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Strategic Minerals in Tanzania:

Policy Options for Expanding Domestic Value Chains

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List of abbreviations

ASM	-	Artisanal and small-scale mining
AU	-	African Union
CETM	-	Critical energy transition minerals
COMESA	-	Common Market for Eastern and Southern Africa
CRM	-	Critical raw materials
EAC	-	East African Community
EARS	-	East African Rift System
ECRM	-	Extended critical raw materials
EPZ	-	Export Processing Zone
EU	-	European Union
FDI	-	Foreign direct investment
GST	-	Geological Survey of Tanzania
IEA	-	International Energy Agency
JORC	-	Joint Ore Reserve Commission
MMFL	-	Minjingu Mines Fertilizers Limited
PGMs	-	Platinum-group metals
REEs	-	Rare earth elements
REOs	-	Rare earth oxides
SADC	-	Southern African Development Community
SEZ	-	Special Economic Zone
SMs	-	Strategic minerals
TEITI	-	Tanzania Extractive Industries Transparency Initiative
UK	-	United Kingdom
UN	-	United Nations
URT	-	United Republic of Tanzania
US	-	United States of America

Abstract

Tanzania is endowed with a wealth of strategic minerals that have the potential to drive sustainable socioeconomic development. Mitigation solutions to address the accelerating climate crisis, such as increased generation and use of renewable energy and production of electric vehicles, are minerals intensive, driving global demand for minerals needed for green energy technologies, such as lithium, cobalt, nickel, graphite and copper. This increased demand presents a unique opportunity for Tanzania to leverage its strategic mineral potential to generate revenue, create employment, develop new skills and chart a new course towards prosperity, inclusive growth and sustainable development. Effectively managing and utilising these resources can transform the country's economic landscape. However, past mineral booms, for example the spike in gold prices between 2004 and 2014, left Tanzania and many other mineral-rich countries in Sub-Saharan Africa disappointed, largely due to the low levels of integration of these activities into the wider economy.

This study employed qualitative methods to examine the value chains of six strategic minerals (SMs) in Tanzania—phosphate, copper, nickel, graphite, rare earth elements (REEs) and titanium—which were selected on the basis of proven reserves in Tanzania and their global demand in green energy technologies. On the production side, the study found that Tanzania currently has no operating smelting or refining capabilities for strategic minerals, and, on the consumption side, very few factories utilize SMs or other mineral products processed locally. In short, existing capacity for value addition for strategic minerals in Tanzania is very limited. Overall, Tanzania has a fairly strong policy foundation, but it lacks a strategic policy to identify, define, categorize and prioritize strategic minerals for value addition. Most existing policies and plans were created before the global focus on energy transition and do not acknowledge the importance of strategic minerals.

To leverage its mineral potential, the findings emphasize the need for development of a facilitative policy and regulatory environment to guide the operations of the SM subsector together with integrated strategies to broaden the country's resource base, develop domestic capacity and workforce skills for mineral processing and manufacturing, and foster strategic regional cooperation.

Key Words: *strategic minerals, value chain, energy transition, regional cooperation*

Photo credit: Africa Invest Group

1 Introduction

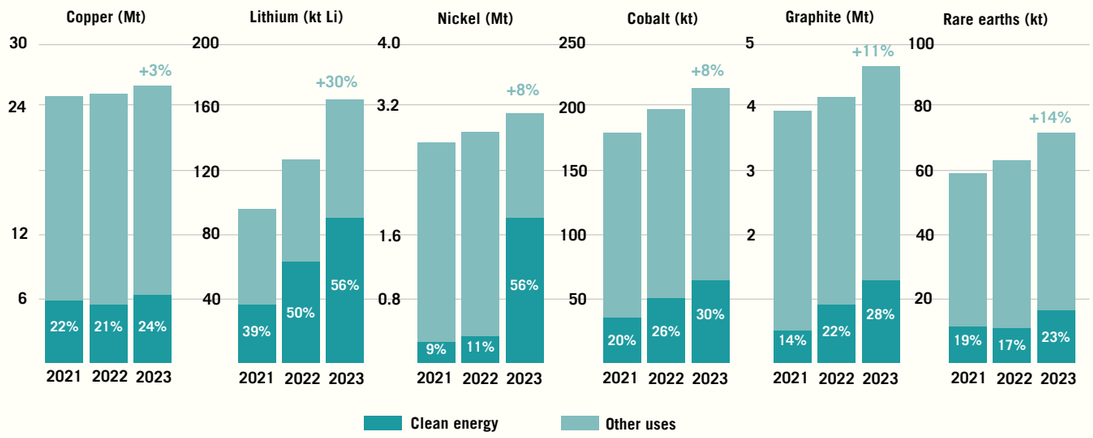
Tanzania is rich in a variety of minerals including metals (gold, iron ore, cobalt, silver, aluminium, tin), diamonds and other gemstones (tanzanite, sapphire, ruby, emerald, zircon, red garnet, alexandrite, spinel, zircon and tourmaline), industrial minerals (limestone, soda ash, gypsum, salt, phosphate, gravel, sand and dimension stones) and fuel minerals (coal and uranium). The country's geology also shows high potential for copper, rare earth elements, lithium, graphite, titanium, vanadium, and platinum group metals (PGMs) (URT 2017).

The Government has been promoting private investment in the mining sector over the past two and half decades, albeit intermittently. During this period, the mining sector's contribution to Gross Domestic Product (GDP) has been increasing yearly. In the financial year 2020/21, the mineral sector's contribution to GDP rose to 7.2 percent from 6.7 percent in 2019/20 (URT 2023) and became the leading foreign exchange earner. The sector contributed 218,353 full-time employment equivalents (FTEs) or 0.9 percent of total direct employment in Tanzania (TEITI 2023). According to the Bank of Tanzania's (BoT) Monthly Economic Review for September 2023, the export of non-traditional goods grew by 5.6 percent, driven by minerals, particularly gold and coal. However, these minerals are often not processed domestically into high-value products.

As the climate crisis intensifies [1], mitigation solutions, such as solar photovoltaic (PV) and wind energy generation systems, electric vehicles, and electrolysers for producing low-emission hydrogen, are minerals-intensive technologies thus driving global demand for minerals such as lithium, cobalt, nickel, graphite and copper. Some projections indicate that demand for these minerals could increase almost fourfold by 2030 (UNCTAD 2024a). By specific mineral, the demand for graphite is projected to quadruple while demand for nickel, cobalt and rare earth elements is expected to double by 2040 in pursuit of the goal of net zero emissions (NZE) (IEA 2024, Figure 1).

The demand for nickel witnessed substantial growth in 2023 and is projected to further increase by about 9 percent in 2024 (Global Mining Review 2024). This surge in demand, however, has also been met with a simultaneous rise in production costs. Consequently, the global nickel market experienced over double the surplus in 2023 compared to 2022.

Figure 1: Global market outlook for strategic minerals



Source: International Energy Agency

[1] Human-induced global warming is increasing at an unprecedented rate, reaching 0.26 °C per decade over the period from 2014 to 2023. https://essd.copernicus.org/articles/16/2625/2024/essd-16-2625-2024.pdf

The demand for copper in clean energy systems is forecast to increase from 23 percent of total demand across all applications to over 42 percent by 2050 (UNCTAD 2024b). Graphite and rare earth elements may not face supply issues in terms of volumes but are among the most vulnerable in terms of market concentration. For instance, over 90 percent of battery-grade graphite and 77 percent of refined rare earths in 2030 will originate from China, where demand for copper, aluminium, lithium and cobalt is also expected to grow between 2025 and 2034 (Wang and Gao 2020; Wang et al. 2021). This may affect the price globally (Massari and Ruberti 2013). Global exploration spending in strategic minerals grew by 15 percent in 2023, with Canada and Australia registering the largest increases, followed closely by Africa (IEA 2024). Overall, the global market outlook for these strategic minerals remains strong with a combined market value to reach USD 770 billion in 2024.

The accelerating global demand, therefore, presents Tanzania with a unique opportunity to discover and extract strategic minerals, develop industrial linkages through value addition domestically, and sell through regional and global supply chains. Such linkages can generate greater revenue, create employment, develop new skills and chart a new course towards prosperity, inclusive growth and sustainable development.

However, the country's optimism about potential benefits derived from the global energy transition is dampened by its experience from past resource booms. For example, the spike in gold prices between 2004 and 2014 left Tanzania and many other mineral-rich countries in Sub-Saharan Africa (SSA) disappointed. Weaknesses in domestic value addition, taxation and management of revenues meant that gold-producing countries did not fully benefit from this period of high prices. Large proportions of minerals are still exported in raw or semi-processed form. The situation is encapsulated in the quote from SSA Trade Unions Association: *"Our raw materials are exported, and we are left in poverty. That's why beneficiation must be on the agenda of every union."* (IndustriALL 2019)

This resentment has driven the shift in the discourse on "getting a good deal" for Tanzania away from a narrow focus on taxing upstream operations and exports of raw minerals at the expense of broader national development opportunities. Therefore, this study explores policy options for Tanzania to effectively leverage its strategic minerals potential to benefit more from the current boom in these commodities. It identifies six key strategic minerals and examines their value chains from exploration to processing and manufacturing. The report addresses three key questions:

- What are the current policies and regulations supporting domestic mineral value addition, and what gaps exist?
- Does Tanzania need an exclusive policy for its strategic minerals?
- What are the enablers (to take advantage of) and obstacles (to mitigate) for Tanzania to leverage its strategic mineral wealth and boost the economy through value addition?

1.1 Defining strategic minerals

Terms like strategic, critical, green and transition minerals are often used interchangeably. However, there can be subtle differences in their connotations depending on the context. In recent years, countries such as Australia and the United States (as importers of strategic minerals) have developed lists of minerals that they consider to be at risk of supply chain disruptions. Hence, they use the term "critical" largely from the perspective of supply risk. China and Russia also vaguely use the term "critical minerals." Disruptions may emerge as a result of geopolitical dynamics among dominant global consumer countries which may trigger the use of protective trade policies by countries that dominate the supply chain.
Such trade measures may adversely impact their manufacturing industries, hence, their competitive advantage in the mineral and metal-related manufacturing value chains.. For instance, in 2012, China imposed restrictions on the export of various forms of rare earths, tungsten and molybdenum (WTO 2015). Again, in 2023 China announced a ban on rare earth extraction and separation technologies (Financial Times 2023) with significant implications for U.S. national, economic, and rare earth security.

Regional economic blocs with more diverse interests

define strategic minerals differently. For example, the European Union (EU) broadly refers to them as critical raw materials (CRMs) to feed manufacturing industries in the EU while the African Union (AU) categorizes them as green minerals to drive a green industrial revolution on the continent in line with the AU's Agenda 2063 (AfDB 2022).

The United Nations (UN) and International Energy Agency (IEA), whose interests are purely about global solutions to the climate crisis through energy transition, refer to these commodities as critical energy transition minerals (CETMs) (UN 2024) and energy transition minerals (ETMs) (IEA 2022), respectively, to differentiate them from non-energy-related critical minerals.

These terminologies, therefore, reflect strategic interests and the pivotal roles these commodities play in national/regional economies and global energy transition strategies. The key factors informing the choice of the term tend to revolve around interest centered on the purpose, use, impacts, vulnerabilities and geostrategic importance.

For the purposes of this study, the term "strategic minerals (SMs)" is used to refer to the minerals and metals produced by a country (in this case, Tanzania) that may be exploited for specific and/or emerging opportunities and strategically leveraged to achieve the country's long-term sustainable development vision.

Photo credit: Shutterstock/RHJPhotos

2 | Research methodology

This research utilized a qualitative approach that combined semi-structured interviews and desk research. Given the limited data available for the research topic, the researchers utilized an inductive study design to answer the research questions. Interviews were used to include the perspective and understanding of the key players' context (Ritchie et al. 2013). The data analysis and collection were conducted simultaneously, as is typical in qualitative studies, to ensure that key findings are supported by multiple data sources. The data triangulation in this study involved three main steps. First, a literature review was conducted to compare conceptual definitions and frameworks of strategic minerals and to learn from past efforts. Second, 11 key informant interviews (KIIs) were held with representatives of the Ministry of Minerals (2), Mining Commission (1), Ministry of Trade and Industries (1), Ministry of Energy (1), Vice President's Office, Environment Division (1), State Mining Corporation (1) and upstream mining operators (4). The contents of each interview were transcribed, translated and thematically coded. Nvivo software was used to develop codes and identify recurring ideas and topics in the data. The central and sub-themes coded from transcripts were used to address the research questions and integrated with other findings presented in the report. The third step involved desk research, which included: (1) studying success stories from other countries to inform potential policy options for Tanzania; (2) collecting statistical information on mineral potential, exports and imports to assess Tanzania's potential for value addition; and (3) conducting a policy environmental scan to understand the policy and regulatory environment, national development aspirations, needs, priorities and capabilities. Real-time data availability was a major limitation encountered alongside time constraints.

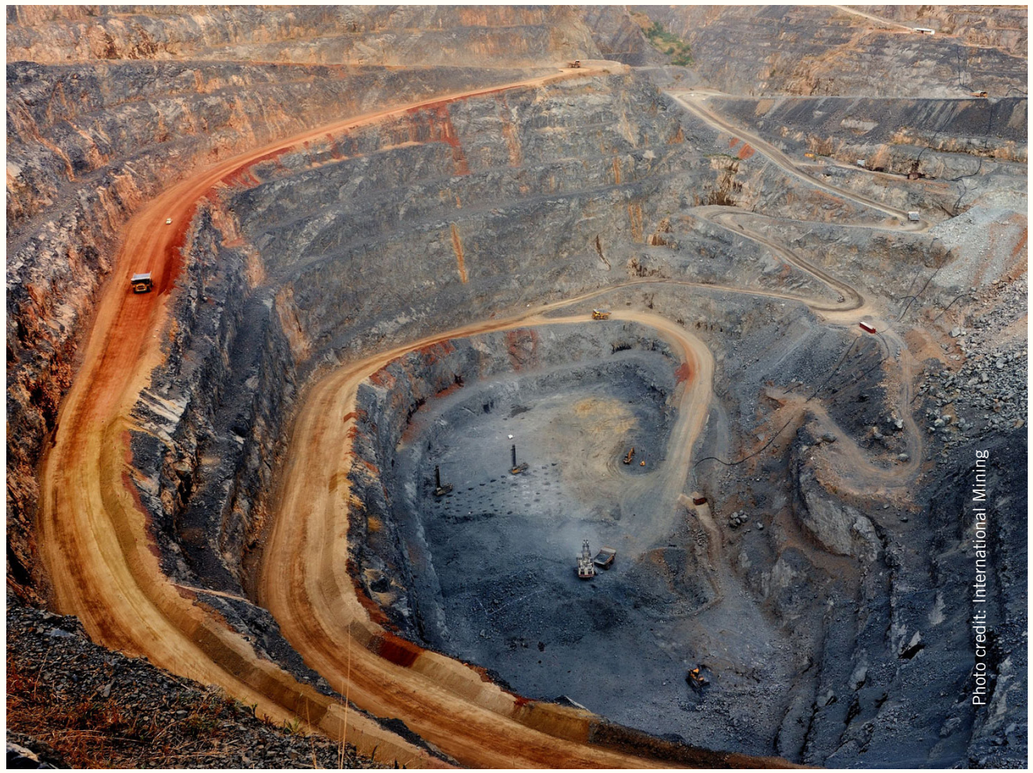


Photo credit: International Mining

3 | Tanzania's strategic mineral potential

3.1 Distribution of strategic mineral deposits

Tanzania is rich in various strategic minerals, including nickel, cobalt, platinum group minerals, graphite, rare earth elements, copper, titanium, aluminum, lithium, tin, tungsten and vanadium. According to the Geological Survey of Tanzania (2015), strategic minerals are distributed across the entire geological terrain of the country. Selected minerals and their occurrence in Tanzania are described below.

Copper (Cu) is a strategic mineral for clean energy systems like wind, geothermal and solar technologies, energy storage, power transmission, electronics and electric vehicles. Copper is found and exploited from the Lake Victoria goldfields where it occurs as iron and copper sulfide minerals within the Nyanzian rock system. The Bulyanhulu gold mine produces copper sulfides from the Nyanzian rocks as a byproduct of gold mining and processes it into a concentrate for export. Copper also occurs as a malachite mineral in the Mpanda mineral field, Lupa (Chunya) and Singida goldfields and is present in metamorphic geological terrains in Morogoro, Tanga and Mbeya. Malachite is also found and exploited as copper ore by artisanal and small mining operations in numerous locations across the country, including Mpwapwa in Dodoma region, Ruangwa district in Lindi region and Mwanga district in Kilimanjaro regions, again for export.

Nickel (Ni) serves as a foundational material in various industries due to its corrosion resistance, durability and magnetic properties. Its significance has grown exponentially with the surge in demand for electric vehicles, where nickel is a key component in lithium-ion (Li-ion) battery technology, enhancing energy storage capabilities and extending battery life. Apart from its role in the production of EV batteries, nickel is also used in grid storage and portable electronics, the manufacture of stainless steel, and alloys that are used across the aerospace, military and construction sectors, underscoring its broad utility.

In Tanzania, nickel has been found in the Karagwe-Akolean and Bukoban rock systems at Kabanga in the Kagera region and is ready for mine development at the time of this study. Nickel is also found in the mafic rocks within high-grade metamorphic rocks at Nditi in Lindi region, and Zanzui and Dutwa in Simiyu region. In addition, huge potential exists for nickel deposits in the northwestern and southern parts of Tanzania.

Rare earth elements are essential metals for various high-tech industries and are pivotal in the development of clean energy and other modern technologies. They are used extensively in the manufacturing of permanent magnets that are very important in clean energy technologies like wind turbines and hybrid electric vehicles. Additionally, REEs play a critical role in technologies that drive the electronics industry, such as televisions, computers and other devices that have visual displays, and laser technology. REEs are also key materials in the manufacture of smartphones and advanced defense systems where they are used for their unique optical, magnetic and electronic properties.

Graphite, a form of carbon (C), plays an essential role in various high-tech applications due to its excellent conductivity, heat resistance and lubrication properties, making it a critical material in the manufacture of Li-ion batteries used in electric vehicles and portable electronics such as smartphones and computers. Its utility extends from brake linings to moderators in nuclear reactors (Ceylon Graphite 2021). In Tanzania, graphite is present within the Usagaran metamorphic rock units in Morogoro, Lindi, Tanga and Arusha regions.

Lithium is found in pegmatite in granites at Hombolo in Dodoma region, and the East African Rift System (EARS) may hold brines rich in lithium (Stephenson 2023). Salt lake brines are the main sources of lithium in the world today.

Phosphate (P2O5) minerals are widely used as medicinal salts of phosphorus to treat some illnesses, such as urinary tract infections (Britannica 2024). Moreover, phosphates have recently been discovered that can make stable complex oxide structures allowing the design of safer, better performing and economically viable large-scale storage batteries (Gauthier 2012). Phosphate is found in the Minjingu mine area in Arusha region, which is owned by the Minjingu Mines and Fertilizer Limited (MMFL) company.

Titanium (Ti) is an essential mineral in clean energy technologies. Due to its photocatalytic properties, titanium dioxide (TiO2) is one of the building blocks in the future of renewables, used in existing and new solar energy technologies. Meanwhile, hematite (a common iron ore) used together with titanium oxide can allow electrical charge generated from photocatalytic activity to be extracted for use in ion-lithium batteries. Titanium dioxide is also a valuable mineral for improving battery capacity and longevity and as a pigment in paints to improve the energy efficiency of buildings (TMDA 2021). In Tanzania, titanium and vanadium are found alongside iron ore within mafic titano-magnetite meta-anorthosite intrusive rocks in Liganga, Ludewa district, Njombe region. Heavy mineral sands along the Tanzania Indian Ocean shoreline also host titanium deposits.

Other strategic minerals found in Tanzania include platinum group metals which are found in the anorthosite intrusive mafic rocks at the Kapalaguru area in Kigoma Region and Luwumbu in the Njombe region. Aluminium (bauxite) deposits are found in the highly weathered profiles of the Usambara mountains at Amani and Magamba in the Tanga Region. Tin and tungsten are mined at Kyerwa mainly by ASM.

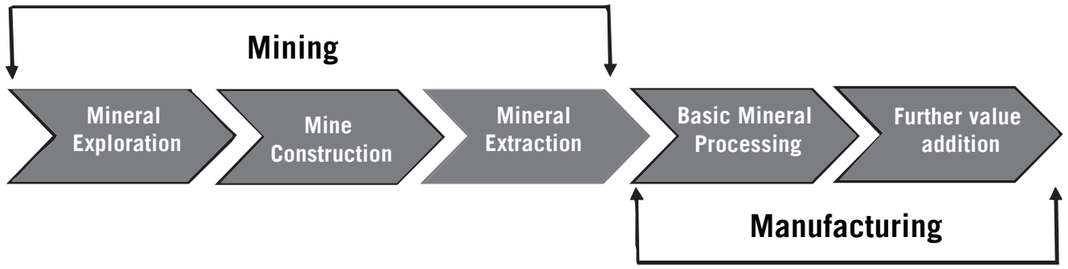
3.2 The value chains of strategic minerals in Tanzania

This section describes the potential value chains of six strategic minerals in Tanzania: phosphate, copper, nickel, graphite, REEs and titanium. These minerals were selected on the basis of proven reserves in Tanzania and their global demand in green energy. Exploration efforts to date have shown that Tanzania has geological potential for these minerals and, therefore, the possibility to develop extended value chains.

An extended mineral value chain refers to the stages, activities and processes involved in transforming raw mineral resources into final products. The mineral value chain starts with exploration (to establish the availability and value of a mineral deposit/reserve) and progresses through mine construction and mineral extraction, to processing, stockpiling, waste management, transportation, and the integration of downstream manufacturing and market dynamics (Lamghari et al. 2019).

In low-and middle income developing countries, the first part of the value chain, which encompasses exploration, mine construction and mineral production (Figure 2), is relatively developed and is governed by the sector policy in the host country. The second part tends to be less developed largely due to the narrow industrial base in these countries (UNCTAD 2019) .

Figure 2: Mineral value chain



Source: ECDPM - Ramdoo, (2015)

Photo credit: iStock/statu-nascendi

Value chain underdevelopment is largely attributed to a lack of specific policies that are tailored to stimulate the development of a particular industrial sector or industry (manufacturing). These policies, which typically take the form of government incentives and other support to address inherent market failures with respect to skills, capabilities, transport and energy infrastructure in the host country, are intended to complement the mining sector policy which by itself is not sufficient to promote the development of the manufacturing sector that produces or uses mineral products (Ramdoo, 2015). Consequently, low-and middle income, mineral-rich countries end up exporting their minerals for processing in industrialized countries. The value chains for the selected strategic minerals are described below, commencing with phosphate.

Phosphate is largely used in the fertilizer industry but can also be used in energy transition technologies. It is the only SM that has a recognizable extended mineral value chain in Tanzania that goes to stage of manufacturing and used in further value addition. At this stage of the chain, 100,000 tons per annum (tpa) of phosphate is mined, concentrated and granulated into fertilizer to be used on farms, thereby creating linkages between the mining, manufacturing and agricultural sectors. Demand for fertilizer domestically and regionally—in the predominantly agrarian economies of Tanzania and neighbouring states—is a key factor for value chain development. Phosphate is also in high domestic demand in other sectors such as component manufacturing for solar photovoltaic systems.

Copper value chains entail all the activities from exploration and mining, processing into a copper concentrate and then smelting into copper ingots or rods. After refining, the copper is sent to manufacturing industries for the production of copper and copper alloys to be used in various industries from the transmission to the storage of electric power. In Tanzania, copper ore is mined on a large scale at the Bulyanhulu gold mine as an associated product of gold extraction. It is then processed into a copper concentrate and exported to Japan and China for smelting. At present, Tanzania does not have a smelting or refining factory.

As for copper, the **nickel** value chain starts with the exploration and identification of commercially viable nickel ore bodies followed by processing and refining to separate associated metals, typically cobalt (Co) and manganese (Mn). These are important metals for the manufacturing of nickel-manganese-cobalt precursor components. During stage three of the value chain, these components are used to produce goods for the fourth and final stage of the nickel value chain. In Tanzania, nickel is at the first stage of the value chain; mining is expected to come on stream soon. The study found that Tembo Nickel Corporation Ltd has completed bankable feasibility studies (BFS) with a reserve of 58 million tons (Mt) at a grade of 2.62 percent Ni accredited by the International Joint Ore Reserve Commission (JORC Committee 2012). The project plans to install a multi-metal processing facility (nickel, copper and cobalt) to produce battery-grade materials domestically to about 99 percent purity level at Kahama township when the nickel mine is commissioned. (Life Zone Metals 2023).

The **graphite** value chain is similarly serially staged and includes exploration, mining and processing. The fourth and final stage is the production of electrical anodes and other products like graphene. This stage may take place domestically (if capacity exists) or exported. These precursor products are then delivered to manufacturing factories and plants to produce final goods for end users. Graphite exploitation in Tanzania is at stage one of the value chain with six large-scale exploration projects poised to come on stream soon. These projects include Mahenge, Epanko, Chilalo, Bunyu, Lindi Jumbo and Nachu (Table 1).

Table 1: Recoverable reserves of selected strategic minerals in Tanzania

Mineral	Recoverable Reserve (million tons)	Location
Copper	28.1	Bulyanhulu, Kahama
Graphite	22.4	Nachu (2.4Mt), Chilalo (2.0 Mt),Bunyu (5.6Mt), Epanko (0.9 Mt), Mahenge (7.0Mt) and Jumbo (4.5 Mt)
Nickel	22.1	Kabanga, Ngara
Phosphate	2.8	Minjingu, Arusha
Rare earth elements	18.5	Ngualla Hill, Songwe
Titanium	173.9	Fungoni (8.9 Mt), Liganga (165 Mt)

Source: Computed data from JORC Report and company websites

The titanium value chain begins with exploration and ore extraction, mainly rutile and ilmenite mineral ore. The ore is then processed using the Kroll method to produce a type of sponge titanium concentrate that is then smelted into titanium ingots and billets. Ingots and billets are delivered to plants to manufacture components. In Tanzania, titanium resource exploitation is still at stage one of the value chain where exploration and mine development are in progress. Rich heavy mineral sands have been discovered along the Indian Ocean shoreline of Tanzania and a large-scale mine is being developed by the Nyati Minerals Company at the Fungoni area near Dar es Salaam.

The mineral value chain for **rare earth elements** begins with exploration and mining followed by the processing of the rare earth oxides (REOs) into rare earth elements (metals). The metals are sent to factories for the production of rods of various alloys. The alloys are the cornerstone in the manufacture of magnets, laser coating [2] and electronic REE flour [3] for glueing various micro components in electronic circuits.

The value chain for REEs in Tanzania is still at stage one. The Ngualla REE Project, located in southern Tanzania, is being developed by the Mamba Minerals Corporation company to mine, process and export REO concentrates to the UK, with a future possibility of building an REE value addition plant in Tanzania.

3.3 Mineral value addition capacity in Tanzania

This subsection summarizes the current processing, refining and manufacturing capacities in Tanzania and those under development to identify the linkages between the production of strategic minerals and domestic manufacturing, especially products related to energy transition. Both production and consumption linkages are discussed.

Production linkages include upstream production, processing, refining and transforming mineral outputs into manufacturing inputs. For consumption linkages, the study assessed the extent to which output from mining production is consumed in the domestic manufacturing sector.

With respect to production linkages, the study found that Tanzania currently has no operating smelting or refining capabilities for strategic minerals. However, Tembo Nickel Corporation is in the planning stage for a multi-metal smelting facility by 2026 when the Kabanga Nickel Project comes on stream (Tembo Nickel 2023).

Mamba Minerals Corporation, the operator of Ngualla REE projects, has a plan to establish a REE multi-commodity refinery for the multi-element REE minerals, niobium, phosphate and fluorspar in Tanzania. However, at the time of this study, Peak Resources Limited, the Australian-based parent company, had not made a firm decision on the refinery as it was also considering establishing the facility at its Teesside site in the United Kingdom as an option (Peak Resources 2024).

In 2014, the Nachu project owned by Magnis Technologies was granted a license to operate within the Special Economic Zones (SEZ) in Mtwara region leveraging its proximity to graphite deposits and Kibaha-Coast region for battery manufacturing plant for an initial 10 years. The license is intended for the company to establish a processing plant at the SEZ facility for production of graphite-based technology products like EV batteries (Magnis Energy Technologies 2024). However, the latest information on its value-addition operations could not be obtained.

On the consumption side, the study found that very few factories and industries utilize strategic minerals and mineral products processed domestically (Table 2). This is mainly because of the limited number of mines in Tanzania that currently produce these commodities. Other than phosphate, all other inputs are imported. However, the importation of mineral inputs by Tanzanian-based companies indicates domestic demand.

In short, value addition capacity for strategic minerals in Tanzania is currently very limited but with potential for expansion once the pipeline projects come on stream. Similarly, the study found, with the exception of phosphate, no linkages between the local production of strategic minerals with domestic manufacturing companies in Tanzania that produce consumer products.

[2] A cutting-edge surface engineering technique that utilizes laser energy to deposit thin layers of material onto a substrate, enhancing its surface properties such as hardness, wear resistance, and corrosion resistance. REEs, are known to improve microstructural refinement, oxidation resistance, and thermal stability of coatings.
[3] REE flour refers to finely powdered forms of rare earth oxides or compounds ground to a micro or nano-scale to increase reactivity and uniformity in processes like catalysts, phosphors, magnets, and surface coatings.

Table 2: Selected manufacturing industries linked to strategic minerals

No	Factory/Industry	Location	Manufactured/Used Product	Minerals (Imported or sourced in-country)
1	Minjingu Mines Fertilizers Limited (MMFL)	Arusha	Fertilizer	Rock phosphate **(Sourced In-Country)**
2	East African Cables	Dar es Salaam	Electric cables for high tension and domestic use power transmission.	Copper, aluminium **(Imported)**
3	Aluminium Africa (ALAF)	Dar es Salaam	Aluminium and zinc-coated roofing sheets	Aluminium ingots **(Imported)**
4	TANALEC Company Limited	Arusha	Electric transformers	Copper and aluminium **(Imported)**
5	Drilling companies (mineral, oil and gas exploration)	Across the country	Drilling mud	Barite **(Imported)**
6	YUASA Battery (East Africa Limited)	Dar es Salaam	Batteries	Electrodes, usually made of graphite, copper platinum and titanium **(Imported)**
7	Chloride Exide (TZ) Ltd.	Dar es Salaam	Batteries for internal combustion engine (ICE) vehicles	Electrodes, usually made of graphite, copper platinum and titanium **(Imported)**
8	Matsushita Electric (East Arica) Co. Ltd.	Dar es Salaam	Batteries for radios, torches, cell phones, etc.	Electrodes and graphite powder, aluminium and copper **(Imported)**
9	AMEC Motor and Blower	Dar es Salaam	Electric motors	Powder material (usually made of nickel and cobalt and others) **(Imported)**
10	Construction industry	Across the country	Railway rails, corrugated iron sheets, nails and iron rods	Steel, aluminum and tin **(Imported)**

Source: MIT 2024

4 | Why Tanzania should add value to mineral resources

4.1 Rationale

Over recent decades, mining has contributed to improved macroeconomic indicators in Tanzania, especially the balance of payments, revenue, employment and social expenditure. However, this has been achieved without creating meaningful long-term prosperity (Beare 2017). As discussed in the preceding section, the fact that the strategic mineral sub-sector in Tanzania is nascent and noticeable linkages are yet to be established is well acknowledged. However, drawing from broader mineral sector experience, the persistently weak linkages between mining and the country's economy have often undermined the sector's full contribution to sustainable development.

The creation of effective downstream linkages offers Tanzania with substantial prospects to develop clusters of manufacturing and service activities around the strategic minerals to bridge the industrial gap. Promoting extended domestic value addition, therefore, can stimulate the development and growth of the mineral-based manufacturing sector alongside skills development, an expanded tax base and employment as shown by the experience of Morocco in the production, processing and use of critical minerals (see Box 1).

Box 1: The Case of Morocco

Morocco is a key player in the production of critical minerals such as cobalt and phosphate, which are essential for renewable technologies and EV batteries. Over the past twenty years, the country has strategically positioned itself as an attractive investment hub for medium to high-tech industries, particularly in the automotive, aerospace and renewable energy sectors.

In 2015, the Moroccan government reformed the regulatory and policy framework of the mining sector to attract foreign investments, increase domestic value addition and boost exports. This included incentives for mining companies, such as tax exemptions on imported equipment for investments and reduced tax rates for companies that supply ores to domestic mineral-processing and beneficiation companies. Morocco has significantly increased its renewable energy capacity, with a target of achieving 52 percent by 2030, driven by both government strategies and foreign investments.

The country is actively advancing the value addition of critical minerals essential for high-tech and renewable energy applications. Transitioning from raw material extraction, Morocco is developing local industries capable of processing and adding value to these minerals. This includes manufacturing components for solar panels and electric vehicle batteries, aligning with the broader strategy to position Morocco as an investment hub for medium to high-tech industries.

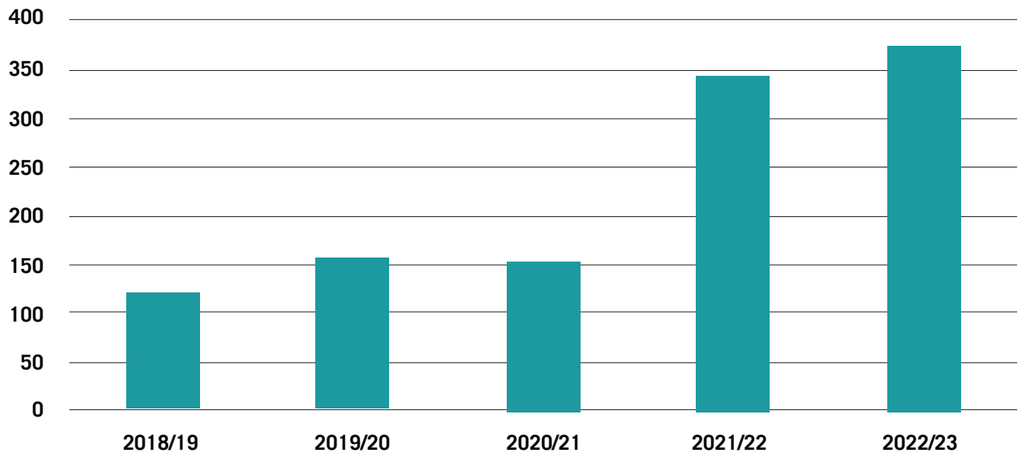
The country's substantial investments in renewable energy, particularly solar and wind power, not only reduce energy imports but also establish Morocco as a leader in sustainable energy practices. Morocco aims to enhance the value of its strategic minerals, cobalt and phosphate, by developing local industries for processing these minerals into high-value products like EV batteries and fertilizers. The country has solidified its position as a leading automotive hub in Africa, with a production capacity of over 700,000 vehicles annually. This sector has attracted major global players like Renault and Stellantis, significantly boosting the country's export turnover. Leveraging its automotive manufacturing prowess, Morocco has also expanded into aerospace manufacturing, producing metal parts, sub-assemblies of aircraft engines, and various other components.

Source: (Andreonia and Avenyo 2023; UNCTAD 2016)

4.2 Current situation

The mineral value chain involves a series of activities that add value at each stage of the chain from identifying and assessing potential reserves through geological mapping through to manufacture of end products. Given that mineral exploration is the foundational activity for mining development, Figure 3 shows data for the issue of prospecting licenses in Tanzania. As the data indicate, the issuing of prospecting licenses significantly increased in the 2021/22 and 2022/23 financial years.

Figure 3: Prospecting licenses issued in Tanzania, FYs 2018/2019 to 2022/2023

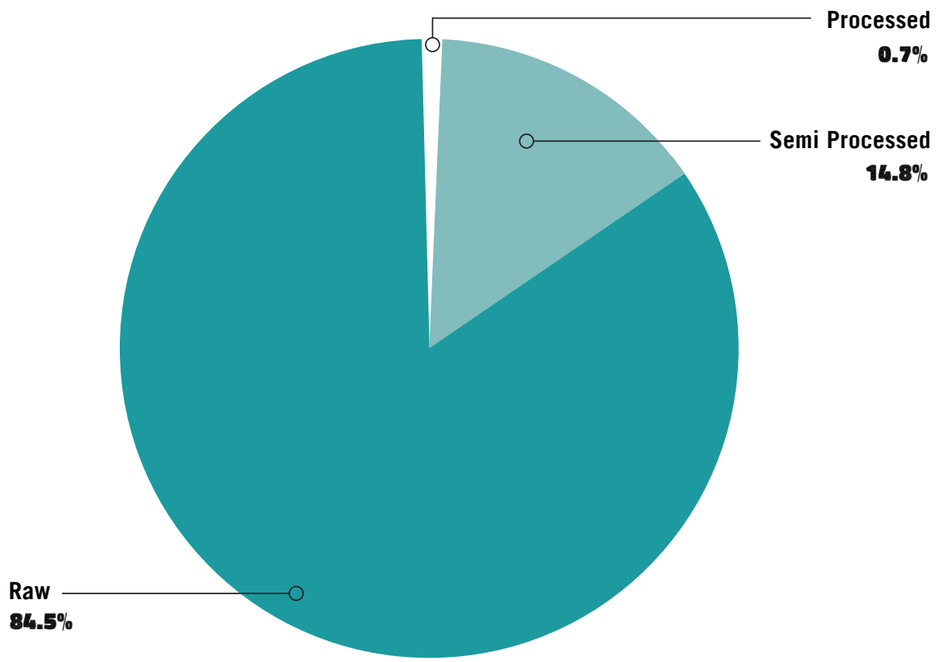


Source: Mining Commission (Tanzania) data

As discussed in the preceding sections, the global energy transition is driving demand for minerals, with the potential to accelerate the creation of linkages between mining and other important sectors of the economy, such as manufacturing and energy. However, to date, Tanzania, like many other mineral-rich developing countries, has had a narrow focus on exporting raw minerals to industrialized countries.

Even where processing is undertaken domestically, the minerals are not processed into high-value products. Figure 4 below shows that of the proportion of minerals exported by Tanzania, approximately 0.73 percent are processed (mainly salt and sulphate) domestically, 14.8 percent are semi-processed and the rest are exported in raw form (84.5 percent).

Figure 4: Tanzania mineral exports, by form, 2019-2023



Source: Computed from Mining Commission data (Tanzania)

The level of processing of minerals extracted in Tanzania varies by mineral and geological formation. For instance, gold extracted from Bulyanhulu gold mine is associated with copper. However, the copper extracted only undergo primary processing to turn the ore into copper concentrates for export, mainly to China and Japan. Bulyanhulu gold mine was expected to produce 20,000 tons per annum of copper concentrate (Yager 2004).

Gold extracted from other mines, principally Geita gold mine and North Mara, undergo intermediate refinement to produce ore bars before being exported for further smelting as they are composed of a mixture of precious metals such as silver.

Again, it is clear that Tanzania has very weak links between extracted/refined minerals and the production of advanced products/materials in the country. If not addressed, Tanzania will not be able to leverage its strategic mineral potential to develop its industrial sector to manufacture components and products related to green energy technology and electronics.

4.3 Current policy foundations and gaps

Overall, Tanzania has a fairly strong policy foundation for domestic value addition for minerals. The goal of value addition is mentioned in all key and relevant policies and plans as follows.

4.3.1 Five Year Development Plan (FYDP)

The overarching national development plans for realizing the long-term goals of the Tanzania Development Vision 2025 (URT 1999) are the sequence of three national Five Year Development Plans: FYDP I (2011/12-2015/16), FYDP II (2016/17-2020/21) and the present FYDP III (2021/22-2025/26). Analysis for this study found that mineral value addition is referenced all three plans. Like its predecessors, FYDP III outlines various priorities and initiatives across sectors, including mining. For example, the plan states that the country shall exercise very close oversight over extraction of the natural resources (URT 2021: 56). The plan explicitly recognizes the importance of strategic minerals such as titanium, vanadium, iron, nickel and REE resources that are vital for emerging technologies and industrial applications. The Mchuchuma and Liganga projects are identified as flagship initiatives for stimulating local industries. FYDP III also underscores the need to improve the availability of data on strategic minerals such as REEs to inform the design and making of investment promotion policies and packages for these minerals (URT 2021: 229).

The plan also highlights that the extraction of natural resources must be socioeconomically and environmentally sustainable for the benefit of the current and future generations (URT 2021: 56), including building local capacity in technologies for value addition and maximizing local content.
At present, however, significant policy gaps exist that may undermine the country's potential to leverage its strategic minerals wealth for sustainable development. These gaps result from the fact that most key and relevant government policies, plans and strategies (except for FYDP II and III) predate the global commitments and momentum to scale up the energy transition, hence, the demand for strategic minerals. Consequently, they do not reflect the dynamics and inter-sectoral linkages between mineral extraction, energy production and industrialization (manufacturing) in the context of energy transition that underpins the importance of strategic minerals.

4.3.2 Mineral Policy 2009

The Mineral Policy 2009 sets the vision for the sector in line with the Tanzania Development Vision 2025 (URT 2009). It aims at promoting economic integration between the mineral sector and other sectors of the economy to maximize the contribution of the mineral sector to the economy (Section 5.2). Again, in Section 5.11 the policy commits to promote and facilitate value addition activities within the country to increase income and employment opportunities. This clearly indicates the government's intention of linking the mining industry with other sectors of the economy by expanding local value chains but, given that the policy predated the global commitment to address the climate crisis, it understandably does not reference the vital link between the value chains in the mining industry and the global energy transition.

4.3.3 The Mining Act RE [Cap 123] 2019

The Mining Act RE [Cap 123] 2019 is a fundamental piece of legislation governing Tanzania's mining sector. This law was enacted in 2010 by repealing the Mining Act 1998. It provides a comprehensive framework for the exploration, extraction and management of mineral resources. In Section 4(1) h), the Act defines important critical/strategic minerals, for example, platinum group metals (including platinum, rhodium and iridium), rare earth elements and transition elements (including ytterbium, beryllium, tantalum and lithium), alloy metals (cobalt and chromium), non-metallic minerals (including graphite) and light metals (including titanium).

The 2019 Act retains clauses on mineral value addition from the Mining Act 2010 that required minerals including gemstones to be value added before export. The law as prescribed in Section 59 "the mineral right holder shall be required to set aside a certain amount of minerals at such a percentage as the Minister may, after consultation with the mineral right holder and the Commission, determine for processing, smelting or refining within the United Republic." From a national interest perspective, this clause is strategic for domestic value addition and economic linkages. However, in the context of limited processing and manufacturing capacity (industrial base), enforcement is challenging at best and or redundant at worst.

While this legal framework has undergone several reviews, the Act remains insensitive to energy transition and climate change goals, and does not include provisions to regulate the exploration, mining, trading and utilization of critical/strategic minerals. In January 2024, the Ministry of Minerals proposed miscellaneous amendments to the Mining Act RE:2019 to among others, define strategic and critical minerals and empowering the Minister to declare certain minerals as such. However, as discussed in Section 4.3.7 below, the process could be improved.

4.3.4 Natural Wealth and Resources (Permanent Sovereignty) Act of 2017

In 2017, two sovereignty laws, the Natural Resources Wealth (Permanent Sovereignty) Act, 2017 and the Natural Resources Wealth (Re-Negotiations of Unconscionable Terms) Act 2017, were enacted to enshrine permanent sovereignty over all natural resources, including minerals, oil and gas, and establish and promote local value chains to increase the benefits of these resources for the country and its people. The Natural Wealth and Resources (Permanent Sovereignty) Act of 2017 aimed at increasing mineral value addition within the country. The Act introduced several key provisions including Section 9(1), where the law explicitly prohibited the export of raw minerals from the United Republic of Tanzania unless they underwent value addition or beneficiation within the country. Consequently, in March 2017, the government banned the export of copper concentrates to encourage domestic value addition. The ban was intended to ensure that "value addition activities," such as smelting and refining, are undertaken within Tanzania. Increasing revenue generation, employment creation and technology transfer were among the stated objectives. However, at the time of imposing the ban, Tanzania did not (and still does not) have installed smelting capacity in the country.

This situation may be viewed as over-regulation of the sector. It would have been strategic for Tanzania to acquire the necessary capacity for value addition before imposing the ban as the costs and benefits associated with smelting and refining copper concentrate are different from those for other minerals ((Scurfield, 2017)). Applying Section 9(1) to all metallic minerals rather than targeting those that are more likely to generate benefits is also likely to reduce chances for success. Due to the ban, mineral exploration activities by both junior and major international mining companies came to a standstill leading to investment stagnation.

4.3.5 National Energy Policy 2015

The policy underscores that renewable energy sources, including solar, wind and geothermal, have relatively small negative environmental impacts, hence, the production and consumption of clean energy should be encouraged. The policy further commits to promoting renewable energies to enhance diversification of the country's energy mix to meet the rising demand. It also recognizes the importance of enhancing renewable energy technologies to facilitate the creation of an enabling environment for the development of renewable energy sources.

However, it does not explicitly link the use of clean energy with energy transition ambitions and, in turn, strategic minerals. Again, this may be explained as the policy predates the 2022 Paris Peace Forum that launched the "Responsible Critical Minerals Sector" initiative. This global initiative aims to ensure responsible use of critical minerals to guarantee the world a just, equitable and peaceful transition to clean energy use and mitigate the impacts of climate change.

4.3.6 Integrated Industrial Development Strategy 2025

This strategy, which was adopted in 2011 to coincide with the 50th anniversary of independence, recognizes the importance of linkages between mining and manufacturing. The strategy advocates that a well-balanced growth process of the Tanzanian economy will be achieved through sector diversification including mining. The Mtwara "Promised Mineral Rich Corridor" (Chapter 7.6) points out the importance of reserves of strategic minerals (referred to as "rare metals"), including nickel, copper, niobium, vanadium and titanium. These minerals were put under the jurisdiction of the National Development Corporation (NDC) as strategic projects that could reinvigorate the local processing industry to spearhead their development. Unfortunately, these aspirations have not been realized due to the fundamental challenges to value addition in Tanzania that have not been addressed.

4.3.7 Does Tanzania need an exclusive Strategic Mineral Policy?

Policymakers globally are paying greater attention to critical minerals. The IEA Critical Minerals Policy Tracker provides information on nearly 200 policies and regulations from 25 countries and regions worldwide (IEA 2022). Over 100 new policies have been enacted just in the past couple of years. Different countries approach the issue with different goals, for example, ensuring supply reliability and resilience, promoting exploration, production and innovation, and encouraging sustainable and responsible practices including domestic value addition. Box 2 below describes the strategy of the Government of Indonesia to develop and extend values chains for the country's substantial mineral reserves.

In African countries where significant strategic mineral reserves exist, the reasons for enacting a new policy also vary. However, creating and capturing more value within individual states or the continent as a whole is an oft-stated policy objective. (UNCTAD 2023). In Tanzania, there seems to be an inclination to develop such a policy. The Government's attempt earlier this year to amend the Mining Act to classify certain minerals as strategic could be taken as a signal of their intent.

However, while this may be a positive move, the process could be improved. Logically and strategically, any changes need to start with visioning what strategic minerals mean to Tanzania's broader and long-term ambitions for sustainable development, drawing lessons from the implementation of existing provisions, and assessing whether the current policy is sufficiently aligned to the country's vision. Once done, a strategic decision to either review the existing policy or develop a separate/exclusive policy can be made. It is at this point that the amendment of the existing law to fill any identified gaps or enact a new law would be logical. Here, too, it is important to note that all of the current policies and the majority of legislation related to the mining sector in Tanzania predate the 2015 Paris Agreement (PA), hence, the policies and statutes are not aligned with the treaty's goals on the global energy transition to mitigate climate change.

Photo credit: Barrick Group Ltd

Box 2: The Case of Indonesia

Reserves.
Indonesia has 42 percent of the world's nickel reserves, as well as substantial reserves of copper, gold, tin and coal. Given this wealth in natural resources, the mining industry is crucially and increasingly important to the country's economic growth. Within only a few years, Indonesia has become the world's largest nickel producer; its share in global nickel extraction has grown from 5 percent in 2015 to 50 percent in 2023. The country is also the world's third largest exporter of copper ore (Thibault 2024).

Strategy.
Indonesia's strategy focuses on the development of new industrial segments of value chains, including refining facilities, hydrometallurgical processing plants, battery factories, etc.
To develop these activities, the Indonesian government is using two main tools: the divestment of foreign companies in local firms and export bans on crude ore exports. Such bans were introduced for nickel in 2020 and for bauxite in 2023, while they are expected for copper in 2024 and perhaps, even later, for tin.

Geopolitical Risks.
Having major mineral deposits and mining activities is no longer considered sufficient by the Indonesian government. So far, the mineral industry's growth has relied hugely on Chinese investments and on low-added-value activities, especially in pyrometallurgy processing. Diversification of trade partners and expansion into new, entire value chains is, therefore, a key objective for the Indonesian government. Indonesia is seeking to boost trade with the United States, the European Union and even the Eurasian Economic Union (EAEU). However, negotiations over respective agreements are currently encountering hurdles due to American legislation (the Inflation Reduction Act and Foreign Entities of Concern status), which could seriously threaten Indonesian exports of battery mineral components to the US market while they also face hurdles to entering the EU due to environmental regulations.

To carry out the tremendous transformation towards net-zero emissions while ensuring steady and sustainable development, the country has signed a Just Energy Transition Partnership and prepared decarbonization scenarios within this framework. Key priorities in the coming years include renewable energy deployment, grid development and an early phase-out of coal. A country that is a monopoly supplier of a commodity like Indonesia with limited substitution may drive out whole industries in a competing import dependent country (Karapinar n.d.). That is why China's restrictions on rare earth metals have attracted so much attention, despite involving relatively low volumes of trade

Source: UNCTAD 2017

Photo credit: Unsplash/Paul Alain Hunt

5 Challenges and opportunities/enabling factors for promoting domestic mineral value addition

5.1 Challenges

To achieve domestic value addition for its strategic minerals, Tanzania will need to address the following fundamental challenges:

- The country's mineral processing capacity is limited. The manufacturing sector is equally small and relies heavily on imported intermediate goods. This limits inter-industry linkages essential for promoting a robust domestic manufacturing base as consumers of processed mineral products (Wangwe et al. 2014).

- Infrastructure and utilities are insufficient to support smelting operations, which are energy-intensive activities (TMAA 2011). Tanzania may be able to overcome this challenge through ongoing efforts to improve transportation networks and increase the domestic electricity supply from both hydro and natural gas.

- Tanzania currently lacks the technology and skills required for utilizing minerals to produce components for renewable energy e.g. solar PV cells, electric vehicle batteries and other energy storage systems.

- The local private sector lacks access to finance, which limits its capacity to fully integrate into mineral and mineral product supply chains.

- The lack of inter- and intra-sectoral coordinated implementation/facilitation of value addition activities affects the success of downstream mineral value addition. At present, coordination between the Ministry of Industries and Trade and the Ministry of Minerals is limited. As a consequence, mineral value addition is largely considered the responsibility of the line ministry rather than an inherently shared development goal.

- Legal and regulatory effectiveness. Under the Permanent Sovereignty Act 2017 and the amended Mining Act, mining companies may not export any raw minerals for processing outside Tanzania, instead are required to develop beneficiation facilities in the country. This integrated mining model has limitations in creating economies of scale that positively impact profitability in both mining and processing as they encourage multiplicity of processing facilities. For example, if Geita Gold Mine and North Mara Gold Mine pull their ore together to a shared processing facility, could create a scale that would attract independent inventors in smelting/refining. This is necessary but not the only factor. While this may work for large and profitable mines, it will be difficult for marginal and low profit-making mines.

- Limited economic scale for viable value addition. This is one of the four pillars of the African Union's Approach Paper (AfDB 2022). The African Union's Green Mineral Strategy highlights the challenge of insufficient economic scale to support effective value addition and the need for a broader market for manufactured goods in Africa.

5.2 Opportunities/enabling factors

To address the challenges outlined above, Tanzania has some significant advantages to promote domestic value addition for strategic minerals and realize the overarching goals of FYDP III to strengthen competitiveness and accelerate industrialization for human development.

- **Geological potential.** The country has already identified significant deposits of high-quality mineral resources, particularly nickel, graphite and REEs, all of which have the potential to attract prospective investors if an enabling environment exists. For example, the Mahenge, Epanko and Nachu graphite projects are lauded for their large flake size and high purity. With further exploration, Tanzania has a huge opportunity to expand reserves of strategic minerals beyond current levels. Access to the different raw materials required to produce intermediated products or components, such as EV batteries, makes the establishment of factories to expand the minerals value chain a feasible option.

- **Energy potential.** If available energy sources (hydro, gas and solar) are developed, Tanzania also has the opportunity to become an energy-surplus country, which will further attract investment.

- **Strategic geographical location.** Tanzania is a gateway to external markets with direct trade routes to Asia and the Middle East, which makes it an attractive destination for mining investments. With three major seaports (Dar es Salaam, Mtwara and Tanga), the country provides access to six neighbouring landlocked East African countries (Burundi, Democratic Republic of Congo, Malawi, Rwanda, Uganda and Zambia).

- **Political stability.** Tanzania's track record of political stability is a key prerequisite for investors in capital-intensive, long-term projects such as minerals processing and beneficiation.

- **Geopolitical dynamics** (both enabler and obstacle). Presently, China dominates the global value chains for many strategic minerals from extraction, processing, manufacturing and recycling, hence, a barrier for nascent industrial countries such as Tanzania. However, at the same time, it heightens supply risk concerns, especially for industrial states in the global north, creating a strong incentive for user countries to diversify their sources of supply of strategic minerals.

- **Opportunities to create and strengthen linkages between the mining sector and other economic sectors.** To extend value chains and optimize local benefits necessarily requires the integration of mining operations and businesses with other sectors of the economy. A mine depends upon transport, water and energy infrastructure, including railways, roads, ports, airlines, electricity, etc. It also needs to provide opportunities for skills sharing, technology transfer and innovation to domestic enterprises and workers. As far as possible, the mine should also procure goods and services and source employees locally. And, on the production side, mines should forge links between local manufacturers and industries to supply raw materials, thereby boosting the country's industrialization agenda. Similarly, other sectors can benefit from mining operations through clear and transparent value chain networks (FMF 2023). For example, in line with the African Mining Vision feedstocks of strategic minerals, such as phosphate, are required for the development of agriculture and achieving food security. Similarly, strategic minerals are essential for electrifying Tanzania (and the continent), particularly through renewable sources as part of the global energy transition.

6 Strategic options for value addition of strategic minerals in Tanzania

6.1

This section discusses three strategic options, both domestic and cross-border (regional) opportunities, that Tanzania can adopt to leverage its strategic mineral wealth and boost the country's economy through value addition. They are: (i) Adopt a cluster model for mineral processing; (ii) Take a strategic approach to downstream value addition; and (iii) Consider cross-border cooperation to achieve economies of scale. Each option is discussed in turn in the sub-sections below. Importantly, to pursue any of these options, the need for policy coherence and strong and effective inter- and intra-sectoral coordination implementation/facilitation of value addition activities cannot be over emphasized.

Adopt a cluster model for mineral processing

Tanzania could adopt a cluster model to develop mineral processing and smelter plants that cater for both large and smaller/marginal mining operations. This will encourage mining companies to form consortiums to establish shared facilities or attract independent investors focused exclusively on processing. The existing SEZs and EPZs in Tanzania offer incentive packages for this type of investment. For example, if developed, the Mtwara SEZ, which has been designated as the "Minerals Corridor" (URT 2011), could strategically serve as a graphite processing cluster. One key informant interviewed by the study suggested:

> *"The Government should support players in exploration and development so that Tanzania becomes a significant producer of graphite hence creating a critical mass production. The geology potential for that does exist"* ***— Respondent 2***

The cluster model could be replicated to other mining zones in the country. However, Tanzania's industrial sector needs significant upgrades in infrastructure and technology to support value addition. Strategic investments in these areas can help improve processing capabilities for strategic and other minerals thus enhancing the overall competitiveness of the mineral sector.

Similarly, key informants interviewed by the study, mainly mine operators, leaned towards constructing a downstream processing plant that serves a group of mines. They thought that the establishment of processing facilities with our customers in Tanzania is good for several reasons. First, they are not competing with customers so there is a higher chance of success, and the customers already have the technology and skills.

For example, great potential exists for nickel to be fully processed in Tanzania. The current plan is for nickel to be mined and processed at Kabanga and the concentrate transported to Kahama for refining. The multi-metal processing plant with a capacity of around 3.4 million tons a year will offer a growth opportunities as the market conditions change. It will be cheaper to sell products domestically than export them. However, this growth potential requires and makes business sense if a country can substantially grow its local manufacturing sector. As another respondent said:

> *"Say the big companies like Tesla manufacture all of their batteries in Tanzania…we have graphite, nickel, cobalt and all materials, almost 95 percent needed for battery production"* ***— Respondent 1***

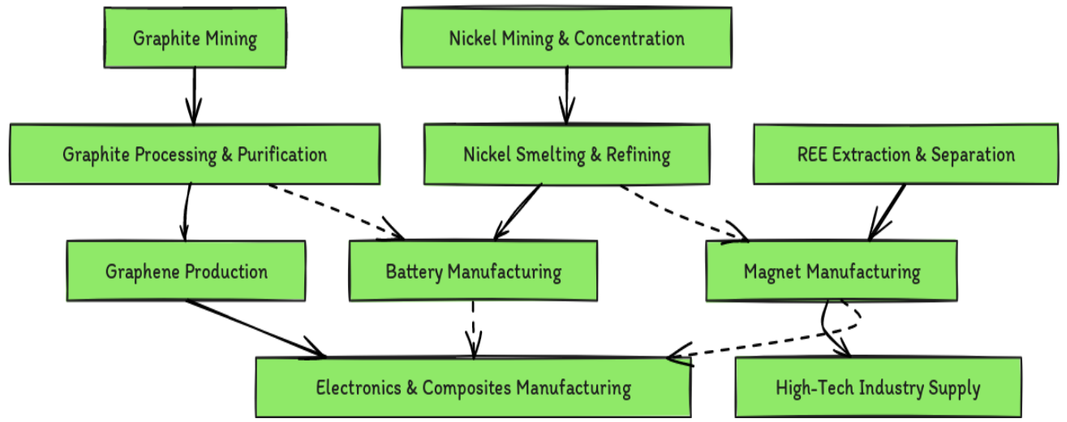
Drawing Zambian experience which has succeeded in developing copper smelting and refining to reduce the weight of exports, from concentrates to cathodes. Tanzania can improve its market since currently there is only a small manufacturing sector using copper and instead imports coppers cables and foil sheets.

6.2 Take a selective approach to downstream value addition

Achieving downstream value addition will require careful and strategic selection of the intermediate or final products to manufacture. The key consideration should be on the potential for these products to feed domestic manufacturing. This approach would allow for targeted fiscal incentives commensurate with the strategic potential to grow domestic manufacturing and inter-sectoral linkages. For example, Tanzania, alongside other countries in the region, is already producing significant quantities of copper wiring to meet local market demand in the construction and motor vehicle industries and for electrical transmission. As electrification increases, so too, does the opportunity for Tanzania to produce and sell copper products domestically.

Minerals are also in high demand in the world's Fourth Industrial Revolution driven by the hi-tech cyber world of communication and global energy transition to mitigate climate change by meeting the global goal of zero emissions by 2050. The availability of strategic minerals, including cobalt, coal, copper, graphite, nickel, PGMs, REEs, titanium and vanadium, offers a significant opportunity for investment in extended value chain activities from refining to smelting to manufacture goods and components for hi-tech industries and energy transition. For example, Tanzania has the potential to leverage its reserves of nickel, graphite and REEs to stimulate downstream manufacturing of EV battery components and electronic devices, such as cell phones. However, as Figure 5 illustrates different types of minerals require different levels of processing and refining to establish linkages with manufacturing and achieve value addition.

Figure 4: Tanzania mineral exports, by form, 2019-2023



Source: Computed from Mining Commission data (Tanzania)

Of note, the flake graphite concentrate produced at Mahenge is considered by experts to be of a particularly high purity. The concentrate is sized in varying dimensions and sold to different customers, except for battery feed material. The product from Mahenge can be used as input for manufacturing and is sold in its final form. In contrast, copper concentrate needs to be smelted and refined before copper can be used for manufacturing.

Some downstream operations can leverage REE processing, such as coating, and purification can be conducted in Tanzania to reduce global high dependence on China for feedstock supplies (IEA 2024). Furthermore, in the context of climate actions and the global call for inclusive development, industrialized countries and investors will be under pressure to add value in low-income producer countries. In response, the UN Secretary-General appointed a panel to develop guiding principles on Critical Energy Transition Minerals. Among the seven guiding principles, *Principle 4: Development must be fostered through benefit sharing, value addition and economic diversification* highlights the critical role of value addition and beneficiation of minerals to industrialization, and, in turn, the economic development of producer countries (UN 2024).

6.3 Consider cross-border cooperation to achieve economies of scale

Tanzania should proactively pursue joint investments and intra-regional trade with and across the region's economic blocs, including the East African Community (EAC), Common Market for Eastern and Southern Africa (COMESA) and the Southern Africa Development Community (SADC). Apart from promoting economies of scale, such cooperation is beneficial, indeed essential, as each country may have different types of strategic minerals. Cross-border value chain activities will help to ensure the availability of raw materials.

The Africa Continental Free Trade Area (AfCFTA) offers further opportunities for cooperation. Key objectives of AfCFTA include eliminating trade barriers between member states, promoting industrial development through diversification and regional value chain development, and boosting intra-Africa trade in value-added production across all sectors of the economy. (AfCFTA 2019).

Tanzania has an option to explore regional cross-border cooperation to leverage synergies with mineral-rich neighboring countries. For example, partnering with Mozambique and Madagascar to establish a joint graphite processing facility would boost competitiveness based on the three countries' combined recoverable reserves of about 70 million tonnes (AMDC. 2024). Coordination could engage different stakeholders. Governments could partner to develop large-scale states-owned joint company and multinational mining companies could coordinate to set clear goods and services needs to inform supplier development plans. Such cooperation is being contemplated between DRC and Zambia to establish a joint battery precursor manufacturing plant (Olan'g and Scurfield 2023). Tanzania could seek to join this initiative or offer to refine ores from both countries at the planned Kahama multi-metal refining plant if spare capacity exists or capacity is expandable. However, any joint agreements must be based on the principles of good governance, mutual and equitable benefit sharing and responsible mining practices. Otherwise, they may jeopardize the chances of Tanzania integrating into global value chains.

7 Conclusion and recommendations

This study examined Tanzania's potential to take advantage of the current surge in global demand for strategic minerals to enhance local value addition. It identified six key SMs available in Tanzania: phosphate, copper, graphite, nickel, REEs and titanium, which have potential to contribute to the country's mineral processing and manufacturing sectors. The findings revealed that the country has valuable reserves of SMs but most mineral projects by large-scale mining companies are still either in the exploration or mine development phases. Artisanal and small-scale miners primarily produce graphite and nickel in small quantities. The limited number of active mines as well as the scarcity of factories and industries exploiting the local value chain, restricts SM value addition. Currently, rock phosphate is the only mineral with a well-established value chain network in Tanzania, reaching stage 5 where the processed phosphate is utilized in domestic (and regional) industrial and agricultural sectors.

The analysis also identified the existing and emerging obstacles in the policy and business environment that could affect the national goals of integrating the mining sector with other sectors of the economy, especially manufacturing. The findings indicate that Tanzania has a strong policy foundation for adding value to its minerals, which is reflected in all key national policies and plans. However, the identified policy and regulatory gaps coupled with weak intra and inter-coordination among key Government stakeholders at the operational level undermine the potential for effective facilitation of industrial linkages. A comprehensive strategic policy to identify, define, categorize and prioritize strategic minerals is yet to be developed, and existing policies and plans were created before the global focus on energy transition and do not acknowledge the importance of strategic minerals.

To leverage its strategic mineral potential, Tanzania must create extended value chains from exploration and extraction through refining, processing, and, ultimately, the manufacturing of intermediate and end products locally. Achieving this transformation will require a multifaceted approach that starts with the development of a facilitative policy and regulatory environment by reviewing the current key policies (Mining, Energy, Environment, Industrial and Trade) and amending related legislation to recognize and guide the operations of the SM subsector. Importantly, this process will need to ensure the following outcomes:

- Expansion of exploration to broaden the resource base of strategic minerals. These minerals are still under-explored and under-developed, presenting an attractive investment opportunity in mineral exploration and mining in Tanzania.
- Investment in advanced technologies and infrastructure to enable efficient extraction, processing, smelting, refining and manufacturing to be undertaken in country.
- Development of a skilled workforce through targeted education and training programs to enable Tanzanians to fully participate in and benefit from the strategic minerals industry.
- Participation in partnerships with and across states in the overlapping regional economic blocs (EAC, SADC and COMESA) to create economies of scale that are attractive and profitable to investors.

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