Joint Impact Model

# Joint Impact Model: Methodology paper JIM 1.4

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# Contents

# 1 INTRODUCTION

## 1.1 Background

Promoting inclusive and sustainable economic growth, employment and decent work for all is one of the main objectives of international development finance institutions ("IFIs"). To track progress on these goals IFIs collect some direct data from their investees, typically on business financials and headcount. However, literature suggests that sales revenues and direct employment are not good proxies for overall economic and employment impacts, and do not say anything about environmental impact.

Over the last few years Steward Redqueen has developed tailored models for IFIs to help them quantify the indirect impact associated with their investments. IFIs have published these results in their annual reports (CDC 2019, FMO 2018). However, despite using the same methodology to quantify impact, results are not comparable due to different assumptions used; and the results mainly focused on indirect jobs.

In January 2019, Steward Redqueen brought together several IFIs to explore harmonisation of approaches, which resulted in an agreement between Steward Redqueen, FMO, CDC and Proparco to work towards one harmonised model. In the months that followed, BIO, the African Development Bank (AfDB) and Findev Canada joined the effort, and activities have been aligned with the European Development Finance Institutions (EDFI) work program of 2019-20 to further align approaches to impact.

The Joint Impact Model (JIM), which is available online, is the result of this joint harmonisation effort between Steward Redqueen, FMO, CDC, Proparco, BIO, AfDB and Findev Canada (the Parties).

## 1.2 Objective

The purpose of the JIM is to enable users to estimate the gross direct and indirect economic, employment and environmental impacts of a portfolio of investments in developing markets in a single year, and to track changes in these impacts over time.

The JIM is a portfolio-level tool that relies on modelling, using statistics reflecting sector and country averages. Impact results from the model can be considered robust at the portfolio level. Results for individual investments or small portfolios will be indicative only; alternative impact measurement tools will generally be preferred.

## 1.3 Key features

The JIM has the following key characteristics:

- *Harmonised*: the methodology and assumptions used in the model are consistently applied across portfolios of users, and guidelines are provided on input data and reporting;
- *Publicly available:* the model will be made accessible to other impact investors besides the Parties;
- *Transparent:* the methodology, assumptions and limitations are published alongside the model;
- *Collaborative:* users and experts are encouraged to contribute to model development. Model improvements/ expansions will always be made available to all users;
- *User operated:* users can upload input data themselves, and generate results based on their own selection criteria;
- *Up-to-date:* the model uses the latest available macro-economic statistics;
- *Secure:* no data or results are stored locally.

## 1.4 Intended users

The intended users of the JIM are:

- Members of the Association of European Development Finance Institutions;
- Bilateral and multilateral development banks;
- International finance institutions;
- Signatories of the IFC Operating Principles on Impact Management;
- Financial institutions with a portfolio of companies in developing countries.

## 1.5 Governance

The Parties established a Governing Board, responsible for oversight of the development of the JIM and its uses, as well as to manage the calendar of updates and model development.

## 1.6 Impact indicators

The key economic and environmental impact indicators of the model are:

- *Employment*: all working age people (15 years and older) who are engaged in any activity to produce goods or provide services for pay or profit, expressed in number of people.[1] Employment is further broken down in:
    - *Female employment:* all working age females (15 years and older) engaged in any activity to produce goods or provide services for pay or profit;
    - *Formal employment:* all working age people (15 years and older) hired by an employer under an established working agreement;
    - *Informal employment:* all working age people (15 years and older) working for an organisation despite not being provided with a working agreement[2];
    - *Youth employment:* all people, regardless of gender, between 15 and 25 years old who are engaged in any activity to produce goods or provide services for pay or profit.
- *Value added:* the sum of wages, taxes and savings, equivalent to gross domestic product, expressed in monetary value;
    - *Wages* (salaries): value of net wages paid to all full-time and part-time employees of the organisation during the reporting period;
    - *Taxes:* all transfers to the government made by a client over the reporting period;
    - *Savings* (profit): value of the organisation's net earnings (profit).
- *GHG emissions:* the sum of $CO_2$ and non-$CO_2$ emissions, expressed in $CO_2$-eq:
    - *$CO_2$ emissions:* $CO_2$ emitted from the combustion of fossil fuels;
    - *Non-$CO_2$ emissions:* methane ($CH_4$), nitrous oxide ($N_2O$) and fluorinated gases (F-gases) emitted.

[1] The employed comprise all persons of working age who, during a specified period, were in the following categories: a) paid employment (whether at work or with a job but not at work); or b) self-employment (whether at work or with an enterprise but not at work). Source: ILOSTAT; This means that the employment results do not reflect fulltime equivalents (FTE).

[2] Specifically, informal employment is defined as an employment relationship not covered in law or practice by national labour legislation, income taxation, social protection, or employment benefits. Likewise, formal employment is defined as an employment relationship that is covered by national national labour legislation. Source: ILOSTAT

Not included are*:* $CO_2$ emissions from forestry and other changes in land use (about 11% of GHG emissions worldwide).[3]

Users can combine indicators to obtain additional insights. For example, the value added per job or salaries per job give some indication of the quality of jobs supported, although there are many other elements of job quality that are not (yet) covered (e.g. working conditions, workplace safety, etc). Furthermore, the GHG emissions per unit of value added can be compared to national ambitions to reduce the GHG emissions per unit of GDP.

## 1.7 Scope of impacts

For these indicators the model covers the following impacts:

- *Direct:* impacts at the client company/ project;
- *Supply chain:* impacts at the client company/ project's suppliers and their suppliers;
- *Induced:* impacts associated with the spending of wages earned by employees of the client company/ project, its suppliers and their suppliers;
- *Finance enabling:* impacts at companies, suppliers of companies, and their suppliers associated with the financial intermediary's lending;
- *Power enabling:* impacts associated with the additional output created by companies that use the additional power generated by the client company/ project, as well as by non-power using firms in their supply chain (e.g. small-scale agriculture).

For GHG emissions, the key reference point is the GHG Protocol. The table below shows how the emissions quantified by the JIM relate to the GHG Protocol Scopes. Keeping the limitations described below in mind, the JIM could help users to report on GHG emissions according to the standards set by the Platform Carbon Accounting Financials (PCAF).

Table 1: The emissions estimated by the JIM compared to the GHG protocol

| GHG Protocol | JIM |
|---|---|
| Scope 1: direct emissions from owned or controlled sources | Direct GHG emissions |
| Scope 2: indirect emissions from the generation of purchased energy | Supply chain GHG emissions related to the client's direct electricity supplier (reported separately) |
| Scope 3: all indirect emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions | Supply chain GHG emissions other than the emissions related to the client's direct electricity supplier<br>Downstream GHG emissions related to activities enabled by additional power supply<br>*Scope 3 emissions not included are: end-of-life treatment of sold products, use of sold products and downstream transportation and distribution* |
| | Induced GHG emissions |

[3] More specifically the following GHG emission are excluded: GHG emissions from biomass burning, tropical forest fire, deforestation, biomass combustion, land sources and sinks of land use, changes of land use and forestry, other $CO_2$ emissions not attributable to fossil fuel combustion such as emissions from chemical, metallurgical and mineral transformation processes, and methane emissions from underground storage and geothermal energy; Combustion of fossil fuels represents about 65% of total GHG emissions worldwide, while non-CO2 gases represent about 24% of all GHG emissions worldwide: https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data.

The impacts quantified are *gross* impacts: the model does not take into account any substitution effects. Employment and value added impacts are limited to the *local* (i.e. domestic) economy– they only capture impacts that arise in the country in which the client operates (or the project takes place) –, while GHG emissions impact includes import-related impacts as well.

The model does not measure impacts related to social wellbeing and health, imports (except for GHG emissions), re-spending of taxes by the government, re-spending of royalties paid by firms, productivity impacts of better logistics and connectivity, and re-spending of personal loans, insurance, or mortgages.

## 1.8 Use of JIM in investment cycle

The JIM can be used for both ex-post and ex-ante impact quantification, although ex-post use is preferred.

**Ex-post**

The JIM is most suited for impact quantification as part of portfolio monitoring and evaluation (ex-post). Users can use the JIM to quantify:

- The impact of a user's outstanding portfolio in a particular year, based on data of all clients the user provided financing to and that are still active accounts in that particular year;
- The change in impact of a user's outstanding portfolio over time:
    - Change in impact between a user's full portfolio in year 1 and in year 2, based on full portfolio data for year 1 and year 2 (sample for both years will not be the same due to exits, loan repayments and new entries);
    - Change in impact for a sample of companies that were in a user's portfolio both in year 1 and year 2.

**Ex-ante**

The JIM could also be used at the investment stage (ex-ante). Users can use the JIM to quantify:

- The expected future impact of a user's committed (or intended) portfolio, based on data of all clients the user committed (or intends to commit) financing to in a particular year;
- The change in expected future impact of a user's committed portfolio over time:
    - Change in expected future impact between a user's committed portfolio in year 1 and in year 2, based on all committed financing in year 1 and year 2.

The ex-ante approach is based on some additional assumptions compared to the ex-post approach:

- Impacts quantified are the expected future impacts of the client/financing over all time;
- Constant production structure, labour productivity and capital productivity of clients and suppliers;
- Committed financing will be fully disbursed.

Data input requirements for ex-post and ex-ante impact quantifications are to a large extent the same. The few differences are further explained in Section 3.3.4 and 3.3.5 of the User Guide.

## 1.9 This document

This document includes a detailed overview of the various methodologies, data sources and calculations used in the Joint Impact Model. The methodology sections of this document include introductions to the methodologies applied for each impact – i.e. supply chain and induced (Section 2), direct (Section 3), financing enabling (Section 4) and power enabling impacts (Section 5) – as well as a discussion of the reason why the methodology is used and key assumptions and limitations. Subsequently this document explains the attribution methodology included in the JIM (Section 6). The data sources section includes detailed descriptions of the main data sources used in the model, both the macro-economic statistics and the user input data (Section 7). This is followed by a section on the confidence level of results (Section 8). The last section looks ahead into possible extensions and improvements (Section 9).

Users of the JIM should rely on this document as a technical reference guide. It is intended to provide in-depth answers to questions regarding the JIM's calculation methodology and underlying reasoning.

The model calculations and formulas are described in a heuristic way, to keep the document accessible for users with different backgrounds, and are therefore somewhat simplified. This document refers to model version 1.4.

# 2 SUPPLY CHAIN AND INDUCED IMPACT

IFIs invest in the private sector in developing countries to support economic growth, employment and decent work. These IFI investments support businesses directly as IFI clients are able to grow, but also indirectly through the additional procurement of the IFI clients, and the re-spending of salaries earned by employees. However, insights into these impacts are often limited due to the lack of observable data. Collecting real data is often a lengthy and costly process, and not feasible for investors who have a portfolio of multiple businesses. To overcome this issue, the JIM uses Input-Output (IO) modelling to derive these impacts.

## 2.1 Methodology

IO modelling traces company revenues through an economy revealing linkages between the company and other domestic sectors. This methodology, which was developed by the Nobel Prize winning economist Wassily Leontief, is commonly used by economists to quantify indirect impacts.

The key ingredient of the IO model is a Social Accounting Matrix (SAM), which is a statistical and static representation of the economic structure of an economy. The SAM describes financial flows of all economic transactions within an economy.

Exhibit 1 shows an example of such a SAM. Columns represent buyers (expenditures) and rows represent sellers (receipts). In the SAM the number of columns and rows are equal because all sectors or economic actors (industry sectors, households, government and the foreign sector, etc.) are both buyers and sellers. Of the four quadrants in the SAM, three are relevant here: consumption and exports, intermediary demand, and value added.

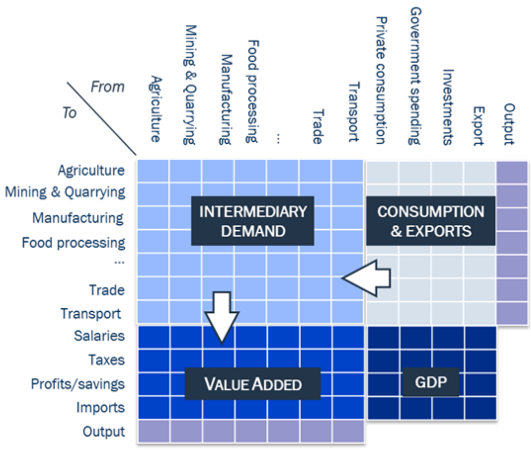



Exhibit 1: Simplified SAM

Final consumption and exports of a company's goods and services induces production, which leads to financial transfers between various sectors that subsequently generate incomes for households, the state (taxes) and businesses (dividends and savings). The latter is also referred to as *value added*. Households subsequently spend these incomes again on consumption which leads to induced money flows. These supply chain and induced money flows can subsequently be linked to employment intensities and GHG intensities to estimate the employment and GHG impact.

Exhibit 2 shows how the JIM combines client financial data and statistics to derive supply chain and induced impacts.

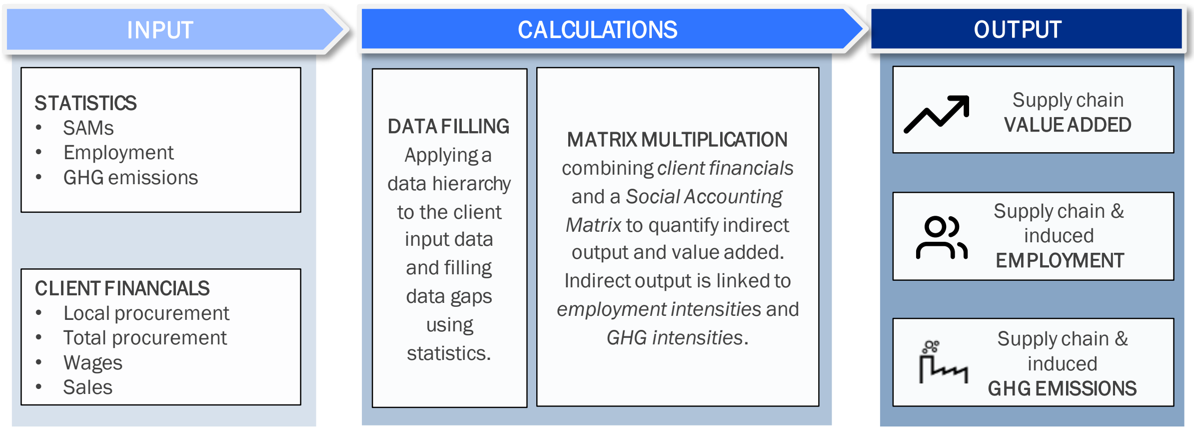



Exhibit 2: Overview methodology supply chain and induced impact

## 2.2 Inputs

The model has two key inputs (i.e. statistics and client financials), which need data to be prepared in order to use them in the model calculations.

### 2.2.1 Statistics

The key statistics used in the methodology to derive the supply chain and induced impact are SAMs, employment intensities and GHG intensities.

**Social Accounting Matrices (SAMs)**

The JIM uses SAMs for 75 individual countries, 17 regions and 65 sectors (for a full list see Appendix 1).[4] The base year of the SAMs in JIM version 1.4 is 2014. Data to compile the SAMs was derived from the Global Trade Analysis Program (GTAP). Datasets that have been used are firms' domestic purchases, household domestic purchases, firms' imports, firms' expenses on endowments and taxes. More information on GTAP is provided in Section 7.

The SAMs in the JIM have been simplified in the sense that factors and institutions are combined in three value added categories: salaries, taxes and savings. These are compiled from data on endowments (i.e. from land, unskilled labour, skilled labour, capital and natural resources) and taxes.[5] Subsistence farming and dwellings are excluded from the SAMs so that the SAMs only represent economically productive sectors and exclude non-market transactions.[6]

SAMs are updated every 2-4 years when new GTAP data is released.

**Employment intensities**

Employment intensities reflect the number of employed people per unit of output in a certain country and sector.

$$\left(\frac{\text{Employment}}{\text{Output}}\right)$$

[4] For the regional SAMs, individual country tables and 'rest' tables are used of countries within the region. 'Rest' tables from GTAP typically cover multiple countries for which no individual tables are available.
[5] Aguiar, A., Chepeliev, M., Corong, E., McDougall, R., & van der Mensbrugghe, D. (2019). The GTAP Data Base: Version 10. *Journal of Global Economic Analysis, 4(1)*, 1-27. Retrieved from https://www.jgea.org/resources/jgea/ojs/index.php/jgea/article/view/77
[6] As a large share of agriculture in low- and lower middle income countries is subsistence farming, sourcing by agricultural companies from other agricultural companies, and private sector consumption of agriculture is put to zero. Income classification of countries is based on the World Bank list of economies as of June 2018. The dwellings sector in GTAP reflects imputed rents of houses occupied by owners. They are assumed not to contribute to market transactions.

The JIM uses employment intensities for 75 individual countries, 17 regions and 14 sectors. The base year of the employment intensities in JIM version 1.4 is 2018. The employment intensities have been derived by combining:

- *Employment data:* the number of working age people who are engaged in any activity to produce goods or provide services for pay or profit.[7] The data has been obtained from ILOSTAT, which has modelled estimates available for 2018, for 14 sectors (ISIC rev. 4) and 189 countries. Employment data is disaggregated by gender, age group and job types. More information on ILOSTAT is provided in Section 7.1.2;
- *Output data:* the value of goods and services produced in a given period. Output for 2018 has been estimated by combining GTAP and World Bank data:
  - *2014 Output data* has been obtained from GTAP for 75 individual countries and 65 sectors;
  - *2014-2018 GDP growth* rates have been obtained from the World Bank Development Indicators (WBDI) for 75 individual countries and 4 sectors (i.e. agriculture, manufacturing, industry, services).

  To derive 2018 output per country and sector, GTAP output of 2014 per country and sector has been multiplied by the GDP growth rates from the WBDI (Exhibit 3). For all GTAP agricultural sectors, the WBDI growth rate for agriculture was used, for all GTAP manufacturing sectors the WBDI growth rate for manufacturing was used, etc. If WBDI data per sector was not available, the model used data on total GDP change (2014-2018). The key assumption here is that output grows in line with GDP. More information about the WBDI used is provided in Section 7.1.3.

$$\text{Output 2014 (\$)} \times \left(1 + \Delta \text{ GDP 2014-2018 (\%)}\right) = \text{Output 2018 (\$)}$$

Exhibit 3: Calculations to derive 2018 output

Countries and sectors of the employment and output data have been matched using the greatest common denominator.[8,9] The mapping list between the SAM sectors of GTAP and the ISIC rev. 4 sectors of ILOSTAT is included in Appendix 2. After the mapping, employment per sector and country/region has been divided by the output per sector and country/region.

Employment intensities are updated on an annual basis to capture changes in labour productivity over time. They are likely to be one year behind as data of the previous fiscal year only becomes available in the course of the next year.

### Formal/informal sector employment intensities

$$\frac{\text{Formal employment}}{\text{Formal output}} \;\Big|\; \frac{\text{Informal employment}}{\text{Informal output}}$$

Employment intensities are assumed to differ for the formal and the informal sectors of developing country economies since workers in the formal sector are assumed to be more productive than in the informal sector. This becomes clear when data on the size of informal sector contribution to GDP is compared with informal sector share of employment. In all regions, the formal sector contributes more to GDP than the informal sector, while it employs less people. As the clients' suppliers are not expected to only have formal employees, the JIM provides a formal/informal jobs breakdown for supply chain and induced employment.

[7] https://ilostat.ilo.org/

[8] Regional employment intensities are based on individual country data of countries in the particular region. Data needs to be available for both datapoints for the countries to be included.

[9] Only for Madagascar it was not possible to develop employment intensities for 14 sectors due to data issues. For this country, the employment intensities are aggregated to the 4 ISIC sectors.

The formal/informal sector employment intensities per continent have been compiled as follows:

1. First, the share of informal sector GDP and employment has been identified for 6 regions, based on the following data sources:

    - *Share of informal sector GDP*: the share of GDP contributed by the informal economy.[10] The data has been obtained from the regional economic outlook for Sub-Saharan Africa, published by the IMF (2017), which has unweighted estimates available for 6 regions worldwide. The base year of the data is 2010-2014;

    - *Share of informal sector employment*: the share of working age people employed in the informal economy[11]. The data have been obtained from ILOSTAT, which has estimates available for 69 countries, with varying base years. Countries were mapped to the regions used in the IMF paper, and an unweighted average was derived for the same 6 regions worldwide, using the base year closest to 2014.

Table 2: Size of informal sector per region

| Region | Informal GDP (% of total GDP) | Informal employment (% of total employment) |
|---|---|---|
| Sub-Saharan Africa | 38% | 83% |
| Latin America & Caribbean | 40% | 62% |
| South Asia | 34% | 78% |
| Europe | 23% | 38% |
| Middle East & North Africa | 22% | 63% |
| East Asia | 22% | 69% |

2. Second, the total formal/informal employment and output per continent has been determined by multiplying total employment and output in the continent by the estimated informal sector shares of their corresponding region. For a mapping of the continents to the regions for which informal sector shares are available, please see Appendix 4.

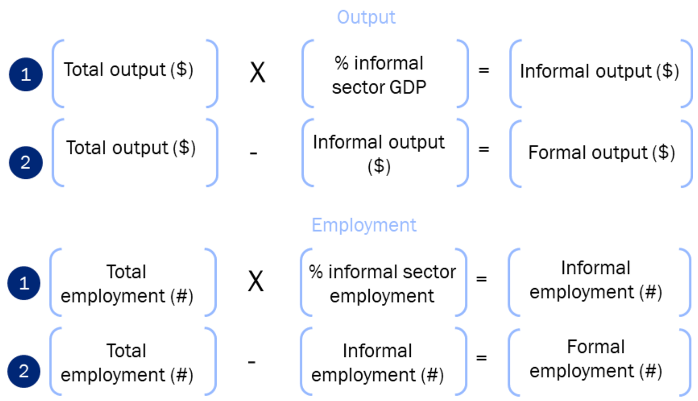



Exhibit 4: Quantification of total informal and formal employment and output

[10] In the IMF report, the informal economy was defined as including (1) household enterprises that have some production at market value but are not registered; and (2) more broadly, underground production, where productive activities are performed by registered firms but may be concealed from the authorities to avoid compliance with regulations or the payment of taxes, or are simply illegal. See IMF. (2017). Retrieved online 20 February 2020 from https://www.imf.org/en/Publications/REO/SSA/Issues/2017/05/03/sreo0517)

[11] ILO defines the informal economy as including own-account workers outside the formal sector, contributing family workers, employers and members of producers' cooperatives in the informal sector, and employees without formal contracts. Retrieved online 13 March 2020 from ILO webpage https://ilostat.ilo.org/topics/informality/)

3. Third, the formal/informal employment and output had to be distributed over the SAM sectors to be able to derive formal/informal sector employment intensities per sector. Based on the sector assumptions in Table 3, the 'clear' formal/informal employment and output per sector could be estimated.

Table 3: Assumptions on formal sector

| ISIC sector | GTAP Sectors | Assumption[12] | Formal sector data |
|---|---|---|---|
| Agriculture; forestry and fishing | 1-14 | Only informal sector | Clear (none) |
| Mining and quarrying | 15-18 | Mix formal & informal sector | Unclear |
| Manufacturing | 19-45 | Mix formal & informal sector | Unclear |
| Utilities | 46- 48 | Only formal sector | |
| Construction | 49 | Mix formal & informal sector | Unclear |
| Wholesale and retail trade; repair of motor vehicles and motorcycles | 50 | Mix formal & informal sector | Unclear |
| Transport; storage and communication | 52-56 | Mix formal & informal sector | Unclear |
| Accommodation and food service activities | 51 | Mix formal & informal sector | Unclear |
| Financial and insurance activities | 57 58 | Only formal sector | Clear (all) |
| Real estate | 59 | Only formal sector | Clear (all) |
| Business and administrative activities | 60 | Mix formal & informal sector | Unclear |
| Public administration and defence; compulsory social security | 62 | Only formal sector | Clear (all) |
| Education | 63 | Mix formal & informal sector | Unclear |
| Human health and social work activities | 64 | Mix formal & informal sector | Unclear |
| Other services | 61 | Mix formal & informal sector | Unclear |

For SAM sectors 1-14 all employment and output has been allocated to the informal sector ('clear' informal sector employment and output). For SAM sectors 46-48, 57-59 and 62, all employment and output has been allocated to the formal sector ('clear' formal sector employment and output)[13]. The remaining sectors are assumed to be a mix of formal and informal sector, for which the exact numbers are unclear.

4. Subsequently, to determine the formal/informal employment and output, in the 'unclear' sectors, the 'clear' formal/informal sector employment and output have been deducted from the totals. Subsequently, the share of 'unclear' formal output in the total 'unclear' output was applied to the total output of the remaining sectors (15-45, 49-56, 60-61 and 63-64) to derive the formal output in these sectors. The same was done for employment. Hence each of the four variables (i.e. total formal employment, total informal employment, total formal GDP and total informal GDP) are conserved.

[12] ILO estimates the informal employment in agriculture to be at least 90%; Retrieved 1 March 2020, www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_627189/lang--en/index.htm. Assumptions for other sectors are based on the informal sector data from the Kenyan statistical office report titled "Economic Survey 2014 – Kenya", which shows that persons engaged in informal sector activity are in manufacturing, construction, wholesale and retail trade, hotels and restaurants, transport and communications, community, social and personal services.

[13] Assumptions based on the fact that agriculture, forestry and fishing in many developing countries are characterized by high degrees of informality, while the utilities, business services, and public services sectors are highly unlikely to have informal employment given the nature of the work.

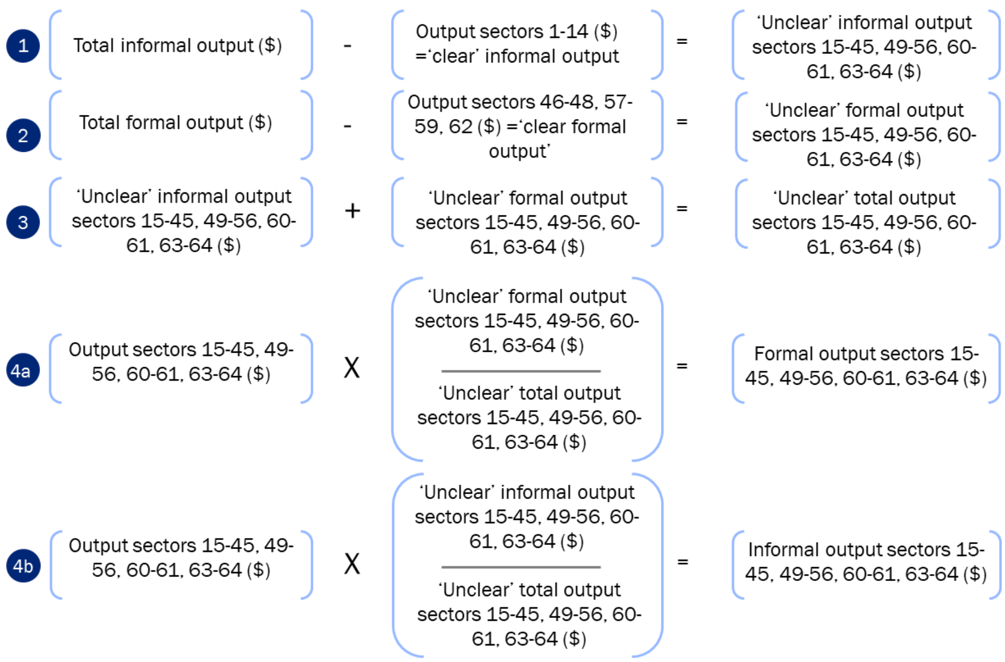
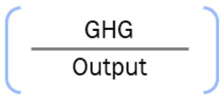



Exhibit 5: Quantification of formal and informal output for 'unclear' sectors

5. Finally, formal/informal employment were respectively divided by the formal output and the informal output per sector to derive the formal and informal sector employment intensities.

**GHG intensities**




GHG intensities reflect the metric tonnes of $CO_2$ and non-$CO_2$ emissions per unit of output in a certain country and sector.

The JIM uses GHG intensities for 65 sectors, 75 individual countries and 17 regions, with 2014 as base year. The GHG intensities have been derived by combining:

- *$CO_2$ and non-$CO_2$ emission data*: the $CO_2$ emitted in the combustion of fossil fuels and methane ($CH_4$), nitrous oxide ($N_2O$) and fluorinated gases (F-gases), expressed in $CO_2$-eq. The data has been obtained from GTAP for 75 countries and 65 sectors, and has 2014 as a base year.[14]
- *Output data*: the value of goods and services produced in a given period by a sector. The data has been obtained from GTAP for 75 countries and 65 sectors and has 2014 as a base year.

As the countries and sectors of the output data are the same as for the $CO_2$ and non-$CO_2$ emission data, no mapping was needed to derive the GHG intensities. GHG emissions per sector and country/region were divided by the output per sector and country/region. GHG intensities are updated every 2-4 years when new GTAP data is released.

## 2.2.2 Client financials

The model uses a parsimonious approach. There are only a few 'required inputs' for the model to be able to run. However, more data can be provided to refine the calculations ('optional inputs').

[14] Non-$CO_2$ emissions are converted to $CO_2$-eq based on their global warming potential (GWP). The GWP numbers used by GTAP are from the UNFCCC.

**Required inputs**

For clients and projects that are operational, the minimum financial data input required is 'sales', whereas for projects that are temporary and/or in construction phase, the minimum data input is 'project value':

- *Sales*: gross value of sales over the reporting period;
- *Project value*: the cumulative value of all project costs in the reporting period.

In addition to these financial inputs, the JIM requires some general client information (e.g. country of operations, economic activity). A full list of client financial data inputs per client type can be found in Section 3.3 of the User Guide.

**Optional inputs**

Optional inputs improve the model calculations and should always be used when available. These include:

- *Payments to supplier organisations and individuals: local* ('local procurement')*:* value of payments made to local enterprises and individuals that sold goods or services to the organisation during the reporting period;
- *Payments to supplier organisations and individuals: total* ('total procurement')*:* value of payments made to enterprises and individuals that sold goods or services to the organisation during the reporting period;
- *Permanent employee wages: total* ('direct wages'): the value of wages (including bonuses, excluding benefits) paid to all full-time and part-time employees of the organisation during the reporting period;
- *Greenhouse gas emissions: indirect - scope 2* ('scope 2 GHG')*:* Amount of greenhouse gases emitted by the organisation's direct electricity supplier;
- *Economic activity - breakdown #:* specific economic activities and the percentage of the total project value spent on them;
- *Sales (/project value) % - breakdown #:* the percentage of sales or project value spent on the specific economic activities.

A full list of optional data inputs per client type can be found in Appendix 2 of the User Guide.

## 2.3 Calculations

### 2.3.1 Data filling

Data filling consists of three steps:

**Mapping of client financials to model sectors and countries**

The client financials are mapped to the countries and sectors for which SAMs are available in the following way:

- *Country/region mapping*: the country/region names of the client financials are mapped to SAM countries/regions. For most countries, individual country SAMs are available. If this is not the case, sub-regional statistics will be applied. For example, for the Democratic Republic of Congo individual country statistics are not available, and the country is therefore mapped to the SAM of the region 'Middle Africa'. For a list of all countries and regions for which SAMs are available see Appendix 1;
- *Economic activity mapping*: the client's economic activity is mapped to corresponding SAM sectors, according to a mapping list between NACE (level 1-4) sectors and GTAP sectors (see Appendix 2 for a mapping of NACE 1 to GTAP).

If one NACE sector maps to several SAM sectors, the financial data will be distributed across SAM sub-sectors using the proportions of the corresponding sectors in the SAM. Exhibit 6 provides an example of how sales is distributed when the client's economic activity maps to two GTAP sub-sectors.

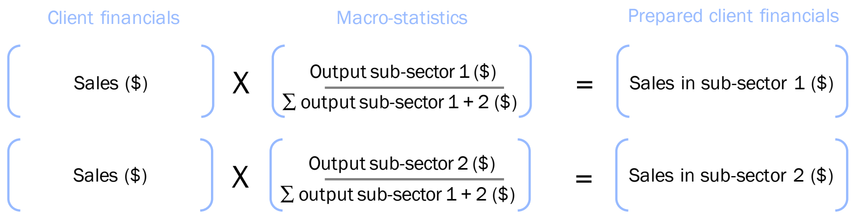



Exhibit 6: Example of how sales client data is divided over 2 SAM sectors

If multiple economic activities are inputted for a single client using the 'Customised breakdown' feature (see Section 3.1.5 of the User Guide), a similar mapping is carried out for each economic activity inserted.

### Estimating the key model inputs

The JIM identifies the best-available client financial input data using a fixed data hierarchy, and subsequently applies SAM data to derive the key model inputs.

- *For the supply chain impact calculations*: the key model input is local procurement per sector, together with import procurement for import GHG emissions. This is derived by multiplying the relevant client financial input data by data from the client's sector in the SAM. Exhibit 7 summarises the data hierarchy for client financial data for quantification of the supply chain impact;

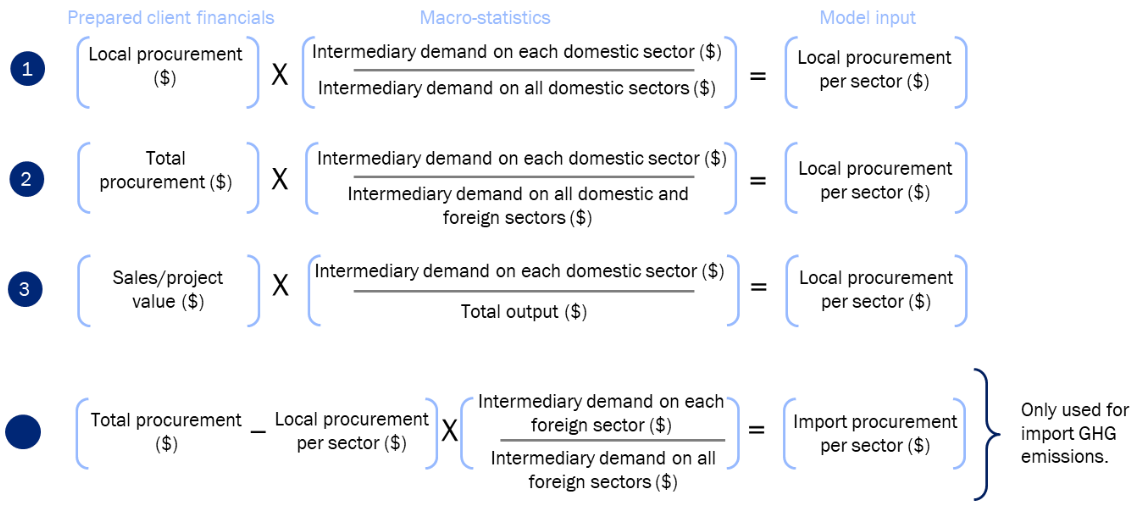



Exhibit 7: Data hierarchy for quantification supply chain impact

- *For construction projects* (which do not have sales revenues): the default model assumption is that the project value is spent on construction (e.g. of a power plant or road). Hence, the model estimates the local procurement expenditures based on project value and the construction sector of the SAM.
- *For the induced impact calculations*: the model uses an additional input: 'direct wages'. If direct wages have been reported, payroll taxes are deducted as these are not spent by households on

consumption. The JIM assumes an average payroll tax (31.41%) for all sectors and regions.[15] When wages are not reported by clients, they can be estimated based on the client's total sales or project value. The proportion spent on wages is then derived from the client's sector in the SAM. Exhibit 8 summarises the data hierarchy for client financial data to quantify the induced impact.

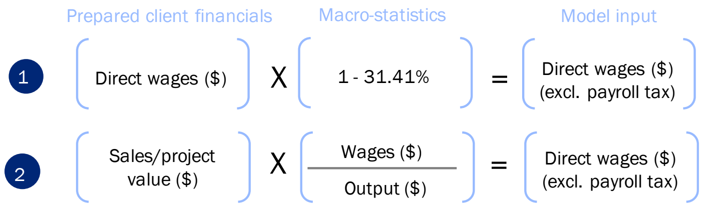



Exhibit 8: Data hierarchy for quantification induced impact

After data has been mapped to the SAM countries and sectors and data has been filled, the model can read the input data, and the supply chain and induced impacts can be quantified.

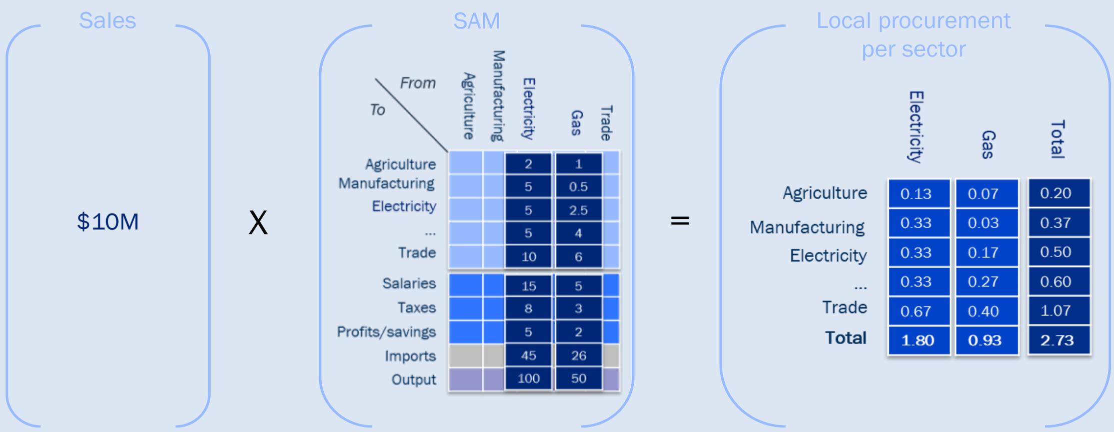
**EXAMPLE ELECTRICITY COMPANY IN NIGERIA**

The following client financials are provided:

- *Sector:* electricity, gas, steam and air conditioning supply
- *Country:* Nigeria
- *Sales:* $10M

To derive the appropriate model input, the model follows two steps:

1. *Mapping of sales data to relevant SAM sectors:* 'electricity, gas, steam and air conditioning supply' maps to two GTAP sectors: 'electricity' and 'gas'. Using the relative size of these sectors in the Nigerian SAM, the sales is divided over these two sectors. The electricity sector represents two third (100/150) and the gas sector one third (50/150). So, of the $10M, $6.7M is allocated to electricity ($10M*(100/150)) and $3.3M to gas ($10M*(50/150));
2. *Estimation of local procurement per sector:* In the SAM the column shows how a typical company in a particular sector spends its money on other domestic sectors, on imports, and on salaries, taxes and profits. Local procurement is estimated using the relative domestic spending pattern of 'electricity' and 'gas' of the Nigerian SAM. For example, that means that to determine procurement from the local agricultural sector, $6.7M is multiplied by (2/100) and $3.3M by (1/50). The sum reflects the total local agriculture sourcing ($0.2M);




3. *Estimation of import procurement per sector:* Import procurement, which is exclusively used to estimate import GHG emissions, is estimated by deducting total local procurement from total procurement spending and then by looking at the relative import spending pattern of those sectors.

[15] This is based on 2018 global average data available from KPMG's individual income tax rates table: https://home.kpmg/xx/en/home/services/tax/tax-tools-and-resources/tax-rates-online/individual-income-tax-rates-table.html

**Scope 2 GHG emissions**

If scope 2 GHG emissions are provided, the input is split between $CO_2$ and non-$CO_2$ using the client's country relative GHG emissions pattern for sector 46 (electricity).

If the data is not provided, it will be estimated by the model (Exhibit 14, Section 2.3.2).

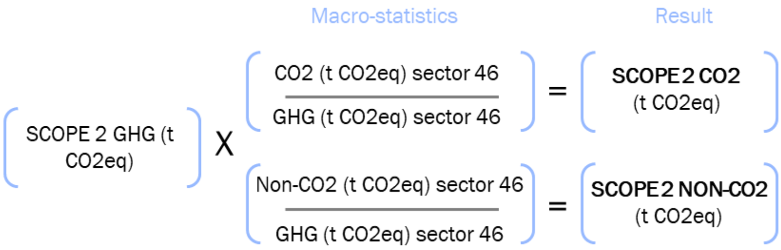



Exhibit 9: Quantification of scope 2 GHG impact

## 2.3.2 Matrix multiplications

**Supply chain impact**

The local procurement expenditures per sector of a client are routed through the SAM using a Leontief matrix calculation in order to derive the total domestic supply chain output and value added generated in other economic sectors (step 1 Exhibit 10). Subsequently, this output can be linked to employment and GHG ($CO_2$ and non-$CO_2$) intensities for each sector to quantify the supply chain employment and GHG emissions (step 2 Exhibit 10).

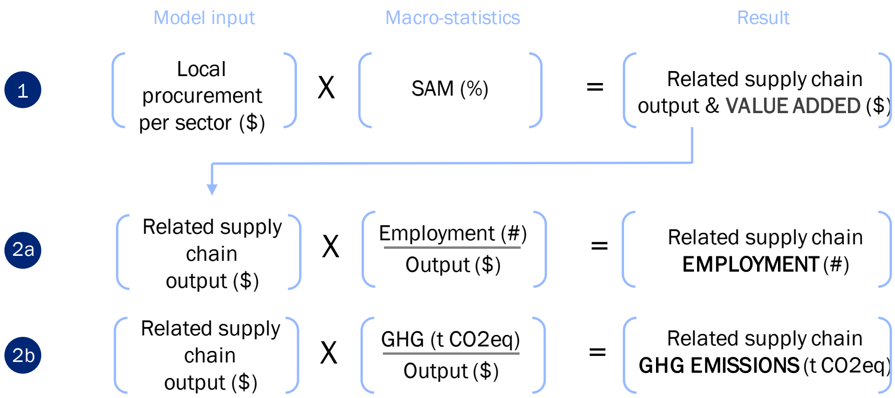



Exhibit 10: Supply chain impact calculations

Similarly, import GHG emissions are derived from import procurement per sector. It is run through the World SAM using a Leontief matrix calculation to estimate the total foreign supply chain output. Ultimately, the output is linked to World GHG intensities per sector to quantify the import supply chain GHG (Exhibit 11).

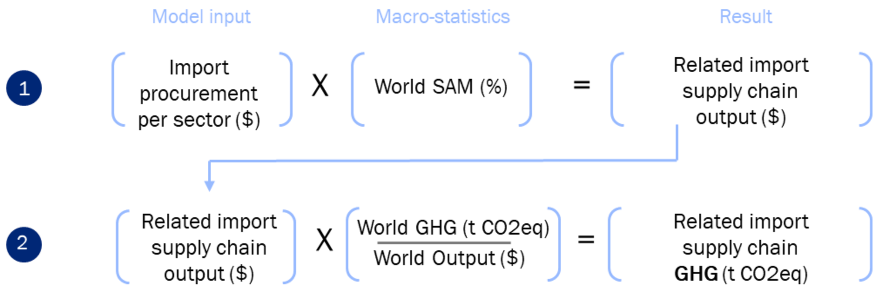



Exhibit 11: Import supply chain impact calculation

The supply chain impacts can be further broken down into sub-categories:

- The related value added impact is the sum of salaries, taxes, and savings. The split between these three sub-categories is directly derived from the SAM.
- The related employment impact can be broken down by gender, age category and formal/informal work (see Exhibit 12).
    - Female jobs are calculated by multiplying the related supply chain employment per country and sector by the share of employed women in the particular country and sector;
    - To quantify jobs for youth, the model uses percentages reflecting jobs for people below 25 years old out of the total jobs in the country. As the shares are only available at country level, the youth employment is only provided as a percentage;
    - Finally, to estimate formal/informal jobs breakdown, supply chain employment per country and sector is multiplied by the share of employment types (formal versus informal) in the specific country and sector.

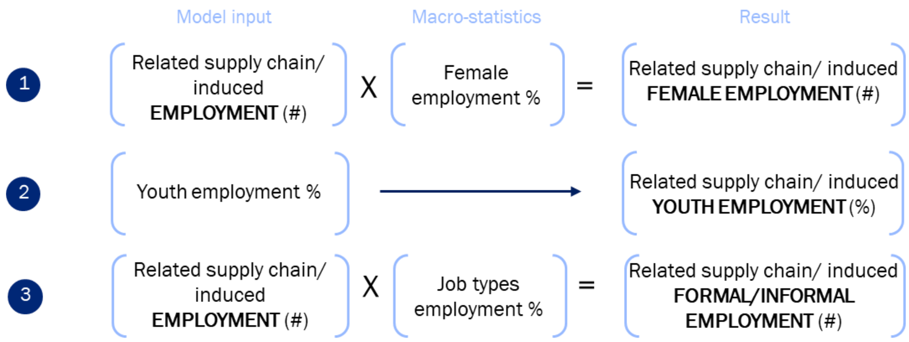



Exhibit 12: Calculations of employment sub-categories

- The related GHG emissions can be split between $CO_2$ and non-$CO_2$ emissions (Exhibit 13) using the JIM's $CO_2$ and non-$CO_2$ intensities. This is applicable for both local and import GHG emissions.

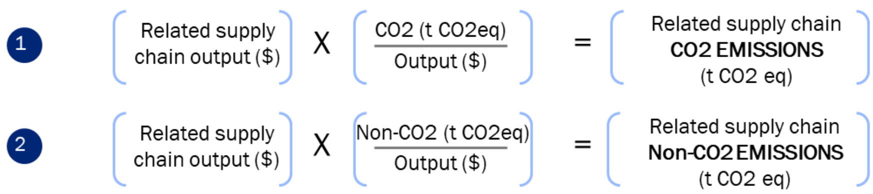



Exhibit 13: Calculations of GHG emissions sub-categories

Furthermore, Scope 2 emissions (related to direct sourcing of electricity) are reported separately from Scope 3 supply chain and induced emissions (Exhibit 14).

If the client is a renewable power plant, the JIM assumes scope 2 GHG emissions are zero (0).

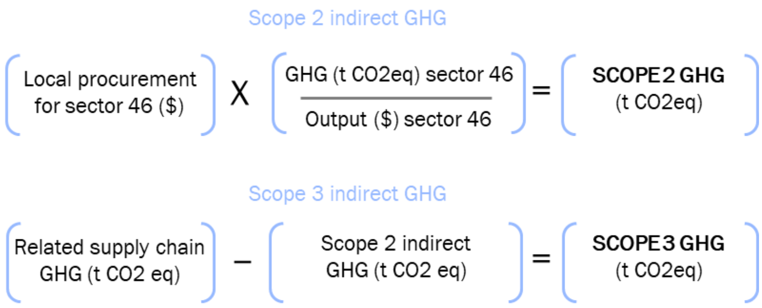



Exhibit 14: Calculations of GHG emissions scopes

### Induced impact

To quantify the induced impacts, first, the indirect wages are quantified by routing the local procurement expenditures per sector of a client through the SAM using a Leontief matrix calculation (step 1 Exhibit 15). Second, the direct and indirect wages (excluding payroll tax) together are inputted to the SAM using a Leontief matrix calculation in order to derive the induced output generated in other economic sectors (step 2 Exhibit 15). And third, this output is linked to employment and GHG intensities ($CO_2$ and non-$CO_2$) for each sector to quantify the induced employment and GHG emissions (step 3 Exhibit 15).

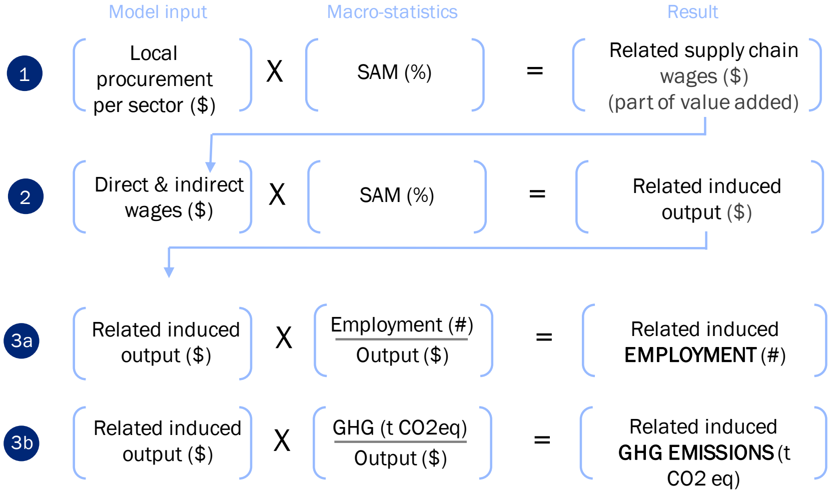



Exhibit 15: Induced impact calculations

The induced value added is not quantified to avoid double counting salaries both as an input (to quantify the induced impact) and as a result (part of the direct value added impact).

Similar to the supply chain related impacts, the induced employment can be broken down per gender, age group and job types (Exhibit 12), and GHG emissions impacts can be split into $CO_2$ and non-$CO_2$ emissions (Exhibit 13).

## 2.4 Outputs

The employment, value added and GHG results quantified are:

- *Gross impacts*: the model does not consider that (part of) these impacts may be offset by a fall in gross employment in less successful firms;
- *Local (i.e. domestic) impacts*: the model only quantifies the impacts that occur in the country of operations of the client; impacts from imports are only captured by the model for GHG emissions;
- *Not time bound:* these impacts might not all occur in the year of the operations modelled, but take place over all time required to generate the purchased goods and services;
- *Reoccurring impacts for operational clients and permanent projects:* impacts are likely to recur every year for clients and projects that are operational, assuming they do not end operations or significantly change their spending pattern;
- *Temporary impacts for construction projects and other temporary projects:* impacts of these projects only last for a limited number of years due to the intrinsic short-term nature of these projects.

Impacts can be quantified for the same client for multiple years using the client's annual local procurement expenses. The difference in impact between the two years reflects the change in gross impacts of a client. If year-specific employment intensities are available for both years, changes in labour productivity over time will be reflected in the results. Results over time should however not be aggregated. For example, the gross jobs quantified for a company in year one are the same jobs as the gross jobs quantified for that company in year two.

## 2.5 Assumptions and limitations

IO modelling has several advantages. First, it captures direct and indirect effects in an industry-specific manner, which means the scope covers an entire economy. Second, it requires little data on the studied intervention. This makes it particularly useful in regions where data is scarce or unavailable. For regions with limited data availability, such as many developing countries, IO tables are typically the best data that is available.[16] Lastly, the number of interventions that can be included scales up easily. However, IO modelling also has clear limitations as it depends on simplistic assumptions:

- *No supply and capacity constraints:* the model assumes additional output is generated regardless of the availability of resources (e.g. labour, raw materials, production capacity), which may be tied up in other activities;
- *Fixed production structures:* IO modelling assumes production structures are "frozen" in time. This implies no change in returns to scale and a fixed production structure with no substitution of inputs.[17] However, business growth is likely to impact the inter-relationships between sectors within an economy (for example, through competitive changes and displacement). Because of this, results describe average, not marginal, effects;[18]
- *Fixed prices*: price changes in the local economy, which could result from policy or crowding out effects, are not considered. Thus, prices do not constrain input availability. The model is therefore most accurate for projecting the impact of relatively small and short-term changes in demand;

[16] See West, G. R. (1995). Comparison of input-output, econometric and computable general equilibrium impact models at the regional level. *Economic Systems Research, 7:* 209-227.

[17] Fiona Tregenna. (2018). Review of CDC's Jobs Methodology, retrieved 17 March 2020 online from: https://assets.cdcgroup.com/wp-content/uploads/2019/08/08140530/Measuring-the-indirect-Impact-of-Business-Growth-20190801_01.pdf

[18] For example, increased demand for a product is assumed to imply an equal increase in production for that product. In reality, however, it may be more efficient to increase imports or divert some exports to local consumption rather than increasing local production by the full amount.

- *Sector averages:* IO modelling assumes that all companies in a certain sector have the same production structure. In reality, each business has a unique way of procuring its goods and services, and businesses backed by DFIs are likely to be atypical of their sectors (they may be more capital intensive, for example);
- *Overstated employment intensities*: imported intermediates are not separated out, which means that the backward linkages and thus the employment multipliers are not confined to the domestic economy, and may be overstated (with this being uneven across sectors depending on how much of a sector's intermediate inputs are imported);[19]
- *No diversification of spending patterns*: the model assumes that all households have the same spending pattern. However, consumption patterns of low-income households are likely to deviate from those of households with a higher income level.

Due to these assumptions the method risks some over overestimation.[20,21] On the other hand, other firm-level development impacts (e.g. from tax contributions, product innovations, foreign exchange savings from exports, knowledge spill overs, imports) are not accounted for, even though they likely create further impacts.

Computable General Equilibrium (CGE) modelling is theoretically more sound than IO modelling as it relies on fewer assumptions allowing it to mitigate some of the drawbacks of IO modelling: it accounts for supply-side adjustments and it considers responses in investment, land supply, population and (commodity and factor) prices.[22] This makes CGE models, in principle, capable of capturing both positive gross multiplier and negative displacement effects from external influences.[23] As a result, CGE modelling is theoretically superior to IO modelling.

Nevertheless, there are disadvantages of using this approach. It is comparatively data intensive. To run the model, many price elasticities must be specified, which is challenging in contexts with low data availability. Moreover, CGE modelling requires intensive calibration of the model and its variables, because the number of variables in a CGE model tends to (far) outstrip the number of equations. This makes it a costly and time-consuming approach. Finally, the complexity of the interactions between variables makes interpreting, explaining and/or communicating results difficult.

Given these trade-offs, IO modelling is more appropriate for use in the JIM. CGE modelling could arguably be impracticable for investors backing multiple businesses in multiple (developing) countries. However, CGE models are available or under development in a range of developing countries, such as South Africa and India. We will explore the feasibility of implementing (elements of) CGE modelling in the future.

[19] Fiona Tregenna. (2018). Review of CDC's Jobs Methodology, retrieved 17 March 2020 online from: https://assets.cdcgroup.com/wp-content/uploads/2019/08/08140530/Measuring-the-indirect-Impact-of-Business-Growth-20190801_01.pdf

[20] See e.g. the discussion in Partridge, M. D. & Rickman, D. S. (2008). Computable General Equilibrium (CGE) Modelling for Regional Economic Development Analysis. *Regional Studies, (44)*10. 1311-1328.

[21] See e.g. the discussion in the Australian Bureau of Statistics, retrieved 27 July 2017 online from: http://www.abs.gov.au/ausstats/abs@.nsf/Previousproducts/5209.0.55.001Main%20Features4Final%20release%202006-07%20tables.

[22] Partridge, M. D. & Rickman, D. S. (2008). Computable General Equilibrium (CGE) Modelling for Regional Economic Development Analysis. *Regional Studies, (44)*10. 1311-1328.

[23] Idem.

# 3 DIRECT IMPACT

Insights into direct impacts of businesses can often be obtained from observable data. However, some indicators are easier to track than others. For example, GHG emissions are often not measured by clients. The JIM requires users to insert as much directly observable data as possible.

## 3.1 Methodology

Where possible, the direct impacts are taken directly from client data. Where client data is not available, the JIM combines client financial data with macro-economic statistics to make an estimate. Note that direct employment is not estimated in the current version of the model[24].

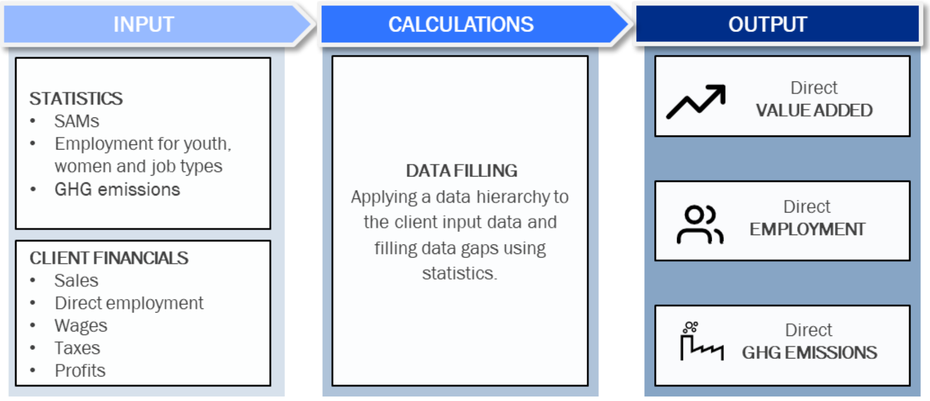



Exhibit 16: Overview methodology for direct impact

## 3.2 Inputs

The model's key inputs (i.e. statistics and client financials) need to be prepared in order to use them in the model calculations.

### 3.2.1 Statistics

The statistical inputs for estimating direct impacts are the same as for the supply chain and induced impact calculations: SAMs, and statistics on GHG emissions and employment.

### 3.2.2 Client financials

There are only a few 'required inputs' for the model to be able to quantify the direct impacts. However, the more observed data, the better.

**Required inputs**

The required inputs from clients or projects that are operational are:

- *Sales*: gross value of sales over the reporting period;
- *Direct employment – operations & maintenance* ('direct operations jobs'): number of full-time equivalent employees as per local definition working for the client company or project at the end of the reporting period. This includes directly hired individuals and individuals hired through third

[24] Estimation of direct employment will be implemented in the model as part of the 2021 improvements.

party agencies as long as those individuals provide on-site services related to the operations of the client company.

For projects that are temporary and/or in the construction phase, the following inputs are required:

- *Project value*: the cumulative value of all project costs during the reporting period;
- *Direct employment – construction* ('direct construction jobs')*:* number of full-time equivalent construction workers employed for the construction of the company or project's hard assets during the reporting period.

In addition to these financial inputs, the JIM requires some general client information (e.g. country of operations, economic activity). A full list of client financial data inputs per client type can be found in Section 3.3 of the User Guide.

**Optional inputs**

The following client inputs will improve insights into direct impacts:

- *Direct employment - operations & maintenance - third party hires* ('direct 3rd party operations jobs')*:* number of full-time equivalent employees as per local definition hired through third party agencies working for the client company or project at the end of the reporting period;
- *Direct employment - operations & maintenance - female* ('direct female operations jobs'): number of full-time equivalent female employees as per local definition working for the client company or project at the end of the reporting period. This includes directly hired individuals and individuals hired through third party agencies as long as those individuals provide on-site services related to the operations of the client company;
- *Direct employment - operations & maintenance - third party hires - female* ('direct female 3rd party operations jobs')*:* number of full-time equivalent female employees as per local definition hired through third party agencies working for the client company or project at the end of the reporting period;
- *Direct employment - construction - female* ('direct female construction jobs')*:* number of full-time equivalent female construction workers employed for the construction of the company or project's hard assets during the reporting period;
- *Permanent employee wages: total* ('direct wages')*:* the value of wages (including bonuses, excluding benefits) paid to all full-time and part-time employees of the organisation during the reporting period;
- *Payments to government* ('direct taxes')*:* all transfers to the government made by client over the reporting period;
- *Net income* ('direct savings')*:* value of the organisation's net profit, calculated as total income minus total expenses, taxes, and cost of goods sold during the reporting period;
- *Power technology type:* category of energy technology used to generate power. This can include wind, solar, hydro, geothermal, natural gas, biomass or heavy fuel;
- *Greenhouse gas emissions: direct - scope 1* ('scope 1 GHG'): Amount of greenhouse gases emitted through the organisation's operations from direct emissions sources during the reporting period;
- *Economic activity - breakdown #:* specific economic activities and the percentage of the total project value spent on them;
- *Sales (/project value) % - breakdown #:* the percentage of sales or project value spent on the specific economic activities.

## 3.3 Calculations

### 3.3.1 Data filling

The first step is to map the client data to the SAM model countries and sectors as described in Section 2.3.1. Subsequently the model applies a data hierarchy to identify the best-available direct impact data for each client. The data hierarchy is the same for clients and projects in operations and construction phase.

**Value added**

For the value added categories (i.e. wages, taxes, savings), the best available input is observed data on the client's wages and tax payments and savings. If this data is provided, payroll taxes are deducted from the direct wages, and added to the direct taxes to get to the net wages for households and total direct tax payments for governments (and savings for companies) (see step 1 in Exhibit 17).

If no direct data on value added categories is provided, the JIM estimates these by multiplying the total sales of the client by the average proportion of sales spent on wages/taxes/savings derived from the client's sector in the SAM (step 2 in Exhibit 17). If one of the value added components (e.g. wages) is provided and the other components are not available, only the components that are not available are estimated (e.g. taxes and savings).

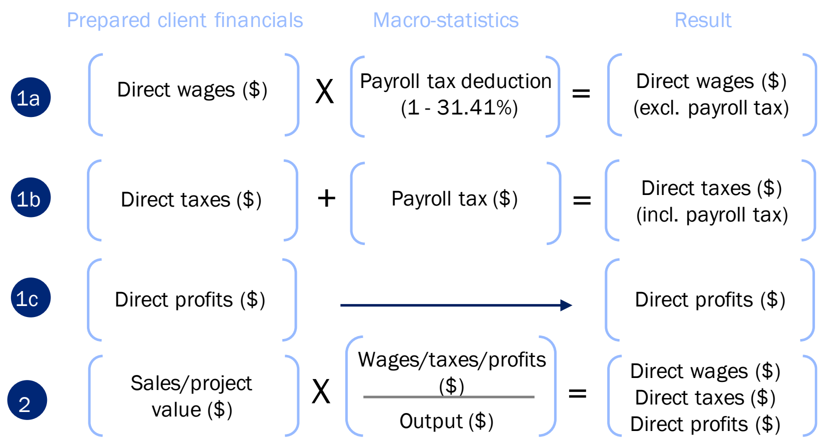



Exhibit 17: Data hierarchy for quantification direct value added impact

When direct value added data is estimated (step 2 in Exhibit 17), the JIM makes sure that the sum of the provided/estimated direct value added data and the total procurement balance out the provided sales.

If there is a gap, the model will adjust the estimated values to match the sales. This might lead to the estimation of negative values. To prevent odd results, two key assumptions are applied:

- If estimated total procurement is to become negative, it is set to 0 and further adjustments are made to any other estimated value;
- If estimated wages are to become negative, it is set to 0 and further adjustments are made to any other estimated value.

**Employment**

Total direct employment is always based on observed data and never estimated. If data is provided on direct employment for third party hires, this is deducted from the direct operations employment. Third party hires are already included in the estimations of supply chain jobs, and keeping them as part of the direct operations jobs would mean they are counted twice.

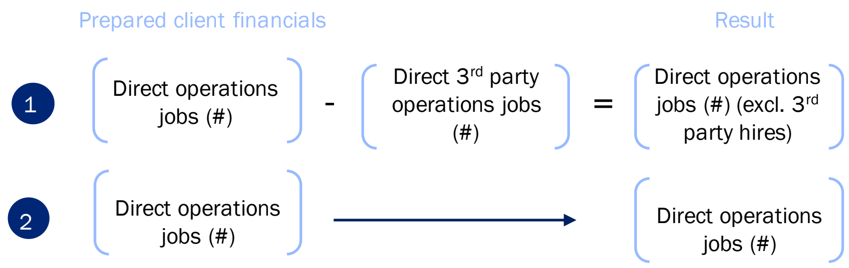



Exhibit 18: Data hierarchy for quantification direct employment impact

For female jobs, the model uses the same data hierarchy as for the total jobs. However, if observed data is not provided, female jobs are estimated using statistics. These estimates use total direct employment and statistics on the percentage of jobs for women in a particular sector and country.

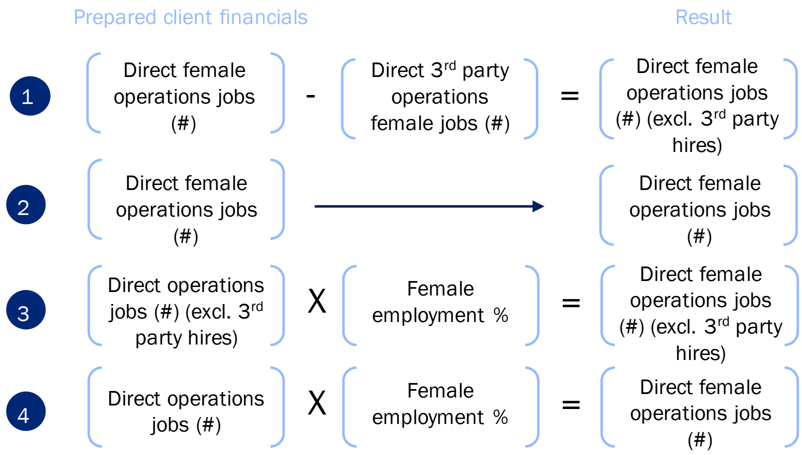



Exhibit 19: Data hierarchy for quantification direct female employment impact

Youth jobs are always estimated. These estimates use total direct employment and statistics on the percentage of jobs for youth in a particular country.

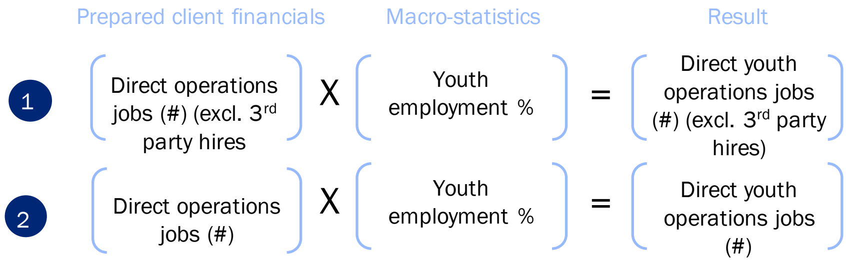



Exhibit 20: Data hierarchy client financials direct youth employment impact

**GHG emissions/sequestered**

If direct (scope 1) GHG emissions are provided, the input is split between CO2 and non-CO2 using the client's sector and country relative emissions pattern.

If data on direct GHG emissions is not provided, the (scope 1) GHG emissions are estimated by multiplying the client's sales by the GHG emission intensity of the client's sector and country.

If the client is a renewable power plant, the JIM assumes direct GHG emissions are zero (0).

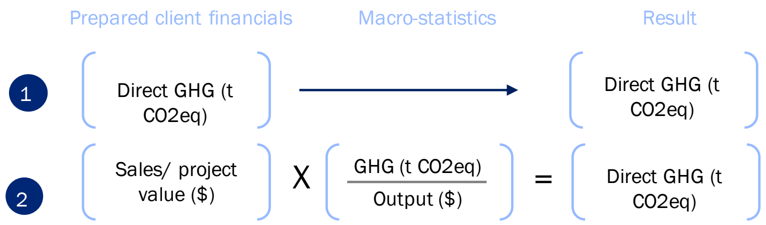



Exhibit 21: Data hierarchy client financials direct GHG emissions

GHG sequestered is never estimated by the JIM. If data is not available, no results are provided.

## 3.4 Output

Like for the supply chain and induced results, the direct impacts presented are gross, reoccurring local impacts (see Section 0). The difference in impact between two years reflects the change in gross impacts of a client.

## 3.5 Assumptions and limitations

Preferably, direct impacts are based on observed data only. Investors could use their direct relationship with clients to convince them to track and share these data points. This significantly increases the confidence level of results. Only when necessary, economic modelling (i.e. data filling) of direct impacts will be used.

A key limitation of modelling the direct impact of clients is that the model assumes all companies in a certain sector and country have the same production structure. In reality, each business has a unique way of producing its goods and services, and businesses backed by DFIs are likely unrepresentative of their sectors (they may be more capital intensive, for example).

It is recommended that investors increase the observed datapoints over time.

# 4 FINANCE ENABLING IMPACT

DFIs and other investors do not always invest directly into companies or projects, sometimes they invest indirectly through financial intermediaries. The financial intermediaries (FIs) they invest in use these investments to increase their company lending, thereby enabling companies (i.e. end-beneficiaries) to increase capacity/economic activity. However, insights into the enabled revenues of on-lending by FIs are often limited by lack of observable data. To overcome these issues, the JIM combines data on capital invested by FIs with economic modelling and statistics to provide insights into the enabled impacts at end-beneficiaries.

## 4.1 Methodology

The FI enabling methodology described here explains how the JIM determines the additional revenues (i.e. output) of companies receiving financing from FIs. Once the enabled revenues are determined, IO modelling can be applied to derive the enabled direct, supply chain and induced employment, value added and GHG emissions (as described in Section 2).

The approach combines capital outstanding, the amount invested by FIs into companies and/or projects in their portfolio, with a constant capital-to-output ratio of 1:0.35 for all sectors and countries. This ratio is a conservative estimate based on the available literature. It means that if a company receives USD1 million of capital, it is assumed the company is able to generate USD350 thousand in additional revenues. In this way, the amount of direct enabled output by companies receiving capital from FIs can be determined.

The capital-to-output ratio of 1:0.35 applies across all firm sizes. However, smaller firms (i.e. micro enterprises and SMEs) are expected to be more capital-scarce than bigger firms (i.e. large enterprises). Relieving this capital constraint by providing access to capital is therefore expected to have a bigger effect on smaller firms than on large enterprises. The JIM adjusts the capital-to-output ratio for firm size, based on ratios from a study from Bas et al (2010). [25]

By multiplying the FI's capital outstanding by the capital-to-output ratio (and the firm size adjustment) the direct enabled output of the FI's clients can be quantified. Subsequently, using the direct enabled output, the model quantifies the enabled direct, supply chain and induced employment, value added and GHG impacts from the FI financing.

The methodology to quantify all enabled impacts is similar to the methodology described in Section 2 and 3, except for the quantification of the enabled direct jobs. Enabled direct employment can be quantified by multiplying the enabled direct output by the employment intensity of the corresponding sector and country. However, the JIM employment intensities account for all employed persons, including people in informal employment, while it is assumed that companies that receive financing from FIs are likely to be formal sector firms in most sectors. As a consequence, applying the employment intensities without adjusting them for the higher productivity of the formal sector, will lead to an overestimation of the number of direct jobs supported by the enabled output. The JIM therefore applies a formal sector adjustment ratio to quantify the enabled direct jobs, distinguishing between SMEs and large enterprises.

[25] These adjustments are based on leverage estimates that include short- and long-term debt as well as equity share of capital. See Bas, T. Muradoglu, G & Phylaktis, K. (2010). Determinants of Capital Structure in Developing Countries. https://www.researchgate.net/publication/228465937_Determinants_of_Capital_Structure_in_Developing_Countries

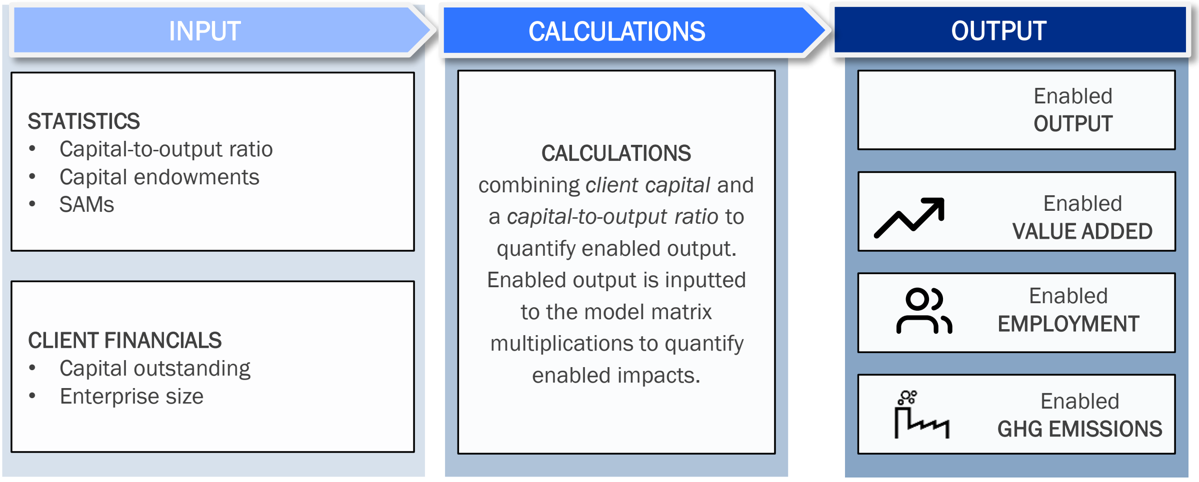



Exhibit 22: Overview methodology finance enabling impact

## 4.2 Inputs

### 4.2.1 Statistics

1:0.35

**Capital-to-output ratio**

The JIM works with a constant capital-to-output ratio of 1:0.35 for all sectors and countries. This ratio aligns with IFC's loans-to-output ratio, which is based on a study of 80 000 firms from the Orbis database (Zaman et al, 2020). The study is not yet published.

**Firm size adjustment capital-to-output ratio**

The capital-to-output ratio is adjusted for firm sizes (i.e. micro enterprises, SMEs and large enterprises). Please see Appendix 4 for definitions of micro enterprises and SMEs. The adjustments are based on a study from Bas et al (2010). Using WBES data, they argue that lack of access to finance may impede growth of small and medium enterprises (SMEs) in developing countries more compared to large corporate firms. The JIM uses the inverse of the average ratio of firms' total liabilities to their total assets by firm size of Bas et al (2010)'s findings, to account for the effect of firm size in translating a capital investment to firm output. [26] The adjustment values derived from the study are provided in Table 4. The numbers show that micro enterprises and SMEs produce 1.2 times more output with one unit of capital than the economy average, and corporates only 0.73.

Table 4: Firm size adjustments to capital-to-output ratios

| Firm size | Value |
|---|---|
| Micro enterprise & SME | 1.20 |
| Large enterprise | 0.73 |

**Social Accounting Matrices**

The JIM uses SAMs for 75 individual countries and 17 regions (for a full list see Appendix 1). The base year of the SAMs in JIM version 1.4 is 2014. For more information on the SAMs see Section 2.2.1.

[26] These adjustments are based on leverage estimates that include short- and long-term debt as well as equity share of capital. See Bas, T. Muradoglu, G & Phylaktis, K. (2010). Determinants of Capital Structure in Developing Countries. https://www.researchgate.net/publication/228465937_Determinants_of_Capital_Structure_in_Developing_Countries

### Capital endowment data

It is the firm's expenses on capital. It has been obtained from GTAP for 65 sectors and 75 countries and has 2014 as a base year.[27]

### Employment intensities

$$\left(\frac{\text{Employment}}{\text{Output}}\right)$$

The JIM uses employment intensities for 14 sectors, 75 individual countries and 17 regions. The base year of the employment intensities in JIM version 1.4 is 2018. For more information on the employment intensities see Section 2.2.1.

### Formal/informal sector employment intensities

$$\left(\frac{\text{Formal employment}}{\text{Formal output}}\right) \Big| \left(\frac{\text{Informal employment}}{\text{Informal output}}\right)$$

The JIM uses formal and informal employment intensities for 14 sectors, 75 individual countries and 17 regions. The base year of the formal employment intensities in JIM version 1.4 is 2018. For more information on the employment intensities see Section 2.2.1.

As the clients of financial intermediaries are likely formal sector clients, the JIM applies the formal sector employment intensities to these clients (instead of the average intensities) to quantify direct jobs. Only for micro enterprises, the JIM uses the average employment intensities to quantify direct jobs at their clients. As the clients' suppliers are not expected to only have formal employees, the JIM provides a formal/informal jobs breakdown for supply chain and induced employment.

### Firm size adjustment

The formal sector employment intensities applied to quantify the jobs supported at direct clients of financial intermediaries are adjusted for firm sizes if this information is known (i.e. SMEs and large enterprises). Please see Appendix 3 for a definition of SMEs. The adjustments are based on a study by IFC on SME access to financial services in the developing world, which discusses the role of SMEs in economic development.[28] The report highlights that 'studies indicate that formal SMEs contribute up to 45 percent of employment and up to 33 percent of GDP in developing economies'. That means SMEs require 1.36 times (45/33) the people to produce the output, and corporates need 0.82 times (55/67) the people to produce the output, see Table 5.

Table 5: Firm size adjustment

| Firm size | Value |
|---|---|
| Micro enterprise & SME | 1.36 |
| Large enterprise | 0.82 |

### GHG intensities

The JIM uses GHG intensities for 65 sectors, 75 individual countries and 17 regions. The base year of the employment intensities in JIM version 1.4 is 2014. For more information on the GHG intensities see Section 2.2.1.

[27] Value of purchases of capital demanded by all firms in a particular sector in a given region, at agent's prices. It is one of five available endowments that are factors of production (the others are land, skilled labour, unskilled labour and natural resources). It is calculated as the price of capital demanded times the quantity of capital demanded.

[28] IFC. (2010). "Scaling-Up SME Access to Financial Services in the Developing World". Financial Inclusion Experts Group with SME Finance Sub-Group for G20 Seoul Summit 2010. Pg 6. https://www.ifc.org/wps/wcm/connect/425e17b5-5213-4c4c-badc-433e8ff8a6cc/ScalingUp.pdf?MOD=AJPERES&CVID=jkCVsg

### 4.2.2 Client inputs

The FI enabling impacts are estimated when clients do not have data on the companies in FIs' portfolios benefitting from their loans. It is used when only the amounts of capital provided to these companies by FIs is available.

**Required inputs**

- *Capital outstanding – financial intermediary*: value of disbursed capital remaining on the finance provider's balance sheet at the end of the reporting period. If capital outstanding amounts are unavailable, clients can use capital committed amounts instead.

**Optional inputs**

- *Size of enterprise:* a categorical indication of the size of the enterprise to which capital is direct. Can be either micro-enterprise, SME, large enterprise, or miscellaneous (if size is unknown).

In addition to these financial inputs, the JIM requires some general client information (e.g. country of operations, economic activity).

A full list of client financial data inputs per client type can be found in Section 3.3 of the User Guide. Personal loans, insurance and mortgages should be excluded, as their impact on the real economy is unclear.

## 4.3 Calculations

### 4.3.1 Data filling

Before the finance enabling impacts can be calculated, client financials need to be mapped to the model sectors and countries. For the country mapping, please see Section 2.3.1. The client's economic activity is mapped to corresponding SAM sub-sectors according to a mapping list between NACE sectors and GTAP sectors (see Appendix 2 for a mapping of NACE 1 to GTAP). If the client's economic activity maps to several SAM sectors, the capital outstanding (or committed, depending on availability) will be distributed across SAM sub-sectors based using the proportion of the corresponding sectors in total capital endowments.

Client financials — Statistics — Prepared client financials

$$\text{Capital outstanding (\$)} \times \frac{\text{Capital endowments sub-sector 1 (\$)}}{\sum \text{capital endowments sub-sector 1 + 2 (\$)}} = \text{Capital outstanding in sub-sector 1 (\$)}$$

$$\text{Capital outstanding (\$)} \times \frac{\text{Capital endowments sub-sector 2 (\$)}}{\sum \text{capital endowments sub-sector 1 + 2 (\$)}} = \text{Capital outstanding in sub-sector 2 (\$)}$$

Exhibit 23: Example of how capital outstanding is divided over 2 SAM sectors

### 4.3.2 Quantification of enabled output

To quantify the direct output enabled by the FI financing, the distributed capital outstanding per sector is multiplied by the capital-to-output ratio (1:0.35), and the firm size adjustment (if the firm size is known). The enabled output reflects the expected increase of firm revenues due to the FI capital provided.

$$\underbrace{\left(\text{Capital outstanding per sector (\$)}\right)}_{\text{Client financials}} \times \underbrace{\left(0.35\right)}_{\text{Capital-to-output ratio}} \times \underbrace{\left(\text{Adjustment value (\%) } \textit{(if known)}\right)}_{\text{Client size adjustment}} = \left(\text{Enabled direct output (\$)}\right)$$

Exhibit 24: Calculating enabled output

## 4.3.3 Matrix multiplication

The enabled output of direct FI clients can be used to quantify the enabled direct impacts from the FI financing, as well as the enabled supply chain and induced impacts.

**Enabled direct impact**

The JIM estimates the enabled direct employment by multiplying the direct enabled output by the employment intensity of the appropriate sector and country (for miscellaneous, SME and corporate clients), the formal sector adjustment of the continent, and the firm size adjustment value (for SMEs and corporates). If the client is a micro enterprise, the average employment intensity is used.

$$\underbrace{\left(\text{Enabled direct output (\$)}\right)}_{\text{Model input}} \times \underbrace{\left(\frac{\text{Employment (\#)}}{\text{Output (\$)}}\right)}_{\text{Employment intensity}} \times \underbrace{\left(\frac{\text{Formal employment intensity continent (\#/\$)}}{\text{average employment intensity continent (\#/\$)}}\right)}_{\text{Formal sector adjustment}} \times \underbrace{\left(\text{Adjustment value (\%) } \textit{(if known and relevant)}\right)}_{\text{Firm size adjustment}} = \underbrace{\left(\text{Enabled direct employment (\#)}\right)}_{\text{Result}}$$

Exhibit 25: Calculations of enabled direct employment

The JIM estimates the enabled direct value added by multiplying the direct enabled output by the average proportion of output spent on wages/taxes/savings derived from the client's sector in the SAM (as explained in Section 3.3).

$$\underbrace{\left(\text{Enabled direct output (\$)}\right)}_{\text{Model input}} \times \underbrace{\left(\frac{\text{Wages/taxes/profits (\$)}}{\text{Output (\$)}}\right)}_{\text{SAM}} = \underbrace{\left(\begin{array}{c}\text{Enabled direct wages (\$)}\\ \text{Enabled direct taxes (\$)}\\ \text{Enabled direct profits (\$)}\end{array}\right)}_{\text{Result}}$$

Exhibit 26: Calculations of enabled direct value added

The JIM estimates the enabled direct GHG emissions by multiplying the direct enabled output by the GHG intensity of the appropriate sector and country.

$$\underbrace{\left(\text{Enabled direct output (\$)}\right)}_{\text{Model input}} \times \underbrace{\left(\frac{\text{GHG (t CO2eq)}}{\text{Output (\$)}}\right)}_{\text{GHG intensity}} = \underbrace{\left(\text{Enabled direct GHG (t CO2 eq)}\right)}_{\text{Result}}$$

Exhibit 27: Calculations of enabled direct GHG emissions

**Enabled supply chain impact**

To quantify the supply chain impacts, the enabled direct output of an FI is routed through the SAM using a Leontief matrix calculation in order to derive the enabled supply chain output and value added generated in other economic sectors (step 1 Exhibit 28). Subsequently, this enabled output can be linked to employment and GHG ($CO_2$ and non-$CO_2$) intensities for each sector to quantify the enabled supply chain employment and GHG emissions (step 2 Exhibit 28).

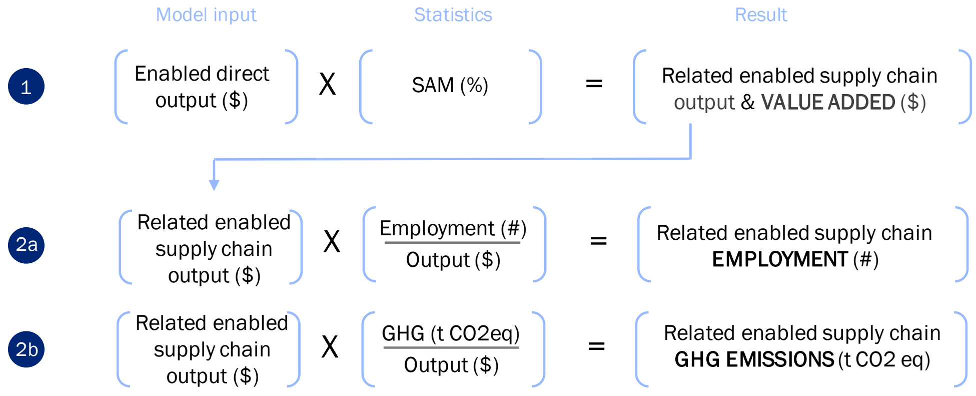



Exhibit 28: Enabled supply chain impact calculations

**Enabled induced impact**

To quantify the enabled induced impact, first, the indirect wages are quantified by routing the local procurement expenditures per sector of a client through the SAM using a Leontief matrix calculation (step 1 Exhibit 29). Second, the direct and indirect wages (excluding payroll tax) together are inputted to the SAM using a Leontief matrix calculation in order to derive the induced output generated in other economic sectors (step 2 Exhibit 29) Third, this output is linked to employment and GHG intensities ($CO_2$ and non-$CO_2$) for each sector to quantify the induced employment and GHG emissions (step 3 Exhibit 29).

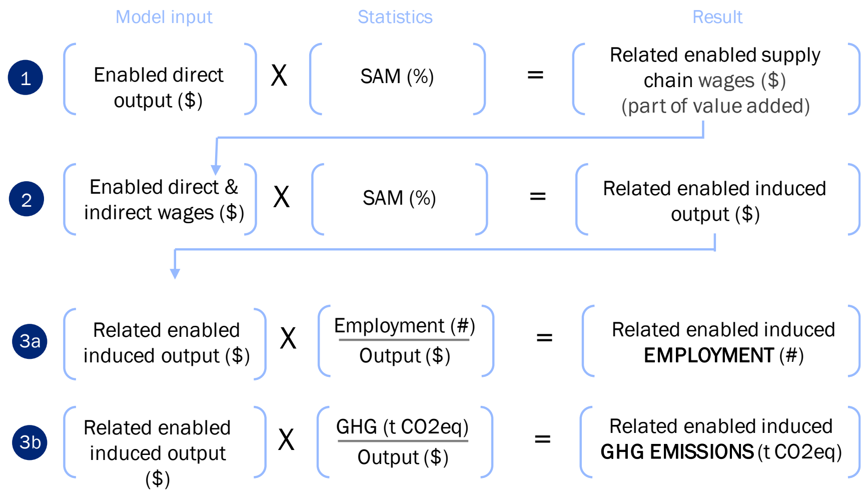



Exhibit 29: Enabled induced impact calculations

## 4.4 Outputs

Like for the direct, supply chain and induced employment, value added and GHG results, the direct impacts presented are gross, reoccurring local impacts over all time (see Section 2.4). The difference in impact between two years reflects the change in gross impacts of a client.

## 4.5 Assumptions and limitations

The limitations of IO modelling as discussed in Section 2 also apply to the FI enabling impacts. The FI enabling approach however uses additional assumptions, which further reduces the confidence level of results. Instead of using observed company data as input (which is the case for the direct, supply chain and induced impacts), the FI enabling impacts are based on modelled company data (using the constant capital-to-output ratio).

The current approach – using a constant capital-to-output ratio for all sectors and countries to calculate changes in firm output in response to an increase in capital – was used to align assumptions with other modelling efforts.

Further collaborations with new partners can improve upon the current approach. We could build upon work SRQ has done together with Standard Chartered Bank (by treating the loan book of FIs as a series of financial flows into specific sectors which the FI lends to[29,30]) and with CDC (analysis of the marginal productivity of capital using World Bank Enterprise Survey data[31]).

[29] The sectoral allocation of the loan portfolio is normally reported by FIs in their annual reports as part of their risk reporting. Bank loans to government, personal loans and mortgages are not routed through the model. Because of leverage, the employment from lending is expected to be quite significant.

[30] Kim, R. & Kapstein, E. (2014) "Banking on Africa: Standard Chartered's social and economic impact." Standard Chartered Plc.

[31] MacGillivray, A., Kim, R., van Moorsel, T. & Kehoe, A. (2017). "Measuring Total Employment Effects: a lean data methodology for a portfolio of investments in developing countries." CDC Group plc, Steward Redqueen (2019). "Modelling the Impacts of Bank Lending: estimating the marginal product of capital for firms by size and region using the World Bank Enterprise Surveys" (unpublished)

# 5 POWER ENABLING IMPACT

Electric power is widely recognised as a critical input to economic development: without it, countries are literally, and figuratively, in the dark. But in many developing countries, electric power supply is low. As a result, power outages are pervasive and stunt growth by forcing businesses to halt operations, or find ways to work without grid electricity, such as investing in back-up generators. By investing in power companies (or projects), investors raise the supply of power, reducing the burden of outages and enabling economic impact.

However, collecting data for estimating these economic impacts enabled by power provision is often difficult, especially if there are many power companies in an investment portfolio. Data may be unavailable all together as projects need time to construct before generating revenues, or they may not have data management systems to collect the data needed to evaluate the economic impacts of the power company.

To address this data availability issue, the JIM uses an economic modelling approach to measure the impact of (a portfolio of) such investments in power. This approach was developed through SRQ's work with several DFIs and is described below.

## 5.1 Methodology

Modelling the relationship between power supply (i.e. electricity) and economic activity is a chicken-and-egg situation since the linkages between growth and power are plausibly multi-directional – power provision can lead to growth, growth can lead to power provision, or there may be no relationship at all.

Since 2015, Steward Redqueen has conducted in-depth, rigorous impact studies on the link between power and economic growth in various developing countries. In total, 11 country studies have been conducted thus far with various DFIs, including in Turkey and the Philippines (for IFC), Uganda (CDC), India and Uruguay (Proparco), Honduras (Finnfund), and more.

In each of these studies, the link between power and growth is teased apart and simplified in order to model the impacts of investments in power. Power supply and demand curves are created to model the effect of an increase in supply on the *affordability* (weighted average generation price) and *reliability* (frequency and duration of power outages) of power in a country. When power becomes more reliable, i.e. the frequency and/or duration of power outages decreases, firms affected by periodic interruptions caused by outages are, generally speaking, able to operate for additional hours, thereby raising total output. This additional output – or company revenues - that is enabled by greater reliability of power is then used together with statistics to estimate the overall impacts of investments in power.

The JIM calculates power enabled impacts following this approach. The JIM combines two main factors to model the effects of power: the share of energy in a country contributed by the generation of the company/project invested in, and a fixed power-to-output translation factor of 0.02 for all countries and sectors. This is a straight average of the sector multipliers of four out of the 11 case studies (i.e. Uganda, Nigeria, Uruguay and Turkey). This selection of four case studies excludes outliers, and countries for which only high-level data was available. The power-to-output translation factor of 0.02 is in line with the ratios used in other models (e.g. IFC).

Combining the power-to-output translation factor with the share of power contributed in a country determines the percentage output increase supported. This is combined with SAM output data to estimate the total output enabled. Total output enabled is subsequently used to estimate value added, employment and GHG emissions impacts.

Power enabled output is neither a direct nor supply chain impact. It is a measure of the total output related to the amount of power produced by a given company/project. As such, these impacts are not labelled as 'direct' or 'supply chain' impacts in the JIM.

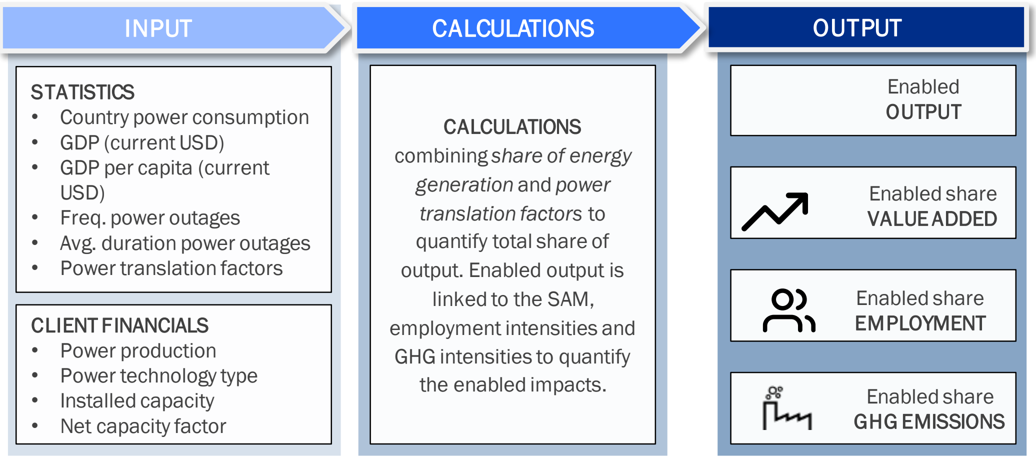



Exhibit 30: Power enabling methodology

## 5.2 Inputs

### 5.2.1 Statistics

**Power-to-output translation factor**

The power-to-output translation factor is a straight average of the sector multipliers of 4 case studies for which data has been verified with experts (i.e. Nigeria, Uganda, Uruguay and Turkey). This factor, of 1:0.02, is applied to all countries and sectors.

**Power consumption**

The JIM uses total electricity consumption (GWh) by country from the International Energy Agency (IEA) database. Electricity consumption data is available for 166 countries and regions for 2017.

To supplement the energy data from the IEA, the JIM uses data from the Energy Information Agency (EIA), a bureau within the US Government's Department of Energy that collects, analyses and disseminates energy information. The JIM uses electricity consumption data provided by the EIA for countries in which IEA data is unavailable, thereby improving coverage. Data is available for 2017 and for 230 countries and regions.

**Net capacity factors**

A net capacity factor is a measurement of the amount of actual electricity generated over a given period in time relative to the maximum amount of electricity generated over that same period. It is typically expressed as a percentage and varies for different types of power generation technologies.

$$\left(\text{Power production (MWh)}\right) / \left[\left(\text{Installed capacity (MW)}\right) \times \left(\text{Potential operations time (H)}\right)\right] = \left(\text{Net capacity factor (\%)}\right)$$

Exhibit 31: Calculation formula for net capacity factor

For renewable energy technologies, the JIM uses net capacity factors from the US EIA based on the 2018 average net capacity factors of utility scale plants in the United States[32]. Seven renewable energy net capacity factors are used in the JIM: biomass, geothermal, hydro, solar, wind, wood, and nuclear power.

For non-renewable energy technologies, including base-load power such as coal and natural gas, and peak load power such as petroleum fired technology, we assume net capacity factors. Since the scope of the JIM is focused on developing countries, using EIA net capacity factors, which are based on utility-scale power plants in the US, where data is more available and plants are more efficient, would underestimate the non-renewable generation. Base-load power net capacity factors, which apply to coal and natural gas, are assumed to operate at near full capacity (100%) since energy is scarce in many developing countries, meaning thermal power is heavily relied on. However, to account for losses and maintenance, among other factors, we assume base-load power capacity factors of 80%. The net capacity factor of peak load plants can be as low as 5%. However, in emerging markets the use of these plants is often more than what is intended: they are often required for base load power. We therefore assume a net capacity factor of 40%.

Table 6: Net capacity factors

| Non-fossil fuels | Net capacity factor |
|---|---|
| Geothermal | 76.0% |
| Hydro | 41.9% |
| Nuclear | 92.5% |
| Biomass | 61.6% |
| Solar[33] | 25.1% |
| Wind | 34.6% |
| Wood | 60.6% |
| Miscellaneous - renewables | n/a |

| Fossil fuels | Net capacity factor |
|---|---|
| *Base load* | |
| Coal | 80% |
| Natural gas | 80% |
| | |
| *Peak load* | |
| Petroleum | 40% |
| Miscellaneous - non-renewables | n/a |
| | |

### Social Accounting Matrices

To quantify the enabled output, the JIM uses output data from the SAMs available in GTAP. SAMs are available for 65 sectors and 75 individual countries. The base year of the SAMs in JIM version 1.4 is 2014. More information on GTAP is provided in Section 7. The SAMs are also used for the value added shares of output to measure the enabled impact on household wages, taxes and savings.

### Employment intensities

To quantify the enabled employment, the JIM uses employment intensities for 14 sectors and 75 individual countries. The base year of the employment intensities in JIM version 1.4 is 2018. The employment intensities have been derived by combining ILO and GTAP data; the same employment intensities used in each other parts of the model are applied here as well.

### GHG intensities

To GHG intensities reflect the metric tonnes of $CO_2$ and non-$CO_2$ emissions per unit of output in a certain country and sector. The same GHG intensities are used in the power enabling calculations as elsewhere in the JIM.

[32] EIA. Capacity Factors for Utility Scale Generators Primarily Using Non-Fossil Fuels. Retrieved 20 February, 2020 https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_b

[33] i.e. photovoltaic

### 5.2.2 Client inputs

JIM users only need to provide a few inputs to estimate power enabling impacts.

**Required inputs**

Either power production or installed capacity and the power technology type must be provided. If power production is not available, installed capacity and the technology type can be used to estimate power production based on modelling. If neither are available, power enabling impacts cannot be measured.

- *Power production (MWh)*: energy delivered to off taker(s) during the reporting period;
- *Installed capacity (MW)*: maximum output of electricity that a power plant can produce under ideal conditions, i.e. the intended full-load sustained output of a power plant;
- *Power technology type*: category of energy technology used to generate power. This can include wind, solar, hydro, geothermal, natural gas, biomass or heavy fuel. A full list is available in Appendix 2 of the User Guide.

  If users do not know the technology and include “Miscellaneous – Non-Renewable” or “Miscellaneous – Renewable” power enabling impact cannot be quantified. This category affects the direct GHG emission calculations, see Section 3.3.

**Optional inputs:**

- *Net capacity factor*: The ratio of the net electricity generated, for the time considered, to the energy that could have been generated at continuous full-power operation during the same period.

## 5.3 Calculations

### 5.3.1 Data filling

The model will identify the best-available client input data using a fixed data hierarchy, and uses modelling to fill data gaps. For the power enabling calculations, the required input is power production. If power production is unavailable for whatever reason, it can be filled if installed capacity, and power technology type are provided. To fill the data, installed capacity is multiplied by the net capacity factor for the technology type and the total potential operations time. Net capacity is either provided as an optional input, or based on the average for the power technology type. Potential operations time is the total number of hours a power company/plant could theoretically be in operation. It is assumed to be a fixed number calculated as total hours in a year, which is equal to 24 hours per day times 365 days a year.

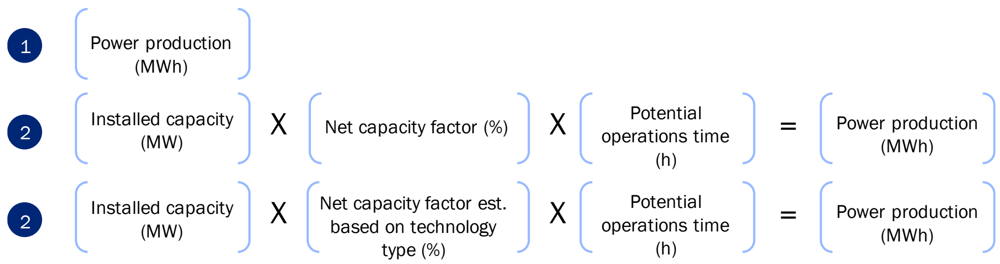



Exhibit 32: Data hierarchy and calculation for power production

### 5.3.2 Quantification of enabled output

To quantify the output enabled by the power production, the JIM follows the following steps:

1. *Calculation of effective power addition:* the effective power addition represents the change in power supported by the power company/project. It is calculated as the amount of power produced

by a given power company/project relative to the total amount of power consumption in a country. By comparing the project's total new power production to the power consumption in the country, the JIM assumes that all additional power produced by the plant is distributed locally, and no power is lost in distribution or transmission.

2. *Estimation of effective output shares per sector:* the effective power addition is multiplied by the power-to-output translation factor to determine the effective output shares per (aggregated) sector. The power-to-output translation factor is used to translate the relative increase in effective generation capacity into a relative change in economic output.
3. *Quantification of total enabled output:* the effective output shares per (aggregated) sector are multiplied by the total output in the country per detailed sector to estimate total enabled output. Total output is based on GTAP data, which has a base year of 2014 and in millions. This data is projected forward to estimate total output in 2018 using GDP growth rates from the World Bank Development Indicators database.

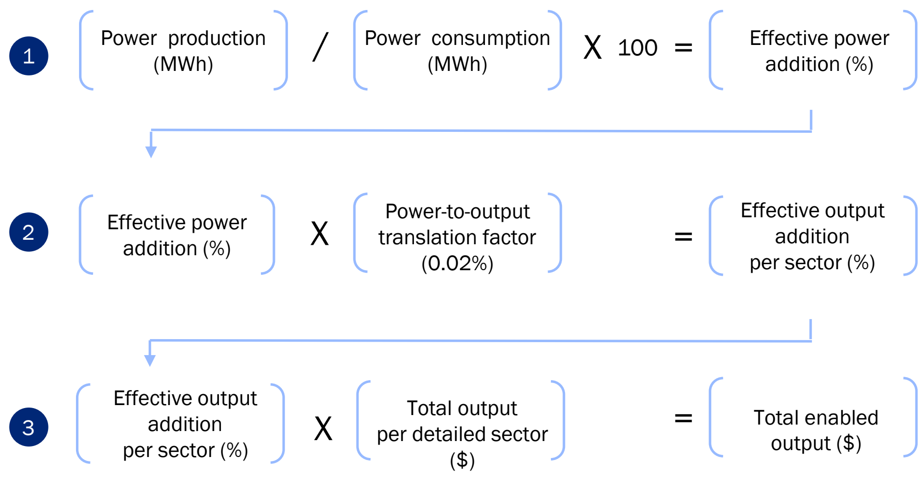



Exhibit 33: Total enabled output calculation

### 5.3.3 Quantification of enabled impact

The total enabled output can be used to quantify the enabled employment, value added and GHG impacts from the power plant, following the methods employed in other JIM modules. The enabled output is multiplied by the value added categories of the SAM to derive the enabled value added, by the employment intensities to derive the enabled employment, and by the GHG intensities to derive the enabled GHG emissions. Note that impacts in the electricity sector itself are excluded to avoid double counting.

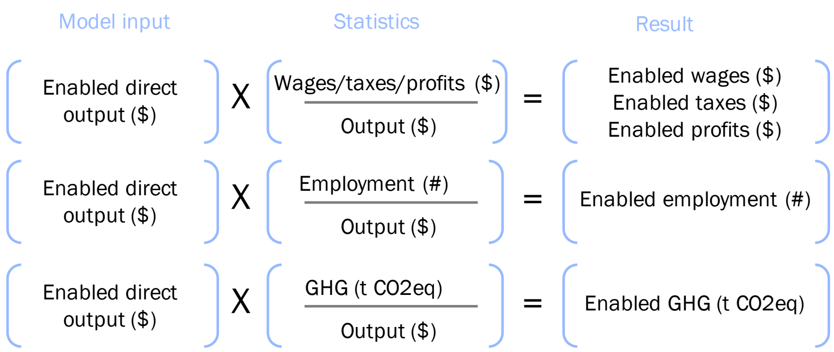



Exhibit 34: Calculations of enabled value added, employment and GHG emissions

## 5.4 Outputs

The impacts quantified are local impacts, and not time bound to the year of the operations modelled. The JIM assumes that power produced in a given year supports a share of output in that year and thus the other impacts in that same year. In reality, however, there may be more of a sequential nature to the impact; power is first consumed, outages are reduced, operations increase, output rises, and then other impacts are enabled. The temporal nature through which these impacts might actually occur is not accounted for.

The level of robustness of these impact calculations, like others in the JIM, declines as additional modelling is involved given the higher levels of uncertainty surrounding the accuracy of the numbers. The confidence level is highest when actual power production data is used and when the power-to-output translation factors are based on a country case study. In comparison, the confidence level is lowest when the power production is modelled using the installed capacity and technology type, and when the power-to-output translation factors are based on modelling.

## 5.5 Assumptions and limitations

There are a number of significant assumptions built into the power enabling impact calculations in the JIM, which reduces the confidence level of results. Instead of using observed company data as input (which is the case for the direct, supply chain and induced impacts), the power enabling impacts are based on modelled company data (using the constant power-to-output translation factor).

The current approach – using a constant power-to-output translation factor for all sectors and countries to calculate changes in firm output in response to an increase in power – was based on a straight average of four detailed case studies, following discussions on alignment of assumptions with IFC and others.

Further collaborations with new partners can improve upon the current approach. We could conduct additional case studies to improve insights into the linkages between access to power and additional firm output (particularly in Asian countries not covered by the current four cases), and reduce the impact of outliers on the power-to-output translation factors. Furthermore, we could use insights from other researchers on this topic once it becomes available.

# 6 ATTRIBUTION

The previous sections explained how the total impact of clients can be quantified. These methodologies did not yet consider that a particular intervention of an investor is likely to be one among many factors contributing to a company's impact. Investors often have a minority stake in companies, and hence other investors likely contribute to a company's business as well (either by providing capital or advice). Furthermore, external circumstances such as changing market conditions, climate change and technological developments may also influence the business. This raises the question of *attribution*: 'which portion of results of an invested company or portfolio of companies is due to the activities of an investor, taking into account other investors and additional factors that may have influenced the achievement of the results'?[34]

The attribution challenge is of course not unique to indirect impact modelling; it applies equally to directly observed impacts. However, since indirect impacts are typically larger than direct impacts, resolving attribution becomes more important where modelling takes place.

The JIM takes a pragmatic approach to this attribution question and applies prorating to attribute part of the impact to the investor's intervention.

## 6.1 Methodology

Prorating is the allocation of a part of the results to an investor based on its capital invested. The advantage of this methodology is that it a simple, quantitative and objective way to measure attribution, and data is relatively easy to collect. The prorating methodology takes the share of capital in total client assets (or project value if the project is in construction phase) to determine the prorating share, and subsequently applies this to the client's impacts. Investors have the option to include capital mobilised as well.

The model distinguishes two attribution approaches:

1. *Commitment approach (for ex-ante estimations):* attribution is based on the share of committed capital in a client's assets;
2. *Outstanding approach (for ex-post estimations):* attribution is based on the share of outstanding capital in a client's assets.

The methodology does not distinguish between debt and equity. However, for equity investments, there is a second option: users could choose to provide information on equity share (instead of inserting capital and the total client assets). Attribution will then be based on the equity share (instead of prorating share).

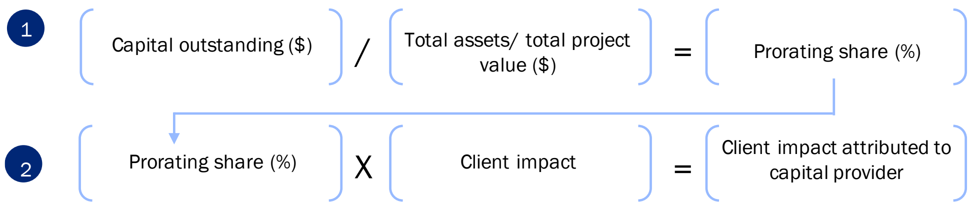



Exhibit 35: Attribution methodology outstanding approach

[34] Vosmer, W. and de Bruijn M. (2017). "Attribution in Results Measurement: Rationale and Hurdles for Impact Investors". The Donor Committee for Enterprise Development. https://www.enterprise-development.org/wp-content/uploads/DCED-Report-on-Attribution-in-Results-Measurement-for-Impact-Investors.pdf

**EXAMPLE JUICE PRODUCER IN NIGERIA**

Let's say the JIM estimated that a fruit juice producing company in Nigeria supported 50 jobs in its supply chain (mainly in the agriculture and transport sectors). To attribute these jobs to the investor, the JIM uses a prorating approach. It takes the outstanding loan amount (in this case $1M) as share of the total assets of the company ($10M) to determine the prorating share (10%) and subsequently applies this to the supply chain jobs (50). According to this methodology, the investor could attribute about 5 jobs in the supply chain of the Nigerian juice producing company to its intervention.

| | | | | |
|---|---|---|---|---|
| Capital outstanding<br>$1M | / | Total assets<br>$10M | = | Prorating share<br>10% |
| Prorating share<br>10% | X | Supply chain jobs<br>50 | = | Attributed jobs<br>5 |

## 6.2 Assumptions and limitations

Many impact investors recognise these relatively straightforward rules of prorating. However, the simplicity of the rule is also a weakness: it omits a number of relevant factors in the equation (such as the catalysing role of investors, the financial instrument, and other value adding services). Impact investors point out that prorating at best paints a simplified picture of their role, while most note that prorating alone does not adequately reflect the benefits of their intervention.[35]

One would ideally compare the situation with an intervention to what would have happened in the absence of the intervention (the counterfactual). However, such a comparison of the situation with and without the intervention is challenging because it is not possible to observe the counterfactual situation. It needs to be constructed by the researcher, which can be a complicated and costly exercise.[36] An example of such studies are randomised control trials (RCTs). Although these can provide detailed insights into attribution factors for a particular intervention, it is simply not feasible to conduct RCTs for a full portfolio of investments. IFIs are working on simplified approaches to counterfactuals.

Despite its limitations, prorating seems to be a useful approach to attribute part of the impact results to an investor. In the JIM it is included as an option that can be switched on and off, depending on user preferences. In the future, we will explore further refinements of the attribution approach.

[35] Vosmer, W. and de Bruijn M. (2017). "Attribution in Results Measurement: Rationale and Hurdles for Impact Investors". The Donor Committee for Enterprise Development. https://www.enterprise-development.org/wp-content/uploads/DCED-Report-on-Attribution-in-Results-Measurement-for-Impact-Investors.pdf

[36] Leeuw, F., and Vaessen, Jos. (2009). "Impact evaluations and development: NONIE guidance on impact evaluation" Washington, DC: World Bank. http://documents.worldbank.org/curated/en/411821468313779505/Impact-evaluations-and-development-NONIE-guidance-on-impact-evaluation

# 7 Data sources

The JIM combines national statistics and client financials to derive results.

## 7.1 National statistics

Statistics are derived from internationally-recognised sources to ensure the reproducibility of results. However, statistics can still be poor in the sense that they are incomplete or lacking validity and reliability.[37] This is a well-known problem, especially in Africa. Although the JIM uses best-available statistics, there is no guarantee that statistics are of sufficient quality. Users should be aware of these limitations and only use the JIM when no observable data is available.

### 7.1.1 GTAP

The Global Trade Analysis Project (GTAP) is a global database of bilateral trade patterns, production, consumption and intermediate use of commodities and services. The database uses input from a global network of institutes, researchers and policy makers conducting quantitative analysis of international policy issues. It is coordinated by the Center for Global Trade Analysis in Purdue University's Department of Agricultural Economics. Underlying the database there are several data sources that are heterogeneous in sources, methodology, base years and sectoral detail.[38] GTAP has made major efforts since the mid-1980s to make the disparate sources comparable and present users with a consistent set of economic facts.

Table 7 provides an overview of the GTAP data used in JIM, including the database's source data, geographical and sectoral coverage of the data and reference year. GTAP releases an updated dataset every 2-4 years. Once updated data is available, this will be included in the JIM. The JIM version 1.4 uses the GTAP 10 database.

Table 7: GTAP data used in JIM[39]

| Data | Description | Source data | Geographies | Economic sectors | Reference year |
|---|---|---|---|---|---|
| SAMs (NVFA, VALOUTPUT, NVPA, NVGA, VALEXPORT, VST, AG01, EVOA, VFM, EVFA, VALIMPORT) | Firms' domestic purchases, household domestic purchases, firms' imports, firms' expenses on endowments (i.e. land, unskilled labour, skilled labour, capital, natural resources), taxes | National statistical institutes<br>Data is harmonised using UN COMTRADE, WBDI, OECD and FAO data | 75 countries | 65 sectors | 2014 |
| $CO_2$ emissions (MDF & MIF) | $CO_2$ emitted in current production in the combustion of domestic and imported fossil fuels (i.e. coal, oil, gas, petroleum and coke, gas manufacture and distribution) | Energy volume data International Energy Agency (IEA) | 75 countries | 65 sectors | 2014 |
| Non-$CO_2$ emissions | Methane ($CH_4$), nitrous oxide ($N_2O$) and fluorinated gases (F-gases) emitted | Emissions Database for Global Atmospheric Research (EDGAR) (for | 75 countries | 65 sectors | 2014 |

[37] Kinyondo, A. and Pelizzo R. (2018). "Poor Quality of Data in Africa: What Are the Issues". Politics & Policy. Vol 46, Issue 6. ; https://onlinelibrary.wiley.com/doi/abs/10.1111/polp.12277

[38] For more detail on the IO tables per country see: https://www.gtap.agecon.purdue.edu/databases/regions.aspx?version=10.211

[39] Aguiar, A., Chepeliev, M., Corong, E., McDougall, R., & van der Mensbrugghe, D. (2019). The GTAP Data Base: Version 10. *Journal of Global Economic Analysis, 4(1)*, 1-27. Retrieved from https://www.jgea.org/resources/jgea/ojs/index.php/jgea/article/view/77

| | | | | | |
|---|---|---|---|---|---|
| | | non-agricultural activities) and FAOSTAT (for agricultural activities).[40] | | | |

On the one hand, the significant geographical and sectoral scope of the GTAP database and harmonisation efforts of GTAP make the database well-suited for economic simulation models like the JIM.[41] Compared to other databases for IO tables such as WIOD and EORA, GTAP has the best coverage of geographies and sectors.[42] On the other hand, GTAP also has a few disadvantages:

- *Outdated data:* the reference year of GTAP is a few years off, and the original datasets in GTAP are often even further behind.
- *Limited scope of environmental data:* GTAP does not have datasets on water and land use for example.
- *Missing individual country tables:* some countries are part of a GTAP 'rest' table, which limits the reliability of results for these countries.

We keep on exploring other datasets to complement and/or replace GTAP data if they have better data available.

### 7.1.2 ILOSTAT

ILOSTAT is the world's leading source on labour statistics. ILOSTAT is hosted by the International Labour Organisation's Department of Statistics. The database contains national labour force statistics as well as modelled estimates of labour market indicators worldwide. The latter are produced for countries and years for which country-reported data are unavailable using econometric models. This has resulted in a balanced panel dataset of aggregates for every year, with consistent country coverage. The JIM uses these ILO's modelled estimates.

Table 8 provides an overview of the ILOSTAT data used in JIM, including the database's source data, geographical and sectoral coverage of the data and reference year. The JIM will update the employment reference year annually.

Table 8: ILOSTAT data used in JIM

| Data | Description | Source data | Geographies | Economic sectors | Reference year |
|---|---|---|---|---|---|
| Employment, disaggregated by sex | All working age people (15 years and older) who are engaged in any activity to produce goods or provide services for pay or profit | Labour force surveys, household surveys, population census | 189 countries | 14 sectors (ISIC rev. 4) | 2018 |
| Employment, disaggregated by age | All working age people (15 years and older) who are engaged in any activity to produce goods or provide services for pay or profit | Labour force surveys, household surveys, population census | 189 countries | n/a | 2018 |
| Informal sector employment as % of total employment | Employment relationship not covered in law or practice by national labour legislation, income taxation, social protection, or employment benefits | Labour force surveys, household surveys | 67 countries | n/a | 2004-2018 |

[40] EDGAR is a joint project of the European Commission DG Joint Research Centre and the Netherlands Environmental Assessment Agency. https://www.gtap.agecon.purdue.edu/resources/download/7813.pdf
[41] https://www.gtap.agecon.purdue.edu/databases/v10/index.aspx
[42] World Input-Output Tables (WIOD) covers 43 countries and 56 sectors. EORA covers 190 countries and 26 sectors.

On the one hand, the efforts of the ILO to produce harmonised indicators from country-reported microdata has greatly increased the comparability of the data, which makes the dataset well-suited for the JIM. On the other hand, the modelling reduced the reliability of the data. The quality of data may be improved by accessing microdata directly. We will further explore this (together with ILO) in the future.

### 7.1.3 World Bank Development Indicators Databank

The WBDI databank is the primary World Bank collection of development indicators. They are compiled from officially-recognised international sources. The data are the most current and accurate global development data available, and include national, regional and global estimates.

Table 9 provides an overview of the WBDI data used in JIM, including the database's source data, geographical coverage of the data and reference year. The JIM will update the reference year of WBDI data annually.

Table 9: WBDI data used in JIM

| Data | Description | Source data | Geographies | Reference year |
|---|---|---|---|---|
| Agriculture, forestry and fishing, value added (current US$)[43] | Corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production | World Bank national accounts data, and OECD National Accounts data files | 75 countries | 2014-2018 |
| Industry, value added (current US$) | Corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas | World Bank national accounts data, and OECD National Accounts data files | 75 countries | 2014-2018 |
| Manufacturing, value added (current US$) | Corresponds to ISIC divisions 15-37 | World Bank national accounts data, and OECD National Accounts data files | 75 countries | 2014-2018 |
| Services, value added (current US$) | Corresponds to ISIC divisions 50-99. They include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services. Also included are imputed bank service charges and import duties | World Bank national accounts data, and OECD National Accounts data files | 75 countries | 2014-2018 |
| GDP (current US$) | Sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products | World Bank national accounts data, and OECD National Accounts data files | 133 countries | 2014-2018 |
| Population, total | Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. The values shown are midyear estimates | United Nations Population Division. World Population Prospects: 2019 Revision, Census reports and other statistical publications from national statistical offices, Eurostat: Demographic Statistics, United Nations Statistical Division. Population and | 217 countries | 2018 |

[43] Value added is defined as the net output of a sector after adding up all outputs and subtracting intermediate inputs

| | | | | |
|---|---|---|---|---|
| | | Vital Statistics Report (various years), U.S. Census Bureau: International Database, and Secretariat of the Pacific Community: Statistics and Demography Programme | | |
| Country income group from World Bank list of economies | Country income classification assigned by the World Bank to countries, distinguishing 4 income groups (i.e. high, upper-middle, lower-middle, low). The assignment is based on GNI per capita using the Atlas method | World Bank national accounts data, and OECD National Accounts data files | 217 countries | June 2018 |

The wide coverage of the database in terms of indicators, geographies and years, makes WBDI a useful data source to complement the other JIM data sources.

### 7.1.4 International Energy Agency

The IEA is an autonomous inter-governmental organisation within the OECD that provides data and analyses on energy related issues surrounding economics and international policy. It has an Energy Data Centre which provides an authoritative and comprehensive source of global energy data. The IEA collects, assesses and disseminates energy statistics on supply and demand, compiled into energy balances.

Table 10 provides an overview of the IEA data used in the JIM, including the database's source data, geographical coverage of the data and reference year. The JIM will update the reference year of IEA data annually.

Table 10: IEA data used in JIM

| Data | Description | Source data | Geographies | Reference year |
|---|---|---|---|---|
| Electric power consumption (kWh per capita) https://www.enterprisesurveys.org/en/data/exploretopics/infrastructure | Electric power consumption measures the production of power plants and combined heat and power plants less transmission, distribution, and transformation losses and own use by heat and power plants | IEA data services | 236 Countries | 2017 |

### 7.1.5 Energy Information Administration

The Energy Information Administration (EIA) offers official energy statistics from the United States (US) government. It collects, analyses, and disseminates independent and impartial energy information.

The EIA data is used in the JIM only when IEA data is not available. Table 11 provides an overview of the EIA data used in the JIM, including the database's source data, geographical coverage of the data and reference year.

Table 11: EIA data used in JIM

| Data | Description | Source data | Geographies | Reference year |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Electricity net consumption (billion kWh) https://www.enterprisesurveys.org/en/data/exploretopics/infrastructure | Total net electricity generation + electricity imports - electricity exports - electricity transmission and distribution losses. Data are reported as net consumption, not gross consumption. Net consumption excludes the energy consumed by the generating units. | Various: central Statistical Offices, Ministries, Central Banks, Utility companies, national energy agencies, etc. | 70 Countries | 2017 |
| Net capacity factors | A net capacity factor is a measurement of the amount of actual electricity generated over a given period in time relative to the maximum amount of electricity generated over that same period. | Local power producers | US | 2018 |

The EIA database complements the IEA data. While the net electricity consumption is available for countries worldwide, the net capacity factors are only based on US power producers. The level is representativeness of the data for all countries worldwide is therefore limited.

### 7.1.6 Academic papers, reports, and other data

In the JIM model a few assumptions are added based on academic research, and some other miscellaneous sources.

| Data | Description | Source | Sample geographies |
|---|---|---|---|
| Capital productivity adjustment per company size | Research to capital structures in developing countries. Data on the capital leverage ratio of large and listed companies versus small and private firms. | Determinants of Capital Structure in Developing Countries (2010) by Tugba Bas, Gulnur Muradoglu, Kate Phylaktis[44] | Eritrea, Ethiopia, Malawi, South Africa, Tanzania, Zambia from Africa region; Cambodia, Indonesia, Philippines from East Asia and Pacific; Brazil, Chile, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Nicaragua, Peru from Latin America and Caribbean; Morocco, Oman, Syrian Arab Republic from Middle East and North Africa; Bangladesh, India, Pakistan and Sri Lanka from South Asia |
| Informal sector GDP | Report on the growth engine of Sub-Saharan Africa, and the informal sector economy. Data on the size of the informal sector GDP of several regions. | IMF, 2017, https://www.imf.org/en/Publications/REO/SSA/Issues/2017/05/03/sreo0517, accessed 20 February 2020 | Sub-Saharan Africa, Europe, East Asia, South-eastern Asia, MENA, Latin America and Caribbean |
| Informality per economic sector | Informal sector data, which shows that persons engaged in informal sector activity are in manufacturing, construction, wholesale and retail trade, hotels and restaurants, transport and communications, community, social and personal services. | Economic Survey 2014, Kenya Statistical Office | Kenya |
| Labour productivity adjustment per company size | Research to SMEs in developing countries. Data on the productivity of SMEs versus corporates. | IFC, 'Scaling-Up SME Access to Financial Services in the Developing World', 2010, p. 6 | Developing economies |

[44] Bas, T. Muradoglu, G & Phylaktis, K. (2010). Determinants of Capital Structure in Developing Countries. https://www.researchgate.net/publication/228465937_Determinants_of_Capital_Structure_in_Developing_Countries

## 7.2 Client financials

The client financials need to be inserted by investors themselves. Ideally data is derived by investors from audited financial statements of their clients on an annual basis. The data inputs for the JIM per type of client are explained in detail in the user guide. The model distinguishes between required data (without these inputs the model does not run) and optional data (inputs that improve the model calculations). The more optional data is provided, the higher the confidence level of the results (see Section 8).

Getting reliable year-on-year financial data for hundreds of businesses is a challenging process, particularly if they are held through financial intermediaries (e.g. private equity funds). It is therefore key that organisations have data quality assurance processes in place to discover and correct data inconsistencies and anomalies. The JIM does not take any responsibility for the quality of the client input data.

However, to help users, the JIM conducts a data validation screening on:

- *Labelling errors*: errors in the labelling of input data that prevent the model from running (e.g. errors in the spelling of country names). Due to these errors the model is not able to identify the appropriate national statistics for the model. Labelling errors need to be resolved before the model can provide results.
- *Value errors*: possible errors in the values of input data. These do not prevent the model from running, but may reduce the reliability of results. Users are advised to verify the values in case a 'value error' pops up. The model runs the following value checks:
    - Payments to supplier organisations and individuals: local < sales
    - Payments to supplier organisations and individuals: total < sales
    - Payments to supplier organisations and individuals: local < Payments to supplier organisations and individuals: total
    - Payment to government < sales
    - Net income < sales
    - Permanent employee wages: total < sales
    - Direct employment – operations & maintenance – third party hires < Direct employment – operations & maintenance
    - Direct employment – operations & maintenance – female < Direct employment – operations & maintenance
    - Direct employment – operations & maintenance – female third party hires < Direct employment – operations & maintenance – third party hires
    - Direct employment – operations & maintenance – female third party hires < Direct employment – operations & maintenance
    - Direct employment – construction phase – female < Direct employment – construction phase
    - Sales >= (Payments to supplier organisations and individuals: total + Payment to government + Net income + Permanent employee wages: total)

# 8 RELIABILITY OF RESULTS

Results should be interpreted as directionally correct estimates. They are calculated on an individual investment basis and subsequently aggregated for analysis and reporting purposes. As the model is based on country and sector averages, it is likely that modelled individual company results differ from real practices due to unique company characteristics. But in the aggregate, companies are expected to reflect these averages more closely. As a result, outcomes become more accurate for a larger number of companies.

The level of confidence in the results is a mapping that depends on the degree of modelling used, input data provided and availability of macro-economic statistics. Confidence levels are rated on a five-level scale, with five being the highest level of confidence and one being the lowest. Direct results, for which no modelling is involved, are assumed to be accurate and therefore given a five-score confidence level. For supply chain impacts, power enabling and finance enabling impacts, results receive four, three, two or one scores depending on the availability of country-specific macro-economic statistics and input data (for more information about input data see Section 3).

| Impact | Max. confidence level | Confidence level reductions | Rationale |
|---|---|---|---|
| Direct | 5 | -1 no optional inputs (if relevant)<br>-1 no real data<br>-1 no country statistics (if no real data provided)<br>-1 fiscal year different from 2017-2019 | The confidence level is highest (5) when no modelling is needed and all (required & optional) real data is provided.<br>If no real data is provided and estimations are necessary, the confidence level of results reduces. Furthermore, if only GTAP regional statistics are available to make estimations, the level of uncertainty increases further, and the confidence level drops.<br>Finally, if the fiscal year is different from the ideal 2017-2019 interval, the confidence level decreases. |
| Supply chain | 4 | -1 no optional inputs<br>-1 no country statistics<br>-1 if 'World' region<br>-1 fiscal year different from 2017-2019 | Supply chain impacts are always estimated[45], which reduces the maximum confidence level to 4.<br>Furthermore, if no optional inputs are provided and no GTAP country statistics are available, the level of uncertainty increases, and the confidence level drops.<br>Finally, if the fiscal year is different from the ideal 2017-2019 interval, the confidence level decreases. |
| Induced | 3 | -1 no optional inputs<br>-1 no country statistics<br>-1 fiscal year different from 2017-2019 | Induced impacts are always estimated. As an additional layer of assumptions is needed compared to supply chain impacts (on household consumption patterns), the maximum confidence level is reduced to 3.<br>Furthermore, if no optional inputs are provided and no country statistics are available, the level of uncertainty increases, and the confidence level drops.<br>Finally, if the fiscal year is different from the ideal 2017-2019 interval, the confidence level decreases. |
| Finance enabling | 2 | -1 no country statistics<br>-1 fiscal year different from 2017-2019 | Finance enabling impacts are always estimated. As financial intermediary client data is not available, additional assumptions have to be made to convert capital into additional company revenues. This reduces the confidence level to 2.<br>Furthermore, if no country statistics are available, the level of uncertainty increases, and the confidence level drops.<br>Finally, if the fiscal year is different from the ideal 2017-2019 interval, the confidence level decreases. |

[45] The exception is Scope 2 GHG emissions, for which real data can be provided. If real data is inserted in the input template, the confidence level will be 5.

| | | | |
|---|---|---|---|
| Power enabling | 2 | -1 no power production data<br>-1 fiscal year different from 2017-2019 | Power enabling impacts are always estimated. As no data is available on the users of power, additional assumptions have to be made to convert power production into additional company revenues. This reduces the confidence level to 2.<br>Furthermore, if no power production data are available, the level of uncertainty increases, and the confidence level drops.<br>Finally, if the fiscal year is different from the ideal 2017-2019 interval, the confidence level decreases. |

# 9 DEVELOPMENT ROADMAP

The methodology presented here allows for the measurement of direct and indirect employment in an investment portfolio that could encompass many hundreds of businesses across multiple regions and sectors, a task that could otherwise appear daunting to impact investors and DFIs that may wish to measure results for impact management. This justifies the caveats detailed above. For small investment portfolios or where the principal impact is a direct one, the model is less appropriate.

The JIM is the result of a collaborative approach where we combine insights and learnings from multiple organisations and research studies. However, this is not the end point. It is a joint process for continuous improvement. Over time, we expect to further improve the JIM based on learning experiences of users, insights of external experts, new research, etc. Elements we aim to look into include (but are not limited to):

- *Regular update of statistics.* Key JIM data sources have updated their statistics, including GTAP (release of GTAP 10a), ILO (updated modelled estimates) and the World Bank (ongoing updates).
- *Adding enabling impacts of infrastructure investments* (e.g. telecom, transport) *and public sector projects* (e.g. education, health). Currently the JIM quantifies the supply chain and induced impacts of these types of investments. However, that often does not cover the main impact of these investments, which is more related to the use of these goods and/or services.
- *Relieving some of the constraints and limitations of the IO methodology*, such as the absence of supply and capacity constraints, fixed production structures, and fixed prices.
- *Improving ex-ante quantifications.* Currently the model works best for projects for which expenses are included for one reporting year. Project data for multiple years can be included, but employment results will likely be overestimated as the increase in labour productivity over time is not accounted for. We could explore possible corrections of this likely overestimation.
- *Improving data sources*. We will continuously explore whether better data sources are available for key statistics used in the model such as IO tables, employment and GHG data.
- *Improving insights into the type of jobs supported*. The JIM provides some insights into the type of jobs supported by showing the value added or salaries per job. However, there are many aspects of job quality that are not yet included, such as working conditions, workplace security etc.
- *Data collection synergies*. As more organisations start using the JIM, we envisage synergies in data collection. Some organisations might be clients of others (e.g. private equity fund managers). If these organisations enter their own data, this might reduce the data collection burden for their investors.
- *Verification of results*. We invite organisations to share case-study results (e.g. from ex-post evaluations) with us, so that JIM results can be compared with observed data. This will help to better understand the confidence level of the results.
- *Benchmarking*. As many organisations are interested in how their results compare to others, we would like to explore the possibility to share results anonymously so that benchmarks can be developed and included in the JIM interface.

We invite you to join the discussion, share learnings, and provide suggestions for further improvement.

# APPENDIX 1: COVERAGE SAMS IN JIM

| Sectors | | | |
|---|---|---|---|
| 1 | Paddy rice | 42 | Machinery and equipment nec |
| 2 | Wheat | 43 | Motor vehicles and parts |
| 3 | Cereal grains nec | 44 | Transport equipment nec |
| 4 | Vegetables, fruit, nuts | 45 | Manufactures nec |
| 5 | Oil seeds | 46 | Electricity |
| 6 | Sugar cane, sugar beet | 47 | Gas manufacture, distribution |
| 7 | Plant-based fibers | 48 | Water |
| 8 | Crops nec | 49 | Construction |
| 9 | Bovine cattle, sheep and goats, horses | 50 | Trade |
| 10 | Animal products nec | 51 | Accommodation, Food and service activities |
| 11 | Raw milk | 52 | Transport nec |
| 12 | Wool, silk-worm cocoons | 53 | Water transport |
| 13 | Forestry | 54 | Air transport |
| 14 | Fishing | 55 | Warehousing and support activities |
| 15 | Coal | 56 | Communication |
| 16 | Oil | 57 | Financial services nec |
| 17 | Gas | 58 | Insurance (formerly isr) |
| 18 | Other Extraction (formerly omn Minerals nec) | 59 | Real estate activities |
| 19 | Bovine meat products | 60 | Business services nec |
| 20 | Meat products nec | 61 | Recreational and other services |
| 21 | Vegetable oils and fats | 62 | Public Administration and defense |
| 22 | Dairy products | 63 | Education |
| 23 | Processed rice | 64 | Human health and social work activities |
| 24 | Sugar | 65 | Dwellings |
| 25 | Food products nec | | |
| 26 | Beverages and tobacco products | | |
| 27 | Textiles | | |
| 28 | Wearing apparel | | |
| 29 | Leather products | | |
| 30 | Wood products | | |
| 31 | Paper products, publishing | | |
| 32 | Petroleum, coal products | | |
| 33 | Chemical products | | |
| 34 | Basic pharmaceutical products | | |
| 35 | Rubber and plastic products | | |
| 36 | Mineral products nec | | |
| 37 | Ferrous metals | | |
| 38 | Metals nec | | |
| 39 | Metal products | | |
| 40 | Computer, electronic and optical products | | |
| 41 | Electrical equipment | | |

| Countries | | | |
|---|---|---|---|
| 1 | Albania | 43 | Mauritius |
| 2 | Argentina | 44 | Mexico |
| 3 | Armenia | 45 | Mongolia |
| 4 | Azerbaijan | 46 | Morocco |
| 5 | Bangladesh | 47 | Mozambique |
| 6 | Belarus | 48 | Namibia |
| 7 | Benin | 49 | Nepal |
| 8 | Bolivia | 50 | Nicaragua |
| 9 | Botswana | 51 | Nigeria |
| 10 | Brazil | 52 | Pakistan |
| 11 | Brunei Darussalam | 53 | Panama |
| 12 | Bulgaria | 54 | Paraguay |
| 13 | Burkina Faso | 55 | Peru |
| 14 | Cambodia | 56 | Philippines |
| 15 | Cameroon | 57 | Romania |
| 16 | Chile | 58 | Russian Federation |
| 17 | China | 59 | Rwanda |
| 18 | Colombia | 60 | Senegal |
| 19 | Costa Rica | 61 | South Africa |
| 20 | Côte d'Ivoire | 62 | Sri Lanka |
| 21 | Dominican Republic | 63 | Tajikistan |
| 22 | Ecuador | 64 | Tanzania, United Republic of |
| 23 | Egypt | 65 | Thailand |
| 24 | El Salvador | 66 | Togo |
| 25 | Ethiopia | 67 | Tunisia |
| 26 | Georgia | 68 | Turkey |
| 27 | Ghana | 69 | Uganda |
| 28 | Guatemala | 70 | Ukraine |
| 29 | Guinea | 71 | Uruguay |
| 30 | Honduras | 72 | Venezuela (Bolivarian Republic of) |
| 31 | India | 73 | Viet Nam |
| 32 | Indonesia | 74 | Zambia |
| 33 | Iran, Islamic Republic of | 75 | Zimbabwe |
| 34 | Jamaica | | |
| 35 | Jordan | | |
| 36 | Kazakhstan | | |
| 37 | Kenya | | |
| 38 | Kyrgyzstan | | |
| 39 | Lao PDR | | |
| 40 | Madagascar | | |
| 41 | Malawi | | |
| 42 | Malaysia | | |

| Regions | | Countries included in the regional tables[46] |
|---|---|---|
| 1 | World | *All countries included in Africa, Americas, Asia, Europe and Oceania, plus British Indian Ocean Territory, French Southern Territories, Bouvet Island, Antarctica* |
| 2 | Africa | *All countries included in Northern Africa, Eastern Africa, Middle Africa, Southern Africa and Western Africa* |
| 3 | Northern Africa | **Egypt,** Libya, **Morocco, Tunisia**, Algeria, Western Sahara[47] |
| 4 | Eastern Africa | Burundi, Comoros, Djibouti, Eritrea, **Ethiopia, Kenya, Madagascar**, **Malawi, Mauritius**, Mayotte, **Mozambique, Rwanda**, Seychelles, Somalia, North Soudan, South Sudan, **Uganda, United Republic of Tanzania, Zambia, Zimbabwe**[48] |
| 5 | Middle Africa | Angola, **Cameroon,** Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Sao Tome and Principe |
| 6 | Southern Africa | **Botswana,** Eswatini, Lesotho, **Namibia, South Africa** |
| 7 | Western Africa | **Benin, Burkina Faso**, Cabo Verde, **Côte d'Ivoire**, Gambia, **Ghana, Guinea**, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, **Nigeria,** Saint Helena, **Senegal,** Sierra Leone, **Togo** |
| 8 | Caribbean | Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Bonaire, Sint Eustatius and Saba, British Virgin Islands, Cayman Islands, Cuba, Curacao, Dominica, **Dominican Republic,** Grenada, Guadeloupe, Haiti, **Jamaica**, Martinique, Montserrat, **Puerto Rico**, Saint Barthelemy, Saint Kitts and Nevis, Saint Lucia, Saint Martin, Saint Vincent and the Grenadines, Sint Maarten, **Trinidad and Tobago**, Turks and Caicos Islands, United States Virgin Islands |
| 9 | Central America | Belize, **Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama** |
| 10 | South America | **Argentina, Bolivia, Brazil**, **Chile, Colombia, Ecuador**, Falkland Islands, French Guiana, Guyana, **Paraguay, Peru,** South Georgia and the South Sandwich Islands, Suriname, **Uruguay, Venezuela**[49] |
| 11 | Asia | *All countries included in Central Asia, Eastern Asia, South-eastern Asia, Southern Asia, and Western Asia* |
| 12 | Central Asia | **Kazakhstan, Kyrgyzstan**, Tajikistan, Turkmenistan, Uzbekistan |
| 13 | Eastern Asia | **China**, **Hong Kong Special Administrative Region**, Macao Special Administrative Region, Democratic People's Republic of Korea, **Japan, Mongolia, Republic of Korea** |
| 14 | South-eastern Asia | **Brunei Darussalam, Cambodia, Indonesia**, **Lao People's Democratic Republic, Malaysia,** Myanmar, **Philippines**, Singapore, **Thailand,** Timor-Leste, **Viet Nam** |
| 15 | Southern Asia | Afghanistan, **Bangladesh,** Bhutan, **India**, **Iran,** Maldives, **Nepal, Pakistan, Sri Lanka** |
| 16 | Western Asia | **Armenia, Azerbaijan, Bahrain**, **Georgia**, Iraq, **Israel, Jordan, Kuwait**, Lebanon, **Oman, Qatar, Saudi Arabia,** State of Palestine, Syrian Arab Republic, **Turkey, United Arab Emirates**, Yemen[50] |
| 17 | Melanesia, Micronesia, Polynesia | Fiji, New Caledonia, Papua New Guinea, Solomon Islands, Vanuatu, Guam, Kiribati, Marshall Islands, Micronesia, Nauru, Northern Mariana Islands, Palau, United States Minor Outlying Islands, American Samoa, Cook Islands, French Polynesia, Niue, Pitcairn, Samoa, Tokelau, Tonga, Tuvalu, Wallis and Futuna Islands |

[46] Deviations from UN Geoscheme are explained in footnotes. As GTAP does not have individual tables for all countries, some countries are in 'rest tables' that cover multiple regions. The rest tables are allocated to the region applicable to most of the countries included. Countries in bold are the ones for which employment and GHG intensities are used to derive regional intensities.

[47] Excludes North Sudan

[48] Excludes British Indian Ocean Territory, Reunion and French Southern Territories

[49] Excludes Bouvet Island

[50] Excludes Cyprus

# Appendix 2: Sector mappings

| ISIC sectors | | GTAP sector |
|---|---|---|
| A | Agriculture; forestry and fishing | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 |
| B | Mining and quarrying | 15 16 17 18 |
| C | Manufacturing | 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 |
| D, E | Utilities | 46 47 48 |
| F | Construction | 49 |
| G | Wholesale and retail trade; repair of motor vehicles and motorcycles | 50 |
| H, J | Transport; storage and communication | 52 53 54 55 56 |
| I | Accommodation and food service activities | 51 |
| K | Financial and insurance activities | 57 58 |
| L, M, N | Real estate; business and administrative activities | 59 60 |
| O | Public administration and defence; compulsory social security | 62 |
| P | Education | 63 |
| Q | Human health and social work activities | 64 |
| R, S, T, U | Other services | 61 |

| NACE sectors | | GTAP sector |
|---|---|---|
| A | Agriculture, forestry and fishing | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 |
| B | Mining and quarrying | 15 16 17 18 |
| C | Manufacturing | 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 |
| D | Electricity, gas, steam and air conditioning supply | 46 47 |
| E | Water supply; sewerage, waste management and remediation activities | 48 |
| F | Construction | 49 |
| G | Wholesale and retail trade; repair of motor vehicles and motorcycles | 50 |
| H | Transportation and storage | 52 53 54 55 |
| I | Accommodation and food service activities | 51 |
| J | Information and communication | 56 |
| K | Financial and insurance activities | 57 58 |
| L | Real estate activities | 59 |
| M | Professional, scientific and technical activities | 60 |
| N | Administrative and support service activities | 60 |
| O | Public administration and defence; compulsory social security | 62 |
| P | Education | 63 |
| Q | Human health and social work activities | 64 |
| R | Arts, entertainment and recreation | 61 |
| S | Other service activities | 61 |
| T | Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use | 61 |
| U | Activities of extraterritorial organisations and bodies | 62 |

# APPENDIX 3: DEFINITION OF MICRO, SMALL & MEDIUM ENTERPRISES (MSMES)

| IFC MSME Definition | | | | MSME Loan Size Proxy |
|---|---|---|---|---|
| Indicators | Employees | Total Assets USD | Annual Sales USD | Loan Size at Origination |
| Micro enterprise | <10 | <$100,000 | <$100,000 | <$10,000 |
| Small enterprise | 10 – 49 | $100,000 - < $3 mln | $100,000 - < $3 mln | <$100,000 |
| Medium enterprise | 50 – 300 | $3 mln - $15 mln | $3 mln - $15 mln | <$1 or $2 mln |

Exhibit 36: Definition of SME (IFC)

# APPENDIX 4: MAPPING OF CONTINENTS TO REGIONAL DATA

| Continent | Regional data |
|---|---|
| Africa | Sub-Saharan Africa |
| Americas | Latin America & Caribbean |
| Asia | Average of South Asia and East Asia |
| Europe | Europe |
| Oceania | Average of Europe and East Asia |
| World | Average of all regional data |

# APPENDIX 5: EXAMPLE CALCULATIONS

The calculations as explained in the previous sections are applied to three types of investments: a corporate investment, an investment through a financial intermediary, and an investment in a power plant Please note the calculations are simplified: the model uses sector-specific data for 65 sectors, while the examples only show the weighted averages of the model sectors. Furthermore, numbers are rounded.

## Corporate investment

### Client input data

| Indicator | Client financials |
|---|---|
| Client name/code | Company F |
| Client type | *Corporate* |
| Fiscal year | *2018* |
| Country/region of operations | *Nigeria* |
| Economic activity | *Manufacture of chemicals and chemical products* |
| Sales | *300,000,000* |
| Direct employment – operations & maintenance | *1,000* |
| Payments to supplier organisations and individuals: total | *50,000,000* |
| Permanent employee wages: total | *2,000,000* |
| Net income | *100,000,000* |
| Financing instrument | *Debt* |
| Assets – fiscal year | *150,000,000* |
| Capital outstanding | *5,000,000* |

### Supply chain and induced impact

*Data filling local procurement per sector*

$$\text{Total procurement (\$)} \times \frac{\text{Intermediary demand on each sector(\$)}}{\text{Intermediary demand on all domestic and foreign sectors (\$)}} = \text{Local procurement per sector (\$)}$$

$$50{,}000{,}000 \times \frac{46{,}602\text{ M}}{69{,}217\text{ M}} = 33{,}663{,}832$$

*Data filing import procurement per sector*

$$\text{Total procurement (\$)} - \text{Local procurement per sector (\$)} = \text{Import procurement per sector (\$)}$$

$$50{,}000{,}000 \text{ X } 33{,}663{,}832 = 16{,}336{,}168$$

*Data filling direct wages excl. payroll tax*

Direct wages ($) X 1 - 31.41% = Direct wages ($) (excl. payroll tax)

2,000,000 X 1 - 31.41% = 1,371,800

*Matrix multiplication local supply chain impact*

Local procurement per sector ($) X SAM (%) = Related local supply chain output & VALUE ADDED ($)

Related local supply chain output ($) X Employment (#) / Output ($) = Related local supply chain **EMPLOYMENT** (#)

Related local supply chain output ($) X CO2 (t CO2eq) / Output ($) = Related local supply chain **CO2** (t CO2 eq)

Related local supply chain output ($) X Non-CO2 (t CO2eq) / Output ($) = Related local supply chain **Non-CO2** (t CO2 eq)

33,663,832 X SAM Nigeria (%) = 47,013,624 & 31,087,137

47,013,624 X 0.0000751 = **3,530**

47,013,624 X 0.001452 = **68,257**

47,013,624 X 0.000406 = **19,110**

*Matrix multiplication local supply chain impact*

Import procurement per sector ($) X World SAM (%) = Related import supply chain output ($)

Related import supply chain output ($) X World GHG (t CO2eq) / World Output ($) = Related import supply chain **CO2** (t CO2eq)

Related import supply chain output ($) X World GHG (t CO2eq) / World Output ($) = Related import supply chain **NON-CO2** (t CO2eq)

16,336,168 X World SAM (%) = 30,359,728

30,359,728 X 0.000251 = **7,611**

30,359,728 X 0.000122 = **3,718**

*Matrix multiplication induced impact*

Local procurement per sector ($) X SAM (%) = Related supply chain wages ($) (part of value added)

Direct & indirect wages ($) X SAM (%) = Related induced output ($)

Related induced output ($) X Employment (#) / Output ($) = Related induced **EMPLOYMENT** (#)

Related induced output ($) X CO2 (t CO2eq) / Output ($) = Related induced **CO2 EMISSIONS** (t CO2 eq)

Related induced output ($) X Non-CO2 (t CO2eq) / Output ($) = Related induced **Non-CO2 EMISSIONS** (t CO2 eq)

33,663,832 X SAM Nigeria (%) = 10,478,547

1,371,800 + 10,478,547 X SAM Nigeria (%) = 8,151,691

8,151,691 X 0.000096 = **781**

8,151,691 X 0.000127 = **1,035**

8,151,691 X 0.000334 = **2,719**

### Direct impact

[Direct wages ($)] X [Payroll tax deduction (1 - 31.41%)] = [**Direct wages** ($) (excl. payroll tax)]

[Direct savings ($)] → [**Direct savings** ($)]

[Sales] - [Total procurement] - [Direct wages ($) (excl. payroll tax)] - [Direct savings ($)] = [**Direct taxes** ($)]

[2,000,000] X [1 - 31.41%] = [**1,371,800**]

[100,000,000] → [**100,000,000**]

[300,000,000] - [50,000,000] - [1,371,800] - [100,000,000] = [**148,628,200**]

[Direct operations jobs (#)] → [Direct operations jobs (#)]

[1,000] → [**1,000**]

[Sales/ project value ($)] X [CO2 (t CO2eq) / Output ($)] = [Direct CO2 (t CO2eq)]

[Sales/ project value ($)] X [Non-CO2 (t CO2eq) / Output ($)] = [Direct Non-CO2 (t CO2eq)]

[300,000,000] X [0.000655] = [**196,623**]

[300,000,000] X [0.000101] = [**30,194**]

### Attribution share

[Capital outstanding ($)] / [Total assets ($)] = [Prorating share (%)]

[5,000,000] / [150,000,000] = [**3%**]

# Financial intermediary

### Client input data

| Indicator | Client financials |
|---|---|
| Client name/code | Bank F |
| Client type | *Financial Institution* |
| Fiscal year | *2018* |
| Country/region of operations | *India* |
| Economic activity | *Financial services* |
| Income (sales) | *600,000,000* |
| Direct employment – operations & maintenance | *4,500* |
| Payments to supplier organisations and individuals: total | *300,000,000* |
| Permanent employee wages: total | *80,000,000* |
| Net income | *100,000,000* |
| Capital outstanding - financial intermediary<br>• Construction<br>• Business services | <br>200,000,000<br>800,000,000 |

### Supply chain, induced and direct impact

See example corporate investment

### Finance enabling impact

All calculations are done for both sectors in which the financial intermediary's capital is outstanding (i.e. construction and business services) separately.

*Quantification of enabled output*

Capital outstanding per sector ($) X Capital-to-output ratio X Adjustment value (%) *(if known)* = Enabled direct output ($)

200,000,000 X 0.35 = 70,000,000

800,000,000 X 0.35 = 280,000,000

*Enabled direct impact*

Enabled direct output ($) X Employment (#) / Output ($) X Formal employment intensity continent (#/$) / average employment intensity continent (#/$) = Enabled direct employment (#)

70,000,000 X 0.000103 X 0.44 = **3,178**

280,000,000 X 0.0000506 X 1 = **14,168**

[ Enabled direct output ($) ] X [ Wages/taxes/profits ($) / Output ($) ] = [ Enabled direct wages ($)<br>Enabled direct taxes ($)<br>Enabled direct profits ($) ]

[ 70,000,000 ] X [ 28%<br>6%<br>6% ] = [ 19,748,237<br>4,094,600<br>4,148,485 ]

[ 280,000,000 ] X [ 45%<br>6%<br>22% ] = [ 126,901,093<br>16,623,447<br>61,668,079 ]

[ Enabled direct output ($) ] X [ CO2 (t CO2eq) / Output ($) ] = [ Enabled direct CO2 (t CO2 eq) ]

[ Enabled direct output ($) ] X [ Non-CO2 (t CO2eq) / Output ($) ] = [ Enabled direct Non-CO2 (t CO2 eq) ]

[ 70,000,000 ] X [ 0.000007 ] = [ **459** ]

[ 70,000,000 ] X [ 0.00000003 ] = [ **2** ]

[ 280,000,000 ] X [ 0.000011 ] = [ **3,115** ]

[ 280,000,000 ] X [ 0.000007 ] = [ **1,895** ]

*Enabled local supply chain impact*

The calculations below are done for capital outstanding in the construction sector only. It works in the same way for capital outstanding in other sectors (e.g. business services).

[ Enabled direct output ($) ] X [ SAM (%) ] = [ Related enabled supply chain output & **VALUE ADDED** ($) ]

↓

[ Related enabled supply chain output ($) ] X [ Employment (#) / Output ($) ] = [ Related enabled supply chain **EMPLOYMENT** (#) ]

[ Related enabled supply chain output ($) ] X [ CO2 (t CO2eq) / Output ($) ] = [ Related enabled supply chain **CO2 EMISSIONS** (t CO2 eq) ]

[ Related enabled supply chain output ($) ] X [ Non-CO2 (t CO2eq) / Output ($) ] = [ Related enabled supply chain **Non-CO2 EMISSIONS** (t CO2 eq) ]

70,000,000 X SAM India = 125,300,138 & 30,676,848

125,300,138 X 0.000037 = **4,579**

125,300,138 X 0.000436 = **53,925**

125,300,138 X 0.000046 = **5,775**

*Enabled local supply chain impact*

Enabled direct import output per sector ($) X World SAM (%) = Related enabled import supply chain output ($)

Related import supply chain output ($) X World GHG (t CO2eq) / World Output ($) = Related enabled import supply chain **CO2** (t CO2eq)

Related import supply chain output ($) X World GHG (t CO2eq) / World Output ($) = Related enabled import supply chain **NON-CO2** (t CO2eq)

4,301,597 X World SAM (%) = 12,262,374

30,359,728 X 0.000251 = **2,332**

30,359,728 X 0.000122 = **273**

*Enabled induced impact*

The calculations below are done for capital outstanding in the construction sector only. It works in the same way for capital outstanding in other sectors (e.g. business services).

| | | | | |
|---|---|---|---|---|
| Enabled direct output ($) | X | SAM (%) | = | Related enabled supply chain wages ($) (part of value added) |
| Enabled direct & indirect wages ($) | X | SAM (%) | = | Related enabled induced output ($) |
| Related enabled induced output ($) | X | Employment (#) / Output ($) | = | Related enabled induced **EMPLOYMENT** (#) |
| Related enabled induced output ($) | X | $CO_2$ (t $CO_2$eq) / Output ($) | = | Related enabled induced **$CO_2$ EMISSIONS** (t $CO_2$eq) |
| Related enabled induced output ($) | X | Non-$CO_2$ (t $CO_2$eq) / Output ($) | = | Related enabled induced **Non-$CO_2$ EMISSIONS** (t $CO_2$eq) |

| | | | | |
|---|---|---|---|---|
| 70,000,000 | X | SAM India | = | 12,111,246 |
| 19,748,237 + 12,111,246 | X | SAM India | = | 89,480,702 |
| 89,480,702 | X | 0.000048 | = | 4,321 |
| 89,480,702 | X | 0.000327 | = | 29,219 |
| 89,480,702 | X | 0.000144 | = | 12,857 |

# Power plant

### Client input data

| Indicator | Client financials |
|---|---|
| Client name/code | Power plant A |
| Client type | *Project finance construction phase* |
| Fiscal year | *2018* |
| Country/region of operations | *Cameroon* |
| Economic activity | *Production of electricity* |
| Project value (annualised) | *150,000,000* |
| Direct employment – construction phase | *44* |
| Installed capacity | *420* |
| Technology type | *Hydro* |

### Supply chain, induced and direct impact

See example corporate investment.

The supply chain, induced and direct impact related to the construction of the power plant are temporary impacts.

### Power enabling impact

*Data filling*

Installed capacity (MW) X Net capacity factor est. based on technology type (%) X Potential operations time (h) = Power production (MWh)

420 X 42% X 8,760 = 1,541,585

*Quantification of enabled output*

Power production (MWh) / Power consumption (MWh) X 100 = Effective power addition (%)

Effective power addition (%) X Power-to-output translation factor (0.02%) = Effective output addition (%)

Effective output addition (%) X Total output ($) = Total enabled output ($)

[ 1,541,585 ] / [ 6,288,000 ] X 100 = [ 24.52 ]

[ 24.52 ] X [ 0.02% ] = [ 0.5% ]

[ 0.5% ] X [ 67,034,988,663 (split over sectors) ] = [ 328,689,948 ]

*Quantification of enabled impacts*

[ Enabled direct output ($) ] X [ Wages/taxes/profits ($) / Output ($) ] = [ Enabled wages ($) Enabled taxes ($) Enabled profits ($) ]

[ Enabled direct output ($) ] X [ Employment (#) / Output ($) ] = [ Enabled employment (#) ]

[ Enabled direct output ($) ] X [ CO2 (t CO2eq) / Output ($) ] = [ Enabled CO2 (t CO2eq) ]

[ Enabled direct output ($) ] X [ Non-CO2 (t CO2eq) / Output ($) ] = [ Enabled Non-CO2 (t CO2eq) ]

[ 328,689,948 ] X [ 23% 12% 16% ] = [ **74,201,493** **39,396,381** **53,515,143** ]

[ 328,689,948 ] X [ 0.000156 ] = [ **51,103** ]

[ 328,689,948 ] X [ 0.000066 ] = [ **21,814** ]

[ 328,689,948 ] X [ 0.000457 ] = [ **150,056** ]