NATURAL RESOURCES

Non-Fuel Minerals and Mining in India

Economic development through efficient and sustainable non-fuel mining

BROOKINGS

@tommills2oceans www.twooceansstrategy.com

TWOOCEANS STRATEGY

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

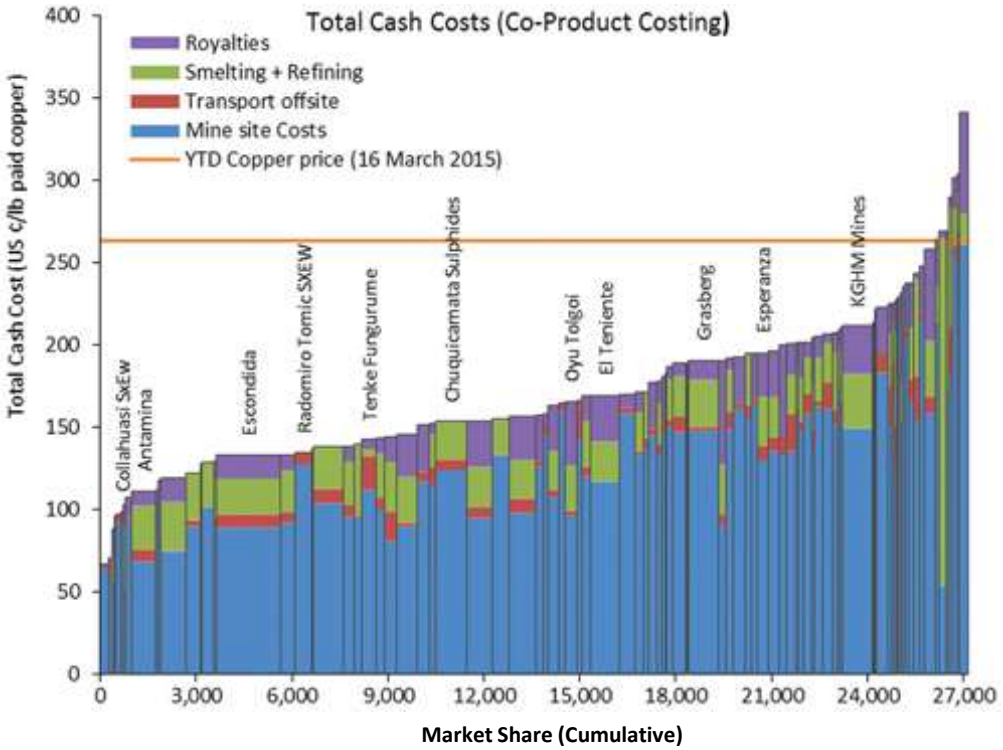
ECONOMIC CHARACTERISTICS OF THE MINING INDUSTRY

PRODUCTION

- Unknown geological endowment
- Geographically fixed
- Finite requiring continous 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



Copper Cost Curve (2015)

Source: SNL

ECONOMIC CHARACTERISTICS OF THE MINING INDUSTRY

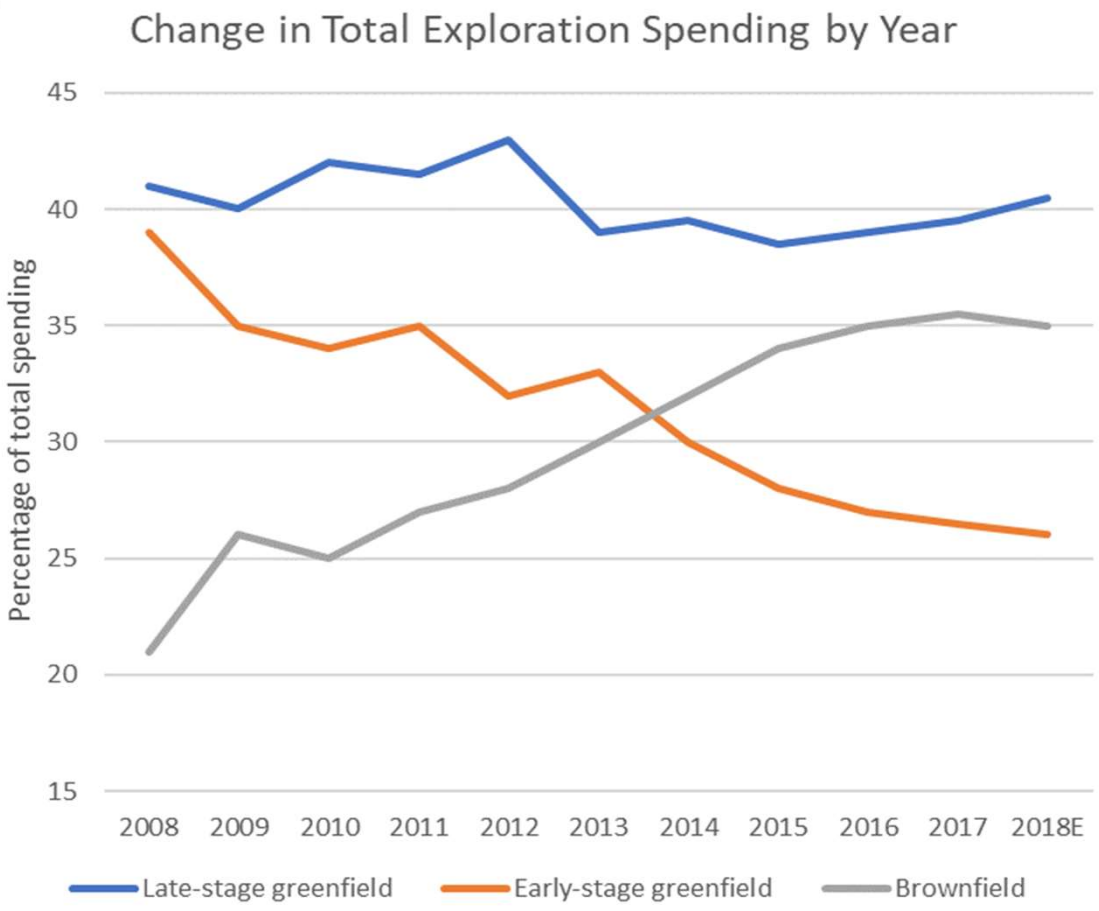
MARKET

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

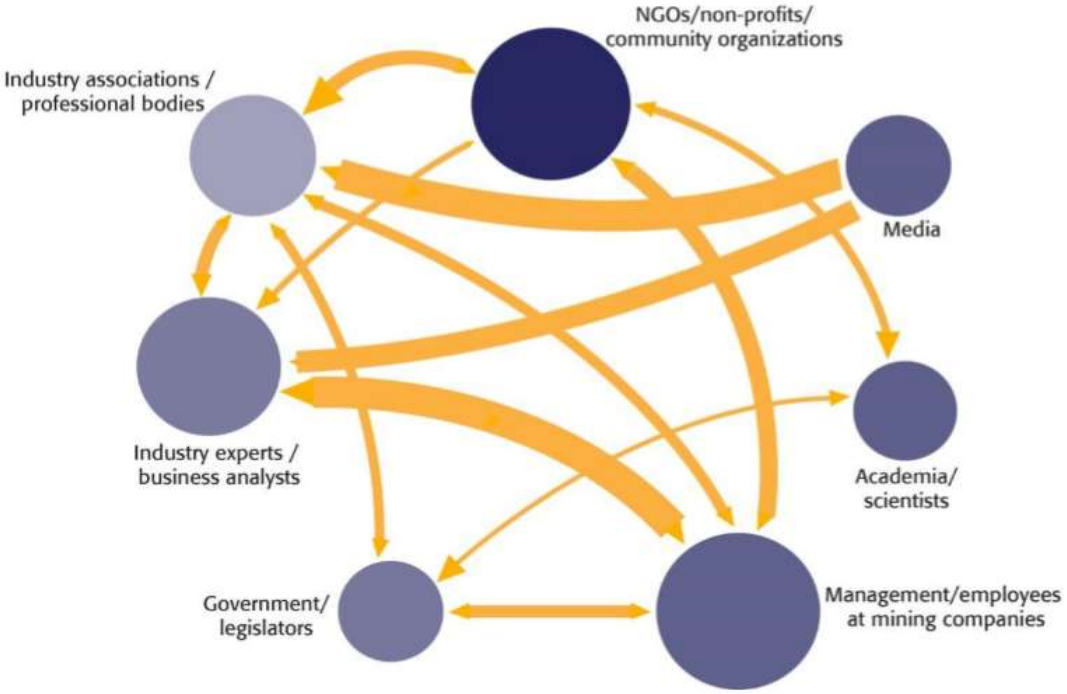
ECONOMIC CHARACTERISTICS OF THE MINING INDUSTRY

SECTOR STRATEGY

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



Source: S&P Global Intelligence
Two Oceans Strategy Analysis



Map of Shareholder Influence in the Mining Industry

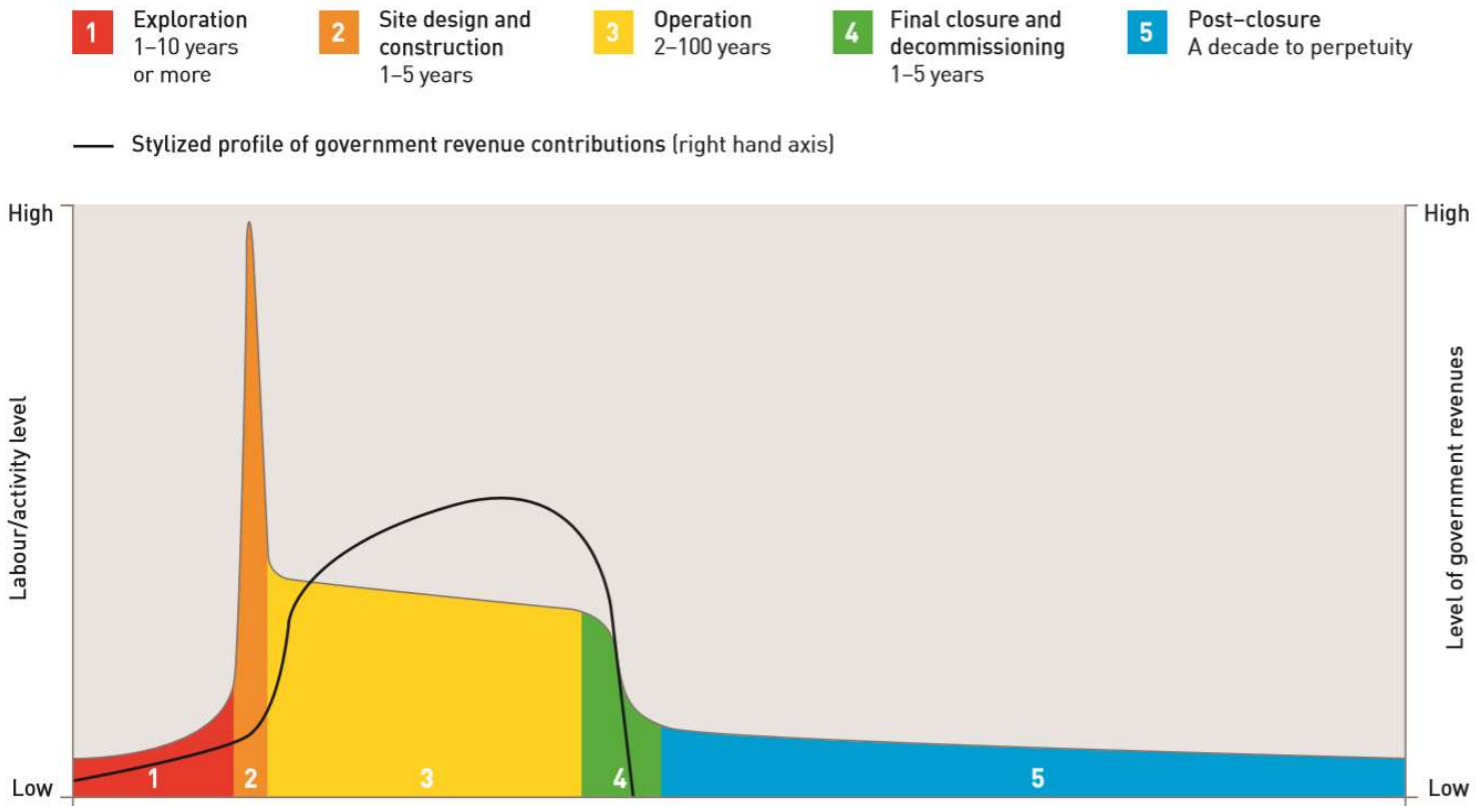
Source: International Council of Mining and Metals 2017

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

Mine Life Cycle and Risk Reward Profile

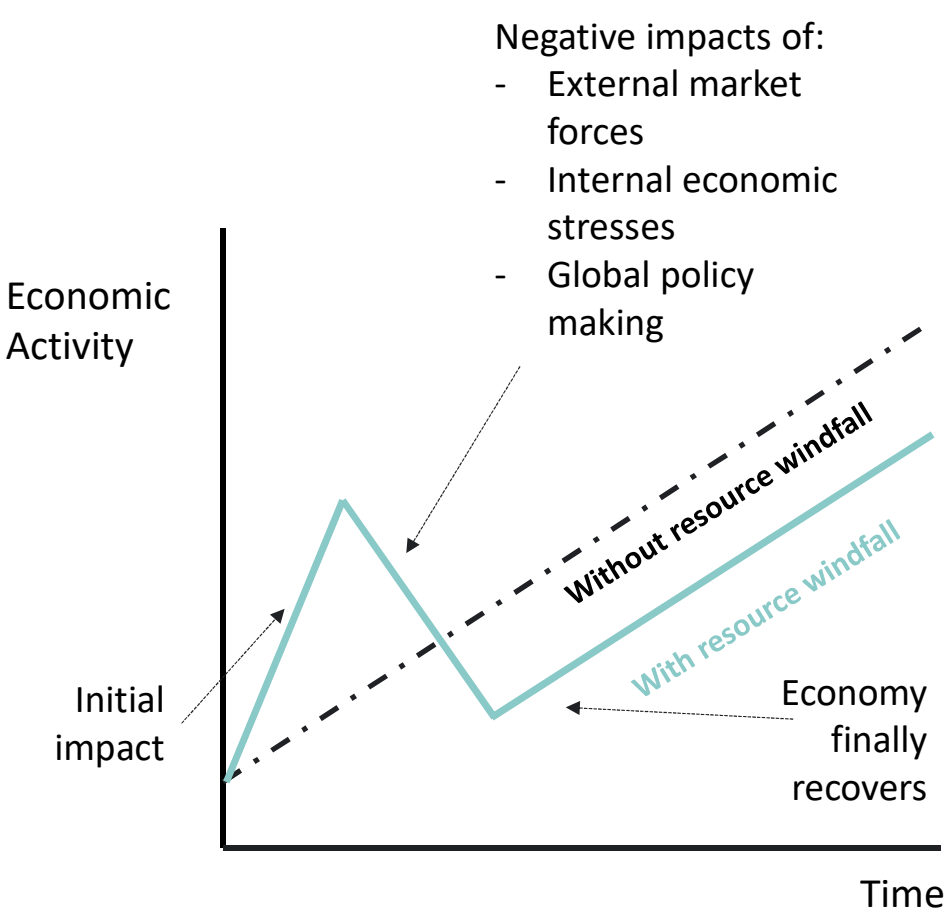


Source: International Council of Mining and Metals 2014

Risks and Challenges to Economic Development

- Resource Curse Hypothesis
- Updating this Hypothesis
- International Standards and Initiatives

RESOURCE CURSE HYPOTHESIS



A simple view of the resource curse hypothesis

Auty 1993 — *"the economic performance of nations with a significant mineral may be worse than those without such endowment""*

Sachs and Warner 2001 — *"Countries rich in natural resources tend to perform badly"*

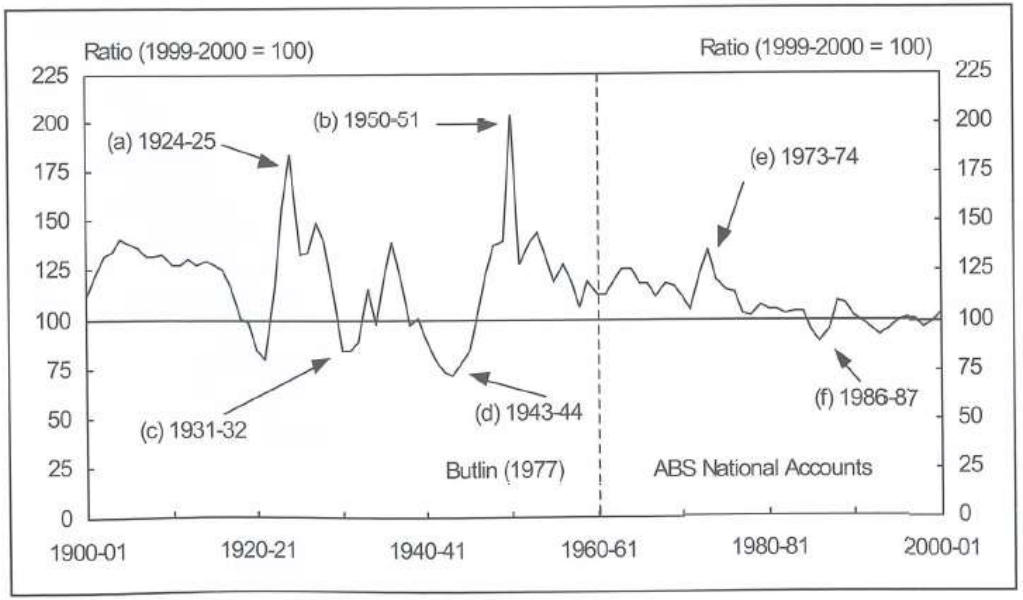
Atkinson and Hamilton 2003 — *"the paradoxical but seemingly robust finding of a negative and significant relationship between natural resource abundance and the growth rate of per capita gross domestic product"*

RISKS AND CHALLENGES TO ECONOMIC DEVELOPMENT

EXTERNAL MARKET FORCES

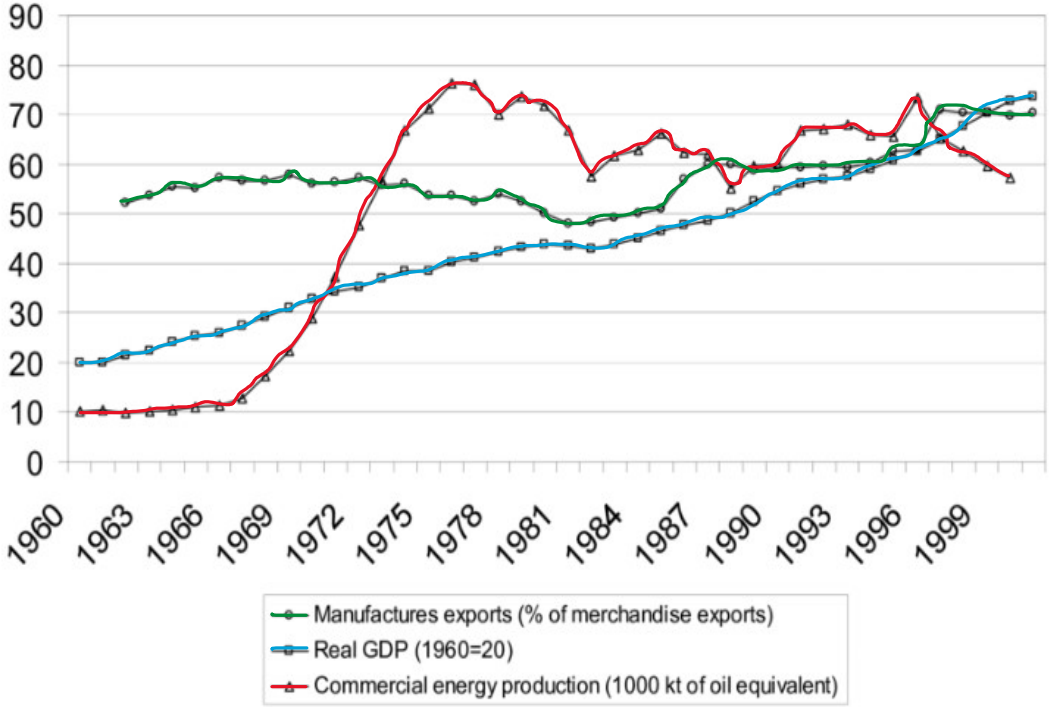
- Declining terms of trade
- Mineral price volatility

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)



Source: Vienna Institute for Economic Analysis 2005

RISKS AND CHALLENGES TO ECONOMIC DEVELOPMENT

INTERNAL ECONOMIC STRESSES

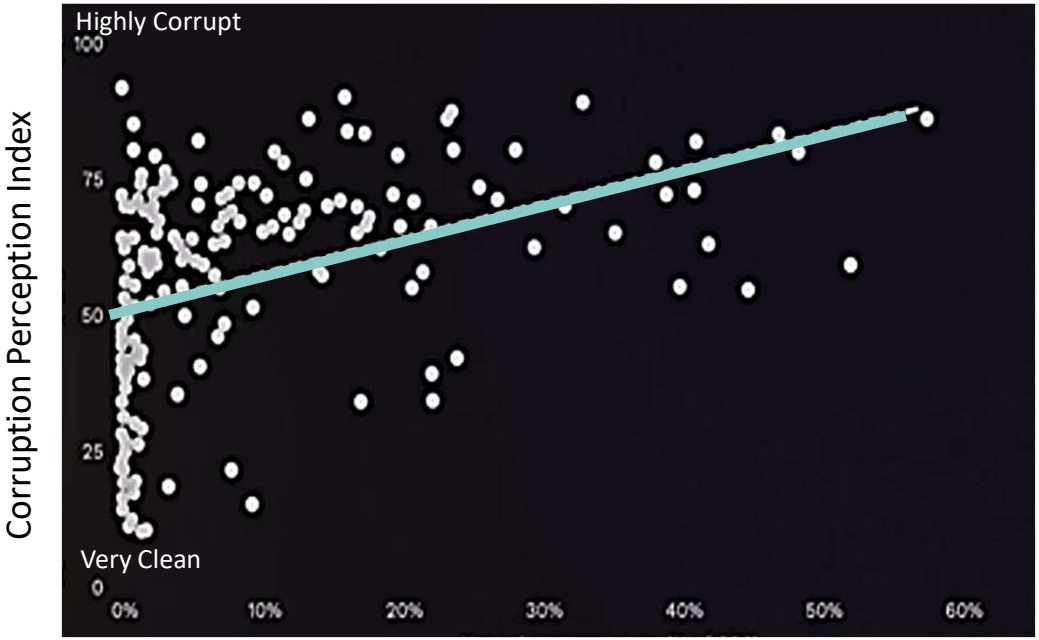
- Dutch Disease
  - Appreciation of the real exchange rate
  - Inflows of currency push up price of non-tradable goods and services

RISKS AND CHALLENGES TO ECONOMIC DEVELOPMENT

GLOBAL POLICY MAKING

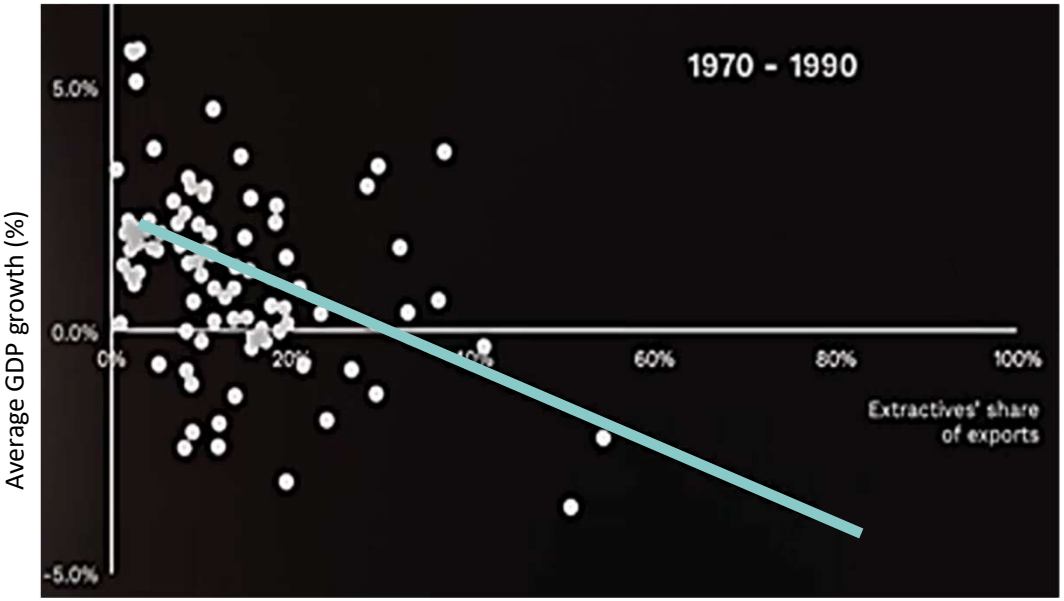
- Excessive rent seeking and misuse
- Corruption
- Undeveloped institutional framework

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



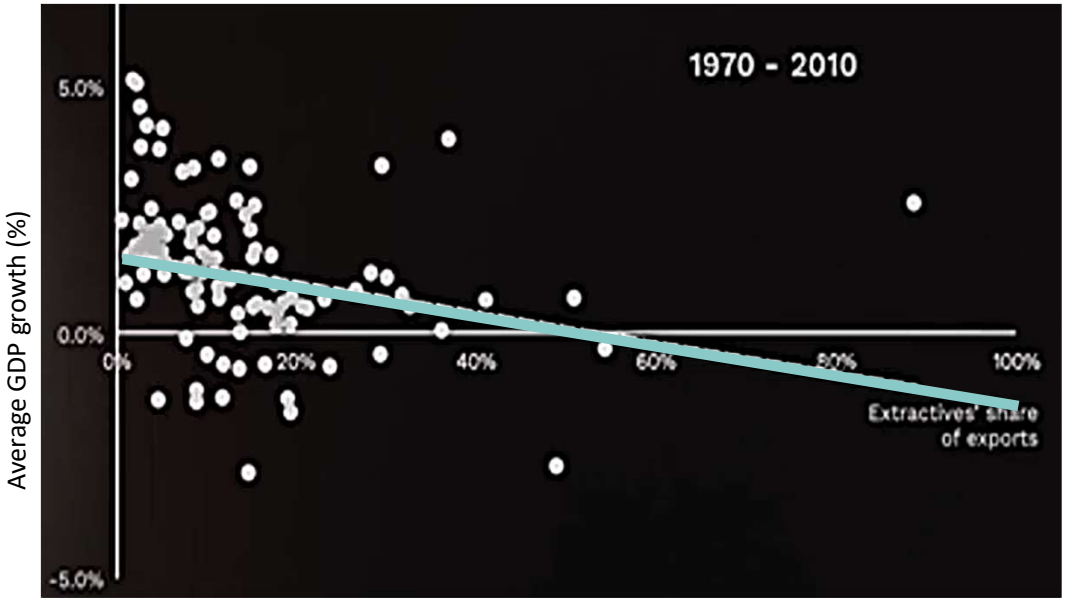
Source: Davis 2019

RISKS AND CHALLENGES TO ECONOMIC DEVELOPMENT

COUNTER ARGUMENT

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

Over longer time periods the extractives industries' adverse effects on GDP growth diminish



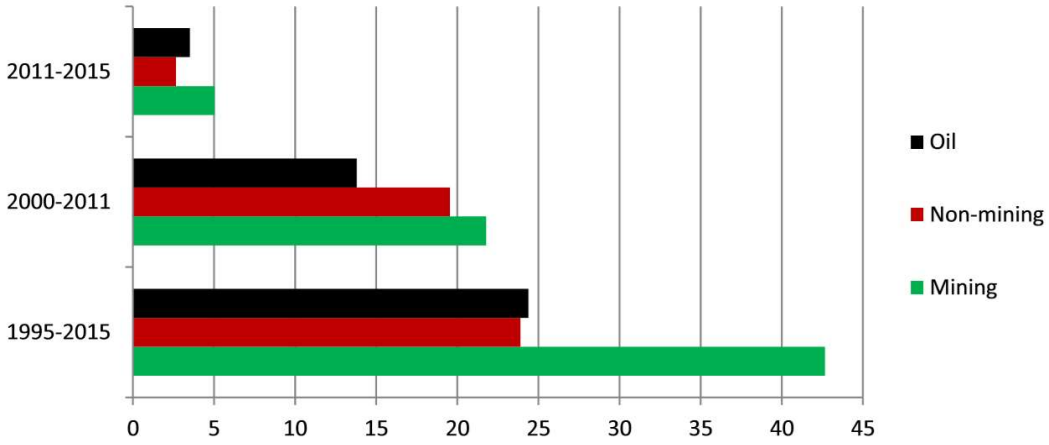
Source: Davis 2019

RISKS AND CHALLENGES TO ECONOMIC DEVELOPMENT

COUNTER ARGUMENT

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

Improvements in Human Development Index from 1996 to 2016 by country industry



Source: Ericsson and Lof 2019

RISKS AND CHALLENGES TO ECONOMIC DEVELOPMENT

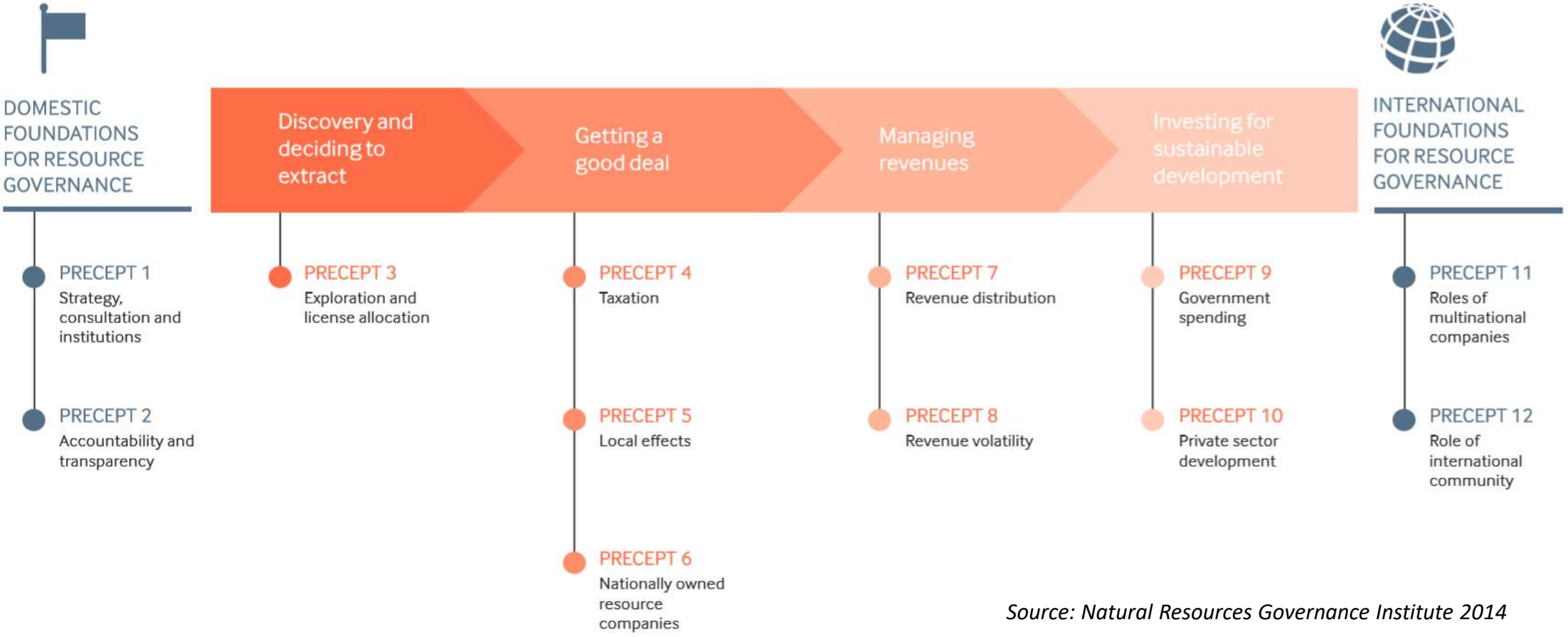
COUNTER ARGUMENT

- 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%

INTERNATIONAL GUIDANCE



Source: Natural Resources Governance Institute 2014

INTERNATIONAL ORGANISATIONS AND STANDARDS FOCUSED ON RISK MITIGATION

EITI

DODD-FRANK ACT

ICMM
International Council on Mining & Metals

The Potential for Economic Contribution from Non-Fuel Mining

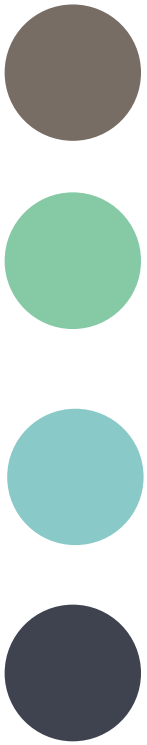
- Defining Sustainability
- Overview of Economic Contribution
  - Employment
  - GDP/Value Add/Income
  - Government Revenue
- Constraints

DEFINING SUSTAINABILITY

*The **simultaneous** pursuit of sustained or enhanced:*

- ***Environmental quality***
- ***Economic Growth***
- ***Social Justice***

Eggert 2006



Creation of Mineral Wealth

Economic Efficiency

Fair Distribution of Surplus

Sustained Benefit

Creation of Mineral Wealth

Economic Efficiency

Fair Distribution of Surplus

Sustained Benefit

POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

CONTRIBUTING FACTORS

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

Upstream Linkages

Industries to supply the mining project: earth moving, logistics, life support, equipment hire, technology, input production

Downstream Linkages

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

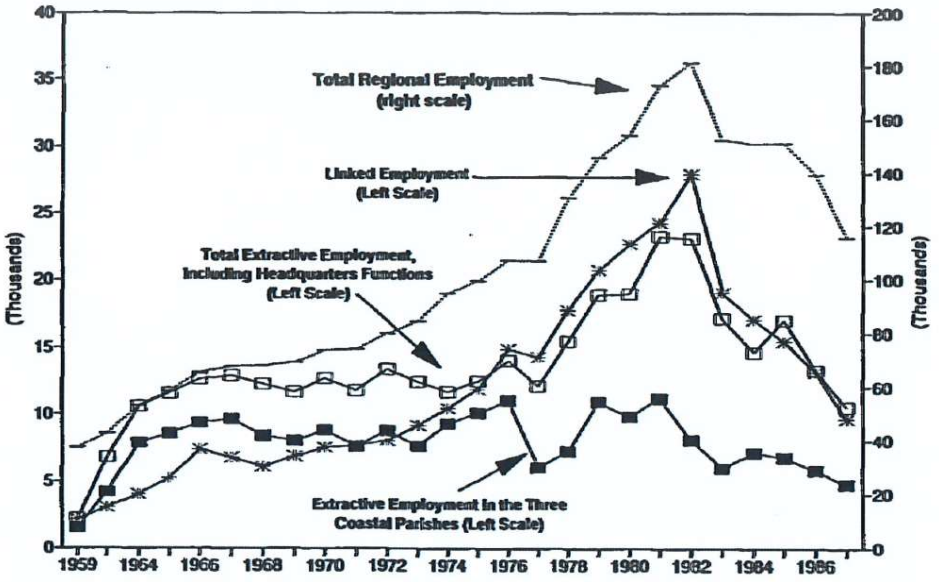
Strength of linkages may be increased by:

- Concentration of activity
- Scale
- Proximity
- Specialisation

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

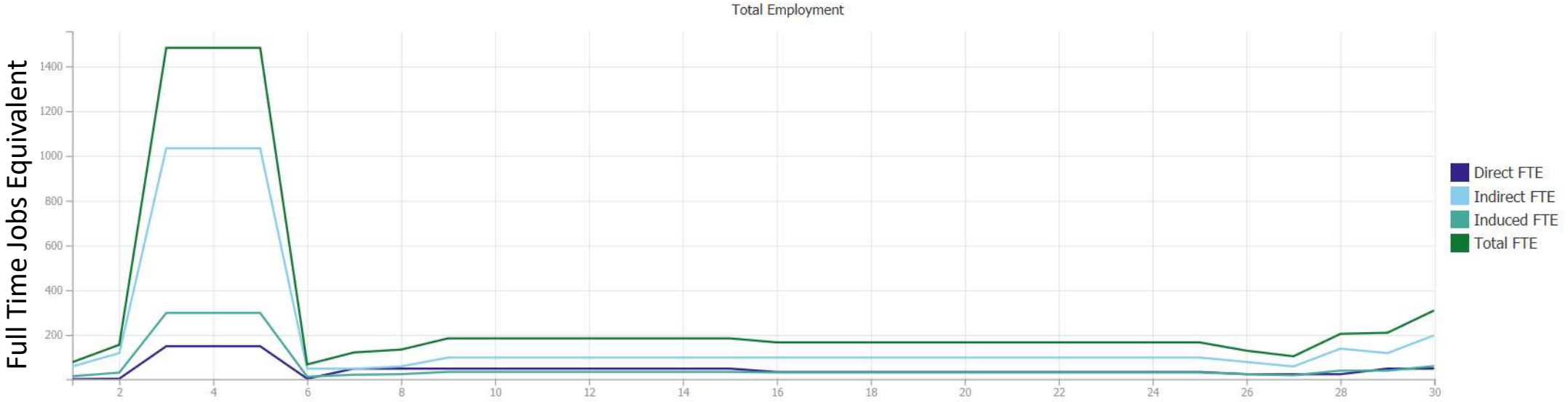
CHALLENGES LEADING TO ENCLAVE MINING

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

POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

EMPLOYMENT

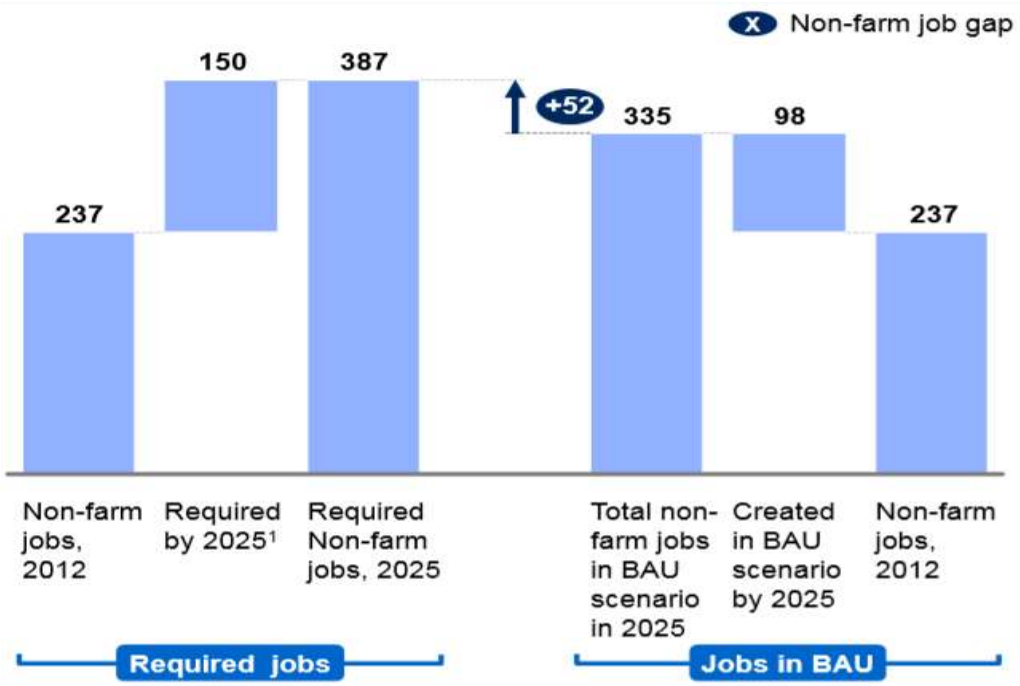
- Lower than expectations
- Each direct mining job can create 3-5 additional jobs
- Employment profile changes over the life of the project
- Impact dependent on local content
- Diversity of highly skilled and unskilled labour
- Synergies with skills in other heavy industry
- Mining offers greater unskilled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



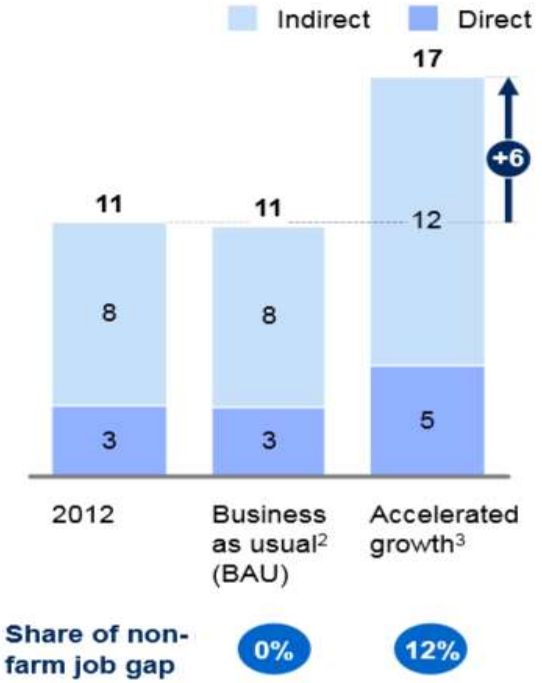
Source: Two Oceans Strategy

POTENTIAL EMPLOYMENT IMPACT FROM INDIA'S MINING SECTOR

Non Farm Jobs (millions)



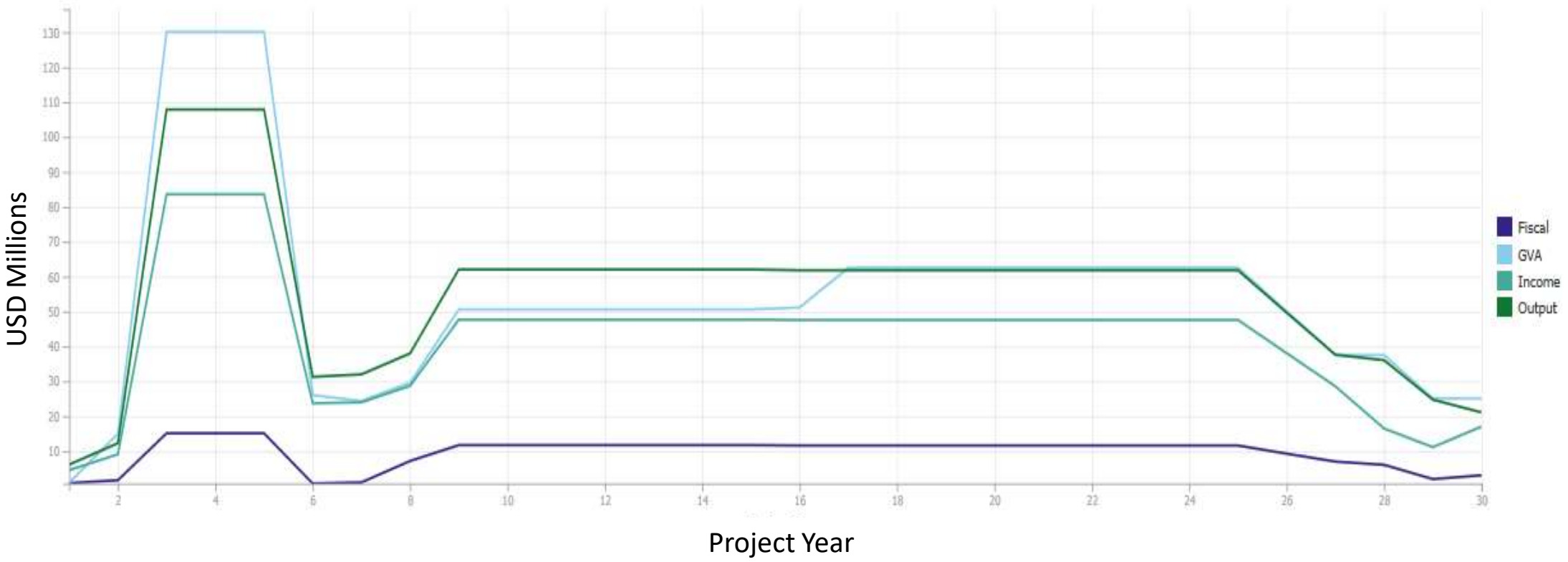
Mining Job creation (millions)



Source: McKinsey 2014

POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

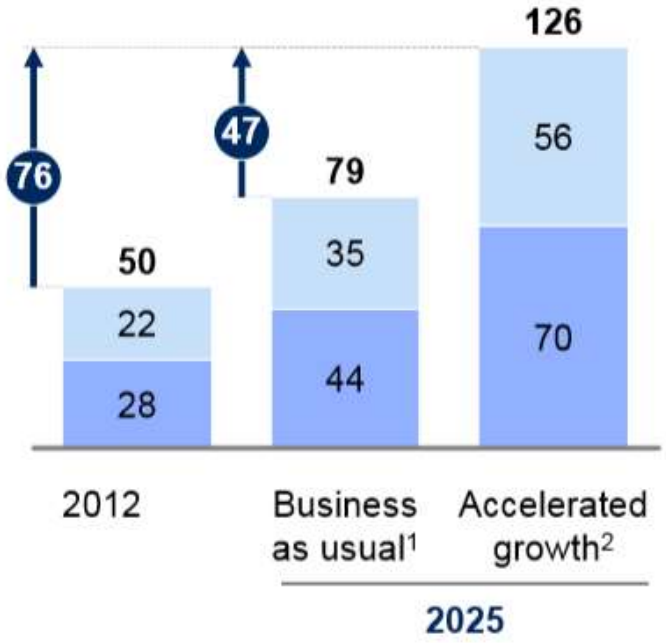
ECONOMIC OUTPUT



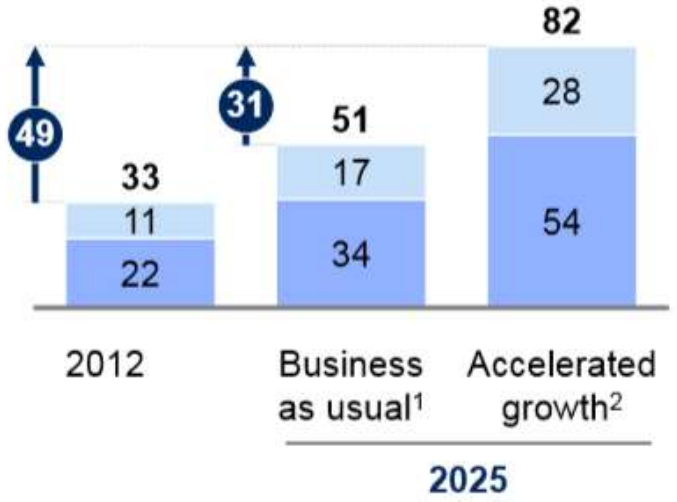
Source: Two Oceans Strategy

POTENTIAL CONTRIBUTION OF THE MINING SECTOR TO INDIA'S OUTPUT

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

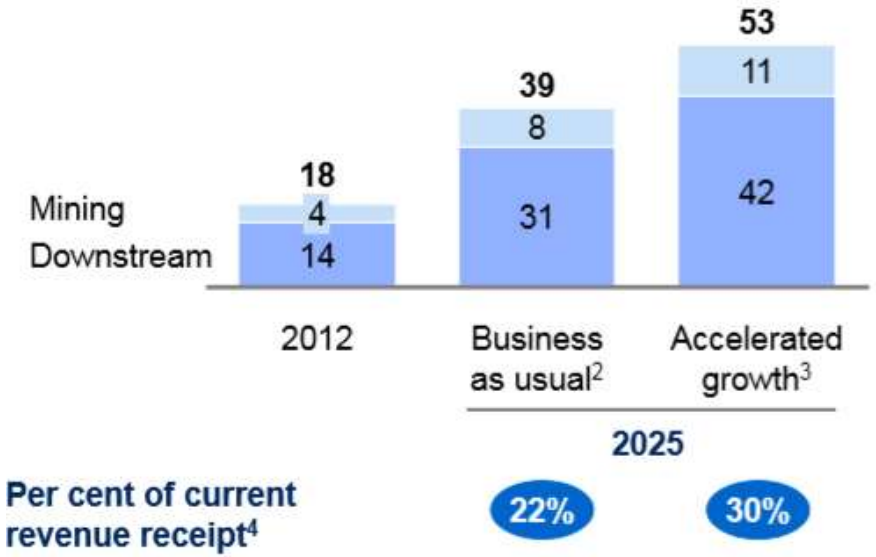


Mining sector contribution to India's GDP value add (USD billion)



Source: World Output Data, IHS economics data, McKinsey Analysis 2014

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



Source: McKinsey bottom up demand model; McKinsey Analysis 2014

POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

FISCAL CONTRIBUTION

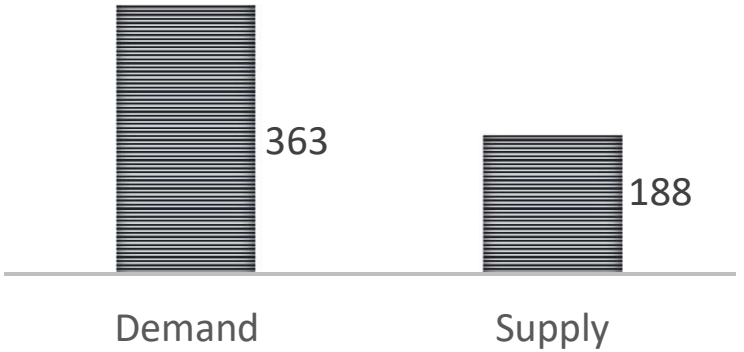
- Non-renewable
- Facilitator of intergenerational equity
- Time lag from exploration to receiving revenues due to carry over tax provisions
- Impacted by the mineral price
- Impacted by the stage of development of the industry

POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

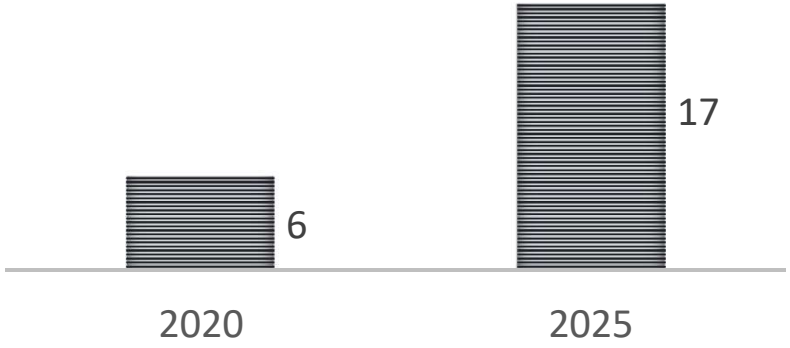
ECONOMIC INPUTS

- 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)

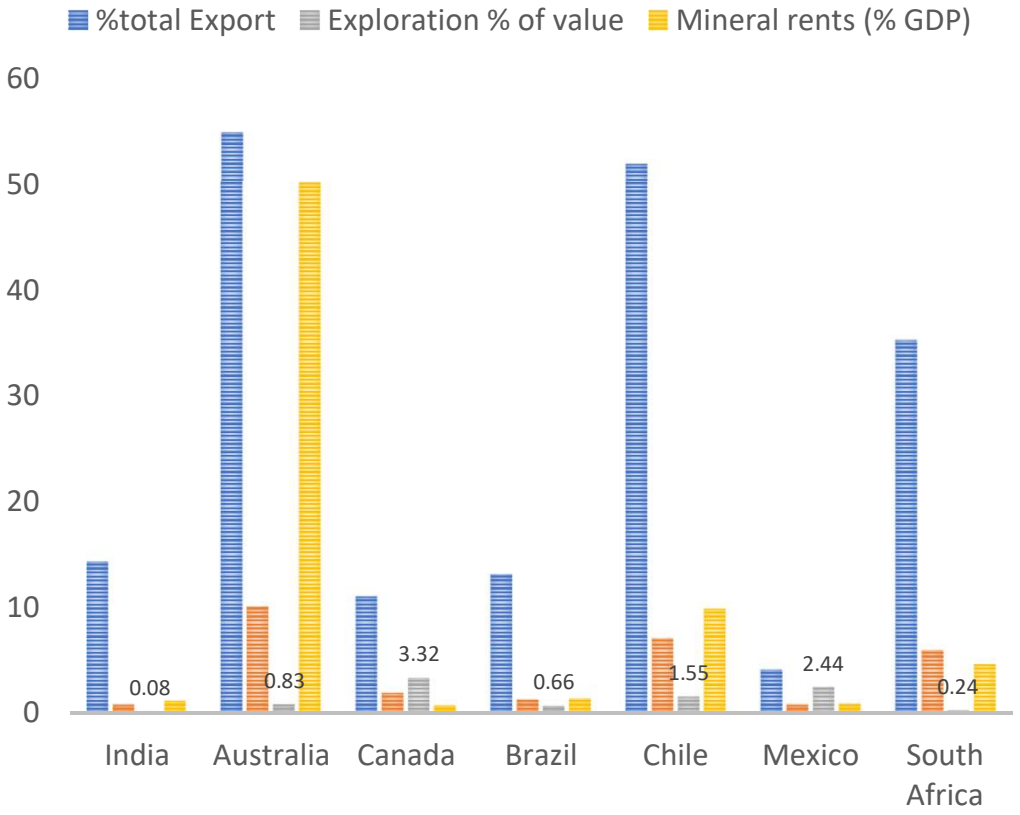


Estimated Forex Spend on Iron Ore by India (USD Billion)



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

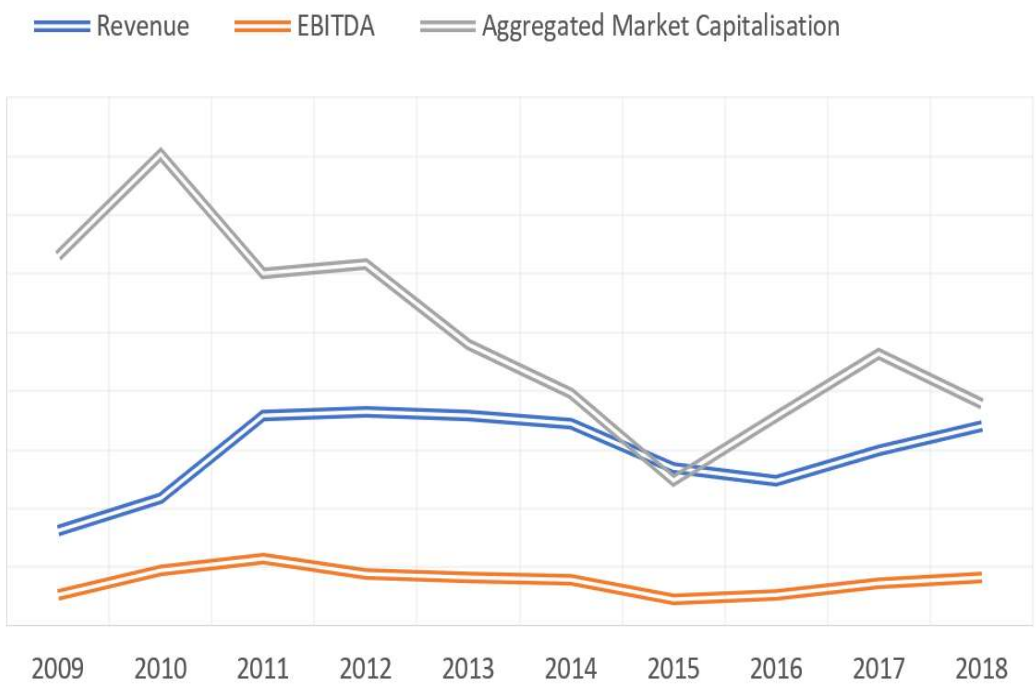
CONSTRAINTS TO ECONOMIC CONTRIBUTION

- 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

Financial Performance Top 20 Mining Companies



Source: PWC 2018

GLOBAL TRENDS

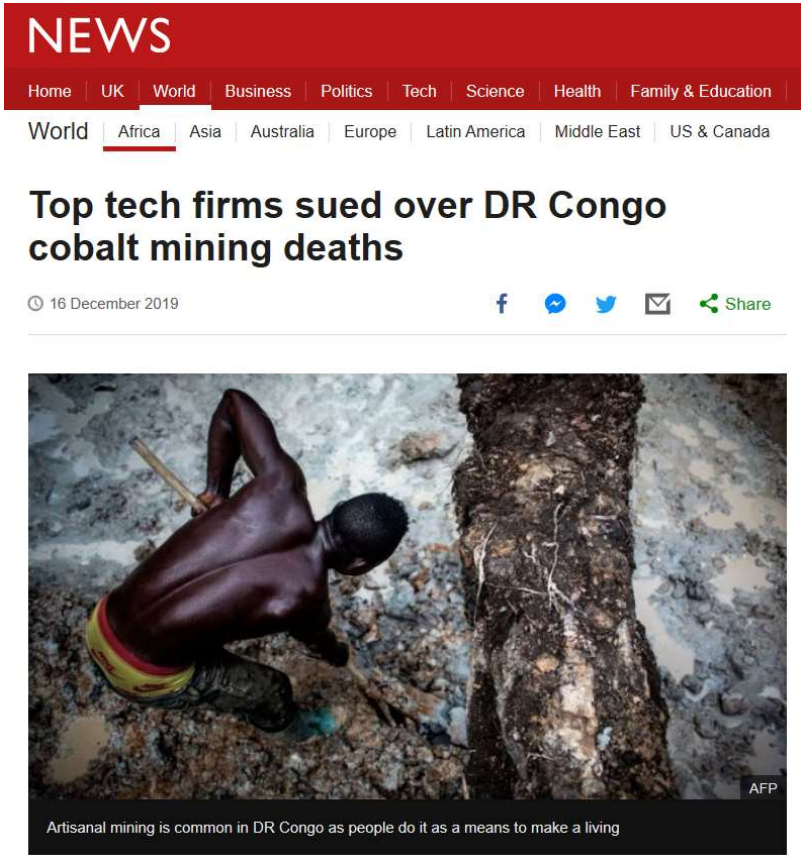
MARKET CAPITALISATION IMPACTED BY NON-FINANCIAL FACTORS

- 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 permiated the investment markets

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

Syama: The World's First Fully Automated Mine

Source: Resolute 2018

GLOBAL TRENDS

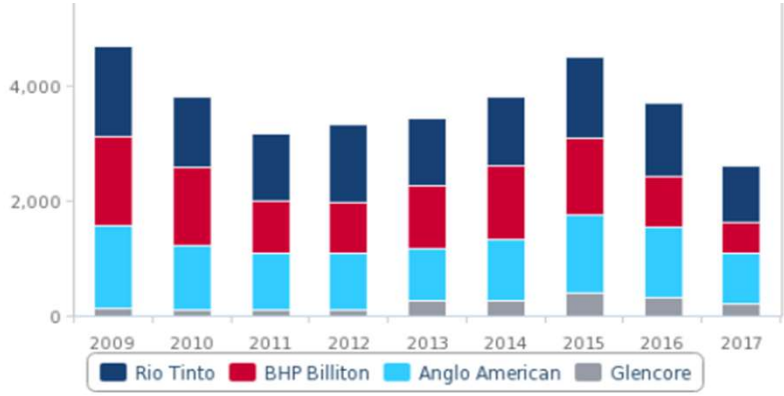
THE SHIFT TO PURPOSE

- 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

Source: Reuters 2019

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

BROOKINGS

@tommills2oceans www.twooceansstrategy.com

TWOOCEANS STRATEGY

Appendix

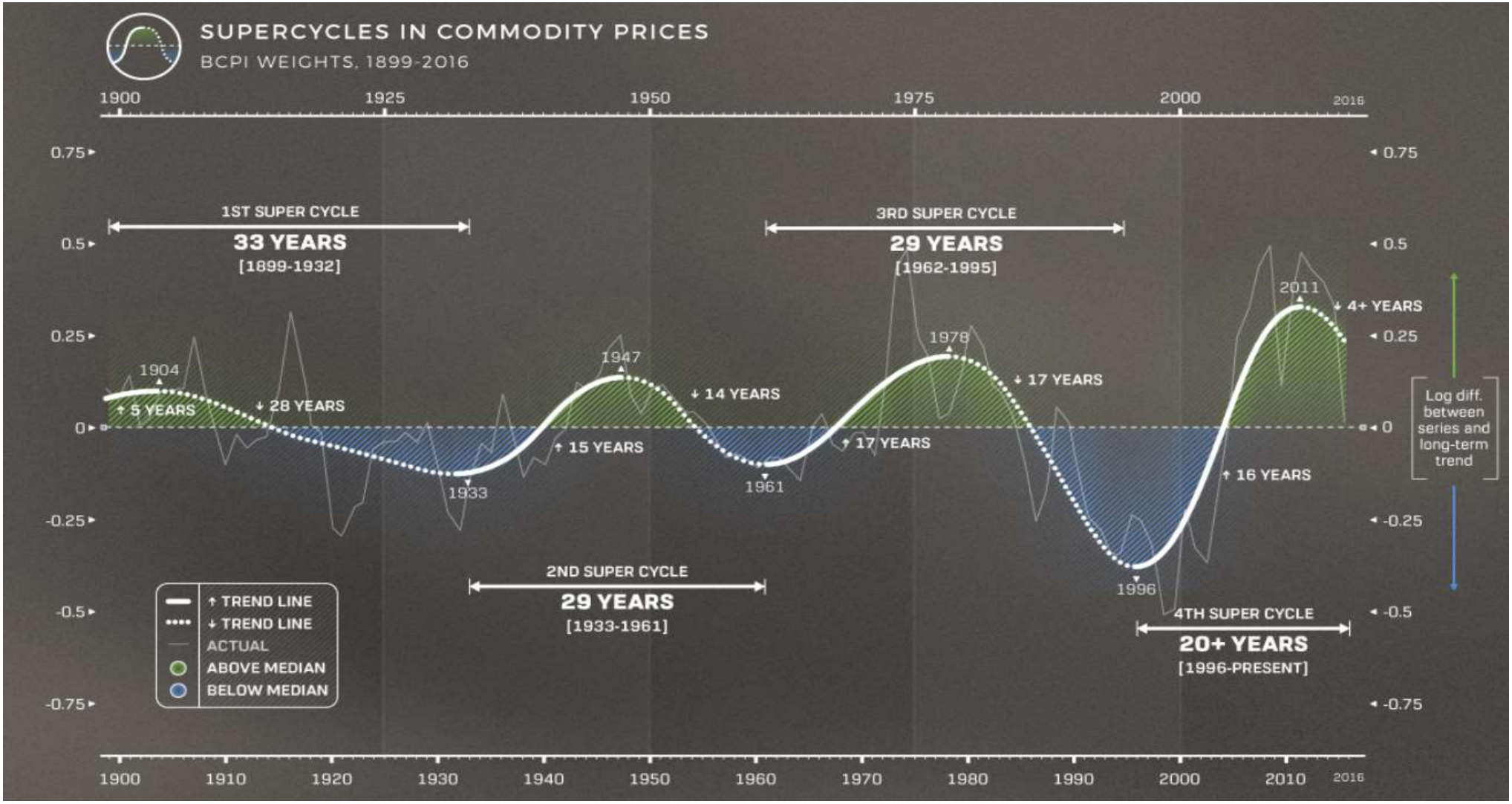
The ring during trading at the London Metal Exchange

Source: LME

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

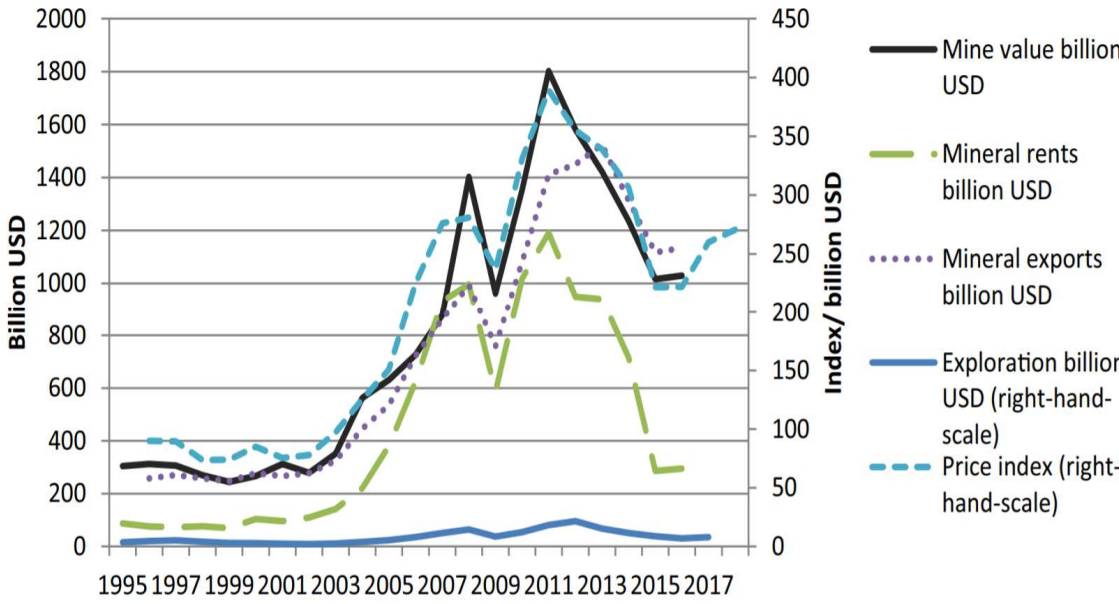


Source: Bank of Canada, Analysis Nicholas LePan 2019

ECONOMIC CHARACTERISTICS OF THE MINING INDUSTRY

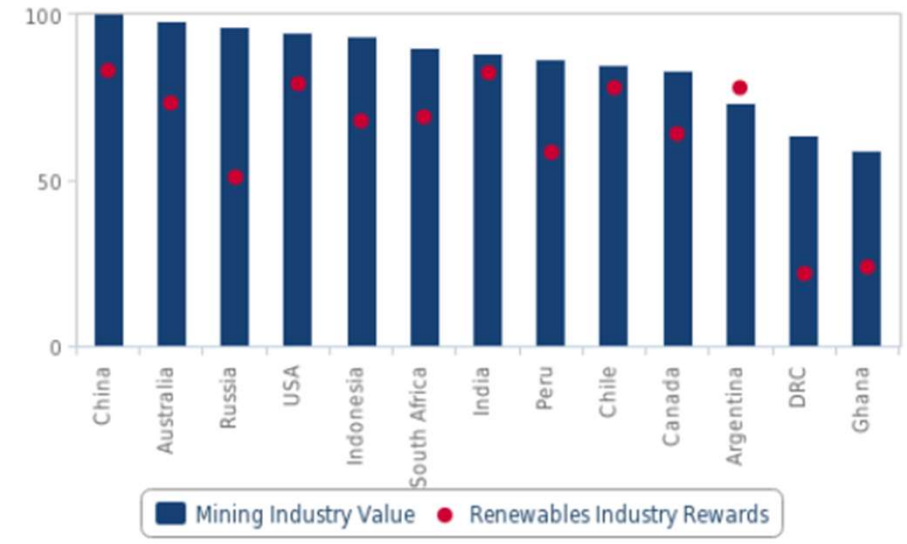
Sector Strategy

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



Source: Ericsson and Lof 2018

Select Countries - Renewables Industry Rewards and Mining Industry Value Scores



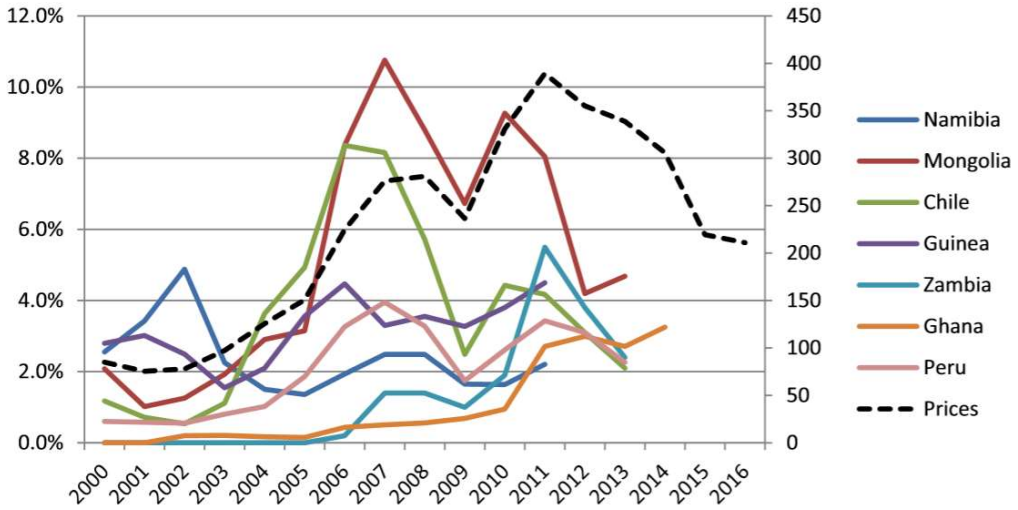
Source: Fitch Solutions Renewables Risk/Reward Index

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 permiated 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

Government Revenues as a share of GDP and Mineral Price



Source: Ericsson and Lof 2019

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 developmet of the industry

RISKS AND CHALLENGES TO ECONOMIC DEVELOPMENT

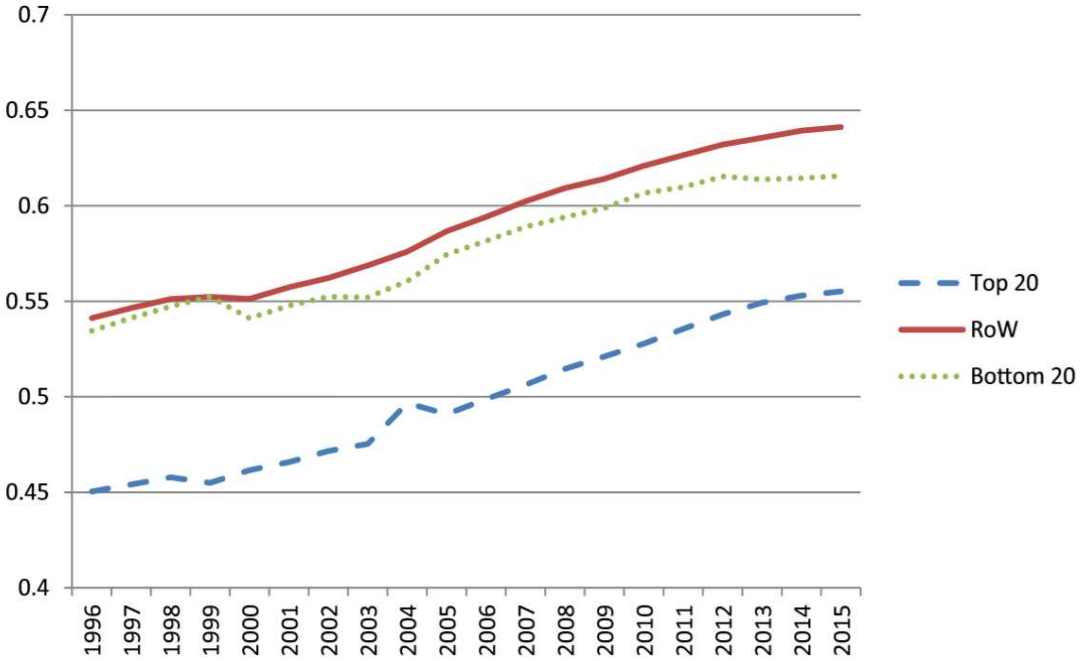
COUNTER ARGUMENT

- 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%

Improvements in Human Development Index from 1996 to 2016 by Mining Contribution



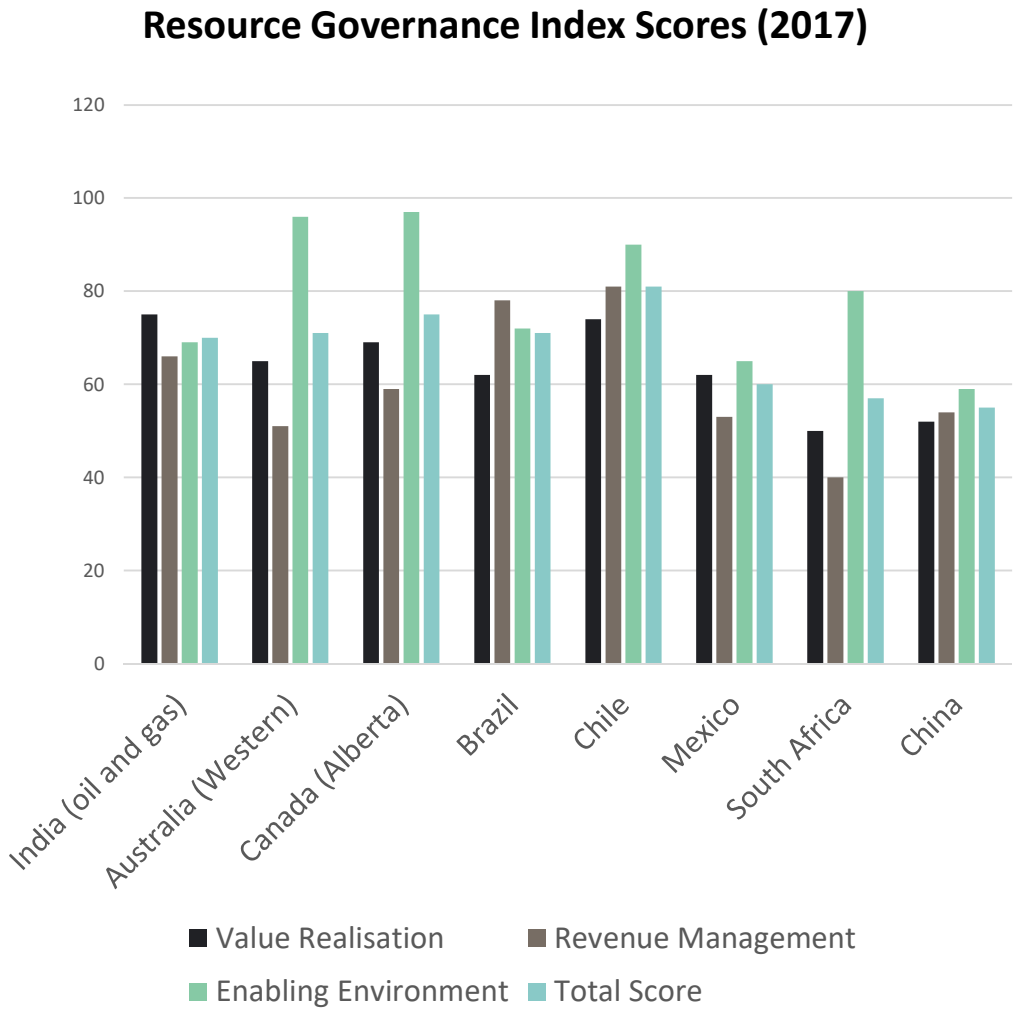
Source: Ericsson and Lof 2019

RISKS AND CHALLENGES TO ECONOMIC DEVELOPMENT

Governance index

- Value realisation
- Revenue Management
- Enabling Environment

- Law v Practice



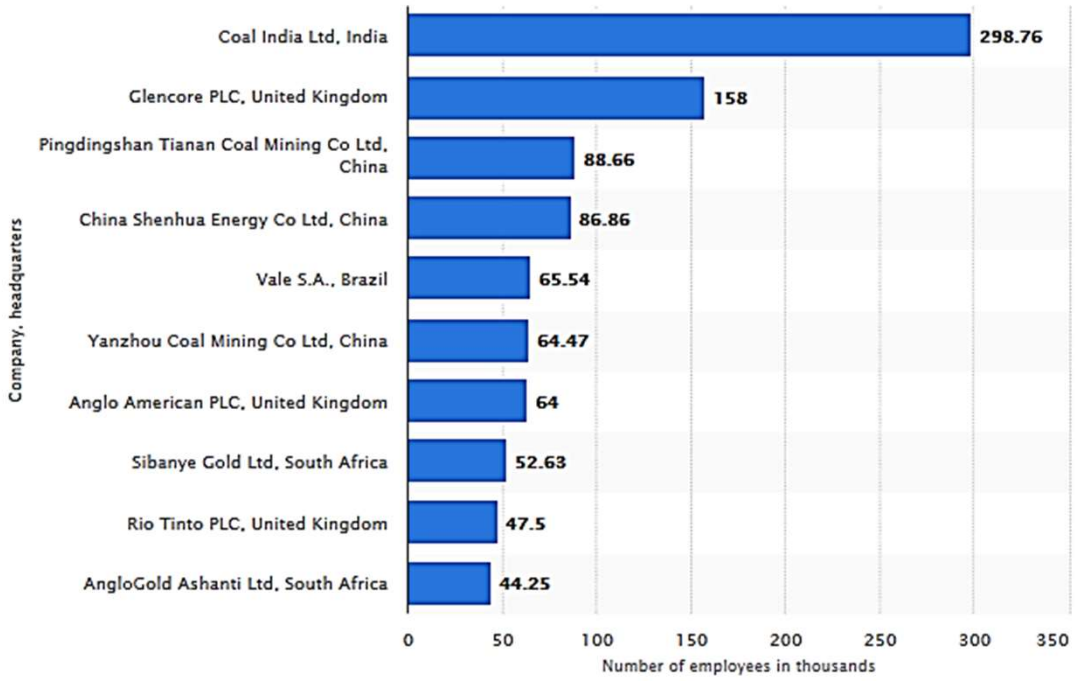
Source: Natural Resources Governance Institute 2017

POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

EMPLOYMENT

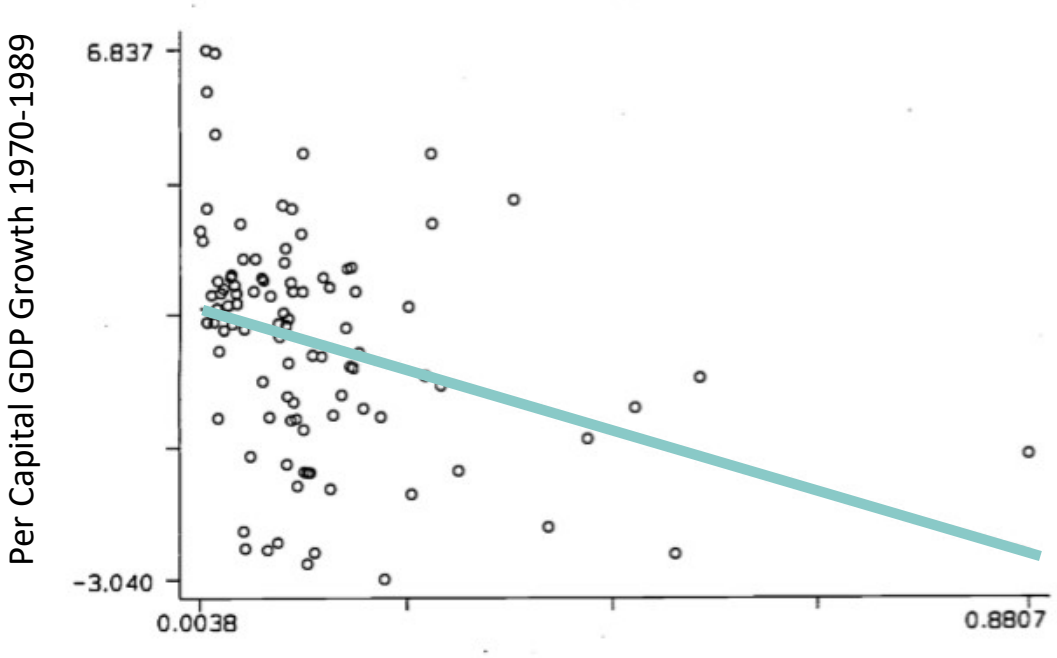
- Lower than expectations
- Each direct mining job can create 3-5 additional jobs
- Employment profile changes over the life of the project
- Impact dependent on local content
- Diversity of highly skilled and unskilled labour
- Synergies with skills in other heavy industry
- Mining offers greater unskilled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

Number of Employees by Company, 2019



RESOURCE CURSE HYPOTHESIS

The Simple Association Between Growth per-Capita 1970 and 1989 and the Share of Natural Resource Exports in GDP in 1971



Source: Sachs and Warner 1995

Sachs and Warner 1995

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

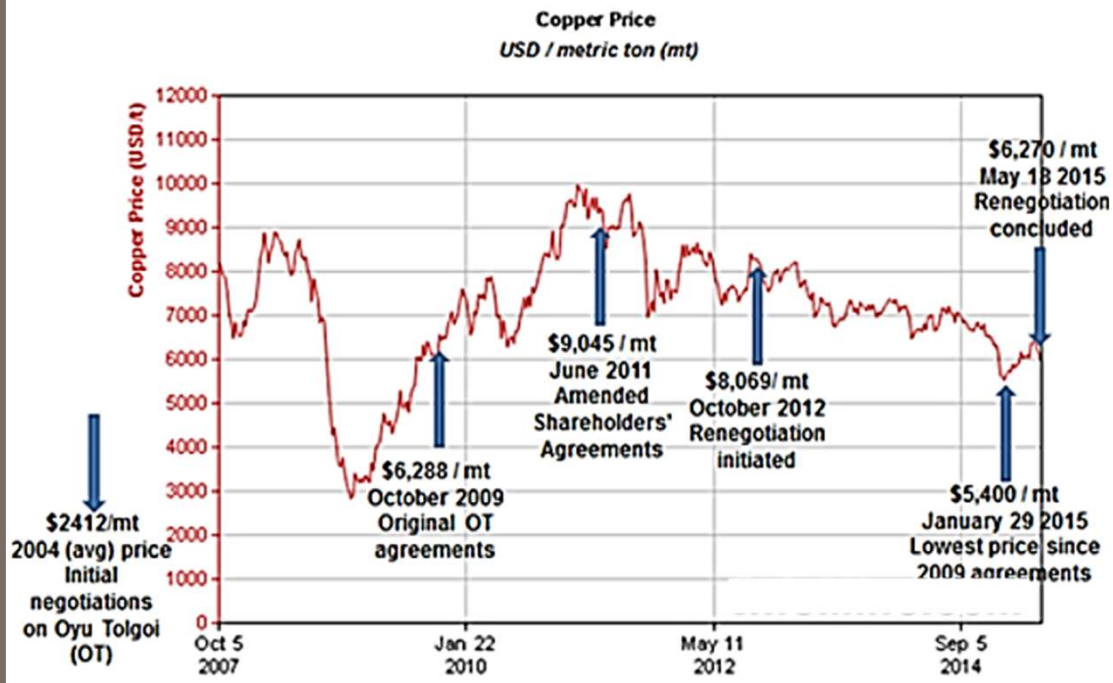
In the past 30 years the world's star performers have been the resource poor Newly Industrializing Economies of East Asia (…), while many resource rich (…) economies have gone bankrupt."

RISKS AND CHALLENGES TO ECONOMIC DEVELOPMENT

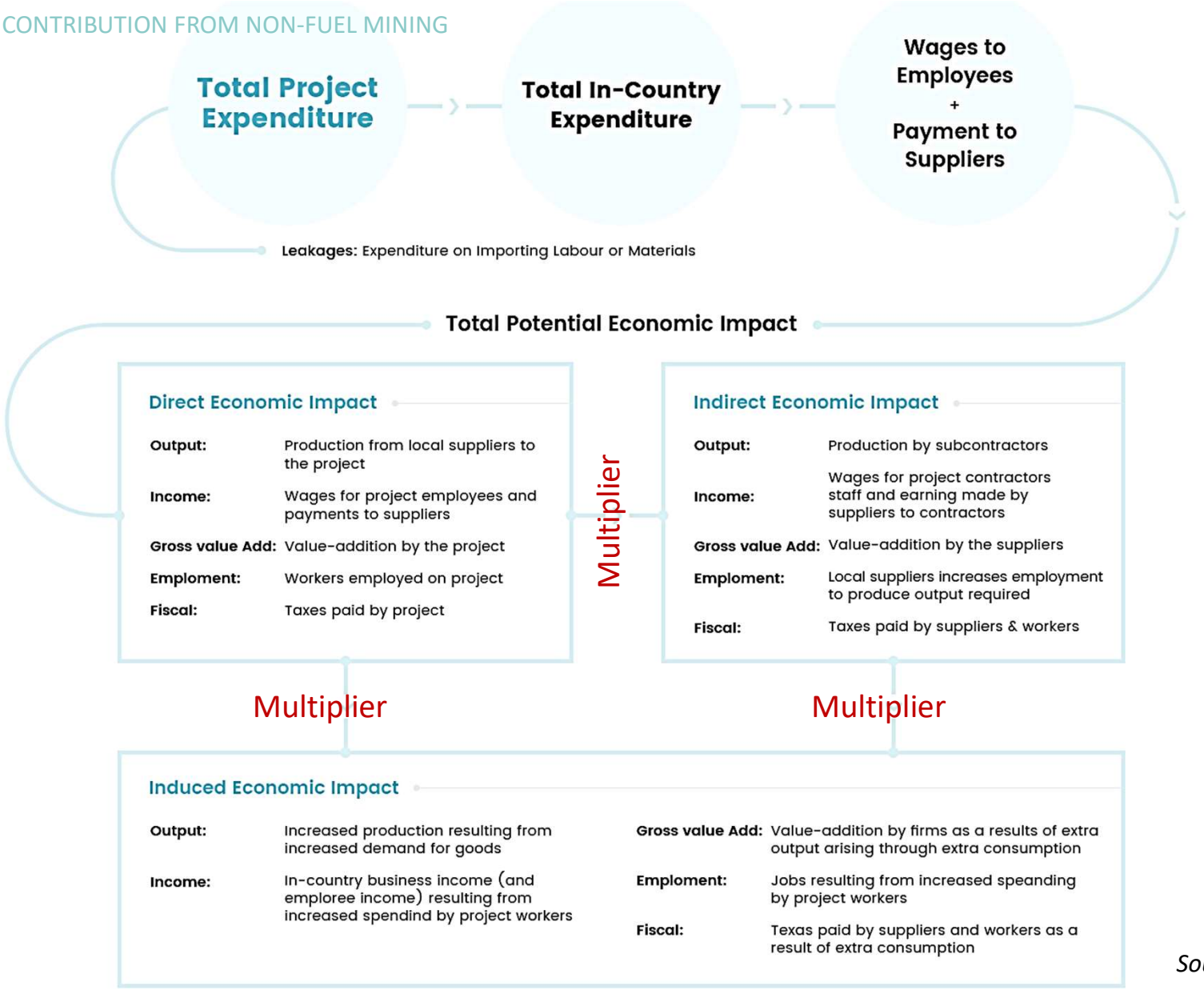
External Market Forces

- Declining terms of trade
- Mineral price volatility

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

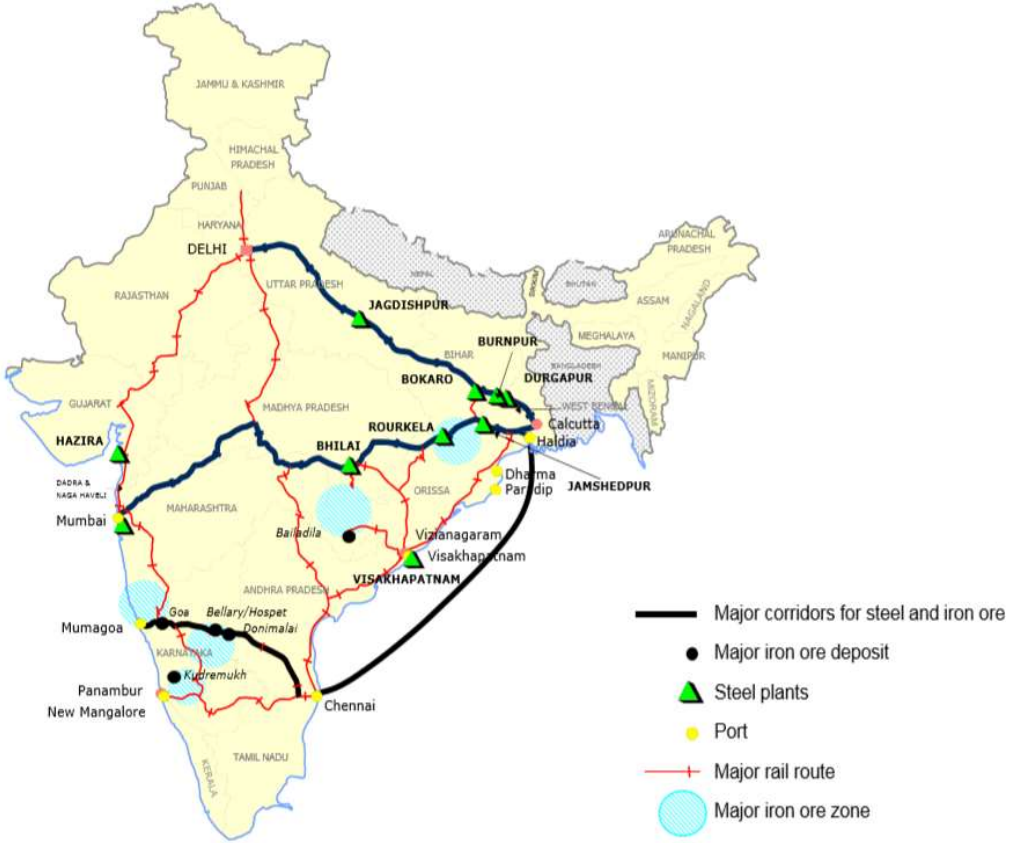


Source: Infomine



Source: Two Oceans Strategy

Resource Corridors

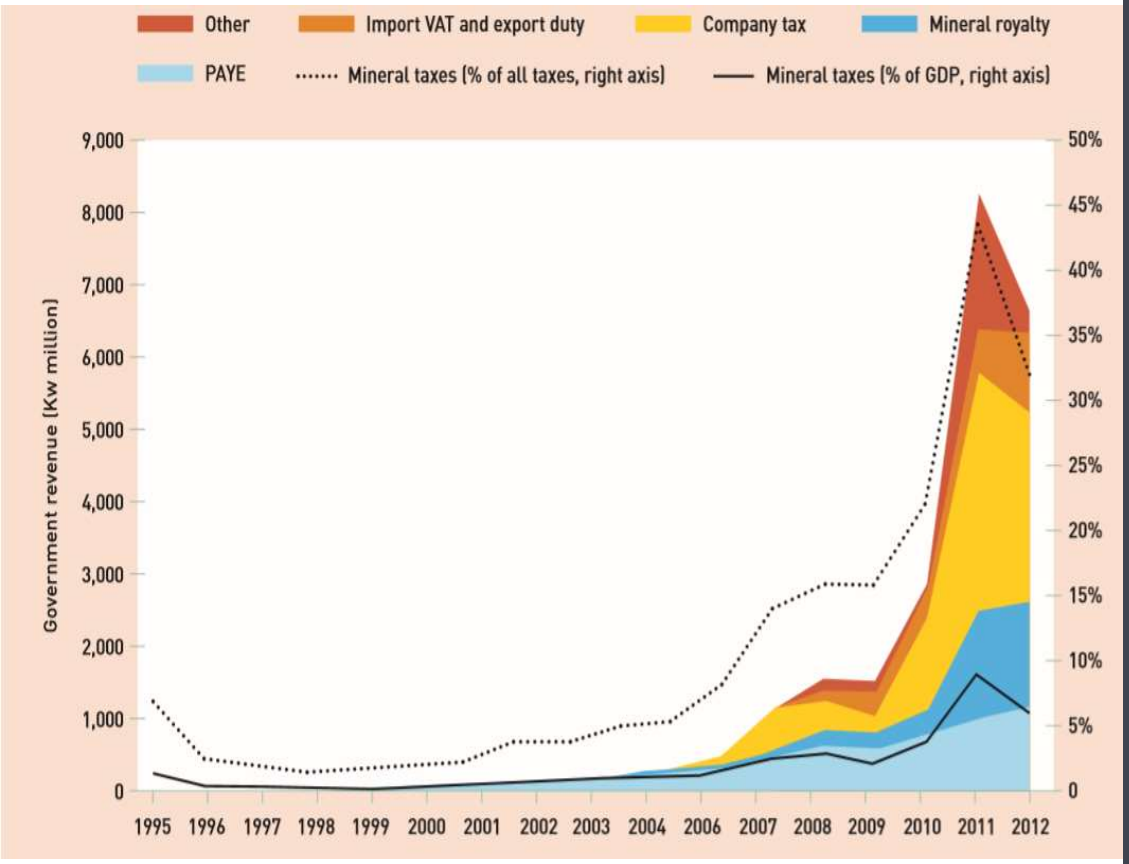


McKinsey 2014

Strength of linkages may be increased by:

- Concentration of activity
- Scale
- Proximity
- Specialisation

Fiscal Contributions From Mining in Zambia 1995-2014



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

POTENTIAL ECONOMIC CONTRIBUTION FROM NON-FUEL MINING

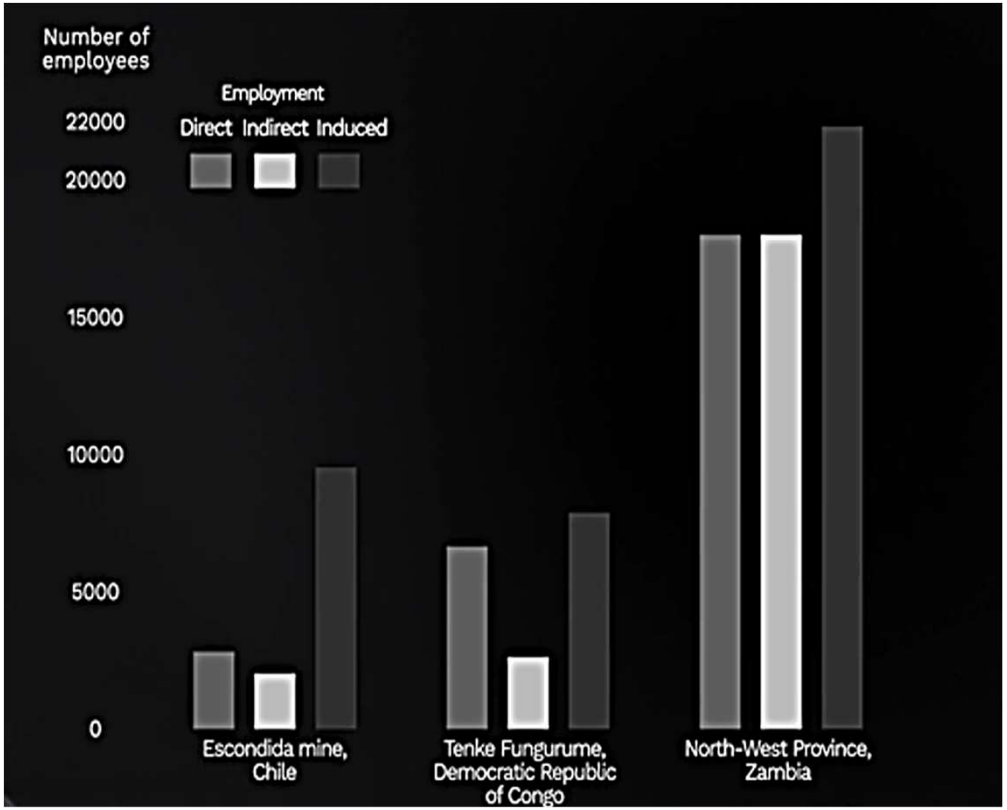
FISCAL CONTRIBUTION

- 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 developmet of the industry

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



Source: Ostensson 2018