Agenda

Section one – Economic impact analysis defined
Section two – Economic impact methodology
Section three – Using economic impact outputs
Section one – Economic impact analysis defined
Welcome!
Course description

Mining companies generate significant economic benefits for communities that may not be well understood by local, government and other key stakeholders.

Economic impact analysis provides a quantitative method to estimate the economic benefits that a particular project or industry brings to the economies and surrounding communities where the specific project or industry is located.

Typically, economic impact studies use financial and economic data to generate estimates of output, GDP, employment and tax revenues associated with changes in the level of economic activity resulting from the project or industry being analyzed.

In general, economic impacts can be estimated at the direct, indirect and induced levels.
Objectives of today’s session

• Understand how capital and operating expenditures contribute to local, regional, and national economies as measured by gross domestic product (GDP), employment and tax revenue.

• Understand how economic impact analysis can provide more robust analysis to support business cases and inform the decision making process on matter such as the construction of a new project, or the expansion of existing facilities.

• Understand how economic impact outputs can contribute to national / state / local economies.
About economics at PwC

Our practice members conduct statistical and economic studies for a wide range of clients located in Canada, USA, UK, Australia, Netherlands and China.

Based on our local and international experience, we have acted as a technical resource for clients in various sectors including natural resources and the public sector.

Comprised of members with advanced degrees in economics and other quantitative disciplines our team provides the following services:

• Economic impact analysis, socio-economic impact
• Benchmarking, industry analysis, and market research
• Statistical and econometric models
What is economic impact analysis?

- Economic impact analysis provides a rules-based and transparent measure of the economic importance of mining operations to an economy.
- Communicates the importance of mining operations using standard measures of economic activity – GDP, jobs, wages, tax revenues.

Measures of economic activity

- GDP
- Employment
- Salaries & Wages
- Government Tax Revenues
What is economic impact analysis

• The **total economic impact** is comprised of the direct impact and indirect impact.
  
  – **Direct impacts** result from expenditures associated with constructing and operating a mine – labour, materials, supplies, capital.
  
  – **Indirect impacts** result from the suppliers of the mine purchasing goods and services and hiring workers to meet demand – these “2nd round” impacts would not occur **but for** mine operations.
  
  – **Induced impacts** results from the employees of the mine purchasing goods and services at a household level.
The audience for economic impact analysis

• Outputs of an economic impact analysis are typically used to demonstrate the economic importance of mining operations to:
  – **Government stakeholders** that generally approve mining operations and establish royalty regimes.
  – **Community stakeholders** that can control and approve the issuance of permits.
  – **Other stakeholders** such as NGOs (and other non-profit organizations) that want to ensure that mining operations benefit local communities.
The audience for economic impact analysis

- Economic impact analysis can be a powerful tool to build stakeholders support, which is critical to the successful establishment of a mine and ongoing operations.
Why needed in the mining sector?

Mining companies face considerable challenges and take on considerable risk in establishing and operating a mine.

Gaining and maintaining stakeholder support by demonstrating economic benefits on a proactive and periodic basis can help limit overall project risks.
Why needed in the mining sector?

• Building and maintaining stakeholder support is essential to successfully establishing a mine and ongoing operations.

• Mining, which generally occurs in rural and/or less developed regions of a country, provides significant economic opportunities for local communities that would not otherwise occur.

• These economic benefits may not be well understood by stakeholders, which can hinder developing and maintaining stakeholder support.

• It is important that mining companies proactively communicate economic benefits to set the agenda and frame discussions with stakeholders.

• Mining companies should also revisit economic impact estimates on a periodic basis to ensure economic benefits estimated at project outset materialize.
Where is economic impact analysis reported?

Corporate Sustainability Reporting (CSR) guidelines: (GRI) indicators for employment and taxes paid, local procurement established.

Industry associations report on contribution to state and local economies to demonstrate importance of industry to support of overall economy.

Environmental Impact Assessments can require proponents to provide number of direct and indirect jobs, expenditures made, and taxes paid.
Section two

Section two – Economic impact methodology
Economic impact methodology

• Wassily Leontief won a Nobel Prize in Economics in 1973 for his explanation of the economy using his Input-Output Model (IOM).
• The Leontief model describes a simplified view of an economy. Its goal is to predict the proper level of production for each of several types of goods or service.
• The most useful application of input-output analysis is the ability to see how the change in demand for one industry effects the entire economy.
• An IOM essentially contains the formula for every output in an economy (recipe analogy).
Economic impact methodology

Economic impact analysis is based on the use of national or provincial input-output tables.

At the national level, Statistics Canada or the Bureau of Economic Analysis (BEA) collects data from establishments in each industry at the national and provincial level.

• The purpose of economic impact analysis is to:
  • Define whether the value of the benefits of a project or policy can be defined in an economically valid and systematic way.
  • Estimate the economic impacts of projects, events or policies
  • Measure the overall contribution to the economy at regional, state/provincial, national levels providing estimates of industries whose activities would otherwise be aggregated into a broader industry category
About the Input-Output model

- Input-Output tables (IOM) organizes the business sector of an economy in terms of who makes what outputs and who uses what inputs. In essence, it is a matrix.

- IOMs are useful for estimating how an increase in demand for a product of one industry could impact other industries and the economy as a whole.

- IOMs are used to construct Input-Output Multipliers which can be used to estimate the economic impacts of incremental spending in an economy.

- Current spending is already factored into the input-output tables which are derived on an annual basis.

- IOMs are measured in dollars with prices valued in producer prices (producer prices are the price that the producer of a good receives rather than what a consumer pays to buy the good produced, which can include transportation and retail mark-ups).
**Input-Output models**

- In Canada, we build input-output models with Excel using the input-output tables from Statistics Canada.
- In the USA, our colleagues have access to IMPLAN (generally used) and REMI software which facilitates the analysis.
- The IMPLAN and REMI software is more flexible in that it can provide regional and local analysis.
- In Canada, we use proxies, usually employment, to model regional impacts.
- Other countries have input-output models based on their system of national statistical accounts, however, in developing countries, robust data may not be available for modeling purposes.
- The OECD produces a set of input-output tables for their member countries as do other global organizations such as the International Food Policy Research Institute.
What are input-output multipliers

Three types of multipliers are used to measure the potential impact at various levels of an economy:

1. Direct
2. Indirect
3. Induced

- Controlling for leakage occurs in the calculation of multipliers.
- Leakage is typically measured as the share of imports in a project / industry’s supply chain purchases.
**What are input-output multipliers**

**Direct multipliers** measure direct impacts which are changes that occur in “front-end” businesses that would initially receive expenditures and revenue as a direct consequence of the operations and activities of a project.

For the mining industry, these include activities directly attributable to mining such as operating expenditures, including the transportation of mine output from the mine to the purchaser.

Direct impacts also include capital expenditures which are normalized to a base year and reported in current dollars.
What are input-output multipliers

**Indirect multipliers** measure indirect impacts arising from changes in activity for suppliers of the “front-end” businesses.

- Indirect multipliers create the “ripple effect” in the economy
- The impact on what the suppliers do to fulfill new incremental spending, i.e., fuel, transportation equipment and machinery.
- Includes their actions with other suppliers and impact on increased labour demand.
- For a mining operation, indirect multipliers come from changes in activity for suppliers of the “front-end” businesses (mining suppliers) such as contractors and other companies providing inputs (goods and services) to mining companies.
**What are input-output multipliers**

**Induced multipliers** measure induced impacts arising from shifts in spending on goods and services as a consequence of changes to the payroll of the directly and indirectly affected businesses. Induced effects are measures of household spending. Induced impacts include spending by mining and supplier employees on consumption items of which a portion can be attributed to the mining industry. Expenditures at this level can include: food, clothes, and cars.
**Economic impacts outputs**

Input-Output multipliers can be used to estimate the impacts on the economy through various measures.

Estimates are used as the underlying data to the input-output tables are based on industry averages.

Economic impact outputs measure the following:

1. Output
2. GDP
3. Employment
4. Wages & salaries
5. Taxes
Economic impact outputs

Output is the broadest measure of economic activity.

- Total gross value of goods and services produced by a given company or industry measured by the price paid to the producer.
- Producer price is compared to the price paid by the consumer, which can include transportation and retail mark-ups.
- Output is a big number but double-counts impacts.
**Economic impact outputs**

**Gross Domestic Product (GDP) or value-added** refers to the additional value of a good or service over the cost of inputs used to produce it from the previous stage of production.

- GDP is equal to net output, or the difference between revenues and expenses on intermediate inputs.
- GDP is the incremental value created through labour or mechanical processing.
- Total GDP is a more meaningful measure of economic impact than output, as it avoids double counting during each round of impacts.
- GDP is smaller than Output but is more important to government stakeholders.
**Economic impact outputs**

**Employment** is the number of additional jobs created as a result of the expenditures made by the mine operations.

- Estimated as the number of jobs per $1 million spent
- Depending on the definition used, direct employment is generally employees on payroll but can include contractors working at the mine site.
- Indirect employment is related to the suppliers workforce.
- Induced employment are the retail and other types of jobs supporting household expenditures.

**Wages and Salaries** are a measure of the cash earnings of employees.
**Economic impact outputs**

**Government tax revenues** come from personal income taxes, indirect taxes less subsidies, corporate income taxes and is measured as the total amount of tax revenues generated for each level of government (municipal, provincial and federal).

- By definition, government tax revenues generated using the input-output approach does not include royalties collected.
- Tax impacts can be complex, additional adjustments may need to be made depending on whether the mine entity is a public company, joint-venture or other corporate arrangement.
- Always good to check actuals to estimates!
**Economic impact inputs**

- Data used as inputs to the model are **current expenditures**, either capital expenditures or operating expenditures as outputs from the model are static.
- Distinguish between costs associated with **construction** and ongoing annual **operating** costs – different multipliers for **capex** vs **opex**.
- Only the new or **incremental cash expenditure** amounts of a project that will be spent in the jurisdiction in which the mining operation is located should be included.
- Secondary data from statistical agencies is used to support the expenditure inputs during the modeling phase.
**Key steps for economic impact analysis**

- **Step 1** – Measure direct impact: capital and operating expenditures for the project
- **Step 2** – Calculate multipliers: build input-output model based on project expenditures
- **Step 3** – Indirect & induced impacts: apply multipliers to expenditure data to derive impacts
- **Step 4** – Impact results: Generate impact results from the model for operating, capital, R&D, and other types of spending
- **Step 5** – Stakeholder communications: Reporting
## Economic impact outputs

### Summary of the economic impact of the BC mining industry

<table>
<thead>
<tr>
<th>Impact</th>
<th>Direct ($ millions)</th>
<th>Indirect ($ millions)</th>
<th>Induced ($ millions)</th>
<th>Total ($ millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>5,166.5</td>
<td>2,732.8</td>
<td>1,034.6</td>
<td>8,933.9</td>
</tr>
<tr>
<td>GDP</td>
<td>2,748.8</td>
<td>1,319.0</td>
<td>622.5</td>
<td>4,690.3</td>
</tr>
<tr>
<td>Taxes</td>
<td>495</td>
<td>253.3</td>
<td>190.3</td>
<td>938.6</td>
</tr>
<tr>
<td>Municipal</td>
<td>37.3</td>
<td>21.2</td>
<td>16.1</td>
<td>74.6</td>
</tr>
<tr>
<td>Provincial</td>
<td>223.2</td>
<td>103.4</td>
<td>88.2</td>
<td>414.8</td>
</tr>
<tr>
<td>Federal</td>
<td>234.5</td>
<td>128.7</td>
<td>86.0</td>
<td>449.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact</th>
<th>Direct (No. of Jobs)</th>
<th>Indirect (No. of Jobs)</th>
<th>Induced (No. of Jobs)</th>
<th>Total (No. of Jobs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment</td>
<td>21,112*</td>
<td>16,590</td>
<td>8,001</td>
<td>45,703</td>
</tr>
</tbody>
</table>

*Direct employment from operating mines as reported in PwC's 2010 mining industry survey is 8,195 and is included in the total direct jobs of 21,112.
Section three

Section three - Using economic impact outputs
**A cautionary tale**

- Multiplier values include direct effects as well as indirect effects, beware of double-counting.
- Multipliers from one industry cannot be added with multipliers from another industry to derive an aggregate multiplier.
- Be cautious of using a multiplier from another study area. Each study is using particular industry inputs that are unique to that situation or jurisdictions.
- Be cautious of large multipliers and large estimates as they can raise red flags, be reasonable and conservative.
- If the ultimate reader is a government agency (Ministry of Finance), they have economists who scrutinize the results of these studies for reasonableness; be comfortable that study results are defensible.
**Understanding economic impact estimates as decision-making criteria**

- Provides one set of measures that can be used to compare against economic development goals.
- Provides external measures of economic contribution as it relates to the national / state / provincial economy.
- Provides estimates only, based on industry averages and different levels of data reliability.
- Static and does not provide information as to when in time the impacts will occur although construction impacts are easier to quantify on a timeline.
- Economic impact estimates do not take into account other considerations such as:
  - ROI to the organization
  - Environmental costs
  - Social costs
Examples of economic impact reporting

Large Confidential Mining Company
- Developed economic impact multipliers for a large mining company with operations in developing countries
- Developed alternative approaches to estimate economic impacts due to significant data limitations

Mining Association of British Columbia
- Economic impact study of the British Columbia mining industry
- Report was publicly released, high profile economic impact study referenced by the association and government

Canadian Association of Mining Equipment and Services for Export
- Economic impact of sector profile of the Mining Supply and Services Sector
- Understanding of the mining value chain and linkages between the supply sector and how this impacts the overall economic contribution of the mining sector
Examples of economic impact reporting

Economic impact of BC’s mining industry

The estimated economic impacts of mining industry expenditures of $3.2 billion are estimated to be $8.9 billion in total output. Expressed as a ratio, each dollar spent in the BC mining industry can be said to have generated $3.75 of total impact (direct, indirect and induced). This represents gross spending by the mining industry in 2016 of an estimated $8,930.9 million in output impacts. Total value added generated by the mining industry and its direct suppliers through spending is estimated to be $4.7 billion. In 2016, this represented approximately 3% of British Columbia’s provincial GDP.

Total tax revenue generated was approximately $585.6 million with $409.5 million in federal tax revenue, $245.5 million in provincial tax revenue and $47.6 million from municipal taxes generated through spending. In addition, $356.4 million was reported as mineral royalties and mineral land taxes.

Direct, indirect and induced employment is estimated at 46,703 jobs and consists of the direct employment of 22,113 jobs of which 1,150 jobs represent employment at operating mines. Direct employment also includes jobs related to the exploration and construction phases when mining companies are highly labour intensive as well as jobs involved with the transportation of mine output from the mine site. In 2016, the direct employment attributed to the mining industry and its suppliers was approximately 3% of British Columbia’s labour force. The balance of employment is made up of indirect employment of 15,593 jobs and induced employment of 9,501 jobs.

<table>
<thead>
<tr>
<th>Impact</th>
<th>Direct</th>
<th>Indirect</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>1,083</td>
<td>2,052</td>
<td>3,135</td>
</tr>
<tr>
<td>CPA</td>
<td>1,194</td>
<td>1,194</td>
<td>2,388</td>
</tr>
<tr>
<td>Taxes</td>
<td>573</td>
<td>419</td>
<td>1,092</td>
</tr>
<tr>
<td>Total</td>
<td>2,850</td>
<td>3,661</td>
<td>6,511</td>
</tr>
</tbody>
</table>

The results of the economic impacts are summarised in the table below.

The direct effects include the economic activity of mine operators, companies providing support to mine operators, and transportation companies that carry mine output to purchasers. Indirect effects include the economic activity of suppliers, including suppliers of capital goods for mining operations. Induced effects measure the economic impact of spending of payrolls resulting from direct and indirect activity.
Examples of economic impact reporting – environmental assessment

BRINGING SIGNIFICANT BENEFITS TO THE KAMLOOPS REGION

Over its two-year construction phase and 23-year mine life, the proposed Ajax project will provide a significant economic boost to the City of Kamloops in the form of jobs, local spending and tax revenues. The project is expected to provide lasting economic benefits even after the project is completed.

JOBS

Average annual jobs during the construction phase:
- PwC 290
- Uninc 360

Average annual jobs during operations:
- PwC 450
- Uninc 360

The average annual salary for a mining job is $105,000.

ECONOMIC STIMULUS

$1.1 million to be spent per day during construction.

$18 million to be spent per year during operations.

- Kamloops: 42%
- BC provincial, municipal: 51%
- Canadian: 14%
- Foreign: 1%
- Wages: 72%
- Payments: 14%
- Permit: 8%
- Services: 5%

ESTIMATED TAX REVENUE OVER THE MINE’S LIFETIME

- Federal and Provincial: $650 million
- BC Mining Royalty: $70 million
- Municipal: $10 million
Global Reporting Guidelines (GRI)  
Indicator Protocols Set – Economic (EC)

- Economic performance indicators are intended to measure the economic outcomes of an organization’s activities and the effect of these outcomes on a broad range of stakeholders.
- Takes into consideration need to report on multiple jurisdictions with systems of national statistical accounts of varying sophistication.
- Even if input-output modeling not used; there is a need to understand the relationship between direct and indirect impacts on local communities.
- Also takes into consideration reporting on EITI (Extractive Industries Transparency Initiative) on payments to governments.
## GRI: EC1 Direct economic value, by country

<table>
<thead>
<tr>
<th>Component</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct economic value generated</strong></td>
<td></td>
</tr>
<tr>
<td>Revenues</td>
<td>Net sales plus revenues from financial investments and sales of assets</td>
</tr>
<tr>
<td><strong>Economic value distributed</strong></td>
<td></td>
</tr>
<tr>
<td>Operating costs</td>
<td>Payments to suppliers, non-strategic investments, royalties, and facilitation payments</td>
</tr>
<tr>
<td>Employee wages and benefits</td>
<td>Total current payments to employees</td>
</tr>
<tr>
<td>Payments to providers of capital</td>
<td>All payments to providers of capital</td>
</tr>
<tr>
<td>Payments to government (by country)</td>
<td>Gross taxes</td>
</tr>
<tr>
<td>Community investments</td>
<td>Voluntary contributions and investments of funds in the broader community</td>
</tr>
<tr>
<td><strong>Economic value retained</strong></td>
<td>Calculated as economic value generated less economic value distributed</td>
</tr>
</tbody>
</table>
GRI: EC1, Direct economic value

Making a positive contribution to society

We develop partnerships that foster the sustainable development of our host communities, enhance socio-economic benefits from our operations and contribute to poverty alleviation.

Why this is a focus area

As large organisations, we have economic and social responsibilities to make a positive contribution to the communities, regions and countries where we operate.

Our brand and economic contribution

At a gross level, we are active participants in industry and sustainability development forums such as the International Council on Mining and Metals (ICMM) and are members of the World Business Council for Sustainable Development (WBCSD). Our aim is to evaluate continual improvements to standards and performance across our suite.

We actively seek to understand our socio-economic impact on local communities and in doing so, we take part in initiatives that aim to address specific needs and requirements. We are committed to improving the living standards and socio-economic development of the people in the regions in which we operate.

We engage with governments on a range of policy issues and aim to play a role in advancing social and environmental governance, through our actions and in discussion with option leaders.

Commercial value

Commercial value for regional economies is generated through revenues, operating costs, employee compensation, royalties and other community payments, shareholder earnings and payments to capital providers and to governments.

Communications

Communications with stakeholders are delivered through media, presentations, reports, websites and a broad range of other media channels.
Summary

• The purpose of economic impact analysis is to define whether the value of the benefits of a project or policy can be defined in an economically valid and systematic way.

• Mining companies generate significant economic benefits for communities that may not be well understood by local, government and other key stakeholders.

• Economic impact outputs include estimates of economic contributions for output, GDP, employment, wages & salaries paid, and government tax revenues.

• The more detailed the expenditure data (inputs) used in the model, the better the estimates.

• Multipliers are project and region specific; borrowing multiplier(s) from a broader mining industry or other studies will not provide accurate impact estimates.
Thank you!

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