www.pwc.com

2012 Americas School of Mines

Economic Impact Analysis – May 16, 2012

Janice Plumstead

pwc

Agenda

Section one – Economic impact analysis defined

Section two – Economic impact methodology

Section three – Using economic impact outputs

Section one

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

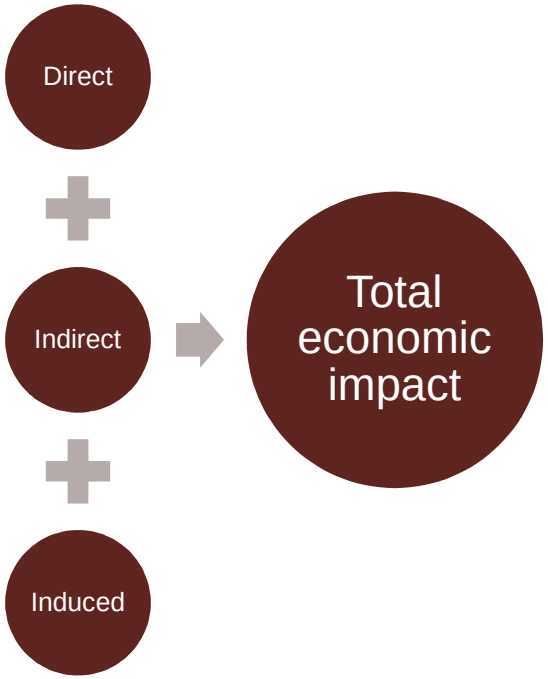
What is economic impact analysis?

- 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 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?

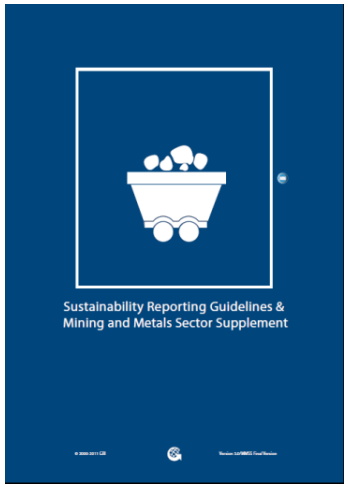
Mining companies face considerable challenges and take on considerable risk in establishing and operating a mine.

Gaining and maintaining stakeholder support by demonstrating economic benefits on a proactive and periodic basis can help limit overall project risks.

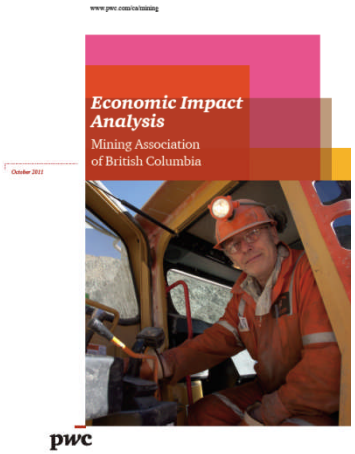
Why needed in the mining sector?

- 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.

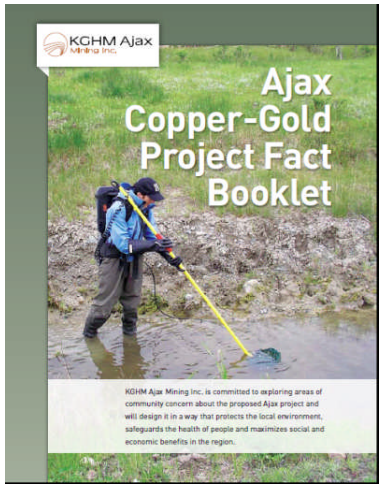
Where is economic impact analysis reported?



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 Internatioal 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 <u>smaller</u> 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

Measure direct impacts

- Step 1 – Measure direct impact: capital and operating expenditures for the project

Calculate multipliers

- Step 2 – Calculate multipliers: build input-output model based on project expenditures

Indirect and induced impacts

- Step 3 – Indirect & induced impacts: apply multipliers to expenditure data to derive impacts

Impact results

- Step 4 – Impact results: Generate impact results from the model for operating, capital, R&D, and other types of spending

Stakeholder communications

- Step 5 – Stakeholder communications: Reporting

Economic impact outputs

Summary of the economic impact of the BC mining industry

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

Impact	Direct (No. of Jobs)	Indirect (No. of Jobs)	Induced (No. of Jobs)	Total (No. of Jobs)
Employment	21,112*	16,590	8,001	**45,703**

* 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

www.pwc.com/ca/mining

October 2011

Economic Impact Analysis

Mining Association of British Columbia

pwc

Economic impact of BC's mining industry

The estimated economic impacts of mining industry expenditures of $5.2 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 $1.73 of total impact (direct, indirect and induced). This represents gross spending by the mining industry in 2010 of an estimated $8,933.9 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 2010, this represented approximately 2% of British Columbia's provincial GDP.

Total tax revenue generated was approximately $938.6 million with $449.2 million in federal tax revenue, $414.8 million in provincial tax revenue and $74.6 million from municipal taxes generated through spending. In addition, $364 million was reported as mineral royalties and mineral land taxes.

Direct, indirect and induced employment is estimated at 45,703 jobs and consists of the direct employment of 21,112 jobs of which 8,195 jobs represent employment at operating mines. Direct employment impacts also include jobs related to the exploration and construction phase when mining companies are highly labour-intensive as well as jobs involved with the transportation of mine output from the mine site. In 2010, the direct employment attributed to the mining industry and its suppliers was approximately 2% of British Columbia's labour force. The balance of employment is made up of indirect employment of 16,590 jobs and induced employment of 8,001 jobs.

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

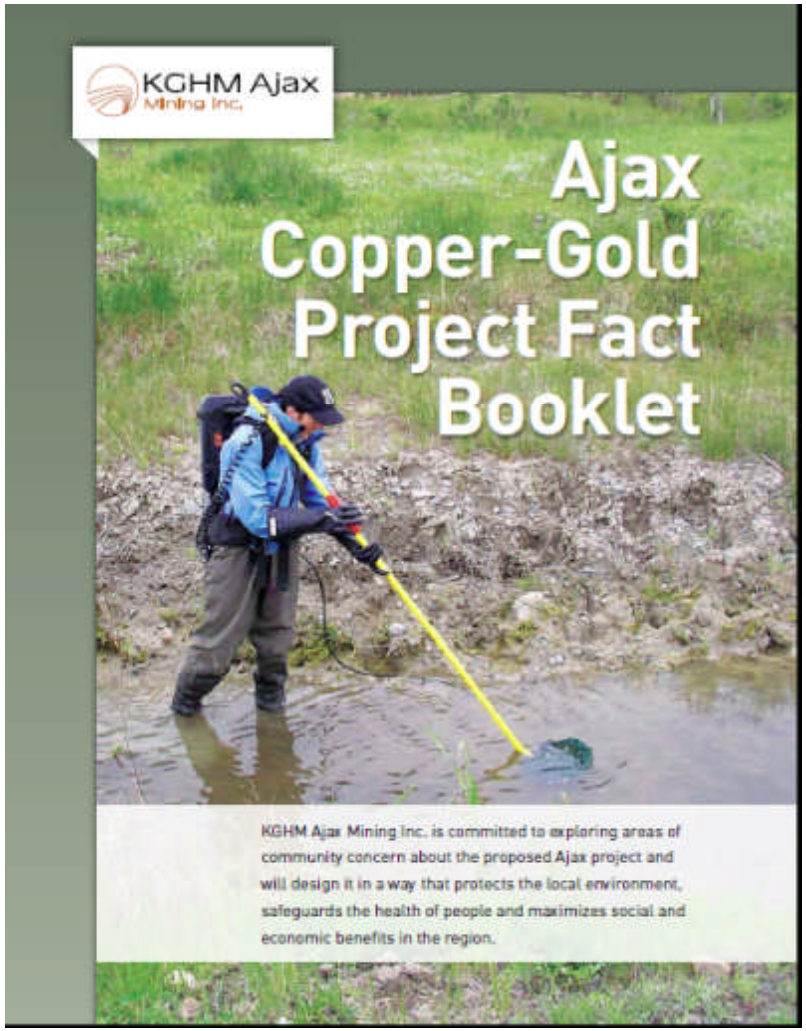
The direct effects include the economic activity of mine operators, companies providing support to mine operators, and transportation companies that carry mine output to purchasers. Indirect effects include the economic activity of suppliers, including suppliers of capital goods for mining operations.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

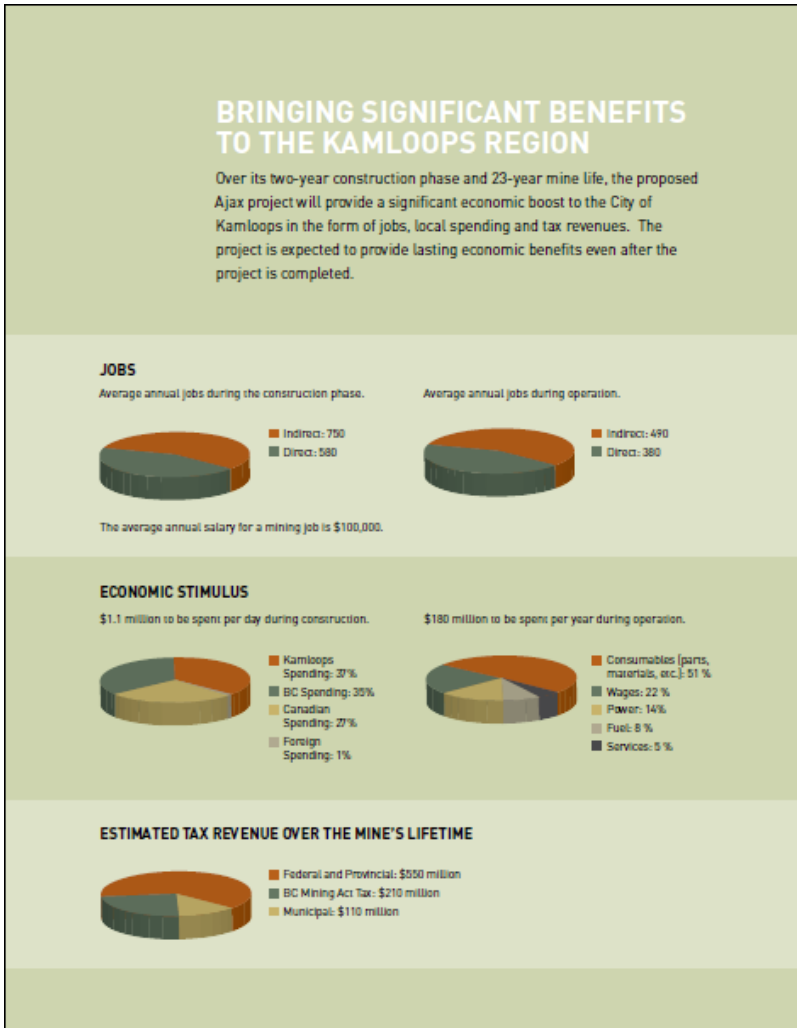
Table E1 Summary of the economic impact of the BC mining industry, 2010

Impact	Direct ($ millions)	Indirect ($ millions)	Induced ($ millions)	Total ($ millions)
Output	5,166.5	2,732.8	1,034.6	8,933.9
GDP	2,748.8	1,319.0	622.5	4,690.3
Taxes	495	253.3	190.3	938.6
Impact	**Direct (No. of Jobs)**	**Indirect (No. of Jobs)**	**Induced (No. of Jobs)**	**Total (No. of Jobs)**
Employment	21,112*	16,590	8,001	45,703

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

Examples of economic impact reporting – environmental assessment





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

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

GRI: EC1, Direct economic value

Go to a section... Contents Search Print Version + − Next ›

bhpbilliton
resourcing the future

Go to a section... Contents Search Print Version + − ‹ Previous Next ›

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 a large organisation, we have an economic and social responsibility to make a positive contribution to the communities, regions and countries where we operate.

Our broad socio-economic contribution
At a global level, we are active participants in industry and sustainable development forums such as the International Council on Mining and Metals (ICMM) and we are members of the World Business Council for Sustainable Development (WBCSD). Our aim is to advocate continual improvement of standards and performance across our sector.

We actively seek to understand our socio-economic impact on local communities and host regions through our participation in the ICMM's multi-stakeholder Resource Endowment Initiative (REI). The initiative aims to enhance the mining industry's socio-economic contribution to the countries and communities where organisations such as BHP Billiton operate, by better understanding the factors that either inhibit or promote social and economic development linked to large-scale mining projects.

We engage with governments on a range of policy issues and also play a role in advocating transparent and ethical governance, through our own actions and in discussion with opinion leaders.

Nationally and regionally, we contribute taxes and royalties to governments that, in turn, provide infrastructure and services to their constituents and we often develop infrastructure ourselves that provides community, as well as business, benefits. Examples include airports, roads, community childcare centres and medical clinics.

Training and employing local people is important to us; however, our ability to have a significant impact on unemployment is limited by the nature of our operations, which are highly technical and mechanised. We make a broader economic contribution via indirect employment, where we focus on building the capacity of local businesses to provide us with a diverse range of services and products.

We also invest in community projects that are aimed at having long-lasting, positive impacts on people's quality of life. This includes implementing new, and supporting existing, community projects in the areas of education, health and environment.

Economic value
Economic value for regional economies is generated through revenues, operating costs, employee compensation, donations and other community investments, retained earnings and payments to capital providers and to governments.

	Economic value generated US$ million	Economic value distributed US$ million					
	Revenues[1]	Operating costs[2]	Employee wages and benefits	Payments to providers of capital		Payments to government[3]	Economic value retained[4] US$ million
Region	Revenue and other income	Payments to suppliers, contractors, etc.	Wages and benefits to employees	Shareholder dividends	Interest payments[3]	Gross taxes and royalties	
Africa	6,958	4,458	730	378	49	530	813
Australia and Asia	41,681	12,320	3,122	3,016	28	6,541	16,654
Europe	3,381	2,666	118	1,653	107	157	(1,320)
North America	5,600	2,004	592	7	282	326	2,389
South America	14,609	5,549	895	<1	31	2,389	5,745
Total	72,229	26,997	5,457	5,054	497	9,943	24,281

[1] Amounts include revenues and costs and are consistent with the Group's financial reporting of elements comprising underlying EBITDA. Underlying EBITDA is earnings before net finance costs and taxation, any exceptional items, and depreciation, impairments and amortisation. The amounts are determined on an accruals basis and extracted from the audited financial statements.
[2] Operating costs relate to expenses recognised in the financial statements. They include expenditure paid to suppliers and contractors for materials and services and exclude employee wages and benefits, payments to governments, depreciation, amortisation and impairments.
[3] This is interest expense on debt for BHP Billiton, determined on an accruals basis.
[4] Comprises income tax and royalty-related taxes paid, royalties paid in-kind and production-based royalties accrued, which approximate cash payments.
[5] Calculated as economic value generated less economic value distributed.

22 | BHP BILLITON SUSTAINABILITY REPORT 2011

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!

Contact:

Janice Plumstead
PwC, Economics & Statistics
604 806 7201
janice.e.plumstead@ca.pwc.com

© 2012 PricewaterhouseCoopers LLP. All rights reserved. PwC refers to the United States member firm, and may sometimes refer to the PwC network. Each member firm is a separate legal entity. Please see www.pwc. com/structure for further details.