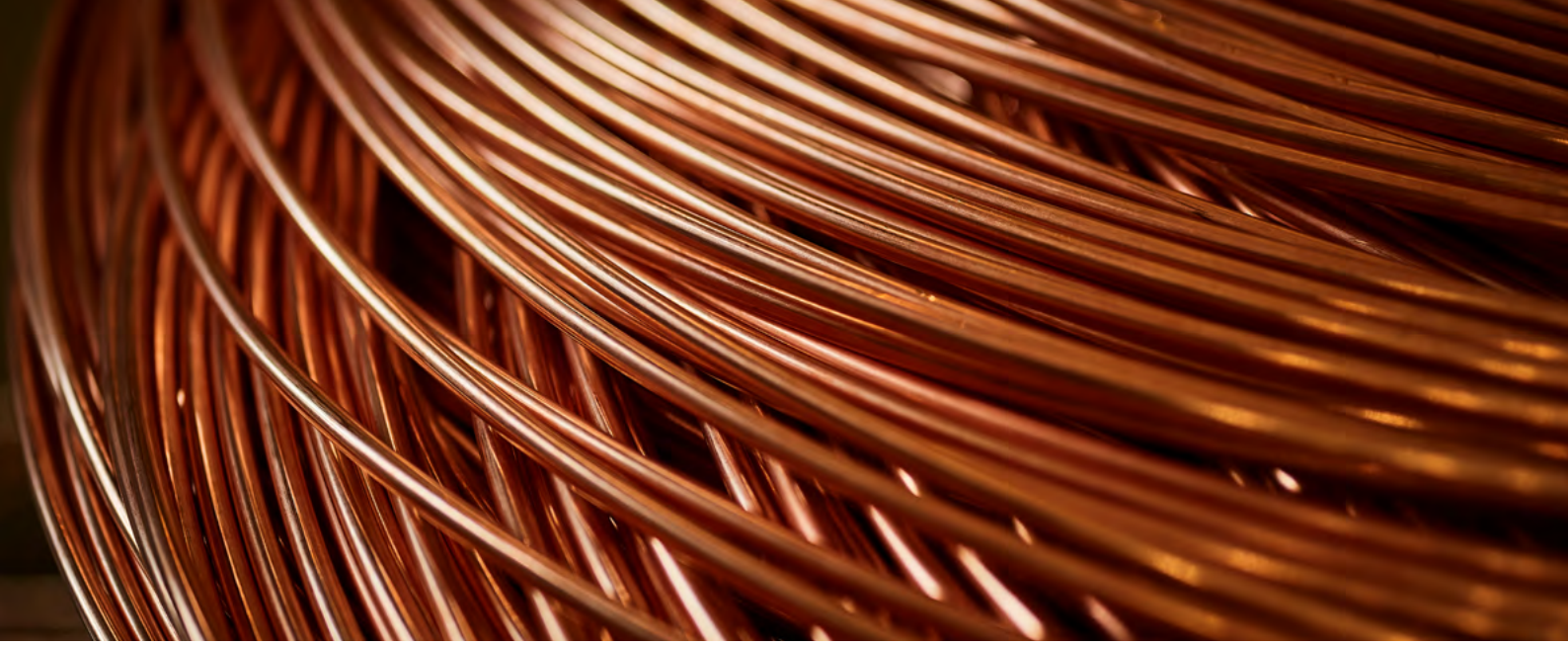
At the strategic level, the National Mineral Resources Development Policy (2022–2027) identified copper value addition as a priority but provides only limited guidance on how trade policy should interact with infrastructure, energy, skills, and industrial policy constraints. Similarly, while the Zambia Development Agency Act facilitates investment through SEZs, bonded facilities, and one-stop support services, it focuses more on enabling conditions than on targeted trade or fiscal incentives explicitly linked to beneficiation outcomes.

6.8 Policies on Environmental and Social Management of Artisanal Mining

Zambia's Geological Minerals Development Act No. 2 of 2025 provides for the creation of the Artisanal and Small-Scale Mining Fund. This fund provides financial support to artisanal and

small-scale miners. The government has decided to require beneficiaries of the fund to submit environmental and social management plans as part of project proposals; these plans must outline mitigation measures for potential environmental and social impacts of the project (Ministry of Mines and Mineral Development, Republic of Zambia, personal communication, December 22, 2025). This measure responds to the need to mitigate the environmental and social effects of artisanal mining, outlined in Section 5.2. Artisanal and small-scale miners may face challenges in developing and implementing environmental and social management plans. The government may therefore wish to consider building their capacity to do so.

Although the Zambia Gold Company is intended to purchase gold produced by ASM cooperatives, Zambia does not have a public agency that purchases the output of artisanal copper miners (Chifunda, 2025). Chile has successfully operated such a buying program, where public company Empresa Nacional de Minería offers to purchase artisanal miners' output, on the condition that such miners formalize (Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development, 2024, p. 23). This can be attractive for artisanal miners, as they may receive better prices if they sell to a public agency rather than the market intermediaries or small-scale processors to whom many of them currently sell (Kapekele, 2025; Vieira, 2025). Empresa Nacional de Minería also operates a copper smelter (Empresa Nacional de Minería, n.d.). Operating a public program to purchase and process artisanal copper could provide additional feedstock to Zambia's copper manufacturers, who are unable to obtain this feedstock at competitive prices from large-scale mining companies in the country. Using copper from artisanal and small-scale miners in this way may be particularly attractive if the volumes that the state can purchase from artisanal miners are at a scale that is too small for international buyers.



7.0 Conclusion and Recommendations

7.1 Conclusion

Zambia's continued reliance on upstream and midstream copper mining constrains economic diversification, job creation, and poverty reduction. Downstream value addition offers one pathway to strengthen development outcomes, but it must be pursued alongside broader efforts to address binding constraints.

The analysis shows that the main barriers to copper value addition are not a lack of opportunity, but structural weaknesses in enabling conditions. Unreliable electricity, limited access to affordable finance, skills shortages, high trade and logistics costs, and limited access to feedstock continue to undermine competitiveness across the copper value chain.

In the near term, copper smelting and refining offer Zambia the most credible value-addition opportunities. Trade diagnostics consistently show that these activities provide the largest and most feasible export gains, building on existing capabilities and infrastructure. Downstream manufacturing, by contrast, offers smaller and more uncertain gains in the short term and remains highly sensitive to access to affordable and sustained energy, various skill sets, and diversified market access, including at the domestic level with other economic sectors and at the regional and global levels.

Over the longer term, copper-based manufacturing can support diversification and technological upgrading. However, international experience shows that attempting to leap directly into downstream activities without first addressing foundational constraints risks low utilization, fiscal leakage, and policy fatigue. A sequenced approach is therefore essential.

Environmental and social considerations are central to the value-addition agenda. Expanding copper production and processing without strong safeguards risks undermining long-term value creation. At the same time, Zambia's low-carbon electricity mix offers a strategic opportunity to position its copper as a cleaner input into global and regional supply chains.

Finally, the effectiveness of copper value-addition policies depends on improved policy coordination, coherence across ministries and public agencies, industry actors, and consistency in the direction of travel, all of which are essential to maintain credibility with partners. Misalignment between industrial ambitions, energy planning, trade policy, and

skills development weakens investor confidence and limits impact. Value addition requires coordinated execution across government, not isolated policy instruments.[10]

7.2 Recommendations to the Government of Zambia

1. **To ensure policy coherence and coordination,** Zambian authorities may consider establishing formal coordination mechanisms across ministries and public institutions to align on objectives, ensure implementation and monitor results. Regular interagency policy assessments and joint planning exercises could create feedback loops that highlight gaps early and enable corrective action.
2. **The Government of Zambia needs to clearly identify and prioritize which segments of the copper value chain it intends to develop, and in what sequence.** Given limited public resources and implementation capacity, policy attention should focus on activities that are economically viable and realistically within reach, rather than attempting to support all segments simultaneously.
3. **To support informed prioritization, the government should invest in the data systems and analytical capacity** needed to estimate value added across different stages of the copper value chain. This includes developing a dedicated database and in-house expertise to analyze firm-level information on costs, inputs, employment, and domestic linkages, enabling more rigorous assessment of where net domestic value creation is greatest and where policy support can have the highest impact.
4. **In the short to medium term, and guided by clearly defined priorities,** the government should focus its industrial development efforts on segments of the copper value chain where Zambia already has capabilities and where near-term returns are most feasible. Evidence presented in this report indicates that consolidating and scaling midstream copper processing—particularly in refining—offers the most realistic pathway in the current context. While most copper mined in Zambia is already smelted and converted domestically, there remains scope to expand refining capacity, especially as mine output increases in line with the 3MT strategy. This creates an opportunity to retain a larger share of midstream processing domestically, provided that investments are commercially viable and aligned with market demand. At the same time, midstream expansion should not be pursued in isolation. Instead, it should be linked to domestic and regional demand—particularly for copper-intensive applications linked to electrification, energy systems, and infrastructure. In parallel, the government should invest in the foundations required for downstream industrial development over time, including reliable and affordable energy, skills, trade logistics, and institutional capacity. This integrated approach would allow Zambia to leverage its midstream strengths while progressively creating the conditions for more sophisticated value addition.

[10] We do not respond to all challenges facing Zambia's copper industry here, in cases where doing so would require significant trade-offs with spending in other industries. This is because fiscal space for Zambia's government is limited, and it is beyond the scope of this study to determine where the government should prioritize spending on the development of copper value chains as opposed to other uses of public funds (ECA, 2025). We instead focus on policy recommendations that may require relatively little additional public spending—e.g., if they can be financed by mobilizing private investment through public–private partnerships or other financing mechanisms.

5. **To foster competitiveness in its value chains, Zambian authorities can consider strengthening the development of SEZs/industrial parks and infrastructures** close to copper mines (Fessehaie & Morris, 2013; Zeng, 2016). The Chambishi MFEZ appears to be successfully increasing downstream copper production outputs, notably due to clustering across different stages of the copper value chain from mining to manufacturing (Page & Tarp, 2020), which has helped cut transport costs and boost productivity.
6. **Local content policies should move from ambition to implementation.** Value retention will depend on clear definitions, enforceable requirements, and realistic alignment with domestic capabilities. A shift toward capability-based local content—anchored in supplier development, predictable demand, and integration with energy, industrial, and skills policies—will deliver stronger results than ownership-based or compliance-driven approaches.
7. **Trade, market diversification, and regional collaboration are essential industrial policy levers of the copper value chain strategy.** They should be anchored in regional collaboration and global partnerships and treated as core instruments of Zambia's copper value-addition strategy, not as export promotion tools. While international markets will remain essential, the current export structure—under which most midstream copper output is sold abroad under established trading arrangements—limits access to feedstock for domestic and regional manufacturers and constrains downstream industrial development.
8. **In the short to medium term, the government should actively strengthen regional and continental market integration alongside continued engagement with global markets.** Demand for copper-intensive products linked to electrification, energy systems, construction, transport, and industrial infrastructure is expanding rapidly across Southern and Central Africa. These markets offer a more proximate, scalable, and commercially viable entry point for downstream copper manufacturing than highly competitive global segments and should be explicitly prioritized in industrial and trade policy.
9. **For a landlocked copper economy, corridor strategies and trade facilitation are core industrial policy tools.** Investments in transport and energy corridors, combined with reforms to customs procedures, electronic trade systems, and one-stop border posts, are essential to reducing trade costs and improving competitiveness (Moïsé, 2013). Regional collaboration can also help overcome national constraints related to scale, energy availability, and investment risk. The Zambia–DRC MOU on battery and electric vehicle value chains provides a concrete platform for coordinating copper-related industrial strategies, while initiatives such as the Lobito Corridor and emerging energy interconnections can support the development of integrated regional industrial ecosystems rather than isolated national projects.
10. **At the same time, Zambia should strategically leverage growing geopolitical efforts to diversify critical mineral supply chains.** As copper is increasingly treated as a critical and/or strategic mineral and importing economies seek to reduce concentration in midstream processing, Zambia is well positioned to attract investment in refining and related activities. Strategic partnerships and MOUs with the United States, the European Union, and other partners should be used to align trade, investment, and industrial policies to support domestic value addition while reinforcing regional integration and global supply-chain resilience.

11. **Taken together, trade policy, regional cooperation, infrastructure planning, and commercial diplomacy should be deployed as mutually reinforcing elements** of industrial strategy, supporting midstream upgrading in the near term and enabling the gradual emergence of competitive, regionally anchored downstream manufacturing over time. In that regard, trade agreements should preserve incentives and policy space for domestic processing to support national objectives of increased value addition.
12. **Trade policies should be aligned with the wider industrial strategy.** Trade restrictions alone, without complementary incentives and logistical support, cannot be used as a substitute for industrial competitiveness. In that regard, measures such as export taxes and quantitative restrictions to foster the beneficiation of unprocessed copper exports should be used selectively and conditionally, be time-bound, align with realistic industrial capabilities, and be complemented by regional coordination. Trade measures cannot be a substitute for competitiveness.
13. **Building on an already established strong relationship with the private sector,** industrial policy design and prioritization of potential industrial segments should remain anchored in structured dialogue with industry actors and local stakeholders. Regular dialogue should also focus on identifying binding constraints and testing implementation options, while preserving government leadership in strategic decision making and prioritization to ensure continuity in private–public dialogues and partnerships. As confirmed during interviews with industry stakeholders, the government could consider providing dedicated technical staff to ensure follow-up and implementation, as well as adequate institutional support to follow up, implement, and monitor actions and commitments. Finally, the Zambia Development Agency may wish to consider regular feedback from firms regarding market access identification so it can organize and optimize trade missions and other export promotion activities.
14. **Access to reliable and affordable electricity should be treated as the most urgent priority for copper value addition.** Accelerating investment in generation capacity is essential, including by implementing the Energy Regulations Board's efforts to get to cost-reflective tariffs combined with targeted protection for vulnerable households.

    i. However, considering the time it may take to translate investments into increased energy supply,[11] greater regulatory flexibility for off-grid and industry-dedicated power solutions can help relieve short-term supply constraints, as was the case in Guinea's emerging alumina-refining industry. Without credible, bankable expansion of electricity supply, efforts to expand smelting, refining, or manufacturing will remain uneconomic or crowd out other productive uses.

    ii. Electricity policy should be strategically aligned with industrial objectives. This requires clearer prioritization of new power capacity between mining, manufacturing, and social needs, as well as tighter coordination between energy planning and copper production targets. Execution and allocation decisions will determine whether an otherwise sound policy framework delivers results.

    iii. To lower greenhouse gas emissions from high-energy-intensive, copper-related industrial sectors, the government may consider an increased focus on

[11] Demand for off-grid energy from industry clients has led to several new power plants being commissioned in Zambia in 2024 and 2025, even without state guarantees or finance (Ecofin Agency, 2025; ESI Africa, 2024; Jardim, 2024).

investments in renewable energy technologies. In that regard, the government can consider mobilizing climate mitigation-focused finance, such as "green" finance schemes, to invest in the country's energy system.

15. **National education and skills development policies should shift decisively toward demand-driven and industry-linked training.** Relevant to the copper sector, technical and vocational education should be aligned with the evolving value chain needs, particularly in processing, maintenance, applied engineering, and technology-related fields of study. Stronger collaboration between training institutions, universities, and mining companies is essential to address the skills gaps that currently constrain both scale and sophistication and plan for future skills needs to anticipate the development of value chains.
16. **Access to finance should be strengthened by prioritizing credit availability over capital market deepening alone.** For copper value addition, the binding constraint is not the absence of financial instruments but limited access to affordable credit. Improving the effectiveness of Zambia's movable collateral framework, therefore, requires active implementation, including targeted capacity building for lenders, stronger enforcement and repossession mechanisms, and awareness campaigns for both financial institutions and borrowers. Without these measures, legal reforms will continue to have limited practical impacts on firms' ability to invest.

    i. Leverage development finance to crowd in international capital. The government can work with international banks to expand access to capital through private placements, anchor investments, and pooled debt and equity instruments large enough to attract investors' interest. While most Zambian firms in the copper value chain are too small to issue international bonds directly, Zambian banks may be able to do so, as has occurred in other sub-Saharan African countries such as the United Republic of Tanzania, thereby expanding their lending capacity to domestic firms (Ayres et al., 2025).

    ii. Tackle illicit financial flows to expand domestic liquidity. Illicit financial flows significantly reduce the supply of loanable funds in Zambia. Investing in electronic risk-assessment systems in customs can help to identify trade-based mis-invoicing, a major source of capital flight (ECA, 2025). Information exchange on international trade reports with partner jurisdictions has already delivered results in countries such as the DRC and South Africa (UN ECA, 2019). Implementing recommendations from the World Customs Organization on trade mis-invoicing and strengthening automatic exchange of tax information under the Global Forum on Transparency and Exchange of Information for Tax Purposes can further reduce incentives to hold assets offshore (ECA, 2025; Soo Choi et al., 2018).

    iii. Strengthen the movable collateral registry. Difficulties in providing acceptable collateral remain a major source of credit risk for Zambian firms. Strengthening the movable collateral registry through lender training, clear enforcement procedures, and improved monitoring can materially improve firms' access to finance, as international evidence shows (Love et al., 2016). The World Bank report *Market Study Report: Movable Asset Based Lending in Zambia Market Study* provides concrete recommendations for improving systems performance (Swiss Confederation et al., 2021).

iv. Mobilize domestic and diaspora savings for productive investment. Beyond firm-level reforms and the development of the capital market, the supply of finance will require macro-financial credibility, risk-sharing instruments, targeted industrial finance, and the mobilization of domestic and diaspora savings. Well-governed national investment vehicles, supported by transparency and a clear pipeline of bankable projects, could help redirect domestic and diaspora savings toward priority infrastructure and industrial investments.

17. **Environmental and social risks should be actively managed as part of the value-addition strategy.** Stronger monitoring, enforcement, and adaptive regulation are needed to ensure that economic gains are not achieved at the expense of natural capital or social stability
18. **Strengthen support for artisanal and small-scale miners to integrate them into local value chains.** To support the development of local mining capabilities and the integration of artisanal and small-scale miners into formal value chains, the government should prioritize targeted capacity building for ASM operators. This includes strengthening miners' ability to develop and implement environmental and social management plans. The planned use of the Artisanal and Small-Scale Mining Fund to promote improved environmental and social practices offers an important opportunity. To maximize its impact, the government should complement financial support with technical assistance that enables ASM operators to meet eligibility requirements and comply with environmental and social standards. The government may also consider establishing a national program to purchase artisanal and small-scale copper miners' output, to achieve better prices for these miners and encourage formalization. Such a program could also process smelted copper ore into refined copper or pay existing processing facilities to do so; this copper could be sold to local manufacturers to provide additional feedstock for this industry.

7.3 Recommendations to Technical and Financial Partners

1. **Technical and financial partners should consider supporting Zambia's copper (and minerals) value-addition strategy** in a way that supports the country's national development plans and priorities. As noted above, Zambia is well placed to competitively expand its copper processing in the near to medium term and, consequently, to deepen its industrial capabilities to manufacture copper-based products. Complementary support to competitiveness is necessary, in the form of investment in industrial activities and technological transfer.
2. **Investment in electricity generation** and in enabling infrastructure should be a central focus of external support. For instance, investments in the expansion of reliable, low-carbon power supply will benefit copper value addition and the wider economy while reinforcing Zambia's competitiveness in cleaner supply chains.
3. **Technical and financial partners can play a critical role in mobilizing finance** by helping to de-risk private investment. Blended finance, guarantees, and investments in large projects (such as infrastructure) can help crowd in capital for energy, logistics, and processing infrastructure and address persistent investor bias against African markets.

4. **Support for regional trade corridors and logistics, including the Lobito Corridor—in the form of investment—can significantly improve Zambia's market access.** The planned extension of the corridor is expected to link the Zambian Copperbelt with the Atlantic Ocean, potentially cutting the cost of transporting copper and copper-based products from the country to alternative buyers (OECD, n.d.-b). The European Union recently announced that it had secured funding that could significantly contribute to supporting the corridor project (Kunda, 2025; United Nations Zambia, 2024).

    i. The corridor's contribution to value addition in Zambia could be undermined if Zambia's import trading partners design and implement measures to localize copper processing and manufacturing industries at home, as they seek to address supply chain pinch points and geopolitical vulnerabilities.

    ii. Investments in cross-border trade corridors should be complemented by national electronic customs harmonization systems, digital trade facilitation, and coordinated corridor governance (United Nations Zambia, 2024) to reduce bottlenecks and delays and avoid increased costs of production and trade.

5. **Finally, technical and financial partners should support stronger environmental and social governance in the copper sector.** Investments in water stewardship, emissions reduction, mine closure planning, and community engagement will help ensure that value addition translates into durable, inclusive, and sustainable development outcomes.

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Appendix A. Overview of Value-Addition Measurements and Methodologies for Trade Diagnostics Used in the Report

A1. Measuring Value Addition in Mineral Value Chains

There are several different ways to measure value added to mineral products by different industrial processes. One measure is how a process increases the price per kilogram of metal/mineral content contained in the product. This gives an idea of how much sale revenues increase as a result of processing. This is shown in the right-hand column of Table 1.

However, such processing also incurs costs. Aside from the minerals that are processed, other inputs, such as energy, chemical reagents, and transport and insurance services, are also used in mineral processing. If the increase in the price of the minerals from processing is less than the cost of the other inputs used to make it, the process may be considered as having "destroyed" value rather than creating it. This makes the host economy worse off, as the total market value of goods and services would be less compared to if no processing were undertaken.

To capture these considerations when measuring whether an industrial process adds value, the value added by a particular economic activity is often measured using "gross value added by activity," as defined in national accounts statistics. Gross value added by activity is equal to the value at which products/services can be sold, less the cost of inputs used to make them (excluding payments to capital and labour). "Net value added" equals gross value added minus the consumption of fixed capital (i.e., the decline in the value of fixed assets). Gross value added by activity is typically expressed at "basic prices" (i.e., taxes less subsidies on products are subtracted).

The value to the economy of this activity may exceed the "gross value added by activity" if other sectors of the economy supply inputs to this activity. To capture this, another measure of value added that can be used is "domestic value added," as defined in literature on global value chains. This is equal to gross value added in making the product in question, plus value added by producing any domestically produced products and services that were used as inputs to make the product in question. It reflects the proportion of a product's value that is captured by workers and capital owners located in the host economy (OECD, n.d.-a).

However, domestic value added does not capture all of the economic effects of a particular activity on the host economy. Effects that are ignored include "side-stream linkages," that is, additional economic activity that results from economies of scale in upstream industries that supply the activity in question—for example, infrastructure. In some cases, marginal costs in upstream industries rise with the level of production, instead of seeing economies of scale. As noted in Section 2, it also ignores the potential for other effects that are not mediated through the market mechanism ("externalities"), whether positive (such as knowledge generated in one industry that can benefit another) or negative (such as pollution or effects on the welfare of individuals living close to production facilities). This is why it is beneficial for policies around mineral value addition to take a comprehensive, multi-dimensional view of the

economic, environmental, and social effects, considering value added by activity, the other components of domestic value added and environmental and social externalities.

Even processes that have positive gross value added by activity or domestic value added are not necessarily profitable for the firms engaged in them or commercially viable without government support. This is because the costs of payments to labour and capital used in production, as well as financing costs, are not subtracted in the calculation of value added. For a mineral-based economic activity to be profitable for the firm involved (and thus commercially viable without government support), the increase in the value of the mineral must be greater than *all* costs involved in processing, including labour and capital.

The costs of non-mineral production inputs and value added in producing domestically sourced inputs are not shown in Table 1, as we lack sufficient information to include them. We still consider the table useful to give a rough indication of the potential of different activities to contribute to the Zambian economy. But it is important for policy-makers to understand these costs so that they can calculate the overall economic contribution of different activities when prioritizing where to focus industrial policy.

A2. Overview of Methodologies for Trade Diagnostics Used in the Report

As noted in Section 4, the ITC produces estimates of countries' opportunities to expand their existing exports. The model is based on three elements:

- Projected economic growth in the exporting country (in this case, Zambia), which is considered to be correlated with supply capacity in each of the economy's sectors.
- Projected growth in demand for these products in Zambia's trading partners, based on their forecast economic growth and how such growth is observed to increase demand for these products.
- Expected changes in tariffs faced by Zambian exporters (e.g., under the AfCFTA) (Decreux et al., n.d.; ITC, 2025a).

The estimates relate to potential exports to the world by 2030. The analysis does not take into account limitations on the country's exports placed by the amount of copper being mined in the country; as a result, as noted in footnote 6, fully realizing the potential export increases that ITC highlights may require an expansion of copper mining, in line with the government's plan to triple copper mine output.

Section 4 also features statistics from the OEC on which opportunities are most promising for Zambia to increase its exports of different products to the rest of the world. These are based on what Zambia currently exports, what its neighbours import and export, and what this indicates about products that the country is most likely to expand its exports of (Jun et al., 2020). The OEC finds that copper anodes are among the top products that Zambia is well placed to export. However, other products, such as dried and shelled beans, sesame seeds, and unroasted coffee, are more promising opportunities. Among manufacturing products, flat-rolled iron or non-alloy steel that is coat/zinc corrugated with a width of more than 6mm and cement clinkers are potential opportunities.

Further corroborating the findings from the ITC and OEC, Zambia has the second-highest "revealed comparative advantage" (an indicator of where the country can most profitably expand its exports) (Department of International Economic and Social Affairs Statistical Office, 1986; Reed, 2024; UN Trade & Development, n.d.).

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