NATURAL RESOURCES
Non-Fuel Minerals and
Mining in India

Economic development through
efficient and sustainable non-
fuel mining
Structure

Economic development through efficient and sustainable non-fuel mining

1. What are the economic characteristics of the mining industry and why is it unique?
2. What risks and challenges does the mining industry present to economic development?
3. How can the mining industry make an economic contribution?
4. What global trends will impact upon the development of India’s mining sector?
Economic Characteristics of the Mining Industry

- Production
- Market
- Industry Strategy
- Key Stakeholders and Evolving Interactions
- Mine Life Cycle / Economic Risk Reward Profile
ECONOMIC CHARACTERISTICS OF THE MINING INDUSTRY

PRODUCTION

- Unknown geological endowment
- Geographically fixed
- Finite requiring continuous replacement
- Unskilled and highly specialised labour requirement
- Highly capital intensive to access the remote and difficult to reach ore bodies that exist
- Large environmental impact
- Long term

Economic Output = f

- Land
- Labour
- Capital
- Environment
**MARKET**

- Fungible products
- Price linked to a volatile international marketplace
- Companies are price takers, not price makers
- Demand is derived
- Highly Competitive
- Industry generates economic rent

---

**Copper Cost Curve (2015)**

*Source: SNL*
ECONOMIC CHARACTERISTICS OF THE MINING INDUSTRY

SECTOR STRATEGY

○ Strategic Convergence
○ Cost cutting and operational efficiency
○ Constriction in green field exploration

Change in Total Exploration Spending by Year

Source: S&P Global Intelligence
Two Oceans Strategy Analysis
ECONOMIC CHARACTERISTICS OF THE MINING INDUSTRY

STAKEHOLDERS

- Government
- Investors
- Contractors and Suppliers
- Service Providers
- Indigenous Communities and their Organisations
- Mining affected communities
- Civil Society Organisations
- Organised Labour
- Academia and Research Institutions
- Current and Future Citizens
- Media

Map of Shareholder Influence in the Mining Industry

Source: International Council of Mining and Metals 2017
ECONOMIC CHARACTERISTICS OF THE MINING INDUSTRY

Mine Life Cycle and Risk Reward Profile

1. Exploration 1–10 years or more
2. Site design and construction 1–5 years
3. Operation 2–100 years
4. Final closure and decommissioning 1–5 years
5. Post-closure A decade to perpetuity

Stylized profile of government revenue contributions (right hand axis)

Source: International Council of Mining and Metals 2014
Risks and Challenges to Economic Development

- Resource Curse Hypothesis
- Updating this Hypothesis
- International Standards and Initiatives
RISKS AND CHALLENGES TO ECONOMIC DEVELOPMENT

RESOURCE CURSE HYPOTHESIS

- Sachs and Warner 2001
  “Countries rich in natural resources tend to perform badly”

- Atkinson and Hamilton 2003
  “the paradoxical but seemingly robust finding of a negative and significant relationship between natural resource abundance and the growth rate of per capita gross domestic product”

- Auty 1993
  “the economic performance of nations with a significant mineral may be worse than those without such endowment”

A simple view of the resource curse hypothesis

Negative impacts of:
- External market forces
- Internal economic stresses
- Global policy making

Economic Activity

Time
EXTERNAL MARKET FORCES

- Declining terms of trade
- Mineral price volatility

Movements in Australia’s Terms of Trade During the 20th Century

Source: Australian Bureau of Statistics 2006
The relationship between economic development, energy production, and manufacturing exports in Holland (1960-2001)

**INTERNAL ECONOMIC STRESSES**

- **Dutch Disease**
  - Appreciation of the real exchange rate
  - Inflows of currency push up price of non-tradable goods and services

Source: Vienna Institute for Economic Analysis 2005
RISKS AND CHALLENGES TO ECONOMIC DEVELOPMENT

GLOBAL POLICY MAKING

- Excessive rent seeking and misuse
- Corruption
- Undeveloped institutional framework

Statistical relationship between resource wealth and corruption

Source: Transparency International, World Bank
Over longer time periods the extractive industries’ adverse effects on GDP growth diminish.

**COUNTER ARGUMENT**

- No economic activity is assured a long term future.
- Financial planning and good governance will manage risks.
- The economic benefits outweigh the risks.

*Source: Davis 2019*
Over longer time periods the extractives industries’ adverse effects on GDP growth diminish.

- No economic activity is assured a long term future
- Financial planning and good governance will manage risks
- The economic benefits outweigh the risks

Source: Davis 2019
Greater improvements in Human Development Index Score from countries at the top of the MCI-Wr Index than at the bottom

HDI improvement for mining countries: 43%
HDI improvement for non-mining countries: 24%

Source: Ericsson and Lof 2019
INTERNATIONAL GUIDANCE

Source: Natural Resources Governance Institute 2014
INTERNATIONAL ORGANISATIONS AND STANDARDS FOCUSED ON RISK MITIGATION
The Potential for Economic Contribution from Non-Fuel Mining

- Defining Sustainability
- Overview of Economic Contribution
  - Employment
  - GDP/Value Add/Income
  - Government Revenue
- Constraints
DEFINING SUSTAINABILITY

The simultaneous pursuit of sustained or enhanced:

• Environmental quality
• Economic Growth
• Social Justice

Eggert 2006
POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

CONTRIBUTING FACTORS

- Employment
- GDP / Value Add / Income
- Import / Export
- Fiscal Contribution
- Foreign Direct Investment

Creation of Mineral Wealth
Economic Efficiency
Fair Distribution of Surplus
Sustained Benefit
Upstream Linkages
Industries to supply the mining project: earth moving, logistics, life support, equipment hire, technology, input production

Strength of linkages may be increased by:
- Concentration of activity
- Scale
- Proximity
- Specialisation

Downstream Linkages
- Mineral Benefication, Marketing and Sale
- Vertical integration of processing plants
- Inputs into other industries

Economic / Employment Multiplier
POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

Extractive Industry Linkages

Louisiana

- Developed backwards linkages:
  - Metal fabrication
  - Ship building and repair
  - Water transportation

- Developed forward linkages:
  - Refining
  - Chemicals and allied products

- Sold specialism on the international market

Source: Freudenburg and Gramling 1998

Source: STI Energy
POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

CHALLENGES LEADING TO ENCLAVE MINING

- Remote
- Specialised skills sets and equipment
- Export focused
- Boom and bust cycles
- Coordination between private and public sector for infrastructure
- Resource exhaustion
EMPLOYMENT

- Lower than expectations
- Each direct mining job can create 3-5 additional jobs
- Employment profile changes over the life of the project
- Impact dependent on local content
- Diversity of highly skilled and unskilled labour
- Synergies with skills in other heavy industry
- Mining offers greater unskilled opportunities than oil and gas

Source: Two Oceans Strategy
POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

POTENTIAL EMPLOYMENT IMPACT FROM INDIA’S MINING SECTOR

Non Farm Jobs (millions)

- **2012**: 237
- **Required by 2025**: 150
- **2025**: 387
- **Total non-farm jobs in BAU scenario by 2025**: 335
- **Created in BAU scenario by 2025**: 98
- **Non-farm jobs, 2012**: 237
- **Non-farm job gap**: +52

Mining Job creation (millions)

- **2012**: 11
- **Business as usual (BAU)**: 3
- **Accelerated growth**: 8
- **Share of non-farm job gap**: 0%
- **12%**

Source: McKinsey 2014
POTENTIAL CONTRIBUTION OF THE MINING SECTOR TO INDIA’S OUTPUT

Mining sector contribution to India’s output (USD billion)

<table>
<thead>
<tr>
<th>Year</th>
<th>Business as usual</th>
<th>Accelerated growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>50</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>70</td>
</tr>
<tr>
<td>2025</td>
<td>76</td>
<td>47</td>
</tr>
</tbody>
</table>

Mining sector contribution to India’s GDP value add (USD billion)

<table>
<thead>
<tr>
<th>Year</th>
<th>Business as usual</th>
<th>Accelerated growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>33</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>54</td>
</tr>
<tr>
<td>2025</td>
<td>82</td>
<td>31</td>
</tr>
</tbody>
</table>

POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

FISCAL CONTRIBUTION

- Non-renewable
- Facilitator of intergenerational equity
- Time lag from exploration to receiving revenues due to carry over tax provisions
- Impacted by the mineral price
- Impacted by the stage of development of the industry

Potential Revenue Generation from Mining for the Indian Government USD (billion)

Source: McKinsey bottom up demand model; McKinsey Analysis 2014
ECONOMIC INPUTS

- Requirement for affordable and secure production inputs
- Domestic production required to balance imports

Iron Ore Supply Demand Balance for India in 2025 (USD Million tonne)

<table>
<thead>
<tr>
<th>Year</th>
<th>Demand</th>
<th>Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2025</td>
<td>363</td>
<td>188</td>
</tr>
</tbody>
</table>

Estimated Forex Spend on Iron Ore by India (USD Billion)

<table>
<thead>
<tr>
<th>Year</th>
<th>2020</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6</td>
<td>17</td>
</tr>
</tbody>
</table>

Source: McKinsey bottom-up demand model; Iron ore supply model; McKinsey analysis 2014
Mineral Industry % Contribution by Country 2016

Source: Ericsson and Lof 2019, Two Oceans Strategy Analysis

POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

CONSTRAINTS TO ECONOMIC CONTRIBUTION

- Human Capital
- Geological data
- Mine Closure
- Permitting time
- Social licence to operate
- Technology
Global Trends

- Climate Change
- Proximity to the Consumer
- Industry 4.0
- Move to Purpose
GLOBAL TRENDS

MARKET CAPITALISATION IMPACTED BY NON-FINANCIAL FACTORS

- Increasing proportion of ESG and sustainability focused funds are not investing in mining companies
- Private equity and institutional investors in public companies increasingly committed to sustainability and ESG
- Shift to stakeholder capitalism
- Market capitalisation linked to court of public opinion
- Narrative of ‘Green Minerals’ has not permeated the investment markets

Source: PWC 2018
GLOBAL TRENDS

INCREASING PROXIMITY OF THE CONSUMER

• Consumers and investors are increasingly concerned about the supply chain of goods

• Expansion of purchaser influence on the supply chain

Source: BBC 2019
GLOBAL TRENDS

INDUSTRY 4.0

• Increasing automation will decrease total number of jobs
• Lower requirement for workforce at and around the mine site
• Shift from low / medium skilled to high skilled workers

Source: Resolute 2018

Syama: The World’s First Fully Automated Mine
THE SHIFT TO PURPOSE

• Purpose will entail personal and corporate costs which will impact shareholders

• Social license to operate by mitigating risk will not be enough
  • Returning to the baseline will result in large global warming

BHP have set a goal of net-zero emissions by 2050

Global Diversified Mining Companies - Total GHG Emissions Intensity Per Sale (tonnes)

Source: Bloomberg, Fitch Solutions
Structure

Economic development through efficient and sustainable non-fuel mining

1. What are the economic characteristics of the mining industry and why is it unique?

2. What risks and challenges does the mining industry present to economic development?

3. How can the mining industry make an economic contribution?

4. What global trends will impact upon the development of India’s mining sector?
NATURAL RESOURCES
Non-Fuel Minerals and Mining in India

Economic development through efficient and sustainable non-fuel mining
Appendix
ECONOMIC CHARACTERISTICS OF THE MINING INDUSTRY

MARKET

- Fungible products
- Price linked to a volatile international marketplace
- Companies are price takers, not price makers
- Demand is derived

The ring during trading at the London Metal Exchange

Source: LME
SUPERCYCLES IN COMMODITY PRICES
BCPI WEIGHTS, 1899-2016

1ST SUPER CYCLE
33 YEARS
[1899-1932]

2ND SUPER CYCLE
29 YEARS
[1933-1961]

3RD SUPER CYCLE
29 YEARS
[1962-1995]

4TH SUPER CYCLE
20+ YEARS
[1996-PRESENT]

Source: Bank of Canada, Analysis Nicholas LePan 2019
ECONOMIC CHARACTERISTICS OF THE MINING INDUSTRY

Sector Strategy

- Strategic Convergence
- Cost cutting and operational efficiency
- Constriction in green field exploration

Source: Ericsson and Lof 2018
GLOBAL TRENDS

MARKET CAPITALISATION IMPACTED BY NON-FINANCIAL FACTORS

- Increasing proportion of ESG and sustainability focused funds are not investing in Mining companies
- Narrative of ‘Green Minerals’ has not permeated the investment markets
- Private equity and institutional investors in public companies increasingly committed to sustainability and ESG
- Shift to stakeholder capitalism
- Market capitalisation linked to court of public opinion
Fiscal Contribution

- Non renewable
- Facilitator of intergenerational equity
- Time lag from exploration to receiving revenues due to carry over tax provisions
- Impacted by the mineral price
- Impacted by the stage of development of the industry

Source: Ericsson and Lof 2019
Greater improvements in Human Development Index Score from countries at the top of the MCI-Wr Index than at the bottom

- HDI improvement for mining countries: 43%
- HDI improvement for non-mining countries: 24%

Source: Ericsson and Lof 2019
RISKS AND CHALLENGES TO ECONOMIC DEVELOPMENT

Governance index

- Value realisation
- Revenue Management
- Enabling Environment
- Law v Practice

Resource Governance Index Scores (2017)

Source: Natural Resources Governance Institute 2017
POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

EMPLOYMENT

- Lower than expectations
- Each direct mining job can create 3-5 additional jobs
- Employment profile changes over the life of the project
- Impact dependent on local content
- Diversity of highly skilled and unskilled labour
- Synergies with skills in other heavy industry
- Mining offers greater unskilled opportunities than oil and gas
The Simple Association Between Growth per-Capita 1970 and 1989 and the Share of Natural Resource Exports in GDP in 1971

Per Capital GDP Growth 1970-1989

Share of natural resource exports in GDP 1971

Source: Sachs and Warner 1995

RISKS AND CHALLENGES TO ECONOMIC DEVELOPMENT

RESOURCE CURSE HYPOTHESIS

“The oddity of resource-poor economies outperforming rich economies has been a constant motif of economic history.

In the past 30 years the world’s star performers have been the resource poor Newly Industrializing Economies of East Asia (…), while many resource rich (…) economies have gone bankrupt.”

Sachs and Warner 1995
RISKS AND CHALLENGES TO ECONOMIC DEVELOPMENT

External Market Forces

- Declining terms of trade
- Mineral price volatility

The Impact of Change Copper Price on the Negotiation Over the Oyu Tolgoi Mine

Source: Infomine
POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

Total Project Expenditure ➔ Total In-Country Expenditure ➔ Wages to Employees + Payment to Suppliers

Leakages: Expenditure on importing labour or materials

Total Potential Economic Impact

Direct Economic Impact
- Output: Production from local suppliers to the project
- Income: Wages for project employees and payments to suppliers
- Gross value Add: Value-addition by the project
- Employment: Workers employed on project
- Fiscal: Taxes paid by project

Multiplier

Indirect Economic Impact
- Output: Production by subcontractors
- Income: Wages for project contractors staff and earnings made by suppliers to contractors
- Gross value Add: Value-addition by the suppliers
- Employment: Local suppliers increases employment to produce output required
- Fiscal: Taxes paid by suppliers & workers

Multiplier

Induced Economic Impact
- Output: Increased production resulting from increased demand for goods
- Income: In-country business income (and employee income) resulting from increased spend by project workers
- Gross value Add: Value-addition by firms as a result of extra output arising through extra consumption
- Employment: Jobs resulting from increased spending by project workers
- Fiscal: Taxes paid by suppliers and workers as a result of extra consumption

Source: Two Oceans Strategy
Strength of linkages may be increased by:

- Concentration of activity
- Scale
- Proximity
- Specialisation

McKinsey 2014
FISCAL CONTRIBUTION

- Non-renewable
- Facilitator of intergenerational equity
- Time lag from exploration to receiving revenues due to carry over tax provisions
- Impacted by the mineral price
- Impacted by the stage of development of the industry

Source: ICMM (2014), based on data from the Zambia Revenue Authority
EMPLOYMENT

- Lower than expectations
- Each direct mining job can create 3-5 additional jobs
- Employment profile changes over the life of the project
- Impact dependent on local content
- Diversity of highly skilled and unskilled labour
- Synergies with skills in other heavy industry
- Mining offers greater unskilled opportunities than oil and gas

Source: Ostensson 2018