COPPER AS AN ENGINE FOR ECONOMIC DEVELOPMENT IN THE DRC

By: Abdurrehman Naveed and Cina Vazir

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Introduction

This presentation is based off research to evaluate downstream opportunities in the DRC for cobalt, copper, lithium, tin, and zinc

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And supported by:

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Value Amidst Transition: Evaluating Strategic Opportunities for Value Addition in the Democratic Republic of Congo

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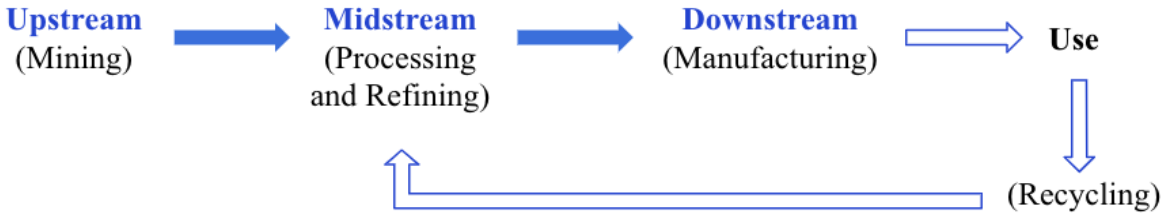
Value addition is an increasingly common national strategy for economic growth

Policymakers in mineral-rich developing countries are seeking to move downstream

Stages of value addition



Mineral-rich developing countries are pursuing, or plan to pursue, domestic value addition

Africa

- Botswana
- DRC
- Ghana
- Namibia
- Zambia
- Zimbabwe

South America

- Chile
- Argentina
- Bolivia

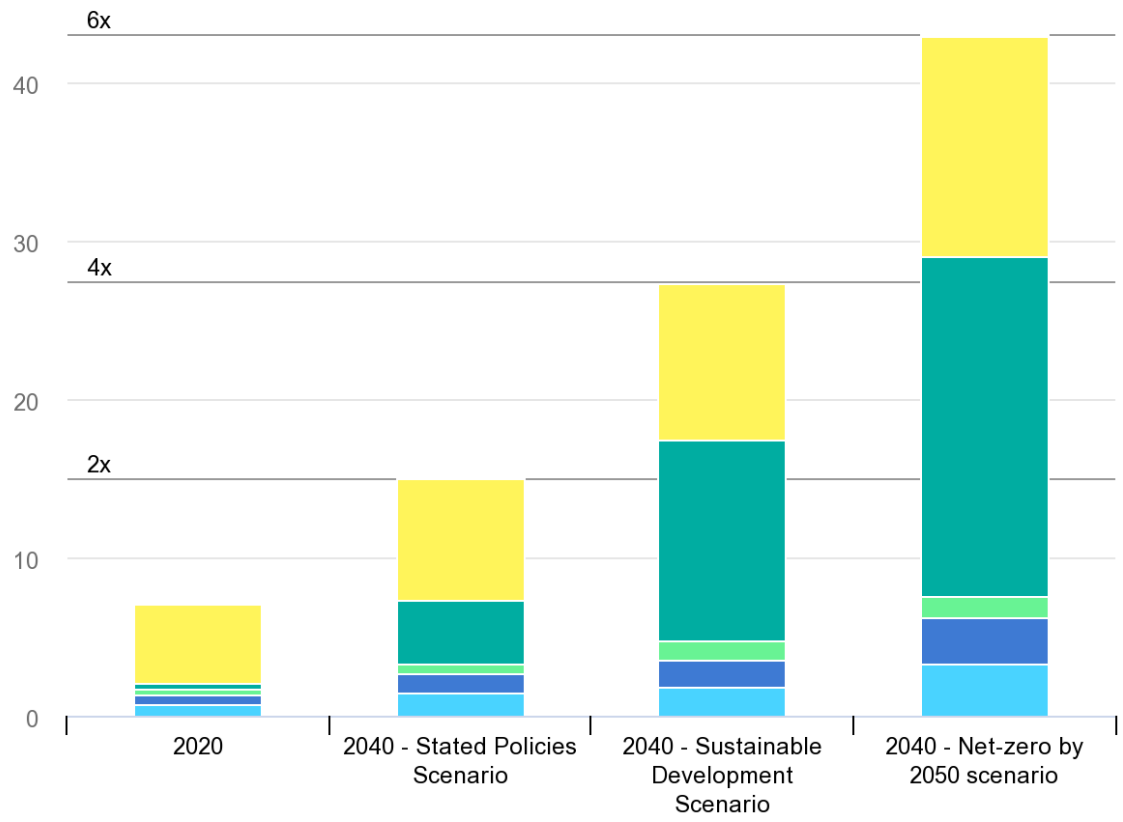
Asia

- Indonesia
- Philippines
- Vietnam

The clean energy transition will drive future demand for minerals

Mineral demand can increase sixfold due to clean energy technologies, esp. EVs and battery storage

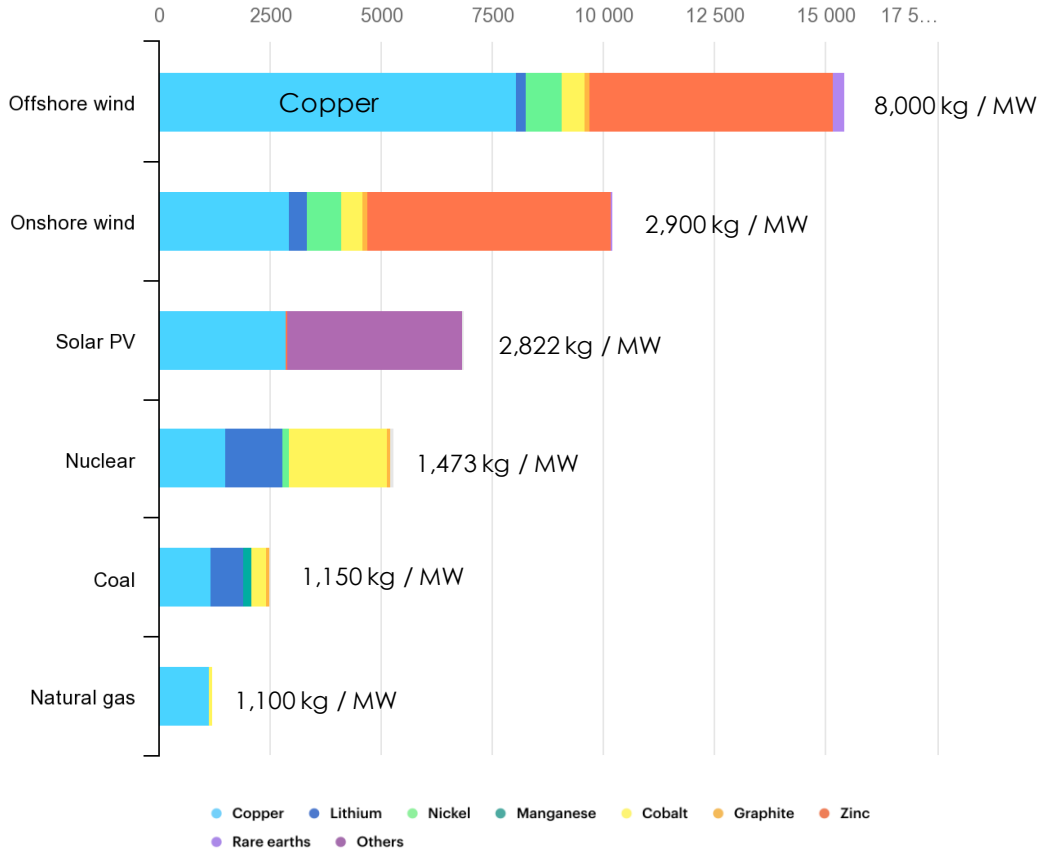
Total mineral demand for clean energy technology by scenario (IEA)



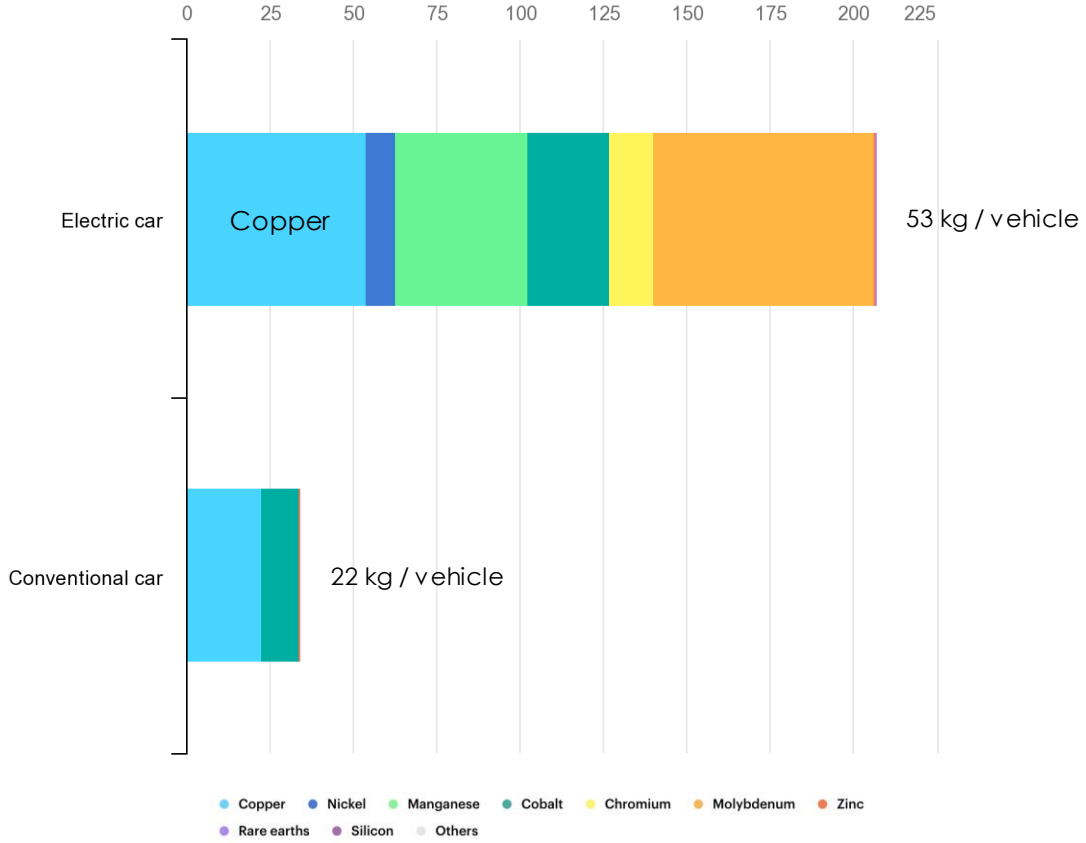
Various clean energy technologies are shaping demand growth

Most clean energy technologies entail a substantial increase in mineral utilization, especially copper

Minerals intensity of clean energy technologies compared to other power generation sources (IEA)



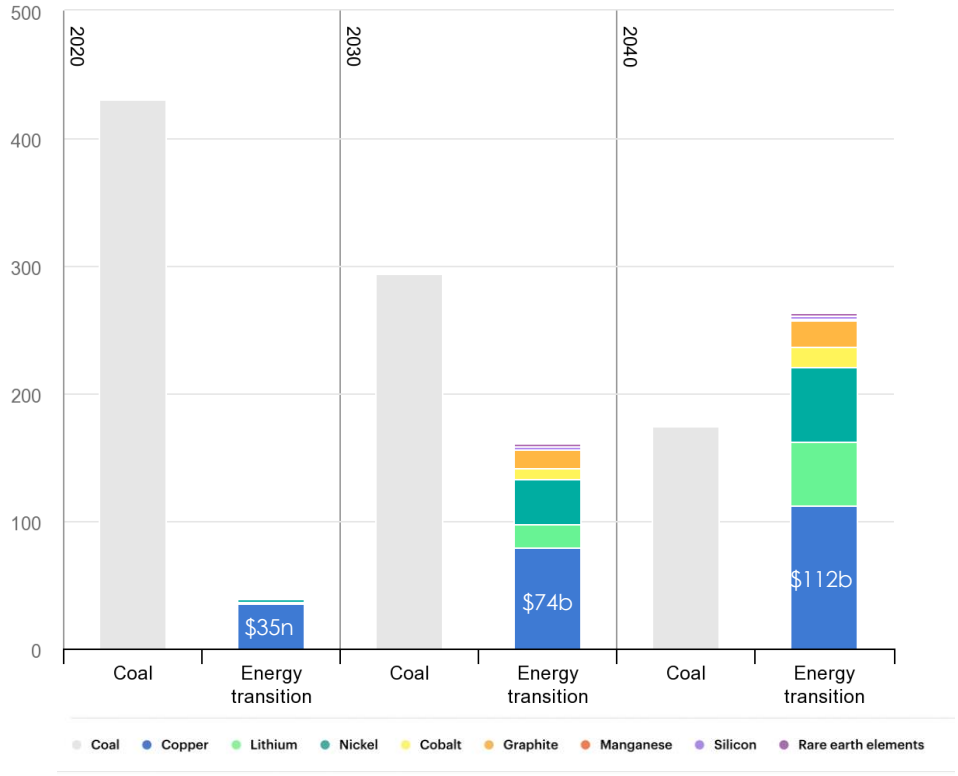
Minerals intensity of electric cars compared to conventional cars (IEA)



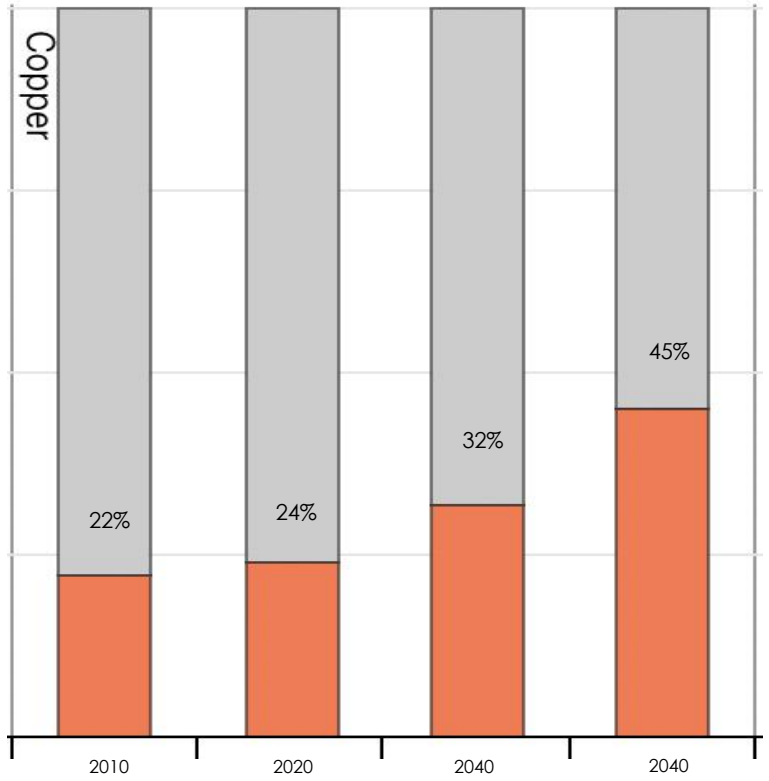
The revenue potential for energy transition minerals is significant

The volume of copper required for clean energy technologies can amount to $112 bn in revenues by 2040

Revenue from production of coal and selected energy transition minerals, 2020-2040 (IEA)



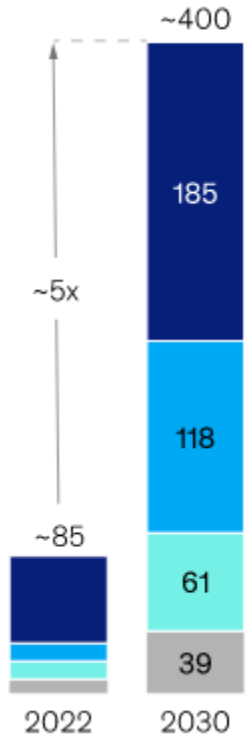
Share of clean energy technologies in total demand for copper, base & high scenario (IEA)



Developing countries view value addition as a pillar of economic strategy

Most of the value generation in the clean energy transition will take place mid- & downstream of mining

Revenue opportunities in lithium-ion battery value chain
Base Case, $ billions (McKinsey)



Revenue opportunities in lithium-ion battery value chain
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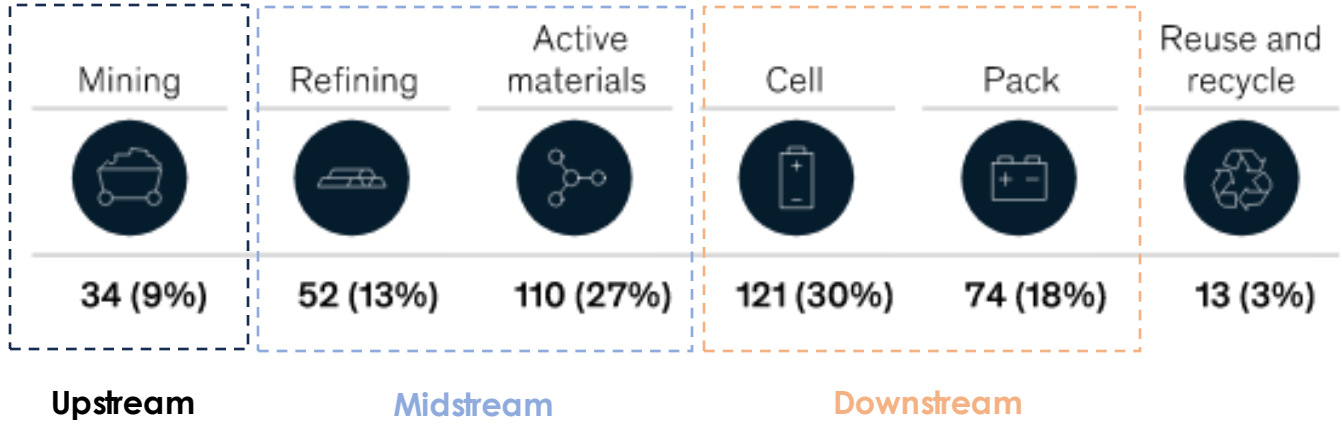
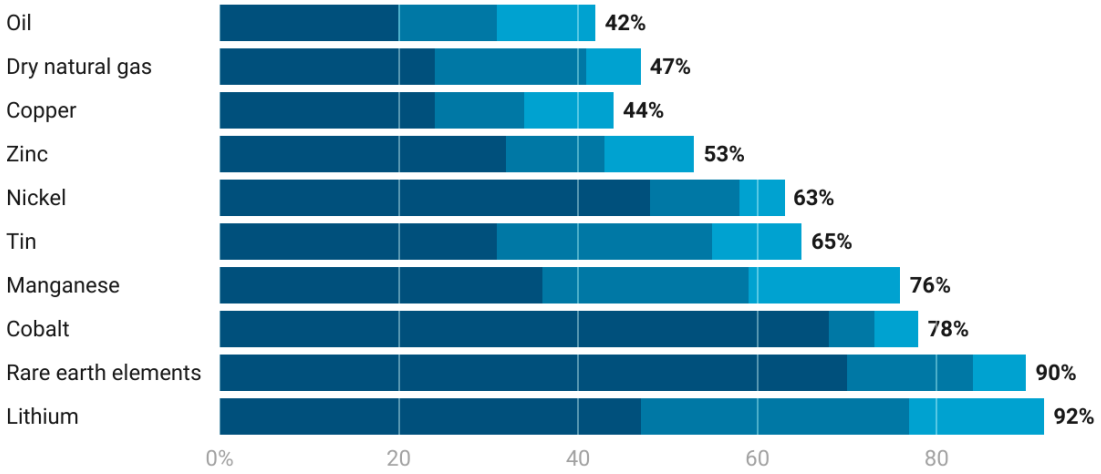


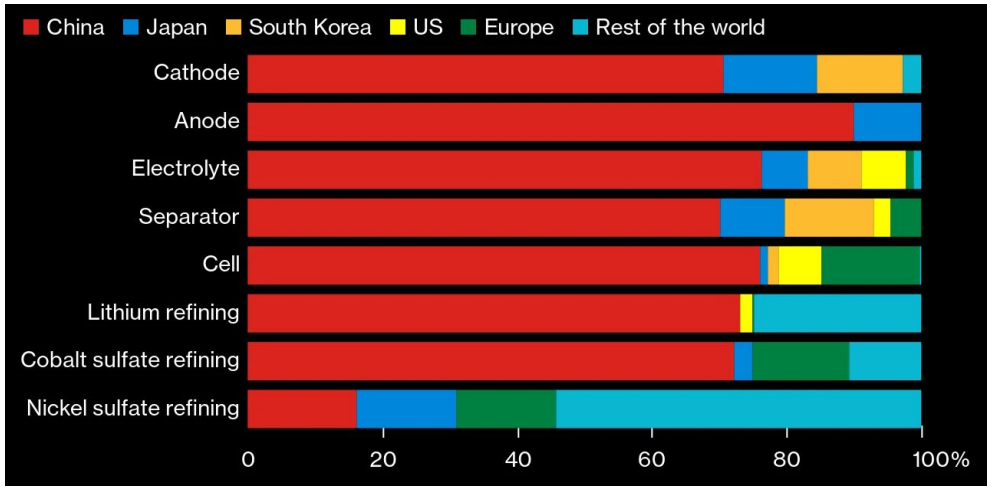
The concentrated nature of mineral value chains has geopolitical implications

The resurgence of great power rivalry and the urgency of the climate transition has the potential to fundamentally change global trade and investment flows

Market share of the three largest upstream producers, 2021 for oil and natural gas and 2022 for minerals (USGS and EIA)



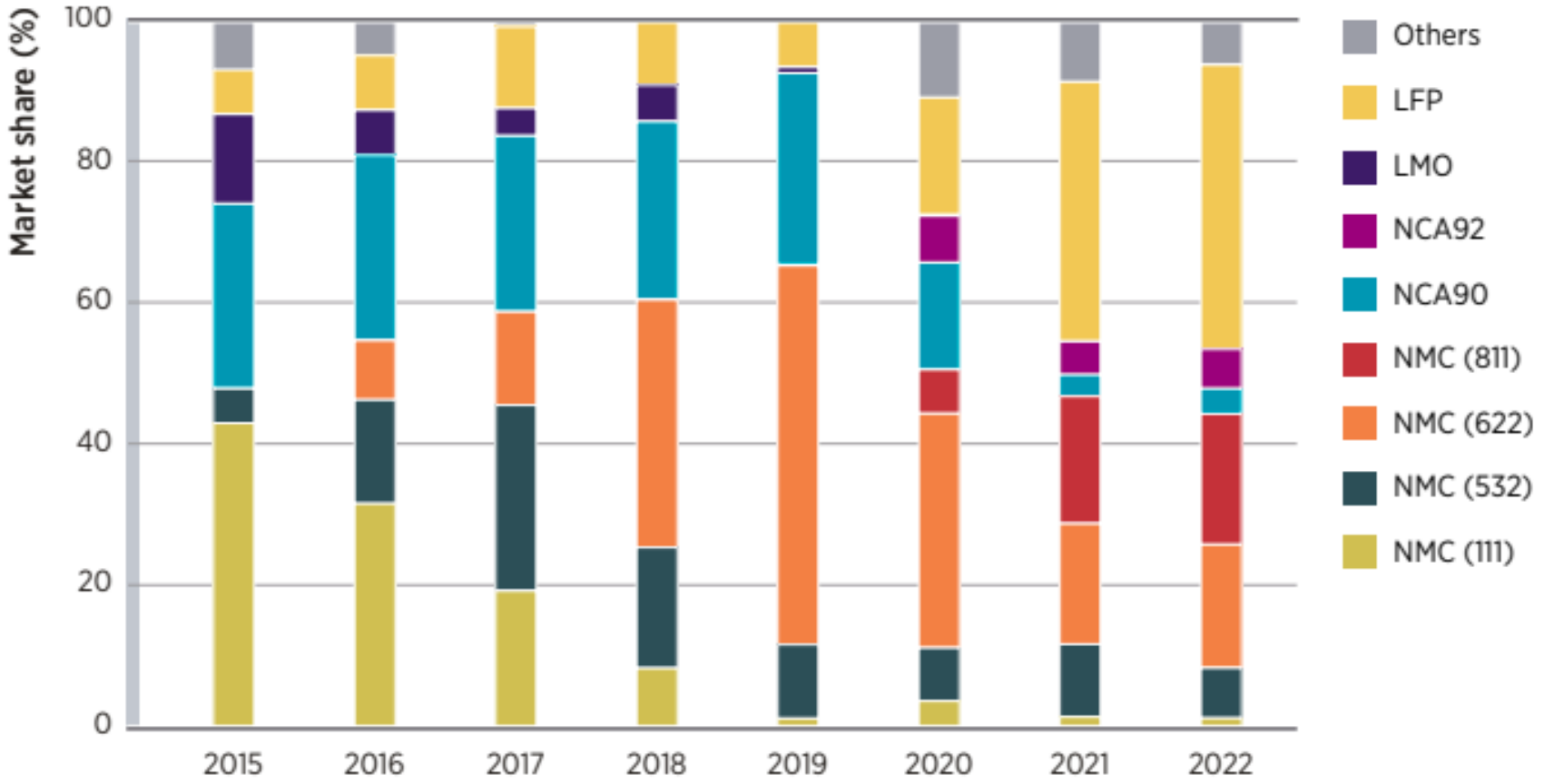
China's domination of the battery value chain BNEF, 2022)



Countries seeking to exert resource leverage face market uncertainty

Variables like technological change inject risk into countries' value addition strategies, particularly for minerals with uncertain demand and where downstream activities have long lead times

Global EV battery chemistry mix (IRENA, 2015-22)



Copper is one of the most secure energy transition minerals for value addition given that growth in demand is relatively less exposed to technology scenarios

In this context, policymakers are seeking to use copper as an engine for growth

The high-level question in the DRC is: how can the country use its copper resources to maximize near-, mid-, and long-term economic growth at the national level?

How can the DRC use copper to:

- Maximize **fiscal revenue, GDP, and export earnings**
- Lessen exposure to commodity **volatility**
- Create more high-quality **jobs**
- Develop capabilities to fuel **economic diversification**

These objectives imply doing things differently than in the past…

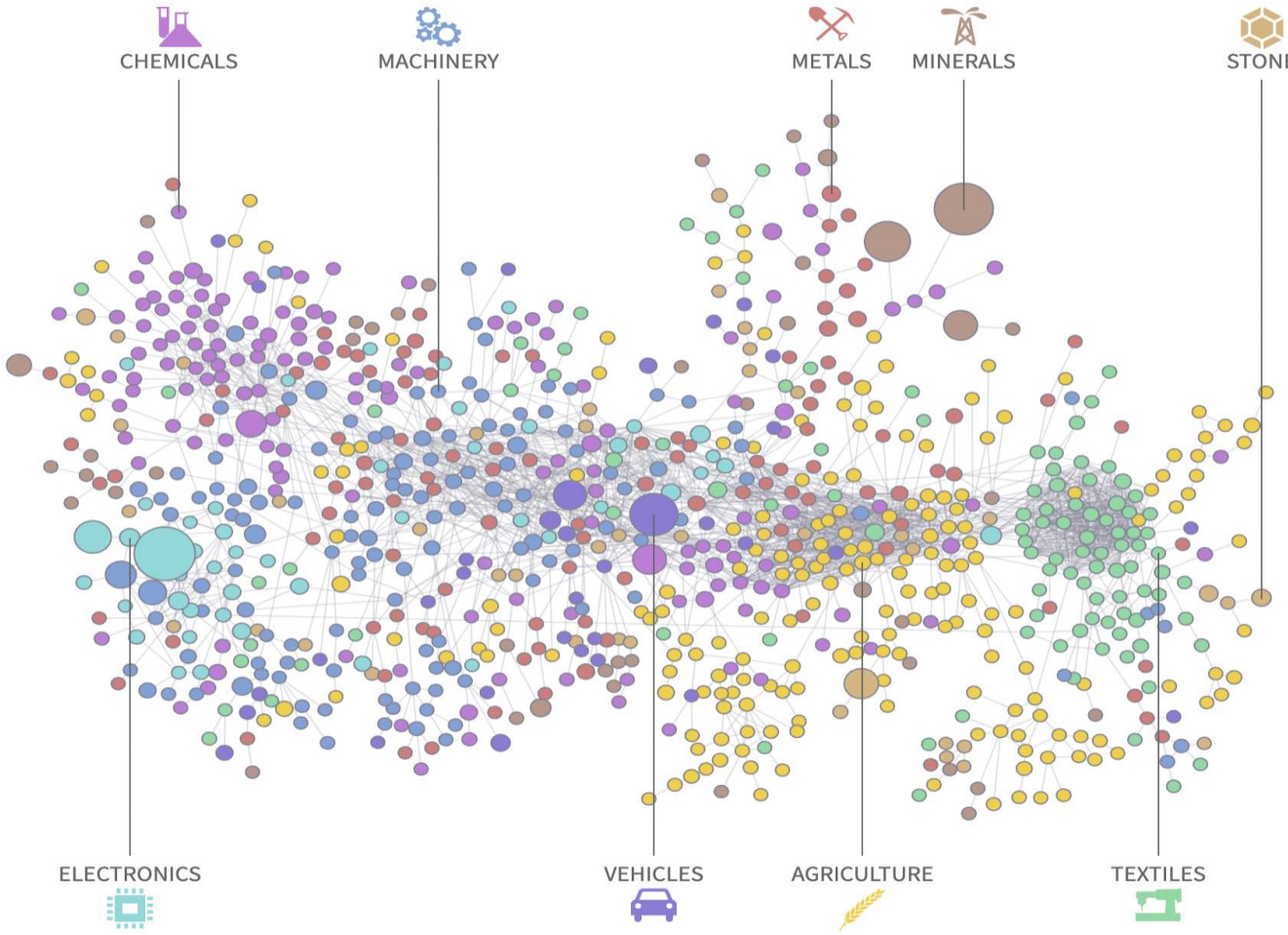
… Meaning new **policy ideas**…

…and new **market opportunities**

Can value addition be part of the solution?

Successful countries will approach value addition with a capabilities framework

Countries whose exports are more complex than expected for their income level tend to grow faster



Growth can be driven by **diversifying know-how** to produce complex goods and services

Countries are more successful in diversifying when they move into production that **builds on existing capabilities**

In diversifying its economy, **the DRC may consider coordinated long jumps** into areas with future diversification potential

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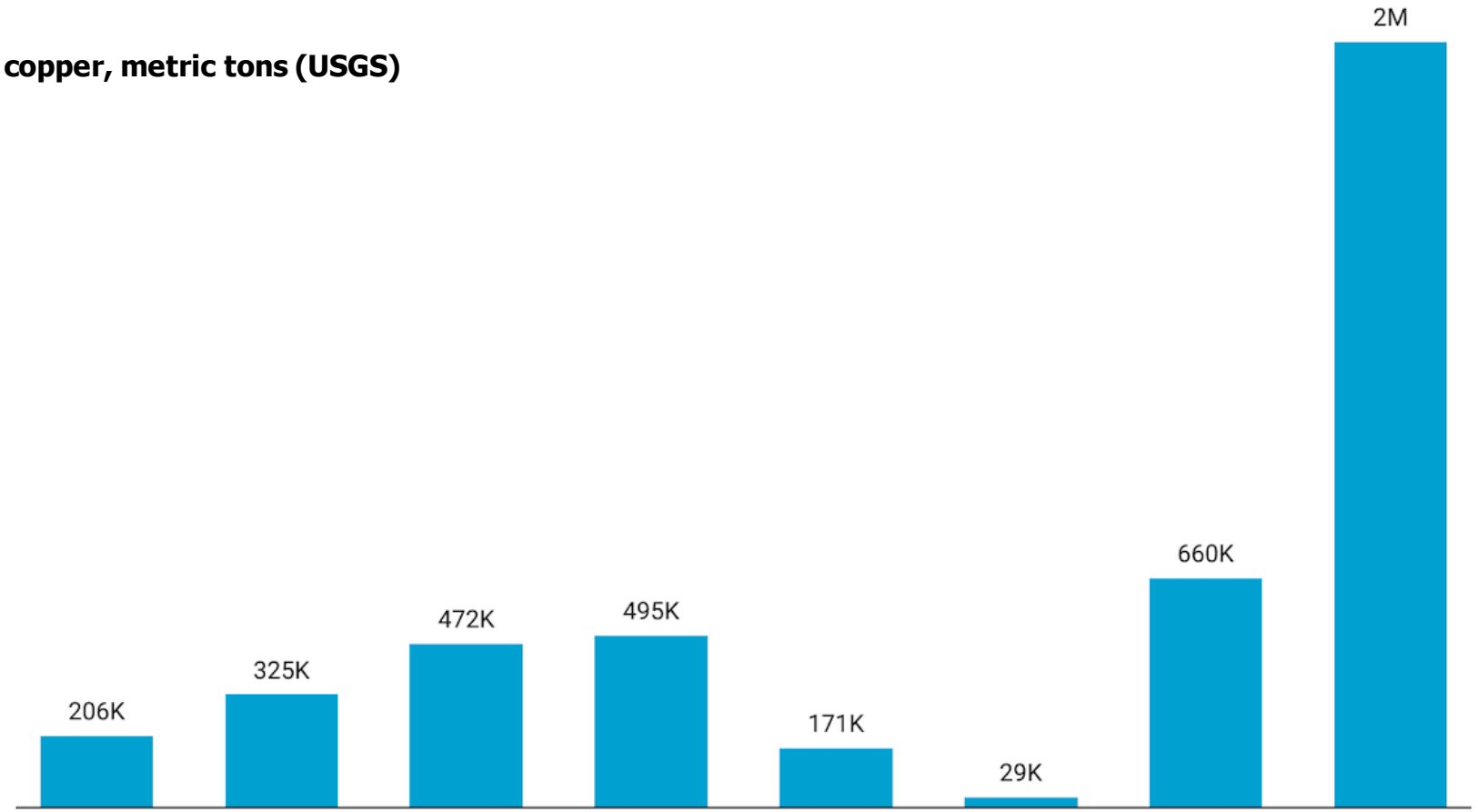
The DRC has historically been an important global producer of copper

Following a plummet in output, the DRC is now at peak levels of production

DRC mine production of copper, metric tons (USGS)

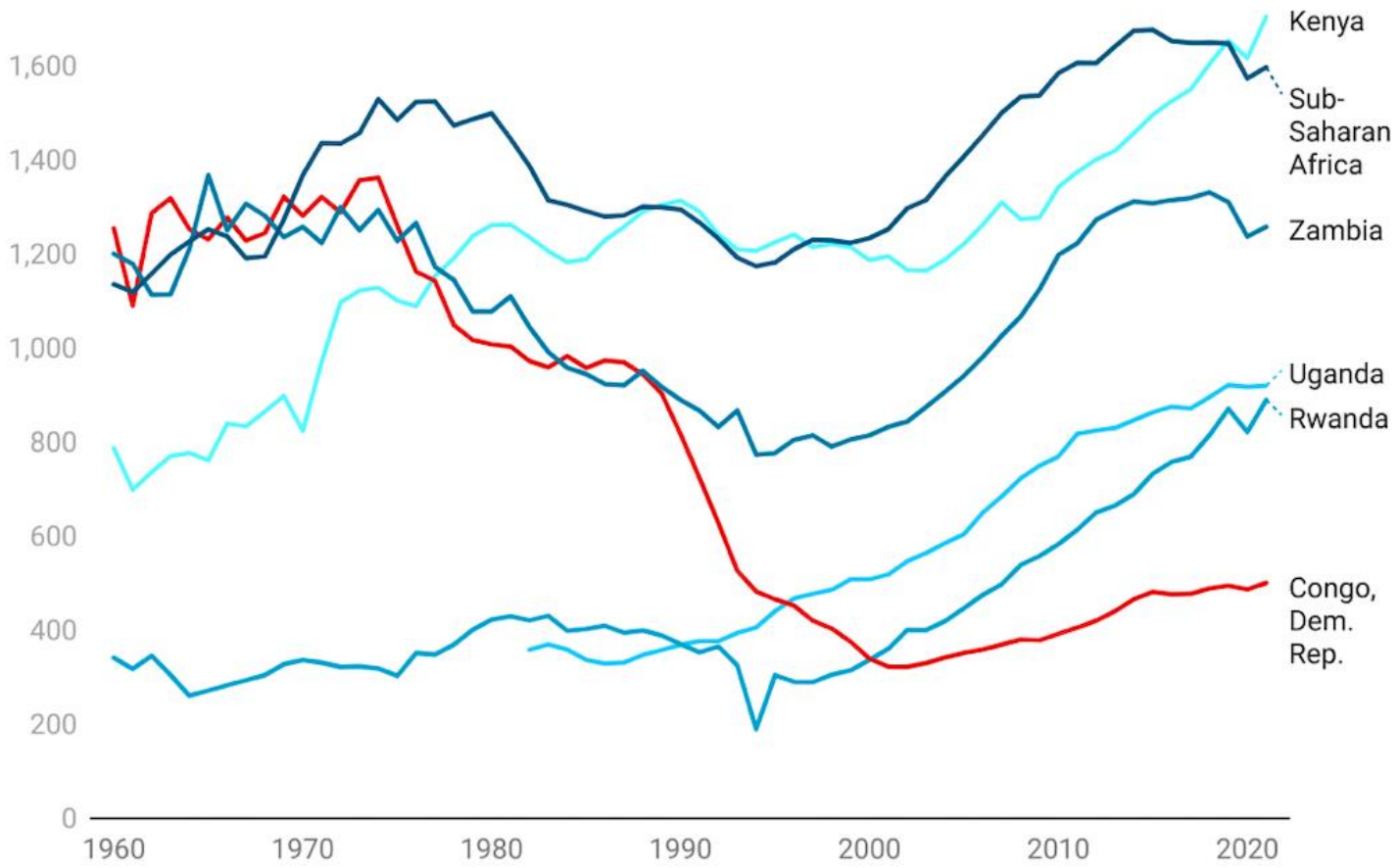


Year	1952	1962	1972	1982	1992	2002	2012	2022
% of world production	**8%**	**6%**	**6%**	**6%**	**2%**	**0%**	**4%**	**10%**

The DRC's GDP per capita is linked to the country's copper industry

GDP per capita fell sharply, along with copper output, for decades before beginning a gradual recovery

GDP per capita, constant 2015 USD (World Bank)



Copper remains extremely strategic for the DRC

Copper constitutes the bulk of the DRC's export earnings, is poised to drive near-term GDP growth, and provides a gateway to another strategic mineral: cobalt

Percent of total exports (Atlas of Economic Complexity, 2021)

Copper in the DRC

- Driver of growth due to project pipeline and untapped potential
- Grades well above global average
- A gateway to the DRC's cobalt

Cobalt

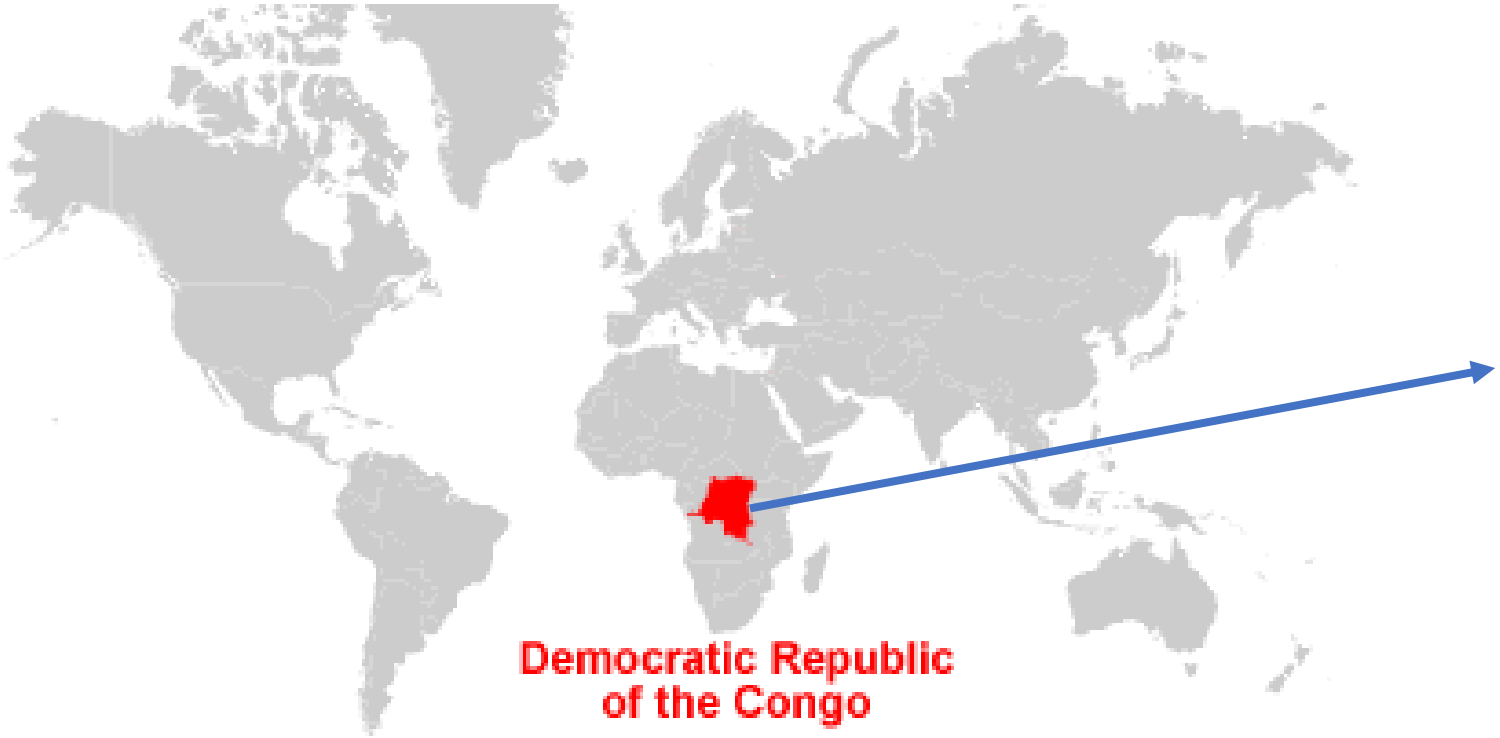
Only two mines (US and Morocco) produce cobalt as the principal product

Most of the world's cobalt is produced as a by-product of copper (DRC) and nickel (Indonesia)

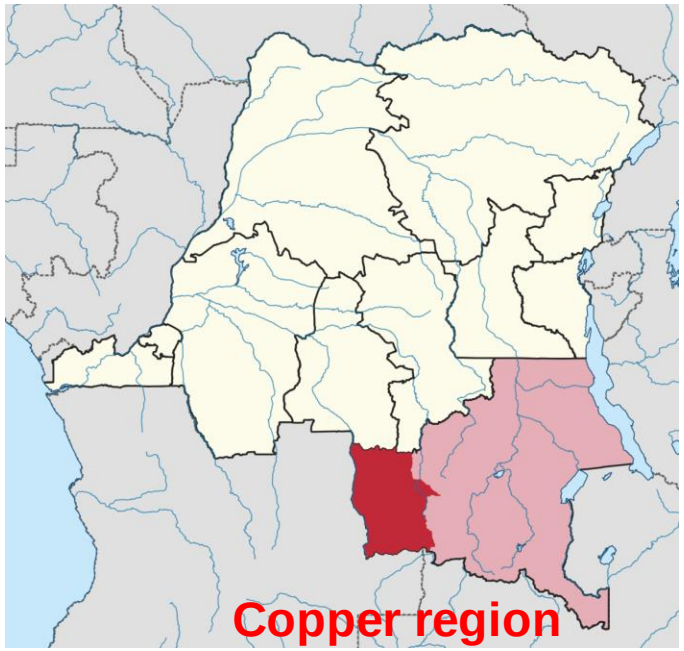
Most copper mining is situated in the southern DRC

The ex-Katanga region, near the Zambian border, hosts most of the country's copper and cobalt operations

World map, with DRC highlighted



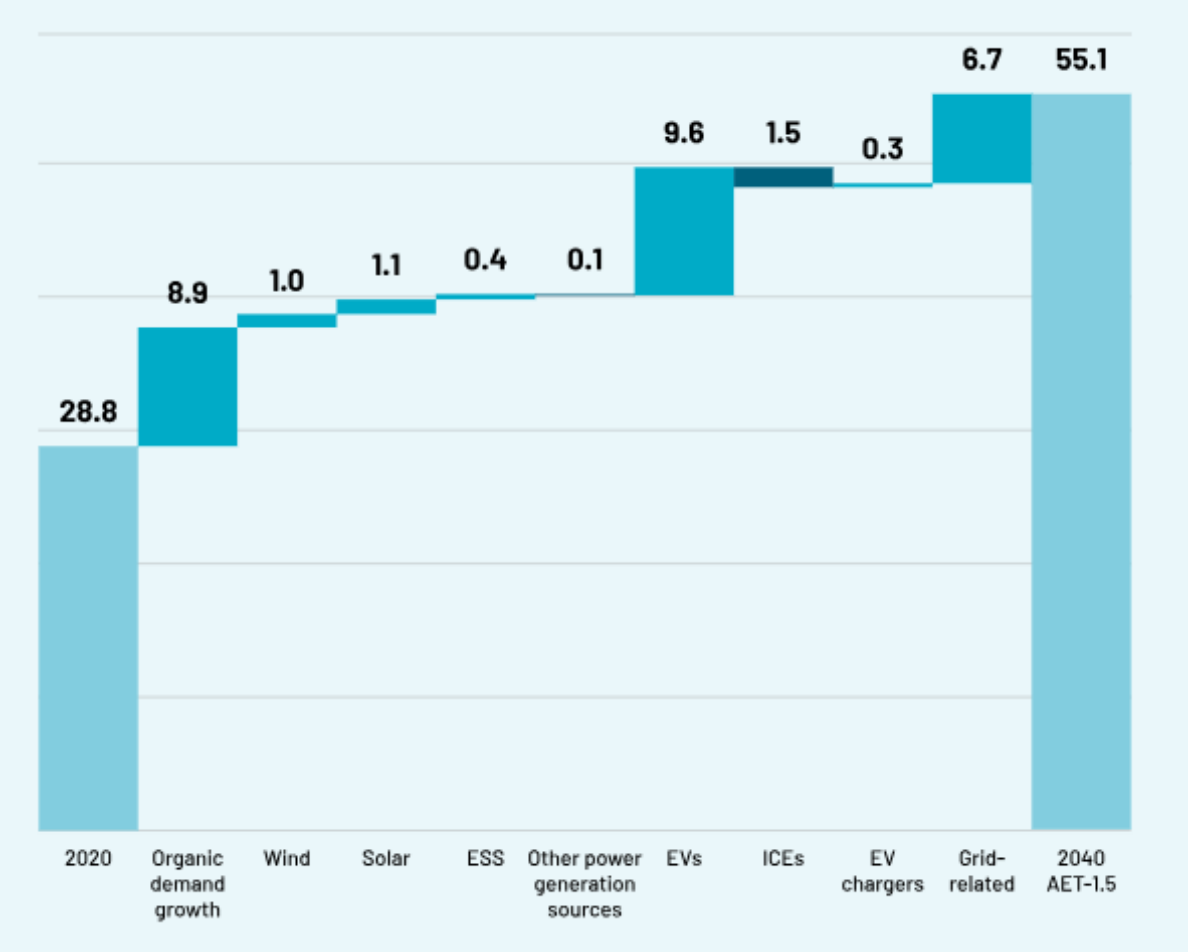
Map of DRC, with principal copper mining regions highlighted



At a macro level, copper is supported by strong demand growth

Demand is projected to increase rapidly, with the energy transition layering onto organic demand growth

Projected global copper demand (Wood Mackenzie)



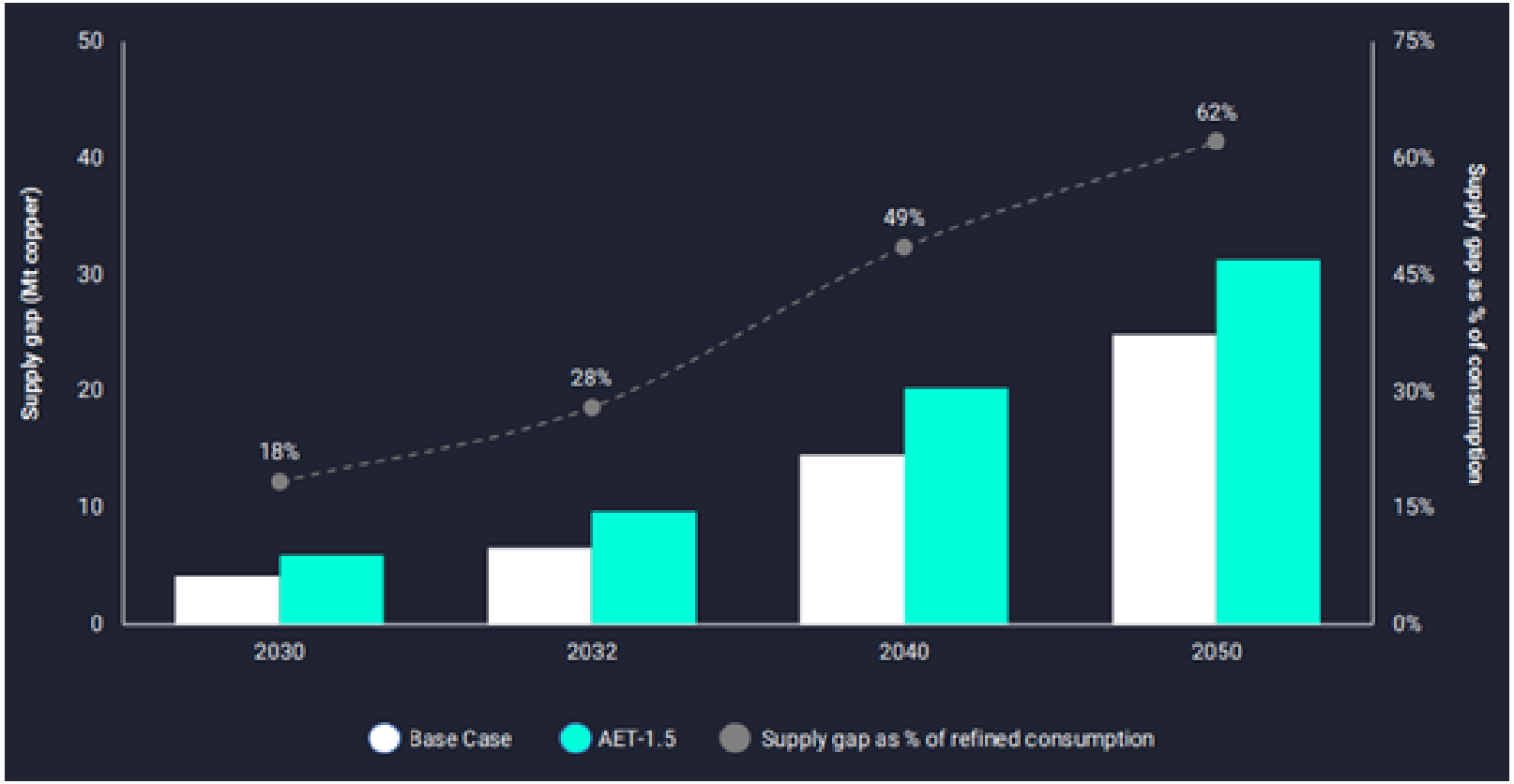
Demand tailwinds include:

- Urbanization and electrification
- Population growth
- Energy transition

And copper could become even more strategic due to supply headwinds

Obstacles to new projects could lead to supply shortfalls over the next decades

Projected global copper supply gap (Wood Mackenzie)



Supply headwinds include:

- Political, social, and regulatory instability in major producing countries
- Growing ESG risks
- Declining ore grades
- Higher interest rates

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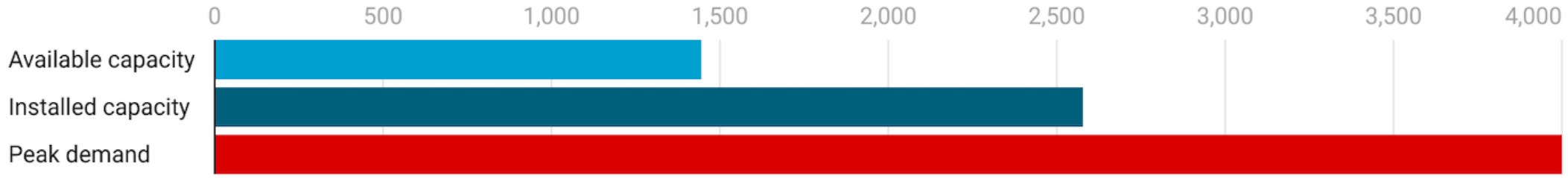
Energy is one of the largest near-term barriers to moving downstream

Despite immense potential for hydroelectric and solar, the DRC currently lacks reliable energy

Megawatts of energy supply and demand in the DRC (World Bank, 2018)



Key data points

- **19%** — population with access to electricity
- **11%** — average annual loss of sales for domestic manufacturing firms due to power intermittency
- **$1 USD per kwh** — near-peak energy costs during periods of intermittency
- **86%** —domestic businesses that say a lack of electricity prevents them from operating properly
- **98%** — total share of electricity that comes from hydroelectric power

Logistics are also a major challenge, both for imports and exports

The DRC has low road density, lack of alternatives (e.g., rail and river), and high compliance costs

Trade data (World Bank, 2020)

Indicator	Congo, Dem. Rep.	Sub-Saharan Africa	OECD high income
Time to export: Border compliance (hours)	296	97.1 (3x)	12.7 (23x)
Cost to export: Border compliance (USD)	2223	603.1 (4x)	136.8 (16x)
Time to export: Documentary compliance (hours)	192	71.9 (3x)	2.3 (83x)
Cost to export: Documentary compliance (USD)	500	172.5 (3x)	33.4 (15x)
Time to import: Border compliance (hours)	336	126.2 (3x)	8.5 (40x)
Cost to import: Border compliance (USD)	3039	690.6 (4x)	98.1 (31x)
Time to import: Documentary compliance (hours)	174	96.1 (2x)	3.4 (51x)
Cost to import: Documentary compliance (USD)	765	287.2 (3x)	23.5 (33x)

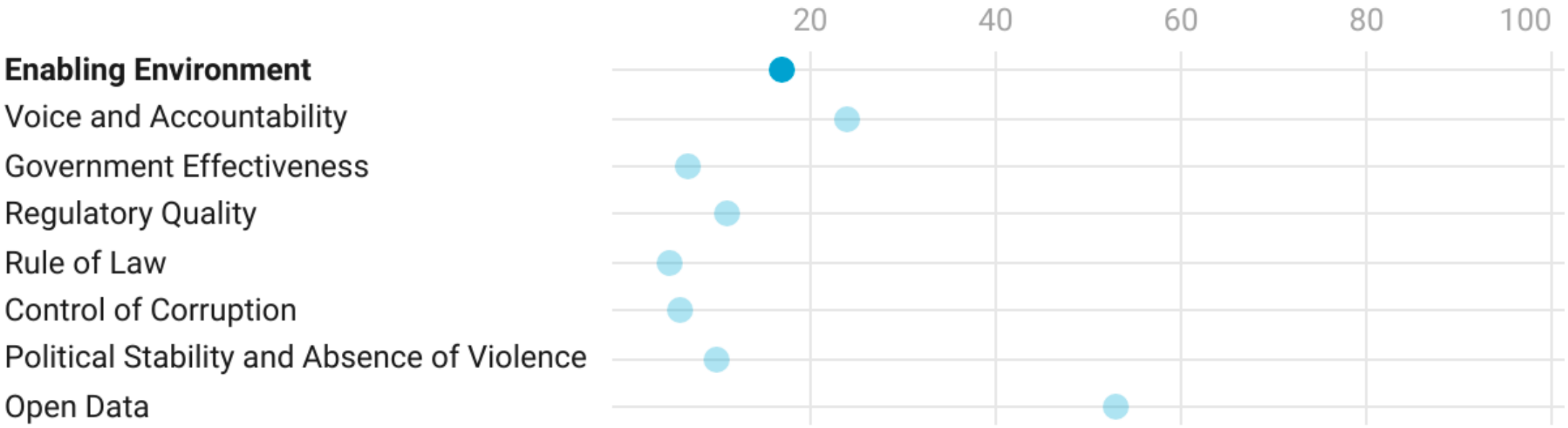
It can take up to two weeks to cross from Kolwezi to Zambia, and up to 35 days to get to South Africa

For Kamoa-Kakula, shipping concentrate to China has cost as much as $0.56 per pound of payable copper, equating to 39% of the company's total cash cost per pound of payable copper in Q3 of 2022

Governance continues to be a major deterrence to investment

The DRC's government does not offer an enabling environment for mining and industrial activity

Scores for the enabling environment of the DRC's mining sector, 2021 (NRGI)



Scores below 30 indicate a "failing" environment

A high cost of capital can hinder the commercial viability of projects

The DRC has one of the highest lending rates in the world, reflecting the country's high risk, as well as the immaturity of its financial market

Lending interest rate (World Bank, 2021)

The DRC's lending interest rate is a major constraint, particularly considering the recent rise in global interest rates along with the high CAPEX requirements that are typical of new mining, processing, and manufacturing projects

The DRC likely lacks the know-how to pursue certain downstream opportunities

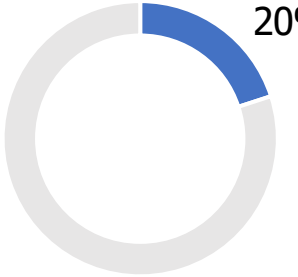
A lack of complex exports, in addition to a struggling education system and one of the world's lowest labor productivity rates, indicates that the domestic workforce may lack preparation to produce complex products

Economic complexity index, ranked 1-133 (Atlas of Economic Complexity)

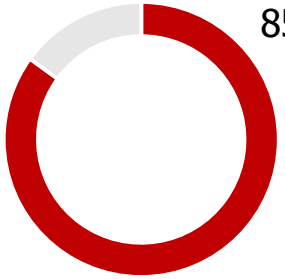
Country	1995 Rank	2000 Rank	2005 Rank	2010 Rank	2020 Rank
China	46	39	29	24	17
DRC	**122**	**106**	**130**	**126**	**122**
Kenya	73	91	93	76	90
Poland	28	24	25	23	26
South Africa	47	44	48	56	70
Uganda	120	123	110	89	87
United States	9	6	8	12	12
Zambia	91	94	106	105	107

These constraints help explain the DRC's lack of manufacturing capacity

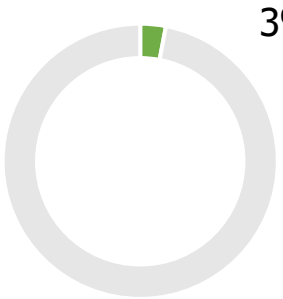
The DRC's manufacturing sector is failing to drive economic growth



Manufacturing accounts for 20% of the DRC's GDP



But 85% of domestic manufacturing is in the food and drink sector, which is not economically competitive, but is necessary for survival and insulated from competition



Only a 3% of exports are manufactured products, indicating the country's lack of internationally competitive manufacturing capacity

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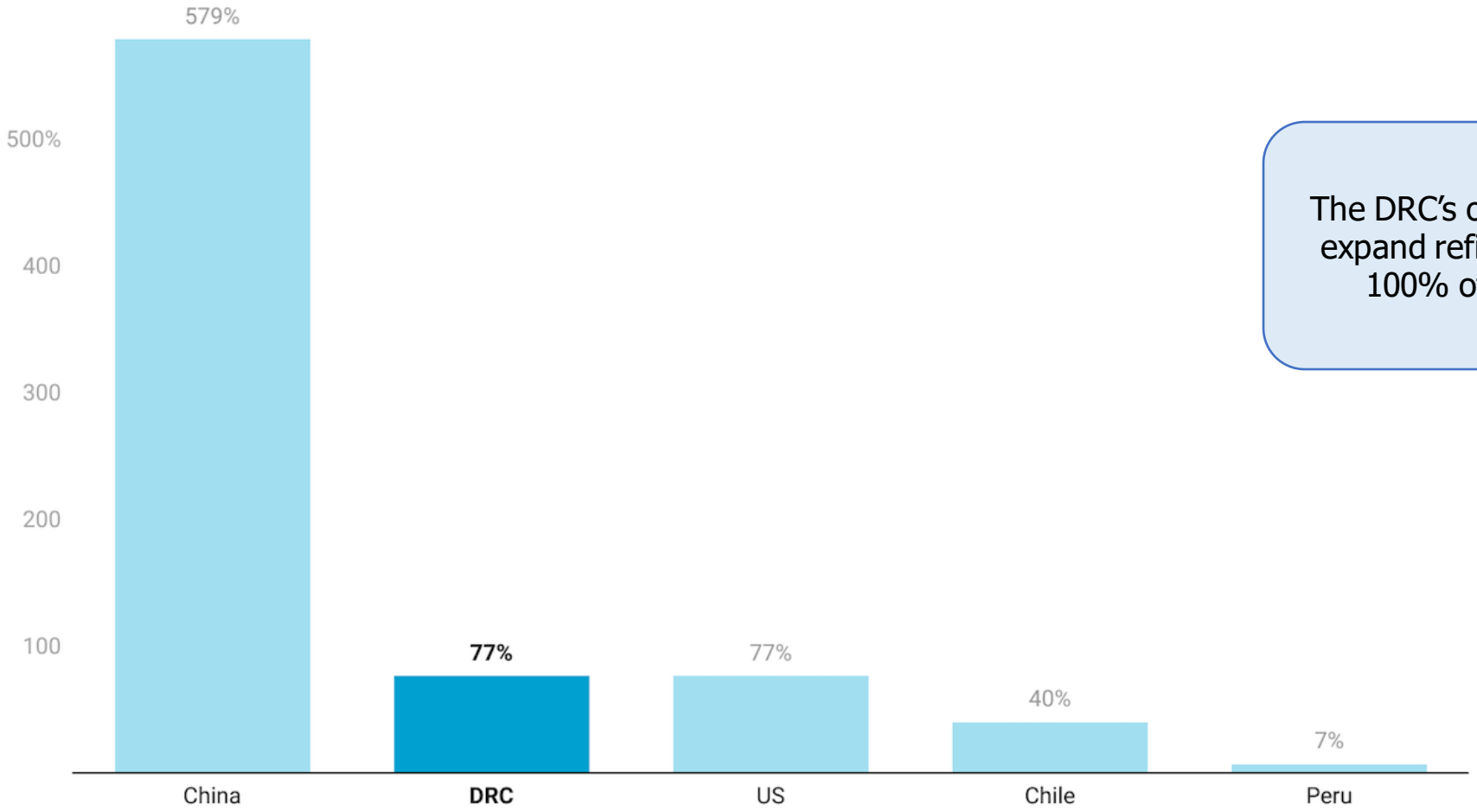
Expanding domestic copper refining is an accessible opportunity for the DRC

The DRC still has vacant potential to continue expanding midstream capacity

Copper refining output as a share of domestic copper mine production (USGS, 2022)



The DRC's opportunity would be to expand refining capacity closer to 100% of mined production

Copper seems the most feasible mineral for midstream expansion

Existing upstream and midstream production, in addition to a relatively low energy requirement, means copper could be one of the more feasible minerals to target for midstream operations

Unlike other minerals…

Upstream production is already stable

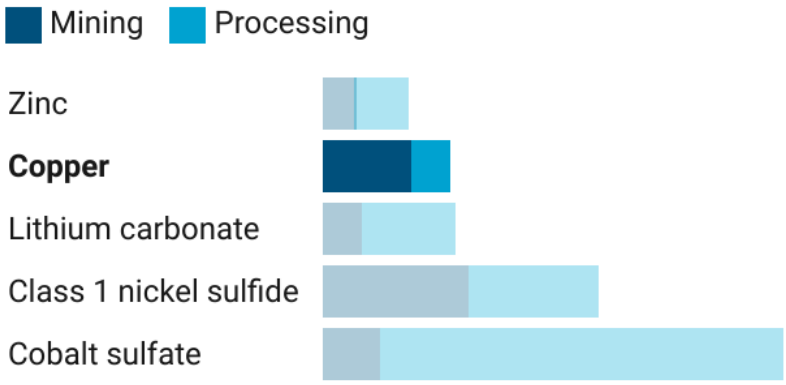
Mineral	Upstream maturity level
Copper	Mature
Cobalt	Mature
Tin	Developing
Zinc	Nascent
Lithium	Nascent

The workforce has the skills for midstream production

Mineral	Midstream maturity level
Copper	Mature
Cobalt	Intermediary
Tin	Intermediary
Zinc	Potential
Lithium	Difficult to develop

Energy intensity is a more marginal increase for producers

Average tons of CO2-equivalent Emissions per ton of Metal Content Production (IEA)



Increasing domestic refining could offer important, but limited, national benefits

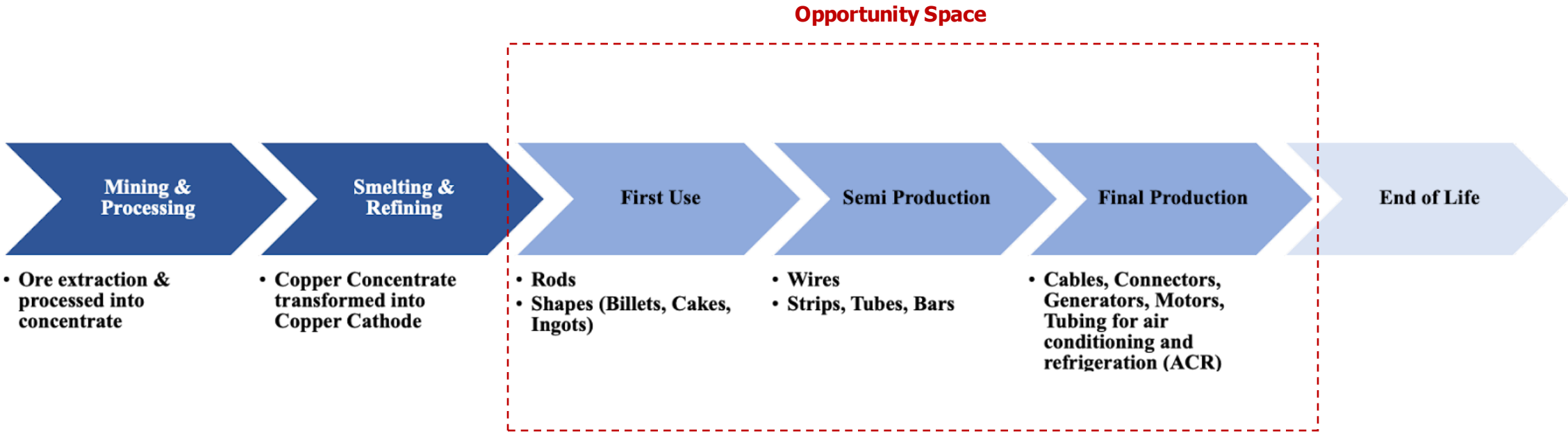
Expanding copper refining would have most notable impacts on export earnings, fiscal revenue, and financial diversification, while the benefits for capability acquisition and job creation would be more muted

	Benefit type	Benefit level	Comments
	Fiscal revenue and export earnings	Medium	Smelting and refining copper is not as lucrative as mining and concentration, but still offers important revenue
	Less exposure to volatility	High	Copper smelters and refineries are often a way to hedge against revenue and profit volatility for miners
	Job creation	Low	Midstream copper processes are about as labor intensive, if not slightly less so, than mining
	Capability acquisition	Low	The capabilities developed from copper smelting and refining are not connected to production of many other complex goods. The know-how also already exists in the DRC's economy

Companies in the DRC can also gain other benefits from in-country smelting and refining, such as **lowering their transit costs** and profiting from access to **secondary products**, including sulfuric acid which is at times in extremely high local demand

The manufacturing of copper products also presents a feasible opportunity

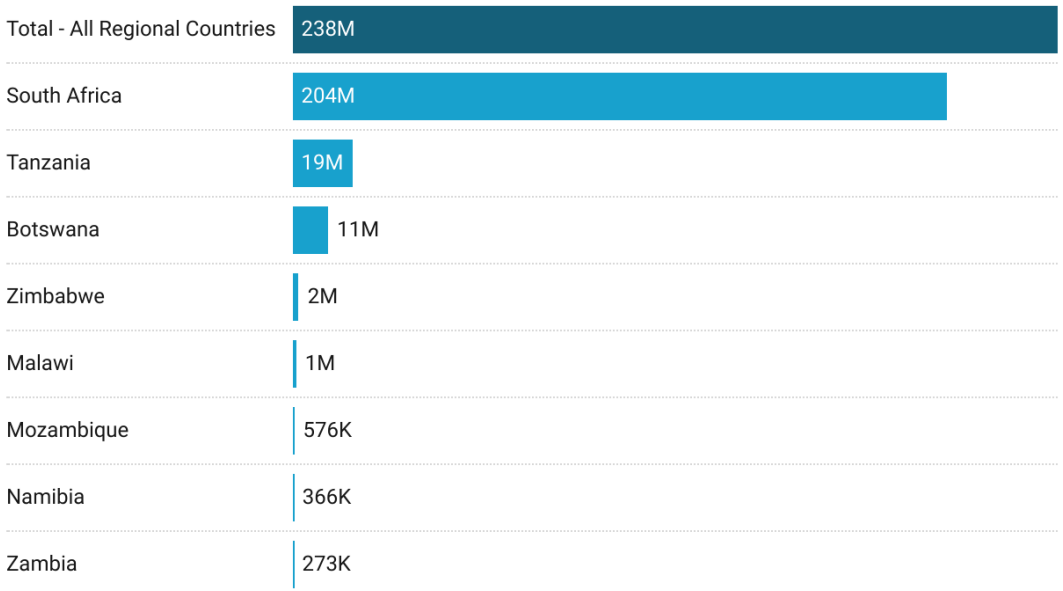
The DRC can develop a robust export-focused manufacturing cluster for copper products



There is a market opportunity for manufactured copper products

The African market for copper wire imports is close to a quarter of a billion USD, some of which can be supplied by ex-Katanga-based manufacturers situated close to existing trade routes

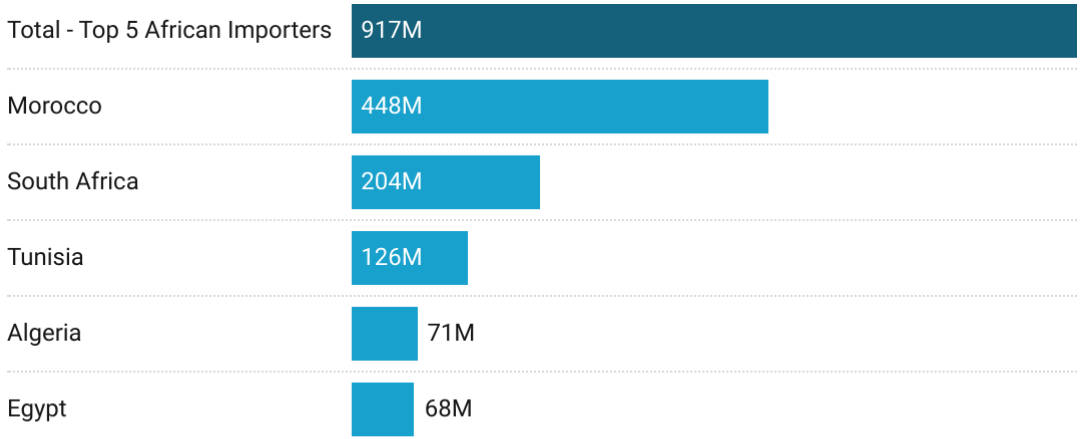
Regional imports of copper wire (Atlas of Economic Complexity, 2020)



Regional countries are classified as those which either trade copper products or support the trade of copper products with/by the DRC

Source: Harvard Atlas of Economic Complexity • Created with Datawrapper

Top African importers of copper wire (Atlas of Economic Complexity, 2020)

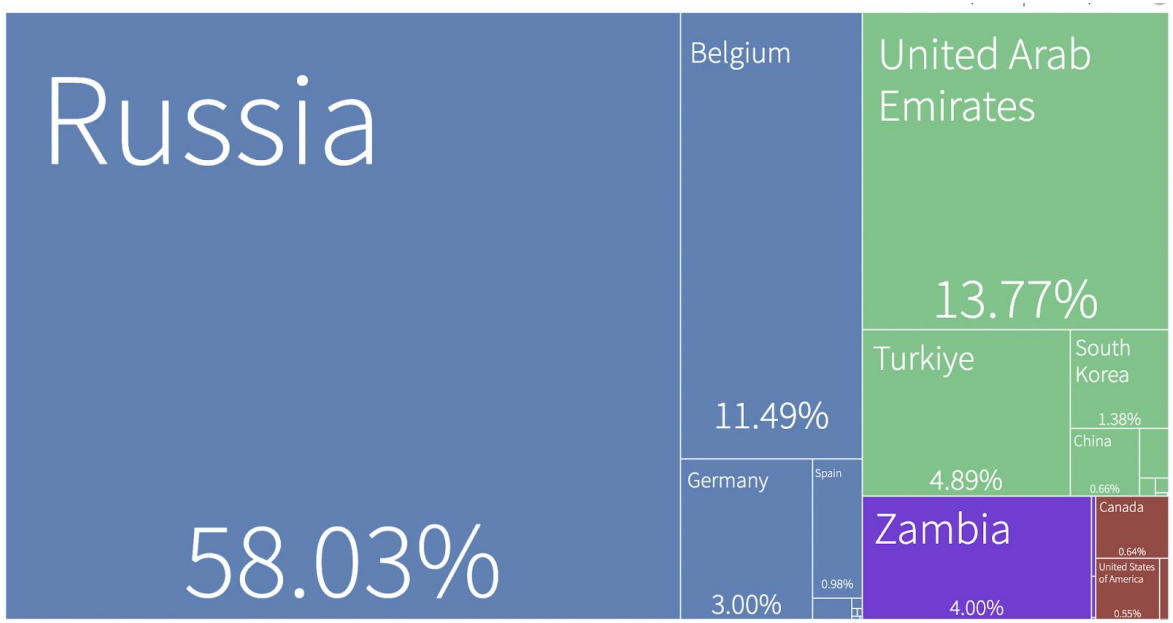


Source: Harvard Atlas of Economic Complexity • Created with Datawrapper

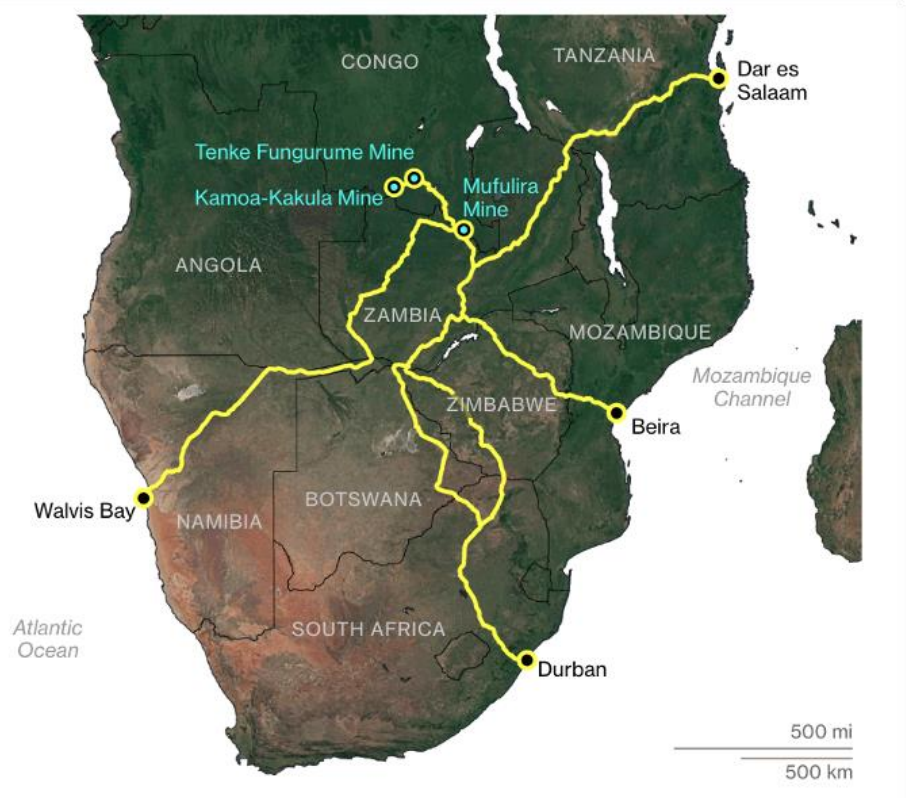
The market opportunity is strengthened by existing dynamics

The DRC's existing export routes and regional agreements make it a logical market entrant

South Africa's copper wire imports, by country (Atlas of Economic Complexity, 2020)



Existing routes From copper and cobalt Mines in Congo and Zambia to ports (Bloomberg)



Notwithstanding sizable constraints, copper product manufacturing remains feasible

The DRC's constraints on energy, logistics, and know-how are surmountable for copper manufacturing

Energy

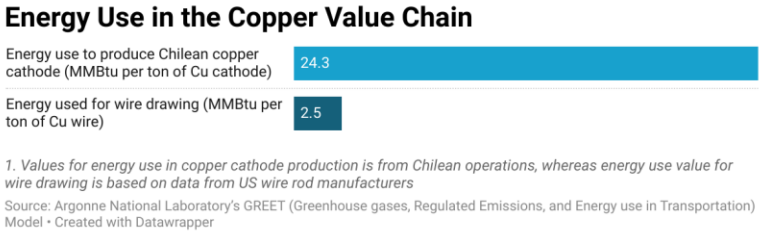
Manufacturing copper products is not energy intense as compared to other upstream and midstream activities

Logistics

Producing and exporting copper products does not require the development of new road infrastructure or logistical capabilities

Know-how

In terms of workforce capabilities, the DRC's existing operations are proof of concept that it already has sufficient know-how, supported by expatriate labor, to produce copper products



And the DRC has various potential comparative advantages

Integrated production, logistics, regional dynamics, and clean energy can all play in the DRC's favor

Lowering cost curve positioning due to integrated production

Locating close to regional sales, and cutting copper export costs

Accessing AFCFTA and regional trade agreements

Leveraging hydro and solar energy for green copper products

At a national level, copper manufacturing is primarily about capability acquisition

While copper manufacturing would have a negligible impact on fiscal revenue, export earnings, and exposure to volatility, it could be a game changer for economic diversification and job creation

	Benefit type	Benefit level	Comments
	Fiscal revenue and export earnings	Low	Individual copper manufacturing operations generally have small revenue and tight margins relative to upstream and midstream activity
	Less exposure to volatility	Low	Prices of copper products are less volatile, but exhibit correlation with, cathode prices. But the smaller market volumes in the DRC would leave little room for meaningful economic insulation from volatility
	Job creation	Medium	Copper manufacturing tends to be more labor intensive per dollar of output than upstream and midstream operations in the copper value chain (and that of other minerals)
	Capability acquisition	High	Copper offers a rare pathway for the DRC to enter manufacturing, developing capabilities and proof of concept that can have positive economic spillovers, particularly in the ex-Katanga region

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Our analysis leads to several initial recommendations for government and industry

Smelting and refining

DRC government

- Codify a framework for **public-private energy partnerships** between SNEL and private sector
- Focus on carrots and **constraint alleviation** rather than sticks

Industry

- Integrate the DRC's copper growth potential, local demand for midstream capacity, and geopolitics as **pull factors for midstream investment**
- Consider **partnerships with clean energy companies** to enable operations and gain favorable long-term energy prices with reliable access

Product manufacturing

DRC government

- Engage with industry to target and implement **fixes to low-hanging fruit**
- Consider **tax holidays** with sunset provisions
- Select partners based on **commitment to developing local manufacturing** and existing capabilities, rather than geopolitical considerations

Industry

- **Develop partnerships to tap into the ex-Katanga region's potential**, including a newly forming Special Economic Zone and integration with copper producers for favorable sourcing agreements
- **Plan for higher initial OpEx** due to importing labor, paying for private quality inspections, etc.

Questions?