CME Economic Contribution Survey 2023/24: Methodology Statement

March 2025

Company Survey

Lawrence Consulting was commissioned by the Chamber of Minerals and Energy Western Australia (CME) to determine the economic benefit to the Western Australia economy based on expenditure data provided by its full-member companies and selected key service members.

Companies were asked to disclose expenditure and other information by postcode in 2023/24 or equivalent reporting years in the following categories:

- Employee salaries and wages (by place of residence) for full-time direct employees and contract workers as well as the number of FTE employees by place of operation;

- Goods and services expenditure by individual supplier, including separate identification of both operational expenditure (opex) data for current projects and capital expenditure (capex) data from projects currently under development;

- Voluntary community contributions by individual organisation;

- Local government payments, including council rates and infrastructure charges;

- State government payments, including royalties, stamp duty, payroll tax and land tax; and

- Federal government payments, including corporate tax and fringe benefit tax.

The data was supplied by Australian postcodes where the salary was paid (residence of the direct employee) and where the community contributions and business expenditures were made.

The postcode spend data were then aggregated using geographical concordance files from the Australian Bureau of Statistics and the economic impacts (direct, indirect and consumption impacts) of the minerals and energy sector were analysed at five geographic levels:

- State (the whole area of Western Australia);

- Regional (represented by 10 regions as defined by the WA Regional Development Commission);

- Local (represented by 139 Local Government Areas in Western Australia);

- State electoral divisions (represented by 59 SEDs in Western Australia); and

- Commonwealth electoral divisions (represented by 16 CEDs in Western Australia).

Modelling Approach

Input-Output Modelling

For this study, input-output (I-O) modelling has been used to estimate the sum of direct, indirect and consumption-induced effects of the companies surveyed on different regions of Western Australia. I-O techniques provide a solid approach for taking account of the inter-relationships between the various sectors of the economy in the short-term and hence are an appropriate tool for determining the direct, indirect and induced economic impact of economic stimuli.

I-O models can be used to capture only the indirect impacts that occur through other industry sectors (Type I models) – which have been adopted for the current study – or the indirect plus the consumption-induced effects (Type II models). Further, the I-O models used in this study were based on the ABS model of the Australian economy generated from general equilibrium models. Note: Type II models involve assumptions about fixed relationships between income and consumption patterns. These factors mean that the results of I-O models should generally be treated as the upper bound of estimates, and that care has to be taken in interpreting the results of very large changes in demand or production.

A concept underlying I-O modelling is that an initial economic shock or stimulus can have multiplier effects through a series of successive spending rounds. The size of the economic multiplier in a local or regional area can be summarised in the following way:

- The extent to which project operators purchase inputs from the local or regional economy. Examples of inputs include wages for labour supplied from the local or regional area, and purchases of goods and services. The more that a project operator sources from the local or regional economy, the more money that is directly injected into the economy; and

- The extent to which money spent in a local or regional economy is retained within that economy. If there is not much opportunity for people receiving income to spend it on goods and services in their local or regional area, then not as much money will be kept in the local or regional area. Larger and more diverse regional economies tend to be better at keeping expenditures in their economy and not 'losing' it to other regions.

Key advantages of using input-output models are the fineness of detail available at a disaggregated industry level, the relative ease of application, particularly for sub-regional levels, and the ability to model effects in a timely manner.

To generate predictions, the economic contribution of an industry is applied to the relevant industry sectors of the input-output model of a regional economy. The stimulus from economic activity can be traced through the economy in several different ways:

- The first-round effect, or direct effect, are those from the industry's expenditure in purchasing goods and services from other industries, paying wages to employees and community and government payments;

- The second-round effects are those from the supplying industries increasing their purchases to meet the additional demand. The second and subsequent rounds of purchasing are termed the indirect effects; and

- The consumption-induced effects, which recognise that the level of local production is important in determining regional levels of household income, that in turn will be spent locally to a large extent and therefore influence the level of regional consumption and the level of output of each sector.

These effects can be represented in terms of multipliers and changes in four key variables:

Output

The output impact measures the increase in gross sales throughout the whole economy by summing all the individual transactions resulting, directly and indirectly, from the economic stimulus.

Income

The income impact measures the additional amount of wages and salaries paid to employees of the industry under consideration and to other industries benefiting from the stimulus to the economy.

Employment

The employment impact measures the combined number of existing jobs sustained and new jobs generated by the stimulus, both directly and indirectly, although allocation between these forms of employment is not separately identified.

Value Added

The value added or Gross Regional Product (GRP) impact measures only the net activity at each stage of production. GRP is defined as the addition of consumption, investment and government expenditure, plus exports of goods and services, minus imports of goods and services for a region. The GRP impacts are the preferred measure for the assessment and contribution of a stimulus to the economy.

Key advantages of using input-output models are the fineness of detail available at a disaggregated industry level, the relative ease of application, particularly for sub-regional levels, and the ability to model effects in a timely manner. However, care has to be taken in its application and interpretation of results. Key assumptions that underpin the application of I-O models are:

- The inputs purchased by each industry are a function of the level of output of that industry. The input function is generally assumed linear and homogenous of degree one (which implies constant returns to scale and no substitution between inputs);

- Each commodity (or group of commodities) is supplied by a single industry or sector of production. This implies that there is only one method used to produce each commodity and that each sector has only a single primary output;

- The total effect of carrying on several types of production is the sum of the separate effects. This rules out external economies and diseconomies and is known simply as the additivity assumption;

- The system is in equilibrium at given prices. This would not be the case in an economic system subject to external influences;

- In the static input-output model, there are no capacity constraints so that the supply of each good is perfectly elastic. Each industry can supply whatever quantity is demanded of it and there are no capital restrictions. This assumption would come into play depending upon the magnitude of the changes in quantities demanded, brought about through changes in taxation levels; and

- The input-output model is an optimisation model that allocates resources between sectors to their most efficient use.

Construction of Regional I-O Models

For the derivation of the regional I-O tables, a variable interference non-survey technique was applied, involving a formalised non-survey method compilation. This allowed data on direct effects of the companies surveyed to be inserted at any stage of the compilation procedure. This approach is based primarily on the Generation of Regional Input-Output Tables (GRIT) technique, a widely used method of constructing local and regional input-output tables in Australia, America and Europe. The procedure utilises cross-industry location quotients as well as superior data (including expenditure patterns of within the primary company data) for the regionalisation of the national direct requirements matrix (DRM) or at the elements of other final payments and demand, which are at the core of any I-O table.

In summary, the construction of the local and regional I-O models employed the following steps:

- Adjustment to the latest available national I-O table;
- Computation of the regional direct requirement matrix;
- Aggregation of regional sectors (if necessary); and
- Computation of the complete regional I-O table.

All the necessary data for the regionalisation procedure were collected from the Australian Bureau of Statistics as well as other reliable sources for secondary data such as regional household expenditure patterns, income and productivity measures. The latest available national I-O tables were 2021-22, which consisted of 114 sectors of economic activity, at the 4-digit level, compiled following the industry-technology assumption, product-by-product, with total flows and valued at basic values in current prices.

For estimating the regional I-O tables, and especially in the interpretation of results, relevant limitations of the I-O approach (static, linear production function, no substitution or scale economy effects, infinite elasticity of supply) were taken into consideration. Once the I-O models were generated, predictions of impact were estimated for each regional area using the available data on salary and business expenditure.

The predictions of the I-O models for regional areas were estimated in separate groups, specifically, expenditure on of the labour force, business goods and services (business suppliers), community contributions and government payments. Each stimulus group was modelled using expenditure coefficients and household consumption patterns applicable for each region, also taking into account the type of commodity and the nature of the expenditure (i.e. operating or capital expenditure).

The outputs of the models can be classified into First Round and Indirect Effects, representing industry impacts through the business chain, and Final Consumption-Induced effects, which represent the economic activity needed to support the increased workforce from Direct, First Round and Indirect Effects.

The data collection and the methodology applied in this study are notable in three key aspects:

- First, the data collected on actual spending by the minerals and energy sector allowed an assessment of impacts by spending in the economy in comparison to the more traditional approach of predicting economic impacts from total revenue changes;

- Second, the collection of primary data by local area allowed a much more accurate assessment of the direct impacts by geographic area than had previously been available; and

- Third, the application of the I-O modelling framework down to the LGA, SED and CED levels, when combined with the accuracy of the primary data, meant that relatively accurate models of local impacts from the WA minerals and energy sector could be generated.

The outcomes of the data collection and modelling approach meant that the assessment of direct, indirect and consumption effects could be expected to be more detailed and accurate at the LGA, SED and CED levels than could be achieved with standard applications of general equilibrium models.

Modelling consumption impacts is problematic for smaller areas with limited economic structures because only a subset of goods and services are available. Smaller and specialised mining areas tend to have larger expenditure leakages, typically to the nearest large regional centre. To incorporate this into the modelling, a further correction factor has been applied, as shown in the table below.

Rates of Adjustment for Local Consumption Expenditure by Population Size	
Population	**Rate of consumption expenditure**
0 – 2,000	40%
2,000 – 5,000	46.7%
5,000 – 10,000	53.3%
10,000 – 30,000	73.3%
30,000 – 50,000	80%
50,000 – 100,000	86.7%
Over 100,000	100%

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