MINERALS AND METAL VALUE CHAINS ANALYSIS

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SESSION OBJECTIVES

To understand:

• the different phases of the mining and metals value chain
• Key decisions along the value chain
• Opportunities and Challenges for capturing more value from mineral resources
SIGNIFICANCE OF THE MINING AND METALS INDUSTRY

- The significance of minerals and metals and the uses they have served across human history can hardly be overstated.
- Minerals and metals are so important that ages of history have been named for them: the Copper Age and the Iron Age.
- Nations have come to greatness and fallen on the rising and ebbing tides of mineral and metal commodity prices.
- Minerals and metals are essential to global economic and social development.
IMPORTANCE OF UNDERSTANDING THE VALUE CHAIN

- Minerals and metals are depletable, non-renewable resources. When they are gone, they are gone forever.
- The finite nature of minerals makes them unique as compared to other industries and revenue sources for companies, governments, and citizens in resource-rich countries.
- Experience also suggests that unless there is prudent management of these resources and tapping into the value chain opportunities, this could be lost. Or, worse, catastrophic economic, environmental and social consequences can occur.
• What is the mineral and metals value chain?
MINERALS AND METALS VALUE CHAIN

- The minerals value-chain represents the stages and processes that a minerals/metal project will go through to produce mineral products. Each stage represents a value-add on the previous and there are opportunities to invest at each of the major stages.
The mining value chain and Africa

The value chain in Africa ends here, at best

Developed countries complete the chain

Most

Exploration → Mining → Mineral processing → Smelting & refining → Semi-fabrication → Final product manufacture

1. Inputs
   - Consulting services (surveying, drilling, design, bulk earthworks)
   - Specialised equipment
   - Utilities and raw materials
   - Finance

Output/Sellable Product
   - Run-of-mine ore for sale to miners

Source: Adapted from Lysall, 2010

THE MINING/METALS VALUE CHAIN
BRINGING A MINE TO LIFE

Exploration
From land permits to mapping and drilling, nothing gets started unless the grades coming out of the ground, work in their respective metals price environment.

Mine Design
A wide range of permitting and studies are required, including community relations, environmental impacts and how the metals will be extracted.

Mine Construction
Depending on the country and region, construction could include anything from power grids to roads to small aircraft landing strips.

Production
Once built, a ramp-up period is needed to get the mine rolling. During the mine life, exploration can be continued around the area, adding to existing reserves.

End Game
At the end of its lifecycle, ramp down of operations begins as equipment is dismantled and the mine is prepared for the reclamation process. This usually takes place with the local governments with an onus on environmental sustainability.

Reclamation
It’s become standard practice to establish an environmentally safe area where the mine used to be. That may come in the form of reforestation, adding vegetation and ensuring no environmentally unfriendly agents remain.
DISCUSSION

What is Prospecting?

What are “greenfield” sites?

What are “brownfield” sites?
Prospecting is the 1st stage of the value chain, modern technology with airborne studies and mapping.

Although most minerals are found beneath the surface of the earth, a certain amount of geological analysis can be conducted by incredibly sensitive recording of gravitational and magnetic fields.

Next comes seismic analysis - analyzing rock structures by using sound waves - and sampling, picking up rocks and analyzing their chemical composition and density.

Collect, process and evaluate geophysical data.
EXPLORATION

- if all the research information provided during prospecting looks good, a company will apply for an exploration permit.
- The permit grants the company the right to look for minerals, but not to take them.
- Validity period varies from country to country e.g. 2/3 years, often with a renewal clause based on the licensing regime of a country.
- The company will also have to submit work programs and budget.
- The permit grants the company the right to look for minerals, but not to take them.
EXPLORATION

• This process involves searching for minerals or determining the extent of a mineral discovery or deposit.
• Involves carry out on-site trenching and drilling; analyzing bulk samples to estimate the size and quality of the minerals.
• Discovery evaluation- once mapping and mineral resource data is collected, and the results are strong, the project can move forward to the design and planning stage.
• Important decision making stage
• key questions will be made i.e. can the minerals be extracted at a profit? Is the potential return enough to justify more resources going in?
• If not answered, further work will be shelved. But if the assessment is positive, then what was the "mineral deposit" now moves up to become, officially, an "ore body".

Q. What is an “ore body?”
• Exploration also includes assessment of the following aspects; convenience of infrastructures, funds from the exploration institution, size and complexity of the deposit, price of end products, government policy, good will, and tax and royalty structures
Key Decision-making Issues: Licensing

The uncertainties and costs associated with mineral exploration are a big part of the challenge faced by host governments in promoting development of their countries' mineral resource endowments.
CHALLENGES

• Prospecting and exploration may involve decades of increasingly focused activity, by both governments and private companies, in an effort to find resources and identify those that may be worth developing.

• Mining profitably and responsibly today poses many challenges, apart from questions of the quality and quantity of the mineral? how to get it out? and how the market is doing?

• What are some of the other aspects that are now accessed?

Q. What is a Feasibility study?
FEASIBILITY STUDY

• Assessments into other related costs e.g. infrastructure, social, environmental and political risks.
• A feasibility study provides a definitive technical, environmental and commercial base and is the key element leading to a decision to invest or not to invest.
• Assessing these issues and understanding the risks and opportunities are central to the feasibility study process.
• After that threshold is crossed, it may take many more years of feasibility studies and project appraisal, along with extensive consultations with government agencies, local communities, financial institutions and other key parties, before a company is able to move on to mine development and ultimately production.
Construction and installation of necessary infrastructure

- The construction process occurs after research, contracts, licensing, permits approvals are complete.
- Construction of mining sites involves building roads, processing facilities, environmental management systems, employee housing and other facilities.

Key Decision making  Opportunities

- Mine development holds much promise for host communities as the key promoter of growth through export earnings, economic expansion, eventual diversification of the economy and massive poverty alleviation (enabling legislative and policy framework).
- Attracting investors
- Setting standards for environment, health and labour safety.
- Governments might include a firm obligation for the company to start development of the mine once all other activities have finished.
CHALLENGES

- Lack of competition, transparent bidding and clear rights awarding procedures
- A company may need to raise funds, or just want to delay its time while a particular commodity price recovers or the political winds change
- Secrecy, confidentiality, discretionary decision-making
- Land use/social conflicts
- Exaggerated development costs
- Political interference and favouritism in individual cases
The two most common methods of mining are surface and underground mining. The method is determined mainly by the characteristics of the mineral deposit and the limits imposed by safety, technology, environmental and economical concerns. The first step in the production stage is recovering the minerals. This is the process of extracting the ore from rock using a variety of tools and machinery.
Surface mining includes many types of mining during which the ore is all removed from the ground.

When there are hard rocks, such as coal and diamonds, companies often use an open pit, while open cast mining is used for soft rocks, such as limestones.

Generally, the terms open-pit, open-cast and open-cut are often used interchangeably. In this process, the minerals are often separated from the other rocks after they are removed from the mining pit.

This form of mining often has a large impact on the surface environment both from the extraction site and the nearby waste deposits.
UNDERGROUND MINING

- With underground mining, the surface remains intact and workers and machines remove the minerals through tunnels or shafts.
- Underground mining begins with a phase of development mining whereby rocks are extracted so that miners can get closer to the ore.
- Health and safety of workers is particularly important to successful underground mining, including ensuring a proper ventilation system and stable tunnels.
The second step is processing. The recovered minerals are processed through huge crushers or mills to separate commercially valuable minerals from their ores.

Once processed, the ore is then transported to smelting facilities.

The final step in production is smelting. This process involves melting the concentrate in a furnace to extract the metal from its ore. The ore is then poured into moulds, producing bars of bullion, which are then ready for sale.
OPPORTUNITIES

- This is the value chain stage that governments are most keen on for reaping the benefits of its resources
- Revenue collection (taxes and royalties)
- Employment creation
- Economic Diversification- regulatory frameworks e.g value addition and beneficiation; local content development

Thrust of the Africa Mining Vision
• The processing plant can fail to achieve its planned metal recovery rate or concentrate grade, and may need to be fine tuned.

• Planned mine production may have been overestimated and the mining systems and approach refined, or equipment changed out or blasting patterns and loadings modified, and so on.

• Tailings containment dams can leak and contaminated waters can escape.

• Surveillance/monitoring of activities, production levels etc

• Revenue management and allocation-regular public reporting, equitable sharing of revenue, how much to spend vs Save?

• Lack of Economic diversification-inadequate infrastructure

• Preferential and favouritism sub-contracting-local content

• Poor management of state owned companies

• Political and administrative corruption
CLOSURE & RECLAMATION

• final stage in the mining operations is closure and reclamation.

• Once a mining site has been exhausted of reserves, the process of closing the site occurs, dismantling all facilities on the property.

• Increasing total recoverable volumes and revenue

• The reclamation stage is then implemented, returning the land to its original state.
CHALLENGES

• Increasing total recoverable volumes and revenue

• Environmental concerns- a comprehensive rehabilitation program has many clearly stated objectives which may include: ensuring public health and safety; minimizing environmental effects; removing waste and hazardous material; preserving water quality; stabilizing land to protect against erosion; establishing new landforms and vegetation
GROUP WORK

- Who is making the decisions in your country?
- Where do you see the biggest challenges in your country? Why?
- Identify entry points for your organisation to influence decisions along the mining value chain?
ENVISAGED TRAJECTORY

• Sign contract/approved permits for exploration and production
• Discover Hidden Wealth
• Transform wealth into revenue flow
• Catalyse growth and development and create/sustain long-term wealth, improvements?
• African countries must be key platers in minerals/ metals exploration, processing and selling
MINE LIFE CYCLE
THANK YOU