

# Chamber of Minerals and Energy of Western Australia (CME) economic contribution analysis

Methodology overview

9 July 2021

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## Summary of our methodology

The Chamber of Minerals and Energy of Western Australia (CME) engaged EY to assist in the preparation of economic statistics to capture the various contributions made by its members to the Australian and Western Australian economies. The purpose of this analysis is to support a stakeholder and general communications strategy with economic factsheets that outline the economic contributions of the operations of CME member companies with mining and energy projects across Western Australia.

This analysis forms part of the sixth economic contribution study conducted for the Western Australian resources sector, and the first time EY has supported the assessment.

EY's approach to this contribution study has incorporated the following key workstreams:

### **A well-known and widely applied economic framework:**

- ▶ We used an Input-output (IO) modelling methodology, which calculates how the impacts created by activity in one industry affect the broader economy through established intra- and inter-industry relationships.
- ▶ We used our in-house regional IO tables to calculate the multiplier impacts of supplier spend at a Local Government Area (LGA) level. The multipliers at an LGA level are a representation of the impact within these regions only.
- ▶ We then accounted for the remaining inter-regional trade of goods and services spend in the rest of Australia to and from each LGA through national multipliers.
- ▶ We modelled the indirect impacts (i.e. type one multipliers) of CME member operations using spend on Australian companies for both operating costs and capital expenditure, estimating the impacts on Gross Value Added (GVA) and jobs.

For additional detail on our IO modelling methodology, see appendix A

### **Data collection and cleansing:**

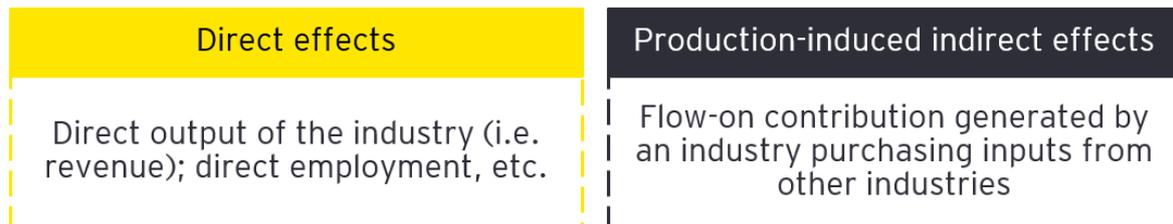
- ▶ Our analysis was based on combining the results of a CME survey of participants for the 2019-2020 financial year, complemented with data from previous reporting periods (from 2016) for entities who did not respond to the survey in 2020.
- ▶ The CME collected data from member companies on a range of aspects from local supplier spend, to taxes, full time employees, and community contributions (amongst others).
- ▶ We worked with the CME to, where possible, consolidate, update and cleanse data, focusing on material issues/gaps such as missing ABNs, incorrect post codes, incorrect allocation of spend (e.g. local council payments allocated to supplier spend).
- ▶ Prior year data was only used for projects that are still operational today.
- ▶ Lastly, where information was available, information from annual reports was used to supplement the survey data.

For additional detail on our data collection and cleansing, see appendix B.

## Appendix A: Input-output modelling

Input-output (IO) modelling calculates how the impacts created by activity in one industry affect the broader economy through established intra- and inter-industry relationships. Our IO modelling measures the interdependence between each mining industry and the rest of the economy using economic multipliers, i.e. the output of one industry may become the input of another industry. Economic multipliers are one way to estimate the total economy-wide contribution of direct and indirect economic activity for a particular industry.

The fundamental multipliers use for this study are described below.



*Direct effects* - measure the initial requirements for an extra dollar worth of output for a given industry. The direct effect on the output of an industry is a one-dollar change in output to meet a one-dollar difference in final demand. Associated with this direct effect is a (direct) difference in GDP (as proxied by Gross Value Added in the calculations), employment, income, etc. The methodology used in this analysis does not estimate the direct economic impacts of the CME member companies but does use the data collected to calculate the indirect effects.

*Production-induced indirect effects (type 1 multiplier)* - measure the changes due to inter-industry purchases in response to the demands of the directly affected industries. This includes the chain-reaction of output up and down the production supply chain. The production-induced indirect effects were estimated using IO modelling, using the supplier spend (for both capital expenditure and operating cost) data given by CME member companies.

Our modelling has not considered any consumption induced effects (*type 2 multiplier*), and therefore only considers the direct and indirect impacts of the CME member operations on the Australian economy.

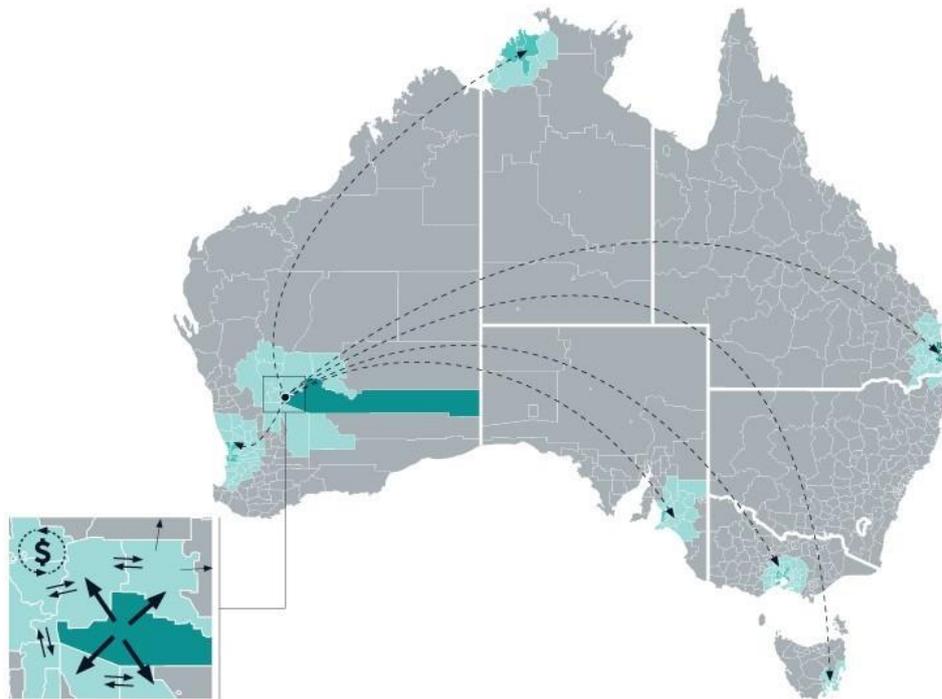
The main data requirements for IO modelling are input-output tables that give an estimate of the total output for a particular industry, as well as all of the interactions between industries within a given economic region. Our primary data source for this study (i.e. the input-output data used to construct the IO model) is sourced from the Australian Bureau of Statistics (ABS Australian National Accounts: Input-Output Tables - 2016-17).

We used our in-house regional Input-Output (IO) tables to calculate the multiplier impacts at an LGA level. The multipliers at an LGA level are a representation of the impact within these regions only. We then account for the remaining inter-regional trade of goods and services spend in the rest of Australia to and from each LGA through national multipliers. Accordingly, we have calculated both the local impact, and accounted for the additional flow-on effects of each member spend across Australia.

The estimation of the out of region (LGA) impacts is based on a gravity model, which measures economic flows across Australia through the combination of the distance between economic centres and the relative sizes of economic activity in different regions. The gravity model was built off the Generation of Regional Input-Output Tables (Grit): An Introspection, as published by West in

1980<sup>1</sup>, and outlined by Guttman and Richards while at the RBA in 2004<sup>2</sup>. This was combined with a Geographical Information System (GIS) analysis of the positions of LGAs across Australia to identify relative distances.

This means that the out-of-region trade with suppliers from an area (such as Leonora, as shown below) is estimated to gravitate towards regions that are closer and have higher economic activity.



A mine operated in the Leonora region with the spend to each supplier captured and the LGA multipliers by sector are calculated on the basis of this spend. Additional supply chain impacts outside of the Leonora LGA through the rest of Australia are accounted for to build up the national multiplier.

### Limitations of Input-output modelling

There are some limitations in the application of IO modelling and analysis, as the use of fixed multipliers implies that the structure of the economy remains unchanged by economic events. IO modelling also applies no supply-side constraints on the availability of inputs, such as labour, capital / equipment and land. While IO is a common form of economic modelling, there are factors that must be considered in interpreting the results, including:

- ▶ The approach assumes fixed production coefficients and constant returns to scale. This means that no matter how much is produced, the per-unit cost of required inputs remains the same;
- ▶ IO assumes unlimited availability of production inputs such as labour, capital / equipment and land (i.e. there is a lack of supply-side constraints);

<sup>1</sup> <https://www.sciencedirect.com/science/article/pii/S0313592680500068>

<sup>2</sup> <https://www.rba.gov.au/publications/rdp/2004/pdf/rdp2004-11.pdf>

- ▶ The approach does not account for price changes that may result from increased competition for scarce resources;
- ▶ The analysis is built on a static picture of the economy that does not consider dynamic adjustments that may occur as a result of potential future shocks;
- ▶ The effect of technology on productivity / production efficiency improvements is not considered; and
- ▶ The method considers average effects, rather than marginal effects, meaning that IO models do not take into account economies of scale, unused capacity or technological change.

## Appendix B: Data collection, aggregation and cleansing

We have worked with the CME, who undertook a survey of member companies to collect and aggregate detailed data on member company operations in 2020 in Western Australia (in AUD), covering a range of areas, including:

- Supplier spend for each member (for both capital and operating expenditure), broken down by supplier, and the location of each supplier by post code;
- Number of full-time employees and contractors for each member, including the locations of workers and associated wages paid;
- Community contributions to each organisation, by postcode;
- Local council payments and the nature of the payment (rates, etc.); and
- Taxes, royalties and other fees to government by operation.

In addition, we worked with the CME to, where possible, consolidate, update and cleanse data, focusing on material issues/gaps such as missing ABNs, incorrect post codes, incorrect allocation of spend (e.g. local council payments allocated to supplier spend).

We used individual ABN numbers to determine the number of unique suppliers to members, reducing the possibility of double counting of suppliers in the dataset. In some instances, only aggregated data was supplied, which has still been used to estimate WA and national contributions and multipliers but has been excluded for local and regional impacts/estimates.

The CME received a lower response rate in 2020 from its member survey, with fewer firms responding than in previous years. Therefore, to complement the low sample size of the data collected by CME from member spend in 2020, information from two additional sources was used. The first source was the data contained in prior year surveys conducted by the CME, where we used entities that had responded in previous rounds but not in 2020. We also used research undertaken by the CME (using the annual reports of member companies) in instances where spend could be identified as being located in Australia yet was not contained within the survey results.

Prior year survey data (going back to 2016) was only used where there was confidence that the operations (as proxied by output) were equal to or higher than the output in 2020. The data collected on spend, taxes and employment has been benchmarked against official data in Western Australia from the Department of Mines, Industry Regulation and Safety<sup>3</sup>.

To keep estimates conservative, and as instructed by the CME, we have removed prior year community contributions from the datasets, as well as small transactions to suppliers in prior years (in this case, the smallest 25 per cent by value), as these vary significantly from year to year.

We used the national industry structures from the ABS Input-Output tables to map out supplier spend by commodity, as per the 114 ANSZIC industry classifications, and where information has been supplied, from post code to the Local Government Area (LGA) level. Where post codes are located in more than one LGA, we have allocated the post code to the LGA based on land area, and further categorized into electoral districts and regions.

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<sup>3</sup> <https://www.dmp.wa.gov.au/About-Us-Careers/Latest-Resources-Investment-4083.aspx>

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