Joint Impact Model

Joint Impact Model v4.0

Methodology

December 2025

Contents

Definitions/Terminology

ATR – Asset-turnover Ratio

EIA – Energy Information Administration

EBITDA – Earnings Before Interests, Taxes, Depreciation and Amortisation

FI – Financial Institution

GICS – Global Industry Classification Standard

GWh – Gigawatt Hour

GWP – Global Warming Potential

FTE – Full-time Employment

GDP – Gross Domestic Product

GFCF – Gross Fixed Capital Formation

GHG – Greenhouse Gas

GTAP – Global Trade Analysis Program

IEA – International Energy Agency

IFI – International Financial Institution

ILO – International Labor Organization

IMF – International Monetary Fund

IO – Input-Output

IQR – Interquartile Range

ISIC - International Standard Industrial Classification

JIM – Joint Impact Model

NACE – Statistical Classification of Economic Activities in the European Community

PAI – Potential Adverse Indicator

PCAF – Partnership for Carbon Accounting Financials

SAM – Social Accounting Matrix

SFDR – Sustainable Finance Disclosure Regulation

SME – Small-Medium Enterprise

WB – World Bank

WBDI – World Bank Development Indicator

WBES – World Bank Enterprise Survey

WIOD – World Input-Output Database

1 Introduction

This document outlines the Joint Impact Model (JIM) version 4.0, designed to assess the economic, social, and environmental impacts of portfolios. The JIM provides users with a tool to estimate both direct and indirect impacts, such as employment, greenhouse gas (GHG) emissions, and value-added, through a combination of macroeconomic statistics and client financial data.

In addition to covering the impacts, the JIM methodology also details the key inputs used in the model. These inputs include the data sources, calculation processes, and assumptions that underlie the model's estimates. By drawing from established data sets and models such as Social Accounting Matrices (SAMs), GHG intensities, and employment intensities, the JIM ensures that impact assessments are both robust and transparent.

The JIM methodology spans five key areas of impact: direct impacts at the client level, supply chain impacts through upstream and downstream activities, induced impacts driven by salaries' re-spending, finance-enabled impacts facilitated by financial intermediaries, and power-enabled impacts associated with additional energy generation projects. Each section provides detailed steps for calculating these impacts, grounded in internationally recognized standards such as the GHG Protocol, IFRS S1, PCAF and the EU Sustainable Finance Disclosure Regulation (SFDR).

JIM members and interested stakeholders 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.

1.1 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.

[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 labour legislation. Source: ILOSTAT.

- *Value-added:* the sum of wages, taxes and net income, 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 organization during the reporting period.
    - *Taxes:* all transfers to the government made by a client over the reporting period.
    - *Net income*: 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.

<u>Not included are</u> CO_2 emissions from forestry and other changes in land use.

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. However, many elements of job quality 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.

1.2 Scope of impacts

In quantifying impacts, the JIM takes the borrower or investee ("client") as the starting point (for financing through financial intermediaries this means the investee of the financial intermediary). The model estimates both the direct impacts and (part of) the indirect impacts of clients, and more specifically the following impacts:

- *Direct:* impacts at the client company/project.
- *Supply chain:* impacts at the client company/ project's suppliers and their suppliers, and downstream actors (e.g. distributors, transporters).
- *Induced:* impacts associated with the spending of wages earned by employees of the client company/ project, of its suppliers and of the supplier's suppliers.
- *Finance enabled:* impacts at companies, suppliers of companies, and their suppliers associated with the financial institution's lending
- *Power enabled:* impacts associated with the additional output generated by companies using the additional power generated by the client project, as well as by the companies' supply chain.

For GHG emissions, the key reference point is the GHG Protocol. The table below provides more details on the JIM's coverage of emissions for each of the GHG Protocol scopes. Keeping the limitations described in this document in mind, users can use these for their PCAF reporting.

Table 1: GHG Protocol Scopes covered by the JIM

Scope	Definition	Comment[3]
Scope 1	Direct emissions from owned or controlled sources.	Direct GHG emissions of client.
Scope 2	Indirect emissions from the generation of purchased energy.	Supply chain GHG emissions related to the client's direct electricity, steam, heat and cooling supplier.
Scope 3	All indirect emissions (not included in Scope 2) that occur in the value chain of the client.	Supply chain GHG emissions of the client's suppliers' (other than direct energy suppliers): • Scope 3 emissions related to the client's local upstream supply chain. • Scope 3 emissions related to the client's local downstream supply chain. • Scope 3 emissions related to the client's international upstream supply chain. Financed emissions are included. Not included are: [4] • Part of Category 11: Use of sold products (by customers, while by businesses is included) • Category 12: End-of-life treatment of sold products.

A fourth category of emissions is returned by the model: "Other". It corresponds to induced (re-spending of salaries) and power enabled emissions.

The impacts quantified are *gross* impacts: the model does not consider 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). Due to a risk of double-counting in the source data, import-related GHG emissions of subregions and regions are not calculated, while they are for individual countries.

The model does not measure 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.

Note that for reporting according to the PCAF standard, reports published in 2025 onwards will require reporting on scope 3 emissions for all sectors, (PCAF, 2025)[5].

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[3] Emissions financed through a financial intermediary are not yet part of the PCAF reporting.

[4] The JIM does not cover part of Scope 3 categories 11 and all of 12. [Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf]

[5] PCAF (2025). The Global GHG Accounting and Reporting Standard Part A: Financed Emissions. Third Edition. [PCAF-PartA-2025-Full-Document-Clean.pdf]

1.3 Use of JIM in the investment cycle

1.3.1 Ex-post

The JIM can be used 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 the 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 in a user's portfolio, both in year 1 and year 2.

1.3.2 Ex-ante

The JIM can 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 which are:

- 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 the User Guide.

2 Inputs

2.1 Statistics

2.1.1 Input-Output tables

2.1.1.1 Definition

Input-Output (IO) modelling traces company revenues through an economy, revealing linkages between the company and other domestic sectors. This methodology, developed by the Nobel Prize winning economist Wassily Leontief, is often used by economists to quantify indirect impacts.

The key component of the IO model is an Input-Output table (IO table), which is a compact and static representation of the economic structure of an economy. The table portrays the financial flows of all economic transactions between productive sectors. In the JIM, the IO tables are used as the cornerstone of the methodology. By using the tables themselves or parts of them, we enable the estimation of most impact indicators.

The JIM uses IO tables for 93 countries, 16 regions and 76 sectors (for a full list see Appendix 1). The base years of the IO tables, years for which source data is readily available, are 2004, 2007, 2011, 2014 and 2017.

Exhibit 1 shows a simplified example of such IO table. Columns represent buyers (expenditures), and rows represent sellers (receipts). In these tables, 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.

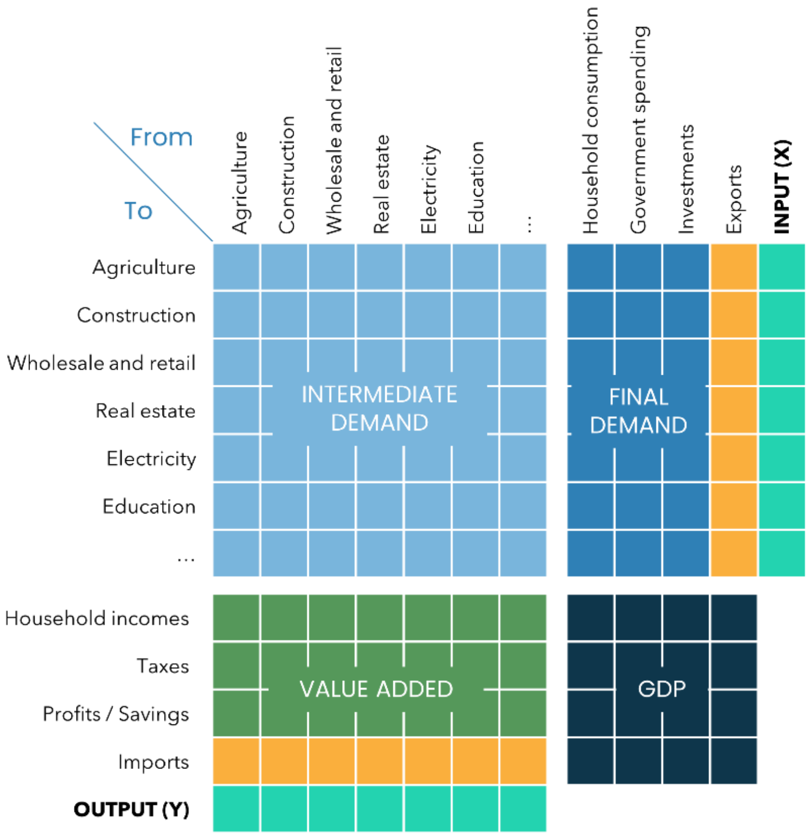

Exhibit 1: Simplified IO table

2.1.1.2 Source data

Data to compile the tables was collected from the Global Trade Analysis Project (GTAP). More information on GTAP and the datasets used is provided in Section 11.

2.1.1.3 Calculation

The IO tables were built following the guidelines of GTAP's Social Accounting Scheme[6]. They have then been simplified to only display the four components from Exhibit 1: intermediate demand, value-added, GDP and final demand. Lastly, primary factors[7] and tax-related items were separated in three value-added categories: salaries, taxes, and net income. These factors are compiled from data on endowments and taxes[8].

Moreover, by transposing the IO tables mentioned above we obtained a new set of IO tables applicable, as stated by B. Kolbl et F. Beckebanze (2024)[9], for downstream calculations.

For the regional IO tables, individual country tables and "rest of countries within the region" tables are used.[10] A country to region mapping is provided in Annex 1.

2.1.2 Relative IO tables

2.1.2.1 Definition

While the IO tables represent the actual total spending of an economy during a specific year, the relative IO tables correspond to the average spending pattern of an economy over that period, expressed in percentages.

2.1.2.2 Source data

The relative IO tables are based on the tables and transposed tables calculated in the previous section.

2.1.2.3 Calculation

The average spending pattern of a given sector is obtained by, in the IO tables, dividing each value in the column of that sector by the output value of that column. To get relative tables, this is applied to all sectors of the Social Accounting Matrix (SAM) described further is section 4.

In Exhibit 2, we show an example of this approach with the agricultural sector using a simplified IO table. The 5 units spent by the agricultural sector in "household incomes" are divided by the 26 units of total output. It tells us that, in average, the agricultural sector of that country would spend 19% of its output as wages.

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[6] Corong, E. L., Hertel, T. W., McDougall, R., Tsigas, M. E., & van der Mensbrugghe, D. (2017). The Standard GTAP Model, Version 7. Journal of Global Economic Analysis, 2(1), 1–119. https://doi.org/10.21642/JGEA.020101AF

[7] Primary factors, or factors of production, correspond to the basic inputs used in the production process. In the GTAP database, they consist of 5 different elements: land, unskilled labour, skilled labour, capital, and natural resources.

[8] 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.

[9] Research published by Rabobank (2024). media.rabobank.com/m/6a2f645745f794dc/original/Rabobank_Estimating_upstream_and_downstream_supply_chain_emissions_Kolbl_Beckebanze_202406.pdf

[10] "Rest" tables from GTAP typically cover multiple countries for which no individual tables are available. https://www.gtap.agecon.purdue.edu/databases/regions.aspx?Version=11.211

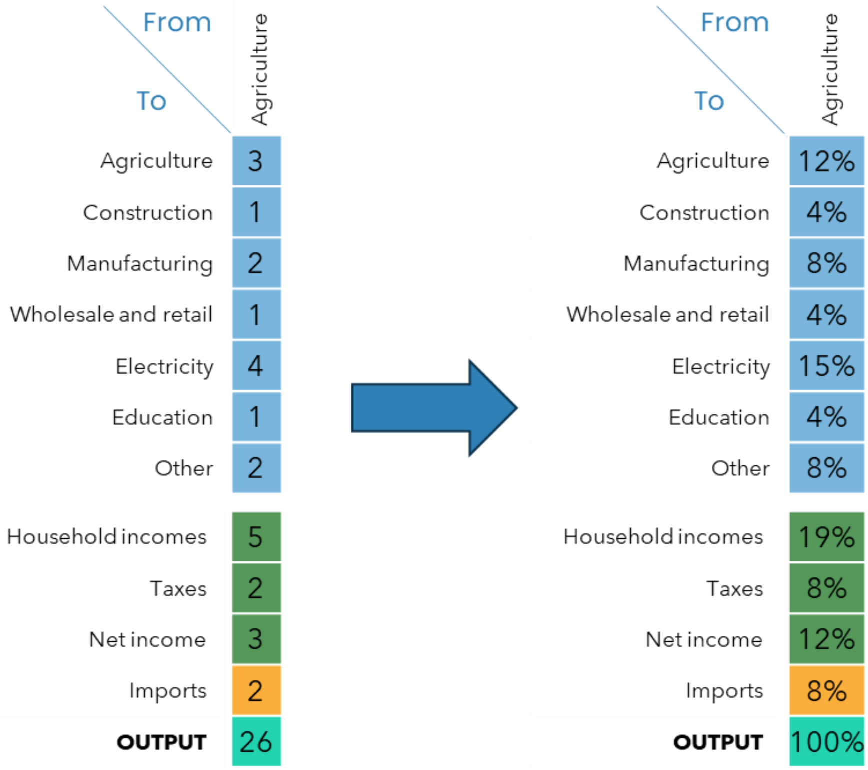

Exhibit 2: Transition from IO table to relative IO table

2.1.3 GHG intensities

2.1.3.1 Definition

GHG intensities reflect the metric tons of CO_2 and non-CO_2 emissions per unit of output in a certain country and sector. The JIM uses GHG intensities for 162 individual countries (out of which high-income countries are deactivated in JIM 4.0), 16 regions and 76 sectors. The base years are 2004, 2007, 2011, 2014 and 2017.

2.1.3.2 Source data

The GHG intensities rely on the following source data (see Section 11.1 for more insights on data sources):

- *CO_2 and non-CO_2 emission data*.
- *Global Warming Potential (GWP) data*.
- *Output data*: the value of goods and services produced during a specific year by a sector, expressed in USD. This data comes from the IO tables (Section 2.1.1).

2.1.3.3 Mapping

As the countries and sectors of the three datasets above mentioned were directly corresponding, no mapping was needed to derive the GHG intensities.

2.1.3.4 Calculation

The intensities were derived by first multiplying the non-CO_2 emissions with their respective GWPs to get CO_2e data. Then, CO_2 and non-CO_2 emissions per sector and country were divided by the output per sector and country to obtain GHG intensities.

Note that CO_2 emissions are already accessible in tCO_2e, and no conversion is needed.

1. (Non-CO2 emissions (mmt)) X (GWP per non-CO2 gas) = (Non-CO2 emissions (tCO2e))

2a. (Non-CO2 emissions (tCO2e)) / (Total output ($)) = (Non-CO2 intensities (tCO2e/$))

2b. (CO2 emissions (tCO2e)) / (Total output ($)) = (CO2 intensities (tCO2e/$))

Exhibit 3: Calculation of GHG intensities

As the countries and sectors of the three datasets above mentioned are the same, no mapping was needed to derive the GHG intensities.

Regional GHG intensities are based on individual country data of countries in the specific region. A country to region mapping is provided in Annex 1.

2.1.4 Employment intensities

2.1.4.1 Definition

Employment intensities reflect the number of employed people per unit of output in a certain country and sector. The JIM uses employment intensities for 162 individual countries (out of which high-income countries are deactivated in JIM 4.0), 17 regions and 14 aggregated sectors. The intensities are prepared for the years 2004, 2007, 2011, 2014 and from 2017 to 2027.

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 over the next year.

2.1.4.2 Source data

The employment intensities rely on the following source data (see Section 11.1 for more):

- *Employment data per sector.*
- *Employment data per gender and age group.*
- *GDP growth rates*.
- *Output data:* the value of goods and services produced during a specific year. This data comes from the IO tables (Section 2.1.1).

2.1.4.3 Mapping

The sector classifications between the GDP growth rates and output datasets are different, there are not direct correspondents, and thus the datasets needed to be mapped. 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, and the respective WBDI growth rate for industry and service sectors was used. If WBDI data of a specific sector was not available, the model used data on total GDP change for all instead. The key assumption here is that output grows in line with GDP.

ILO relies on aggregated ISIC sectors while GTAP has a more granular breakdown. Therefore, to match employment data, output data was aggregated following the ISIC-GTAP mapping provided in Appendix 2. For example, the output data from the first fourteen GTAP sectors were summed to match the "Agriculture, forestry and fishing" employment data of ILO.

2.1.4.4 Data filing

The source data listed in section 2.1.4.2 is not available for all targeted years.

1. Output data for 2018 to 2027 per country and sector needed to be derived by the JIM team. The key assumption here is that output grows in line with GDP. Depending on data availability, three different approaches were used.

    a. Using WBDI data, we multiplied the IO output with the GDP growth rate from the "start" year to the desired year, per country and aggregated sector (i.e. agriculture, manufacturing, industry, and services). If growth rates per aggregated sector are not available, we used WBDI's country-level GDP growth rate data instead. Due to data availability issues, this approach and data source were typically applied to estimate 2018 to 2023 output.

    b. Using WEO data, we multiplied IO output with the GDP growth rate from the "start" year to the desired year, per country. Due to data availability issues, this approach and data source was typically applied to estimate 2024 to 2025 output.

    c. If neither WEO nor WBDI data is available, we applied the linear annual growth rate between the first and last available year to the output. This approach was typically used to estimate 2026 to 2027 output.

2. Employment data for 2023 to 2025 also needed to be estimated per country and sector. While total employment data is readily available per country, it is not per sector. Therefore, we applied the latest available sectoral breakdown from 2022 to 2023, 2024, and 2025's total employment figures to get sector coverage.

3. Finally, we needed a separate estimation for employment data for 2026 and 2027 per country and sector. Using a combination of historical and forecast employment data (2004 to 2025), we estimated the potential growth rate of total jobs in 2026 and 2027.

    Then, as detailed in step 2, we applied the latest available sectorial breakdown (2022) to get sector coverage.

2.1.4.5 Calculation

With employment and output data available for 2004, 2007, 2011, 2014 and from 2017 to 2027, employment data per was divided by the output to obtain employment intensities per sector and country.

Regional employment intensities are based on individual country data of countries in the specific region. Data needs to be available for both datapoints (employment and output) for the countries to be included. A country to region mapping is provided in Annex 1.

2.1.5 Female employment share

2.1.5.1 Definition

It reflects the share of female workers in the total workforce. The JIM uses female employment shares 93 countries, 17 regions and 14 aggregated sectors. The intensities are prepared for the years 2004, 2007, 2011, 2014 and from 2017 to 2027.

2.1.5.2 Source data

The shares rely on the following source data (see Section 11.1 for more insights on source data):

- *Employment data per sector and gender.*

2.1.5.3 Mapping

ILO relies on aggregated ISIC sectors while GTAP has a more granular breakdown. Therefore, the shares calculated below are available for 14 aggregated ISIC sectors but applied to all GTAP sectors.

2.1.5.4 Calculation

1. Female employment data for 2023 to 2025 needed to be estimated per country and sector. While female employment data is readily available per country it is not per sector. Therefore, we applied the latest available sectorial breakdown (2022) to 2023, 2024 and 2025's female employment figures to get sector coverage.

2. Then, we needed a separate estimation for female employment data for 2026 and 2027 per country and sector. Using a combination of historical and forecast female employment data (2004 to 2025), we estimated the potential growth rate of female jobs in 2026 and 2027. Then, as detailed in step 2, we applied the latest available sectorial breakdown (2022) to get sector coverage.

3. Finally, we divide the female jobs with total jobs (Section 2.1.4.5) per year, country and sector to get the female employment shares.

2.1.6 Formal/informal employment share

2.1.6.1 Definition

As the clients' suppliers are not expected to only have formal employees (Section 1.1), the JIM provides a formal/informal jobs breakdown for supply chain and induced employment. The JIM uses formal/informal employment share for 7 regions and 76 sectors. The base years are 2004, 2007, 2011, 2014 and from 2017 to 2027.

2.1.6.2 Source data

The formal/informal employment shares rely on the following source data (see Section 11.1 for more insights on source data):

- *Share of informal sector GDP*: the share of GDP contributed by the informal economy.[11]

- *Share of informal sector employment*: the share of working age people employed in the informal economy[12]. The data have been obtained from ILOSTAT, which has estimates available for 69 countries, with varying base years.

- *Employment intensities*.

2.1.6.3 Mapping

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[11] 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

[12] 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/)

Countries were mapped to the regions used in the IMF paper, and an unweighted average was derived for the same 6 regions worldwide.

2.1.6.4 Calculation

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

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 (Exhibit 4).

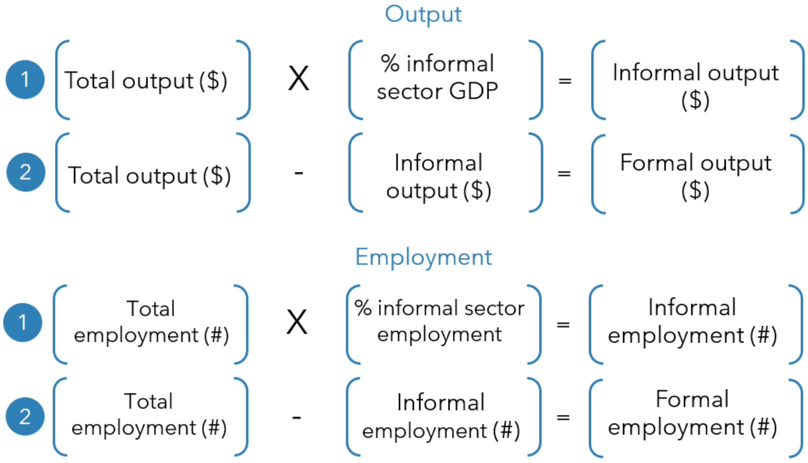

Exhibit 4: Calculation of total informal and formal employment and output

3. Third, the formal/informal employment and output had to be distributed over the GTAP sectors to be able to derive the share of formal/informal employment per sector. Based on the sector assumptions in Table 2, we distinguished 4 types of sectors' formality: "clear (none)" means that most employees are informally hired, "clear (all)" means most employees are formally hired, and "unclear" means that a clear cut can't be determined between formal and informal hires. Using those assumptions and different sector types, formal/informal employment and output per sector could be estimated.

Table 2: Assumptions on formal sector

ISIC sector	**GTAP sectors**	**Assumption[13]**	**Formal sector data**
Agriculture; forestry and fishing	1-14[14]	Only informal sectors	Clear (none)
Mining and quarrying	15-18	Mix formal & informal sectors	Unclear
Manufacturing	19-45	Mix formal & informal sectors	Unclear
Utilities	46-59	Only formal sectors	Clear (all)
Construction	60	Mix formal & informal sectors	Unclear

[13] 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.

[14] 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.

ISIC sector	GTAP sectors	Assumption	Formal sector data
Wholesale and retail trade; repair of motor vehicles and motorcycles	61	Mix formal & informal sectors	Unclear
Transport; storage and communication	63-67	Mix formal & informal sectors	Unclear
Accommodation and food service activities	62	Mix formal & informal sectors	Unclear
Financial and insurance activities	68-69	Only formal sectors	Clear (all)
Real estate	70, 76	Only formal sectors	Clear (all)
Business and administrative activities	71	Only formal sectors	Clear (all)
Public administration and defence; compulsory social security	73	Only formal sectors	Clear (all)
Education	74	Mix formal & informal sectors	Unclear
Human health and social work activities	75	Mix formal & informal sectors	Unclear
Other services	72	Mix formal & informal sectors	Unclear

For GTAP sectors 1-14 all employment and output have been allocated to the informal sector ("clear" informal sector employment and output). For GTAP sectors 46-59, 68-71, 73 and 76, all employment and output have been allocated to the formal sector ("clear" formal sector employment and output). 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 output, in the "unclear" sectors, the "clear" formal/informal sector output have been deducted from the totals. Then, the share of "unclear" formal output in the total "unclear" output was applied to the total output of the remaining sectors to derive the formal output in these sectors (Exhibit 5). Each of the four variables (i.e. total formal/informal employment and total formal/informal output) are conserved and will be used in Section 2.1.7 to calculate formal sector adjustment.

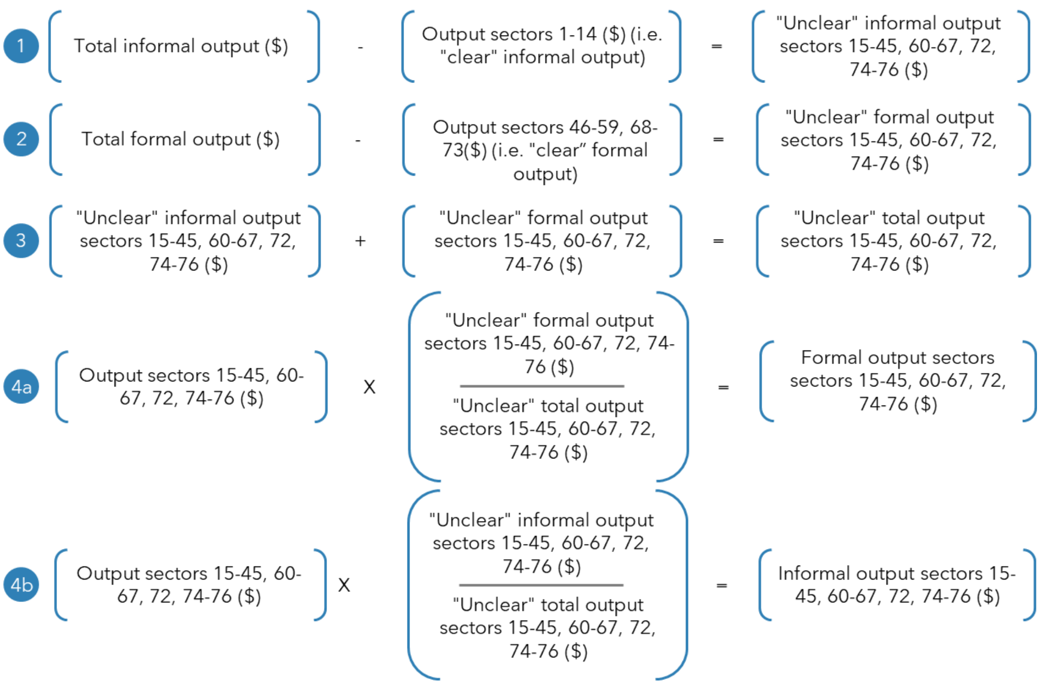

Exhibit 5: Calculation of formal and informal output for "unclear" sectors

The same was done for employment (Exhibit 6).

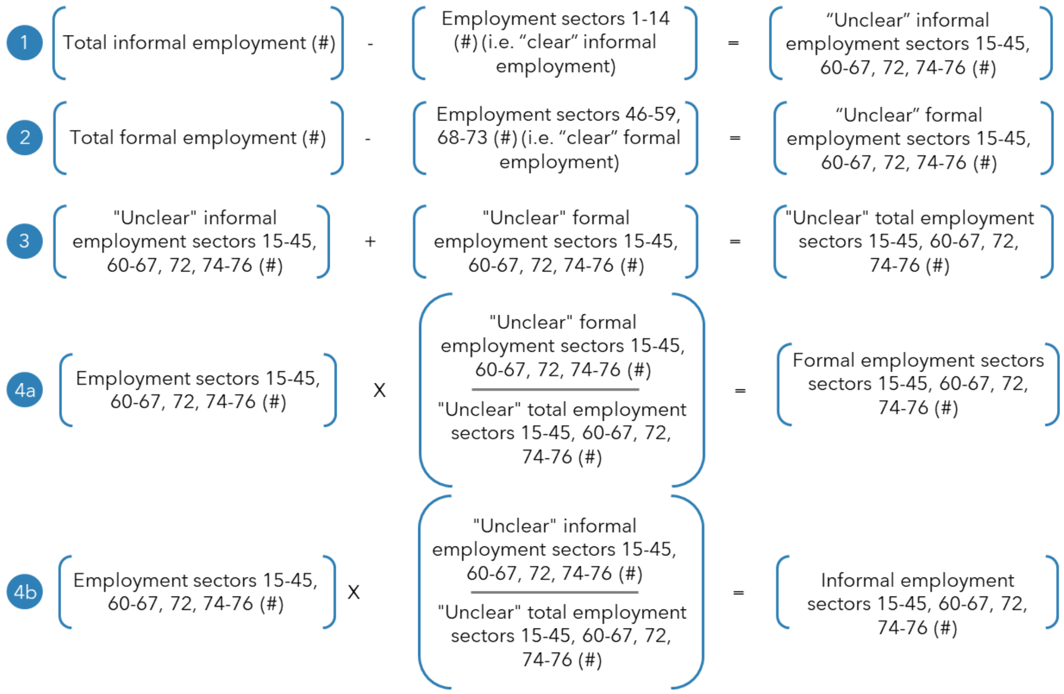

Exhibit 6: Calculation of formal and informal employment for "unclear" sectors

5. Finally, formal and informal jobs were respectively divided by the total employment per sector to derive the formal and informal employment share.

2.1.7 Formal sector adjustment

Using data from the previous section (step 4 of Section 2.1.6.4), we derive formal sector employment intensities by dividing formal employment by formal output, per sector and region. Then, the formal intensities are divided by the regular employment intensities to get the formal sector adjustment per sector and region.

The statistics are calculated for the years 2004, 2007, 2011, 2014, 2017 to 2027, for 7 regions.

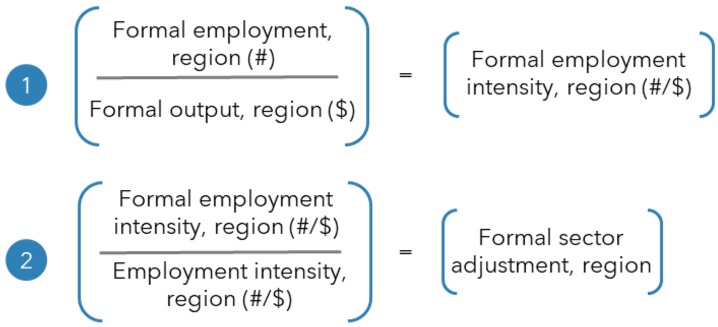

Exhibit 7: Calculation of formal sector adjustments per region and sector

2.1.8 Firm size adjustment to employment intensities

The formal sector adjustment 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) (see Appendix 3 for a definition of SMEs). The adjustments (Table 3) 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.[15]

Table 3: Firm size adjustment

Firm size	**Value**
Micro enterprise & SME	1.36
Large enterprise	0.82

2.1.9 Average private sector asset turnover ratios

2.1.9.1 Definition

Financial institutions struggle to directly measure the impacts of their clients, including factors like value-added, greenhouse gas emissions, and employment, and face challenges when attempting to estimate these impacts based on physical activity or turnover data, especially in the case of numerous clients in various sectors, including emerging markets and developing countries.

A potential solution to these challenges is the use of average private sector asset turnover ratios (ATRs). In such cases, FIs can estimate their share of client turnover by multiplying their investment (a contribution to the client's total assets) by a sectoral ATR. Although using sectoral averages for individual firms might not be ideal, it can balance out for FIs with multiple investments in a sector. This is the method applied in the JIM to calculate Finance Enabling impacts.

The average asset turnover ratios were determined by using total private sector capital stock per sector and total output per sector for 7 regions (i.e. Europe, Asia, China, Africa, North America, Latin America and Caribbean, Oceania). The asset turnover ratios are developed on a regional level instead of individual country level. This higher level of aggregation reduces the effect of outliers due to limited availability and reliability of capital data per sector (especially when sectors are smaller). The base years are 2004, 2007, 2011, 2014 and 2017.

2.1.9.2 Source data

The ATRs rely on the following source data (see Section 11.1 for more insights on source data):

- *Capital stock data*.
- *Capital endowment data*.
- *Gross fixed capital formation (% of GDP)* (GFCF).
- *Gross fixed capital formation, private sector (% of GDP)* (GFCF, private sector).
- *GDP (current USD)*.
- *Output data*: the value of goods and services produced over a given year by a sector. This data comes from the IO tables (Section 2.1.1).

[15] 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.enterprise-development.org/wp-content/uploads/ScalingUp_SME_Access_to_Financial_Services.pdf

2.1.9.3 Data filing

For the calculation of the ATRs, we are missing two statistic inputs:

- Capital stock data per sector, the total value of all assets used to produce goods and provide services in a given period. It was estimated by multiplying the total capital stock data with the capital endowment share per sector for the specific region.

$$\text{Capital stock (\$)} \times \text{Capital endowment \% per sector} = \text{Capital stock per sector (\$)}$$

Exhibit 8: Calculation to derive capital stock per sector

- Average GFCF share data (both total and private sector) per country. We first needed to convert GFCF data to current USD. It was done by multiplying the GFCF data (both total and private sector) by the GDP data of the corresponding country.

  Then, as some data points may be missing for specific base years, we compiled averages over multiple years. For example, for the base year 2017, we made an average of GFCF data from 2014 to 2020. For 2014, an average of 2011 to 2017.

  Finally, we divide the average private sector GFCF calculated previously with the average total GFCF of the same period. Exhibit 9 shows how 2017's data would be calculated.

$$\text{Average private sector GFCF 2010-2017 (\$)} \;/\; \text{Average total GFCF 2010-2020 (\$)} = \text{Average private sector GFCF share (\%)}$$

Exhibit 9: Calculation of 2017's average private sector GFCF shares

2.1.9.4 Calculation

The average private sector asset turnover ratios reflect how much output is supported by one unit of private sector investment in a certain sector and region.

To derive the average asset turnover ratios, the output per sector and region was divided by the capital stock data per sector and region.

$$\text{Output per sector (\$)} \;/\; \text{Capital stock per sector (\$)} = \text{Average asset turnover ratios}$$

Exhibit 10: Calculation of the average asset turnover ratios

Finally, to get to the average private sector asset turnover ratios, we divide the average asset turnover ratio by the average private sector GFCF share (out of total GFCF) of all countries within a region.

$$\text{Average asset turnover ratios} \;/\; \text{Average private sector GFCF share (\%)} = \text{Average private sector asset turnover ratios}$$

Exhibit 11: Calculation of the average private sector asset turnover ratios

2.1.10 Firm size adjustment asset turnover ratio

The average private sector asset turnover ratio is adjusted for firm sizes (i.e. micro enterprises, SMEs and large enterprises). Please see Appendix 3 for definitions of micro enterprises and SMEs. The adjustments are based on a study from Bas et al (2010). Using WBES data, Bas et al (2010) 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. [16] The numbers show that micro enterprises and SMEs produce 1.2 times more output with one unit of capital than the economy average, and large enterprises only 0.73.

Table 4: Firm size adjustments to asset turnover ratios

Firm size	**Value**
Micro enterprise & SME	1.20
Large enterprise	0.73

2.1.11 Power-to-output translation factor

The power-to-output translation factor is based on a research paper, commissioned by the IFC and supported by the World Bank[17], on the effect of electricity consumption on value-added. A factor of 1:0.02 was estimated and is applied for all sectors of all countries.

This factor represents the expected raise in sectorial value-added (0.02%) for a one-percent increase in electricity consumption.

2.1.12 Electricity consumption

The JIM uses total electricity consumption (in GWh) per country from the International Energy Agency (IEA) database. To supplement the energy data from the IEA, the JIM uses data from the Energy Information Agency (EIA).

The JIM uses electricity consumption data provided by the EIA for countries in which IEA data is unavailable, thereby improving coverage. The base years are 2004, 2007, 2011, 2014, 2017 and 2023.

For more information on the data sources, refer to Section 11.1.

2.1.13 Net capacity factors

2.1.13.1 Definition

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

[16] 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

[17] https://documents1.worldbank.org/curated/en/240861634825936309/pdf/Sectoral-Value-Added-Electricity-Elasticities-across-Countries.pdf

2.1.13.2 Source data

For renewable energy technologies, the JIM uses net capacity factors from the US EIA based on the 2017 average net capacity factors of utility scale plants in the United States[18]. Seven renewable energy net capacity factors are used in the JIM: biomass, geothermal, hydro, solar, wind, wood, and nuclear power. The base year for these net capacity factors is 2017.

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%. In emerging markets the use of these plants is often more than what is intended: they are often required for base load power. Thus, a realistic approach is to assume a net capacity factor of 40%.

Table 5: Net capacity factors

Non-fossil fuels	Net capacity factor
Geothermal	73.2%
Hydro	43%
Nuclear	92.3%
Biomass	61.8%
Solar PV[19]	25.6%
Solar thermal	21.8%
Wind	34.6%
Wood	60.2%
Misc. renewables	n/a

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

The above data is used by default by the model. However, when net capacity factors are provided by the user, the JIM will use this data instead.

2.1.14 Energy consumption

2.1.14.1 Definition

For the calculation of PAI 5 and 6, the model needs energy consumption data (excluding non-energy usage), per energy source, sector, and country.

2.1.14.2 Source data

The JIM uses energy usage data available in GTAP. It is available for 16 different energy products[20] (Coal, Oil, Pipeline gas, Petroleum and coal products, Nuclear base load, Coal base load, Gas base load, Wind base load, Hydro base load, Oil base load, Other base load, Gas peak load, Hydro peak

[18] EIA. Capacity Factors for Utility Scale Generators Primarily Using Non-Fossil Fuels. Retrieved on August 21st, 2023, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_b

[19] i.e. photovoltaic.

[20] Electricity consumption mix doesn't change between sectors. Mix is taken at national level and applied proportionally across all sectors.

load, Oil peak load, Solar peak load and Distributed gas). For more information on the data coverage please refer to Section 11.1.1.

However, preliminary adjustments are necessary to make the GTAP data usable in the model.

2.1.14.3 Calculation

1. First, GTAP data on energy usage needs to be converted from Mtoe to GWh through the OECD/IEA efficiency factors[21] and the IEA's conversion rate[22].

Table 6: Efficiency factors and conversion rates applied to energy usage data

Energy products	**Efficiency factor**	**Conversion rate (GWh/Mtoe)**
Coal	100%	11,630
Oil	100%	11,630
Pipeline gas	100%	11,630
Petroleum and coal products	100%	11,630
NuclearBL	33%	3,837.9
CoalBL	39%	4,535.7
GasBL	39%	4,535.7
WindBL	100%	11,630
HydroBL	100%	3,837.9
OilBL	39%	4,535.7
OtherBL	31%	3,605.3
GasP	39%	4,535.7
HydroP	100%	3,837.9
OilP	39%	4,535.7
SolarP	100%	11,630
Distributed gas	100%	11,630

2. Subsequently, meticulous attention was given to the intricacies of accounting guidelines within the energy balance framework, aiming to eliminate the potential for double counting, particularly in cases of shared energy usage across linked sectors, such as petroleum in the manufacturing of plastic products.

   This adjustment is meant to only account for the energy-related usage of the energy products and discard the non-energy related use of the energy products as GTAP data aggregated both. Here, we used research from the Science Base Targets organisation and EUROSTAT, together with energy balance data from the IEA, to determine which energy products are used for non-power related purposes.

   Our findings revealed that, for instance, most industries use oil as a lubricant, and that petroleum is used in the production of plastic. Considering the complexity of dealing with sectors with a risk of double counting, and the lack of data available to help make the distinction, we decided to apply a conservative approach and assumed that all those sectors' energy product usage is non-power related.

[21] Organization for Economic Co-operation and Development, International Energy Agency, Energy. Balances of OECD Countries 1992-1993 (Paris: OECD, 1995).

[22] https://www.iea.org/data-and-statistics/data-tools/unit-converter

The non-renewable energy data was then aggregated to derive the total non-renewable energy consumption per sector. This aggregation process was extended to encompass all energy consumption data, yielding the overall energy consumption per sector.

2.1.15 Energy consumption intensities

2.1.15.1 Definition

The intensities correspond to the amount of energy necessary to produce one unit of economic output. These are calculated for different categories of energy: renewable, non-renewable, electricity, etc.

2.1.15.2 Source data

The data computed in Section 2.1.14 is used here.

2.1.15.3 Calculation

The energy consumption intensities were calculated by dividing total energy consumption by the total output, as per the data available in the IO tables, thereby obtaining total energy consumed intensities (measured in GWh consumed per USD) across countries and sectors. The same approach was applied to renewable/non-renewable energy and electricity, as shown in Exhibit 12.

Total energy consumed (GWh) / Total output ($) = Total energy consumed intensity (GWh/$)

Non-renewable energy consumed (GWh) / Total output ($) = Non-renewable energy consumed intensity (GWh/$)

Renewable energy consumed (GWh) / Total output ($) = Renewable energy consumed intensity (GWh/$)

Electricity consumed (GWh) / Total output ($) = Electricity consumed intensity (GWh/$)

Renewable electricity consumed (GWh) / Total output ($) = Electricity consumed intensity (GWh/$)

Exhibit 12: Calculation of energy and electricity consumption intensities

2.2 Client financials

The model uses a parsimonious approach, meaning 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"). The subsections below list the core inputs the model will rely on when calculating impact.

A full list of client financial data inputs per client type can be found in Section 3.3 of the User Guide, including optional data inputs.

2.2.1 Direct, supply chain and induced impact

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

- *Revenue*: gross value of revenue over the reporting period. For FIs, gross interest income can be used as a proxy.
- *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), used to pull the right statistic data.

2.2.2 Finance enabled impact

FI enabling impacts are estimated when JIM users 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 (or broader sectors) by FIs is available.

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

  Aside from this financial input, the model also requires data on the sectors and countries financed.

2.2.3 Power enabling

To estimate power enabling impacts, the model requires either power production or installed capacity and power technology type. 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, the model cannot measure power enabling impacts.

- *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 5.

  Aside from this information, the model also needs information on the country where the power is being produced.

The data inputs for attribution can be found on Section 8.

3 Direct impact

This impact corresponds to results either retrieved from or extrapolated from the "Individual clients" tab.

Observable data provides insights into direct impacts of business or financial institutions. However, some indicators cannot be easily observed. For example, GHG emissions are often not measured by clients. To estimate GHG emissions, the JIM requires users to insert as much directly observable data as possible.

3.1 Methodology overview

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.

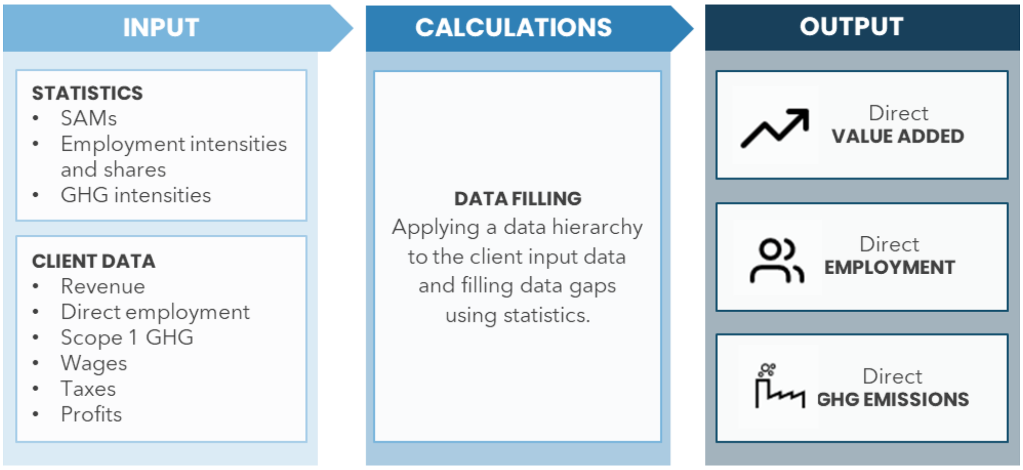

Exhibit 13: Overview methodology for direct impact

3.2 Preliminary mapping

The client data is mapped to the countries and sectors for which IO tables are available in the following way:

- *Country/region mapping*: the country/region names of the client financials are mapped to IO table countries/regions. For most countries, individual country IO tables are available. If this is not the case, sub-regional statistics will be applied. For example, for Angola individual country statistics are not available, and the country is therefore mapped to the IO table of the region "Middle Africa". See Appendix 1 for a list of all available IO tables.

- *Economic activity mapping*: the client's economic activity is mapped to corresponding IO table sectors, according to a mapping list from NACE (level 1-4), ISIC (level 1-4) or GICS sectors (6-digits) to GTAP sectors. Mappings from GTAP sectors to NACE level 1, ISIC level 1 (aggregated) and GICS sectors are available in Annex 2.

If one NACE sector maps to several GTAP sectors, the financial data will be distributed across GTAP sub-sectors using the proportions of the corresponding sectors in the IO table. Exhibit 14 provides an example of how revenue is distributed when the client's economic activity maps to two GTAP sectors. The same approach is applied if multiple GTAP sectors are inserted for a given client.

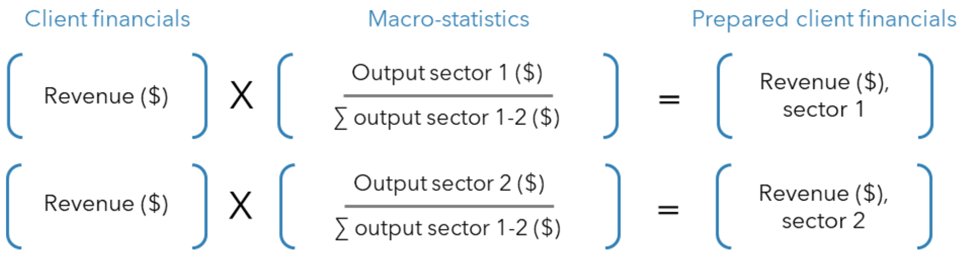

Exhibit 14: Example of how revenue client data is divided over 2 GTAP sectors

If multiple economic activities are inputted for a single client using the "Customised breakdown" feature (see Section 3.3.1 of the User Guide), a similar mapping is carried out for each economic activity inserted but using the shares per sector provided (Exhibit 15).

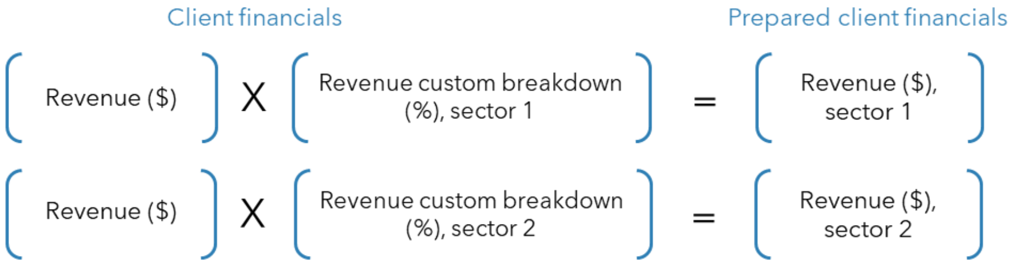

Exhibit 15: Example of how revenue client data is divided using customised breakdown

When optional financial inputs are provided, such as direct wages, they are also split based on GTAP sectors total revenue proportions.

3.3 Impact calculations

3.3.1 Absolute emissions – Scope 1

If absolute emissions – Scope 1 (direct emissions) are not provided, the emissions are estimated by multiplying the client's revenue by the CO_2 and non-CO_2 emission intensity of the client's sector and country. On the contrary, if this data point is provided, the input is split between CO_2 and non-CO_2 using the estimates' distribution.

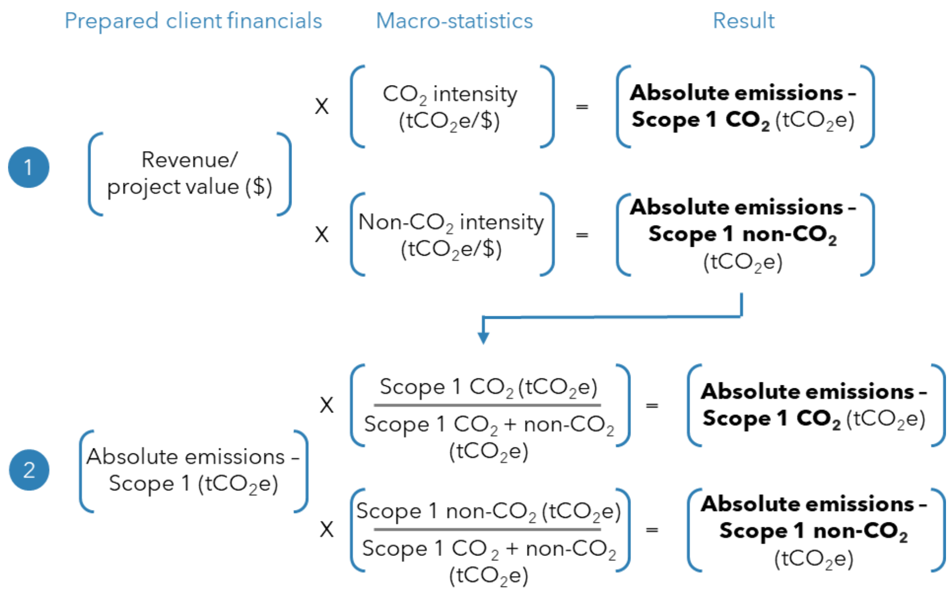

Exhibit 16: Data hierarchy for calculating absolute emissions – Scope 1, with single sector

If multiple economic activities are inserted for a given client, data provided by the client needs to first be split over those sectors (step 1 from Exhibit 17 uses data from Section 3.2).

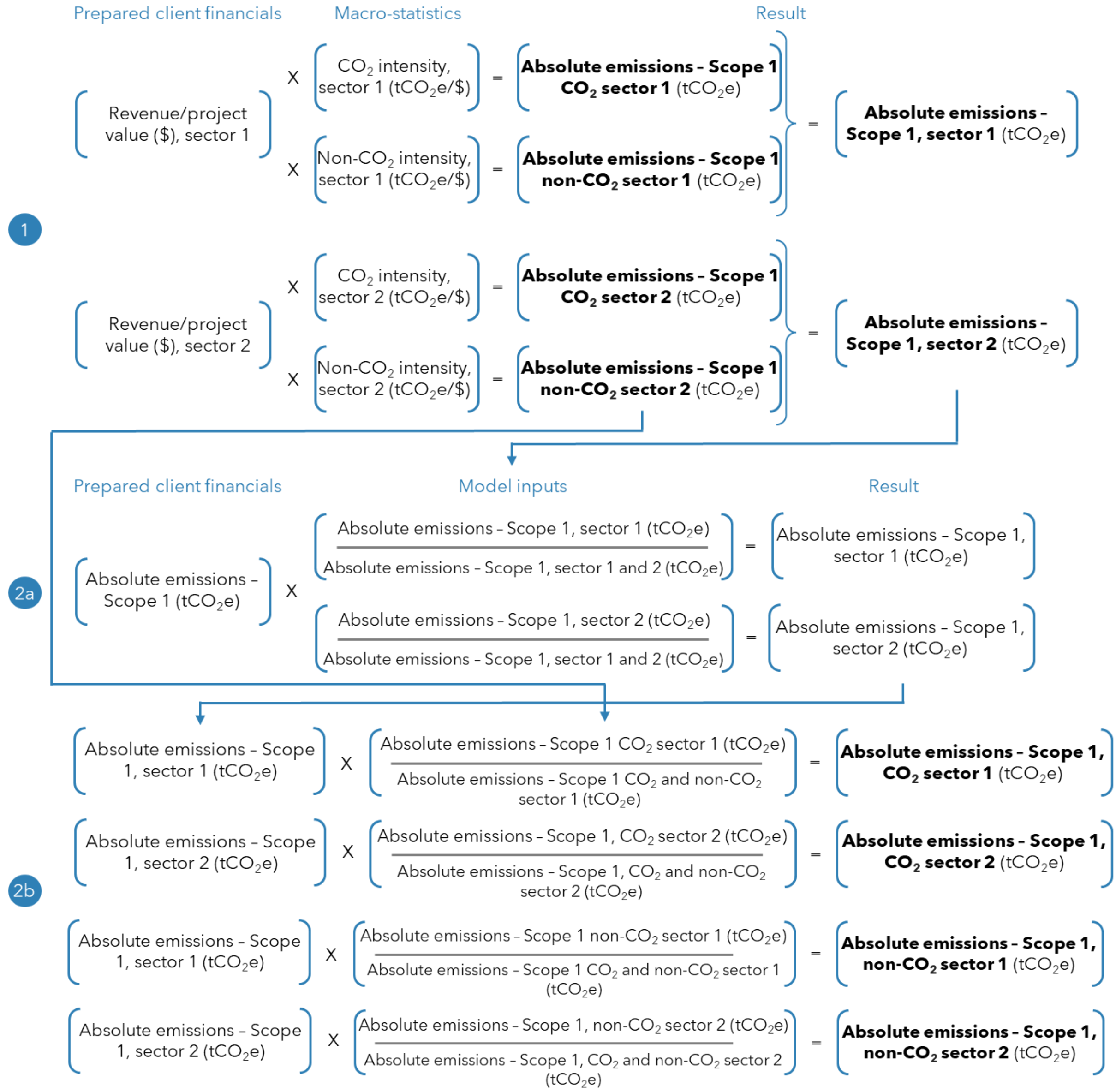

Exhibit 17: Data hierarchy for calculating absolute emissions - Scope 1, with multi-sectors

3.3.2 Emission removal

Emission removals are never estimated by the JIM. The data provided by the user in the dedicated input field is used as is and will not be split between CO_2 and non-CO_2.

If data is not available, no results are provided.

3.3.3 Employment

3.3.3.1 Total jobs

Total direct employment can either be provided directly by the user or estimated from revenue/project value. 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.

Finally, in the last scenario, the revenue/project value is multiplied by formal sector adjustment and the employment intensity of the relevant sector and country to estimate the direct jobs.

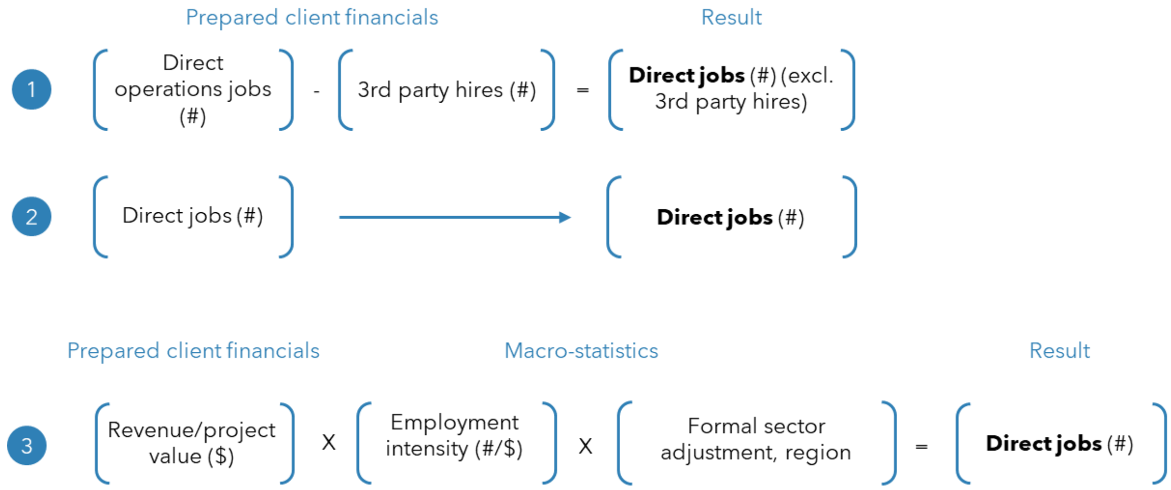

Exhibit 18: Data hierarchy for quantifying direct employment impact

If multiple economic activities are inserted for a given client and jobs are not provided, the revenue provided by the client needs to first be split over those sectors (see Section 3.2) and then estimation can be done.

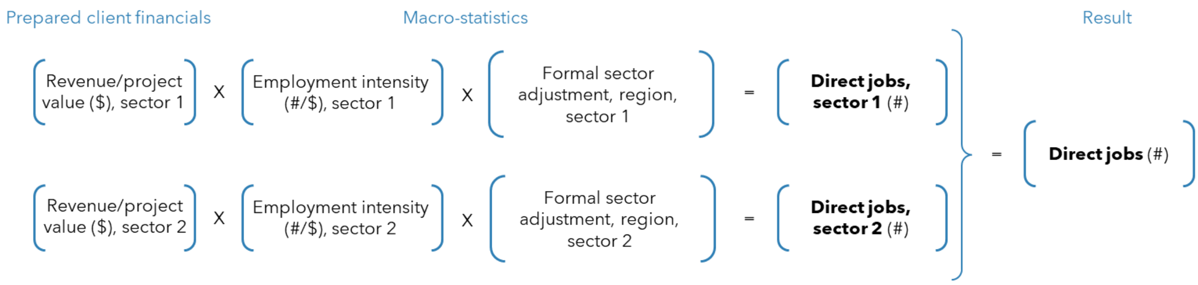

Exhibit 19: Calculation of direct employment impact with multi-sectors

3.3.3.2 Female jobs

For female jobs, the model uses the same data hierarchy as for the total jobs. When estimating direct female jobs, the model applies female employment share in a specific sector and country (Section 2.1.5) to the total direct jobs (Section 3.3.3.1).

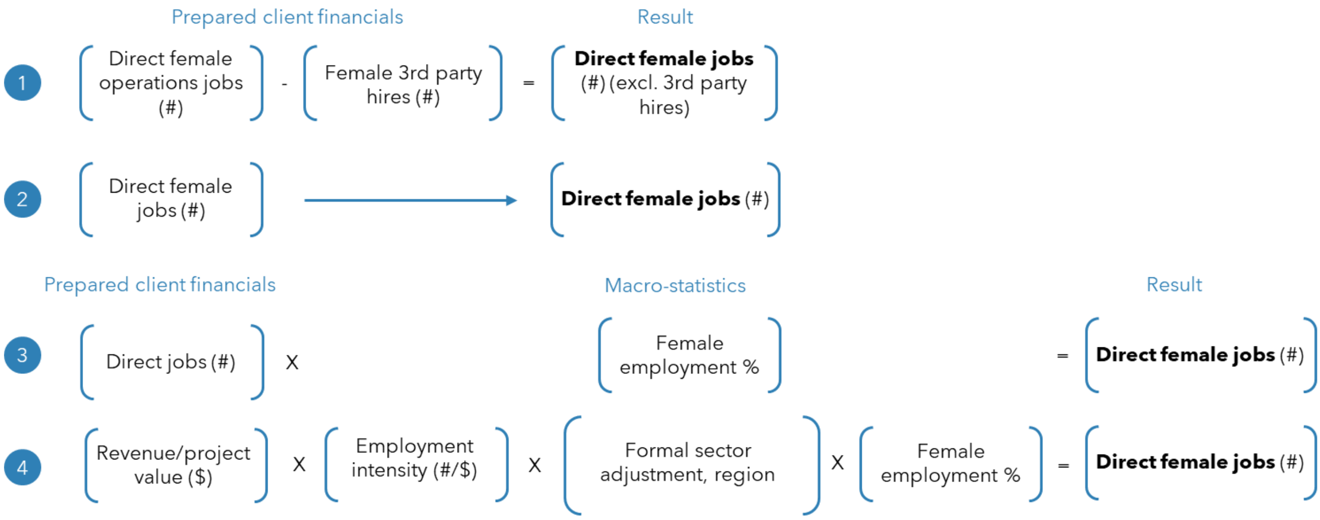

Exhibit 20: Data hierarchy for the calculation direct female employment impact

If multiple economic activities are inserted for a given client and jobs are not provided, the revenue provided by the client needs to first be split over those sectors (see Section 3.2) and then estimation can be done.

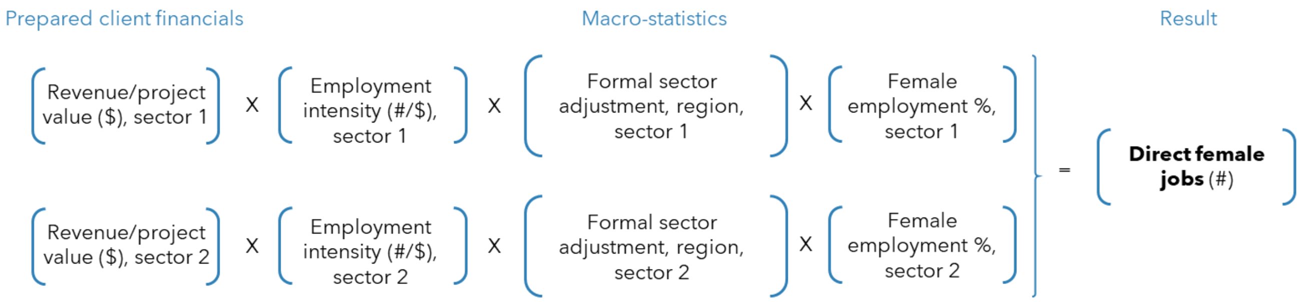

Exhibit 21: Calculation of direct female employment impact with multi-sectors

3.3.3.3 Youth employment

For youth employment, the share from total employment is always provided as a percentage but not applied to the estimated results. This share is based on the percentage of jobs for youth in a particular country and does not have sectorial breakdown (Section 11).

3.3.3.4 Job results annualization adjustments

For some projects and investments, the client data available may not correspond to a 12-month fiscal year. If these non-annualized financials are inserted, the quantified jobs will be in job-years instead of people employed during the project lifetime (i.e. the desired impact indicator in the JIM).

To avoid this unit mismatch and any double counting of jobs (e.g. two job years is equivalent to one person employed over the two years of the project's lifetime), job results will be annualized using the "Project timeline" input column.

Exhibit 22: Adjustment to jobs result (if necessary)

3.3.4 Value-added

3.3.4.1 Wages

If direct wages data is provided, the model outputs data as is. If no direct data on wages is provided, the JIM estimates it by combining the revenue/project value data with optional inputs (e.g. EBITDA, total procurement), or with statistical data if not optional inputs are available.

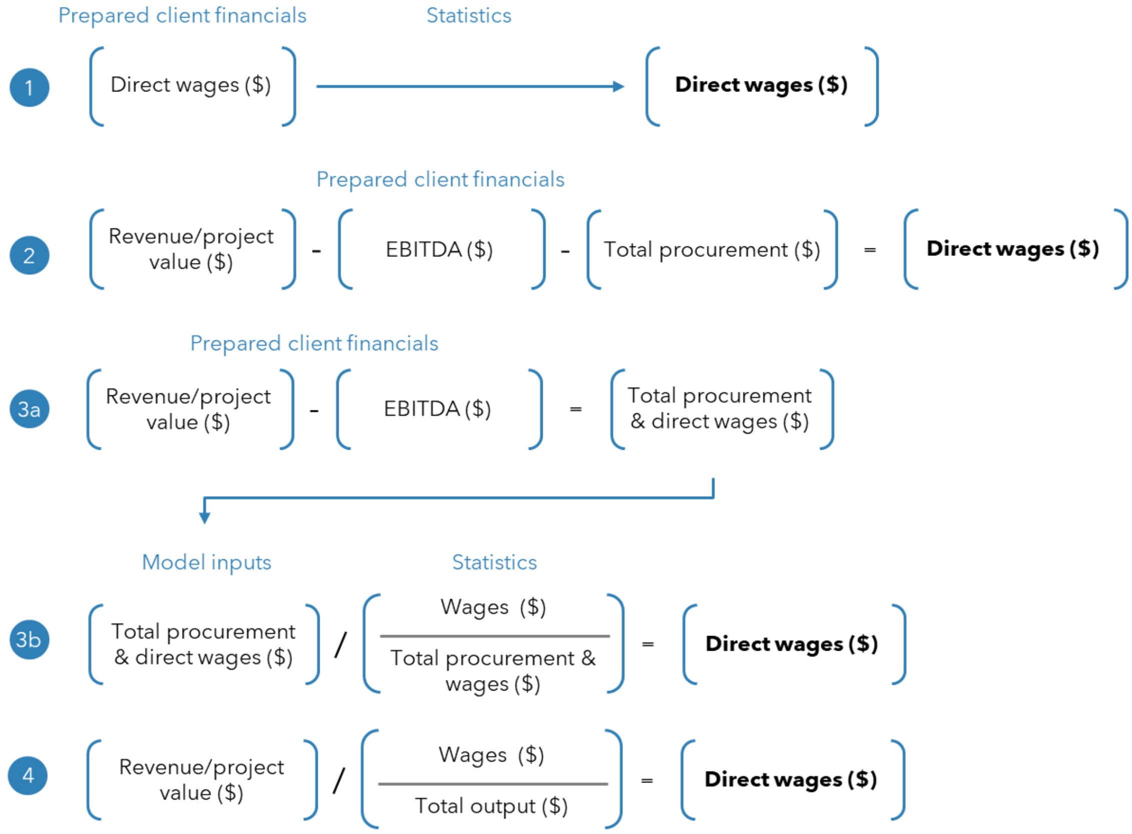

Exhibit 23: Data hierarchy for calculating direct wages

Please note that despite the calculations above, further adjustments may be necessary to ensure data consistency and reliability (see Section 3.3.4.4).

3.3.4.2 Taxes

If direct taxes data is provided, the model outputs data as is. If no direct data on taxes is provided, the JIM estimates it by combining the revenue/project value data with optional inputs (e.g. EBITDA, net income), or with statistical data if no optional inputs are available.

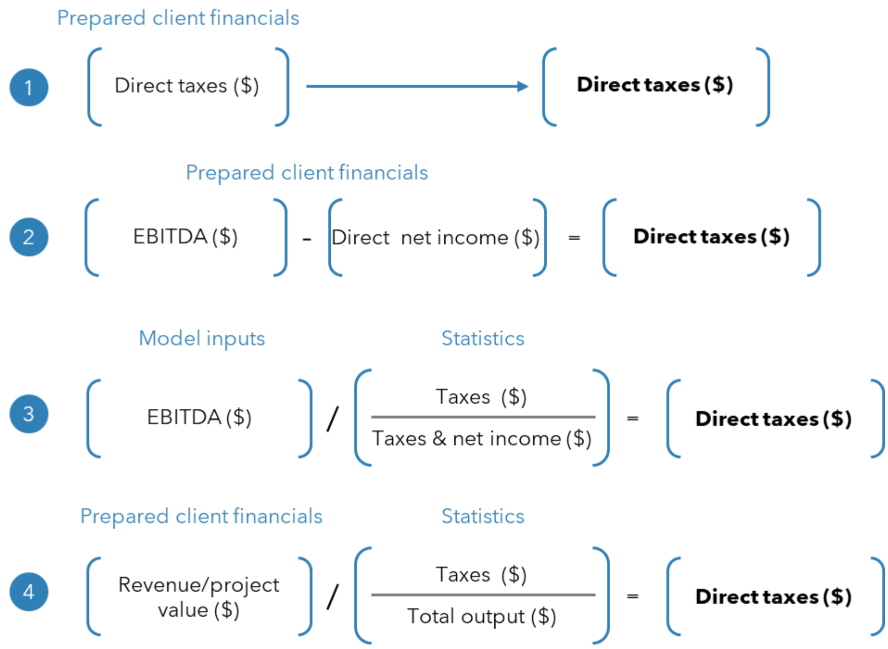

Exhibit 24: Data hierarchy for calculating direct taxes

Please note that despite the calculations above, further adjustments may be necessary to ensure data consistency and reliability (see Section 3.3.4.4).

3.3.4.3 Net income

If direct net income data is provided, the model outputs data as is.

If no direct data on net income is provided, the JIM estimates it by combining the revenue/project value data with optional inputs (e.g. EBITDA, taxes), or with statistical data if no optional inputs are available.

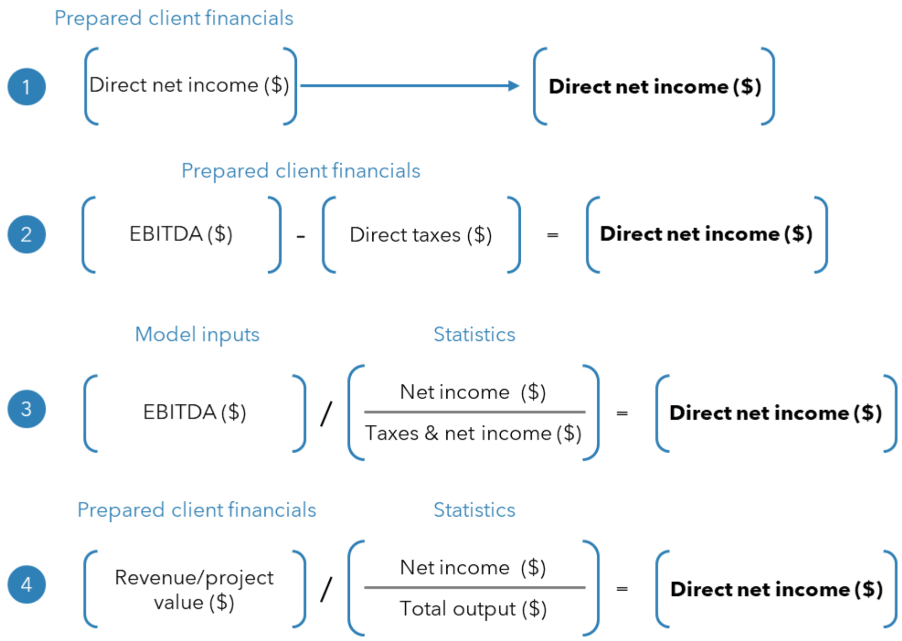

Exhibit 25: Data hierarchy for calculating direct net income

Please note that despite the calculations above, further adjustments may be necessary to ensure data consistency and reliability (see Section 3.3.4.4).

3.3.4.4 Estimates' adjustment

Once the missing direct value-added data is estimated, the JIM ensures that a key assumption of the model is respected: the sum of direct value-added data (i.e. wages, taxes and net income) and total procurement must equal the provided revenue.

Before verifying this assumption, we calculated an additional metric: total procurement (Exhibit 26).

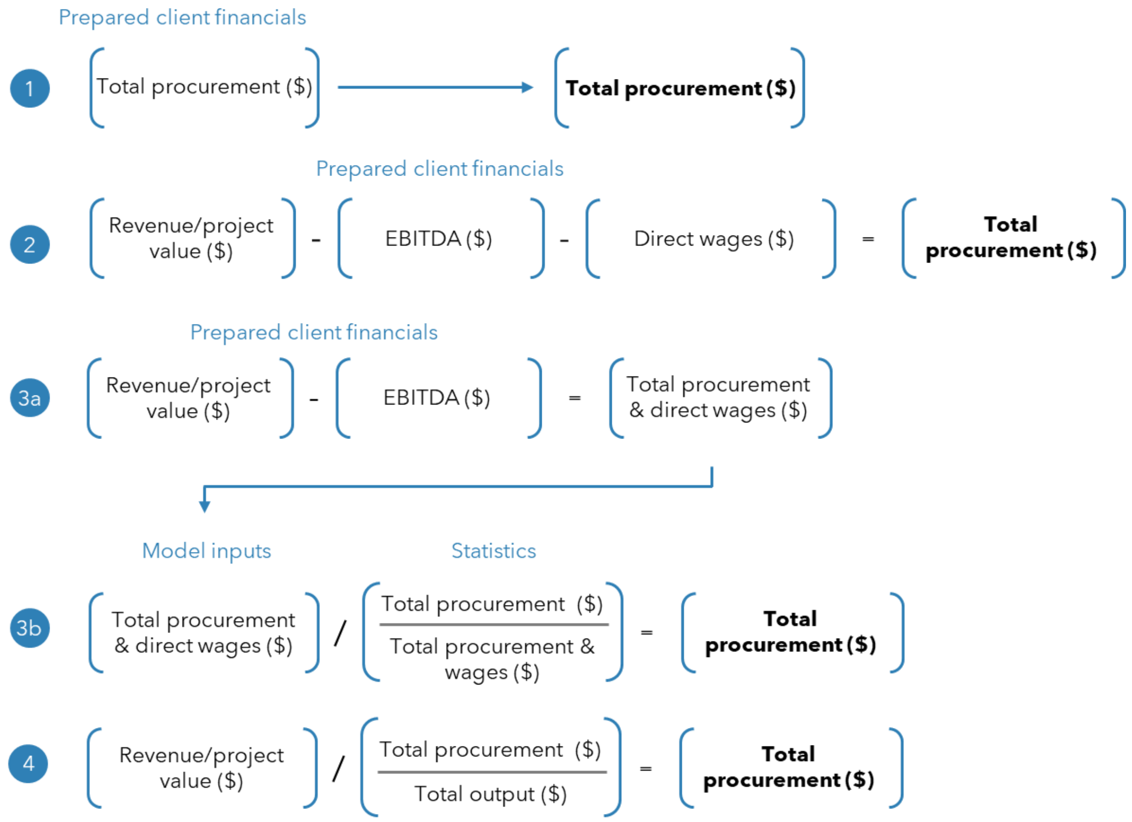

Exhibit 26: Data hierarchy for calculating total procurement

If the above assumption is not respected, the model will adjust the estimated values to maintain the balance (Exhibit 27). Step 3a, 3b and 3c of the exhibit show how the balance is kept by allocating the gap in revenue across the modelled estimates (between wages, taxes, net income and total procurement, if any). In practice, the estimates are adjusted upwards or downwards, depending on the revenue gap.

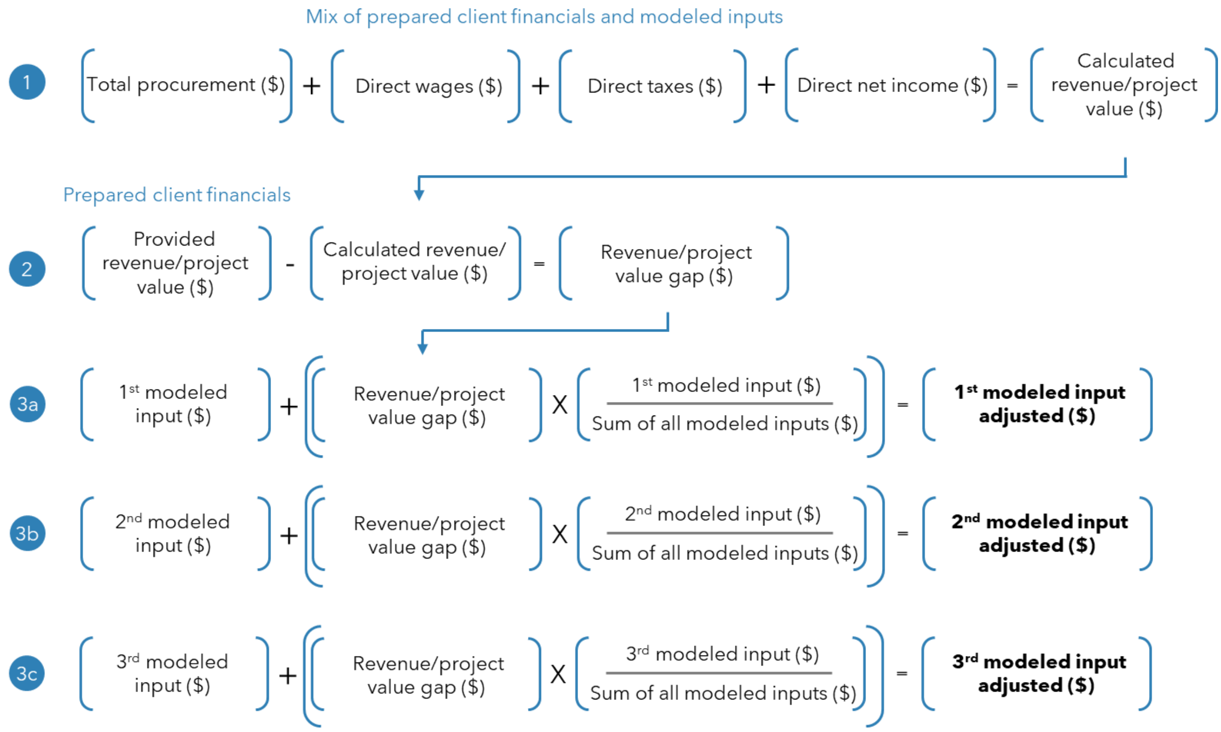

Exhibit 27: Adjustment of modelled estimates

In some edge cases, when the sum of provided inputs is higher than revenue, this adjustment will result in the estimation of negative values. To prevent unrealistic results, two additional assumptions are checked for and applied:

- If estimated total procurement is to become negative, this indicator is set to 0 and further adjustments are made to the other estimated value.
- If estimated wages are to become negative, this indicator is set to 0 and further adjustments are made to the other estimated value.

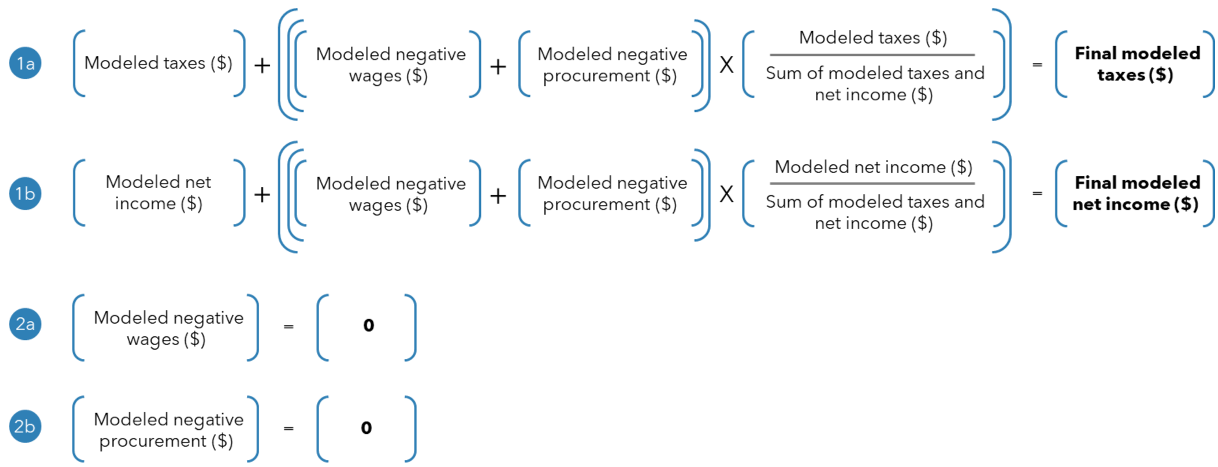

Exhibit 28: Adjustment of modelled inputs if modelled wages and/or procurement are negative

4 Supply chain impact

4.1 Methodology overview

Final consumption and exports of a company's goods and services induces production, which leads to financial transfers between various sectors that subsequently generate value-added. Moreover, the goods and services a company produces or provides are in turn used by other actors of the economy.

These supply chain (both upstream and downstream) money flows are subsequently linked to employment intensities and GHG intensities to estimate the employment and GHG impact.

Exhibit 29 shows how the JIM combines client financial data and statistics to derive supply chain.

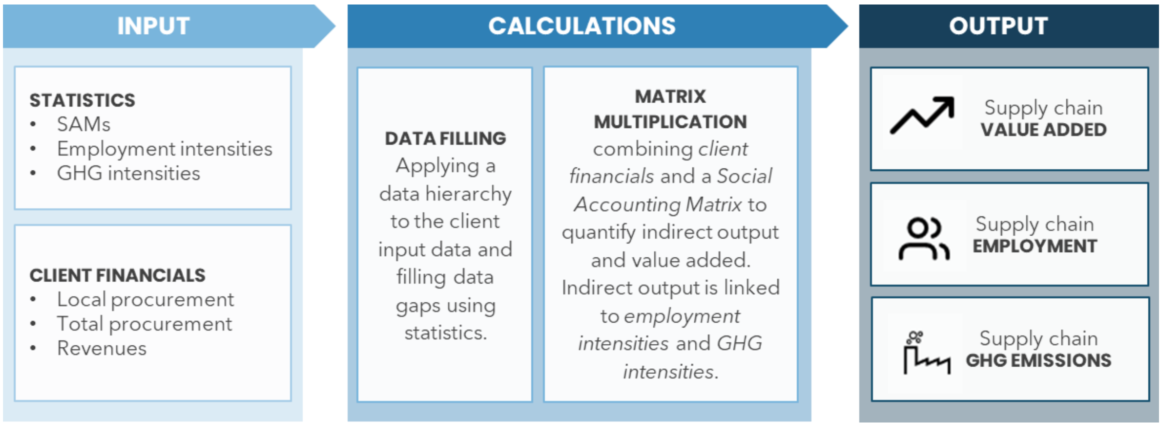

Exhibit 29: Overview methodology supply chain

4.2 Preliminary mapping

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

- *Country/region mapping*: the country/region names of the client financials are mapped to IO table countries/regions. For most countries, individual country IO tables are available. If this is not the case, sub-regional statistics will be applied. For example, for Angola, individual country statistics are not available, and the country is therefore mapped to the IO table of the region "Middle Africa". See Appendix 1 for a list of all available IO tables.

- *Economic activity mapping*: the client's economic activity is mapped to corresponding GTAP sectors, according to a mapping list from NACE (level 1-4), ISIC (level 1-4) or GICS sectors (6-digits) to GTAP sectors.

If one NACE sector maps to several GTAP sectors, the financial data will be distributed across GTAP sub-sectors using the proportions of the corresponding sectors in the IO table. Exhibit 30 provides an example of how revenue is distributed when the client's economic activity maps to two GTAP sub-sectors.

Client financials		Macro-statistics		Prepared client financials
Revenue ($)	X	Output sub-sector 1 ($) / ∑ output sub-sector 1 + 2 ($)	=	Revenue in sub-sector 1 ($)
Revenue ($)	X	Output sub-sector 2 ($) / ∑ output sub-sector 1 + 2 ($)	=	Revenue in sub-sector 2 ($)

Exhibit 30: Example of how revenue client data is divided over 2 GTAP sectors

If multiple economic activities are inputted for a single client using the "Customised breakdown" feature (see Section 3.3.1 of the User Guide), a similar mapping is carried out for each economic activity inserted but using the shares per sector provided instead of statistic data.

4.3 Impact calculations

4.3.1 Preliminary steps

4.3.1.1 Estimation of key model inputs

The JIM identifies the best-available client financial input data using a fixed data hierarchy and subsequently applies IO table data to derive the key model inputs: local procurement per sector, together with import procurement per sector (used for import GHG emissions only).

They are derived by multiplying client financial input data with IO table statistic data from the client's sector. Exhibit 31 and Exhibit 32 shows how client financial data is used to calculate supply chain procurement.

	Prepared client financials		Macro-statistics		Model input
1	Local procurement ($)	X	Intermediary demand on each domestic sector ($) / Intermediary demand on all domestic sectors ($)	=	Local procurement per sector ($)
2a	Total procurement ($)	X	Intermediary demand on all domestic sectors ($) / Intermediary demand on all domestic and foreign sectors ($)	=	Local procurement($)

	Model inputs		Macro-statistics		
2b	Local procurement ($)	X	Intermediary demand on each domestic sector ($) / Intermediary demand on all domestic and foreign sectors ($)	=	Local procurement per sector ($)

Exhibit 31: Data hierarchy for calculating local supply chain procurement

Total procurement ($)	–	Local procurement ($)	X	Intermediary demand on each foreign sector ($) / Intermediary demand on all foreign sectors ($)	=	Import procurement per sector ($)

Exhibit 32: Calculation of import supply chain procurement

Nota bene: for construction projects (which do not yet have 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 IO table.

4.3.1.2 Matrix multiplications

The local procurement expenditures per sector of a client are routed through the relative IO table using a Leontief matrix calculation. It allows us to derive the total upstream local supply chain output generated in other economic sectors (Exhibit 33). It is later used to derive most of the supply chain impact.

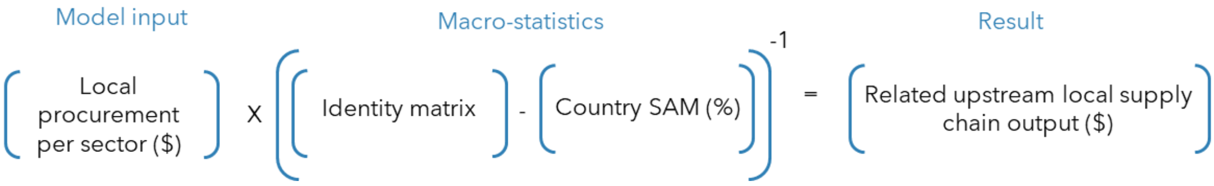

Exhibit 33: Upstream local supply chain output calculation

Similarly, total import supply chain output is derived by running the import procurement expenditures per sector through the World IO table. The output is later used to derive import GHG emissions.

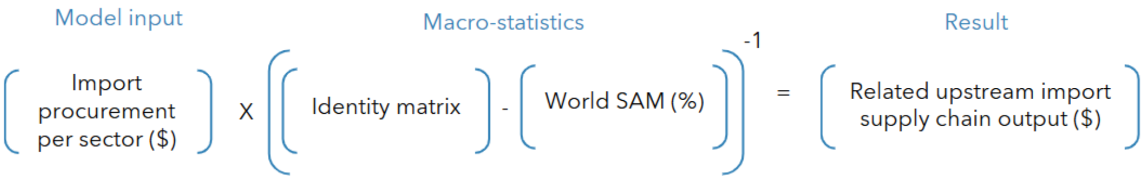

Exhibit 34: Upstream import supply chain output calculation

Finally, total downstream local supply chain output is derived by running the local procurement expenditures per sector through the relative transposed IO table (see end of Section 2.1.1.3), using the same approach. The output is later used to derive downstream GHG emissions.

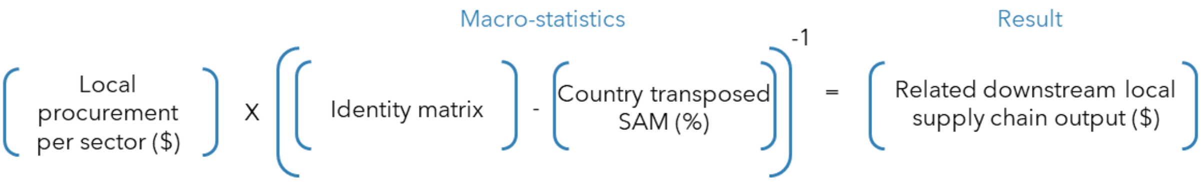

Exhibit 35: Downstream local supply chain output calculation

4.3.2 Absolute emissions - Scope 2

If scope 2 absolute emissions are not provided, it will be estimated by the model using data from Section 4.3.1 for sectors 46 to 57 (i.e. the electricity sectors). If provided, the input is split between CO_2 and non-CO_2 using the model estimate's distribution.

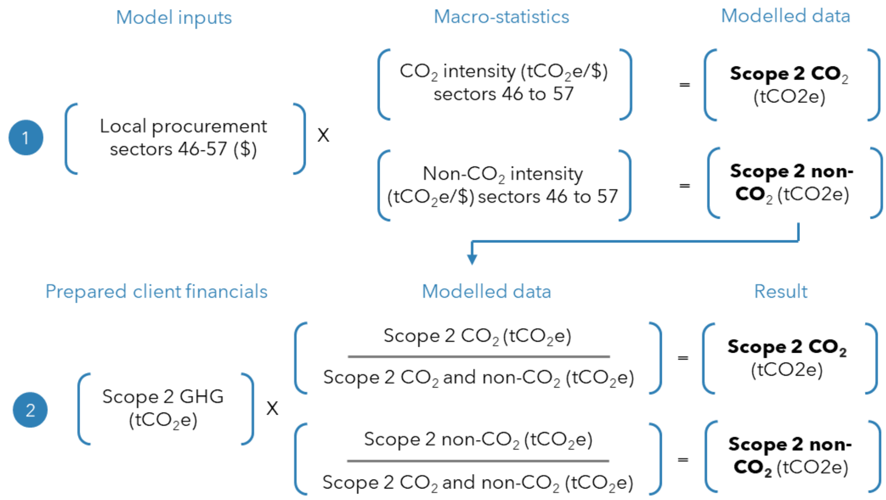

Exhibit 36: Data hierarchy for quantifying absolute scope 2 impact

4.3.3 Absolute emissions - Scope 3

If scope 3 absolute emissions are not provided, they will be estimated by the model using data from Section 4.3.1.2 and 4.3.2 and GHG intensities (Section 2.1.3) (Exhibit 37).

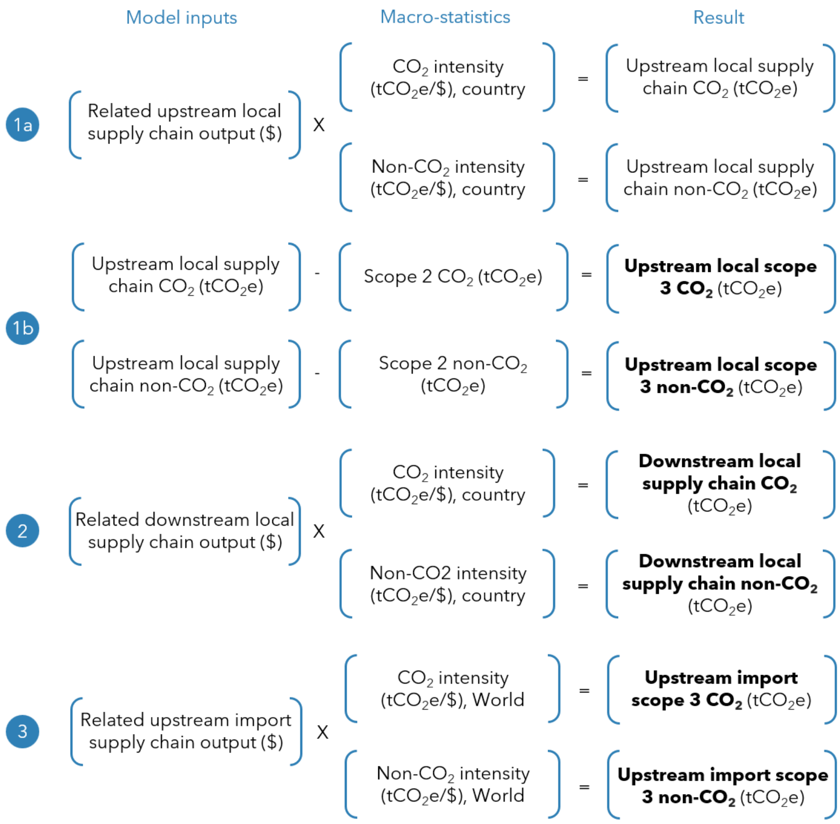

Exhibit 37: Calculation of absolute scope 3 without provided inputs

If it is provided, the input is split between local and import emissions, upstream and downstream local emissions, and subsequently between CO_2 and non-CO_2. This is done using the modelled scope 3's distribution across the different categories (see Exhibit 37).

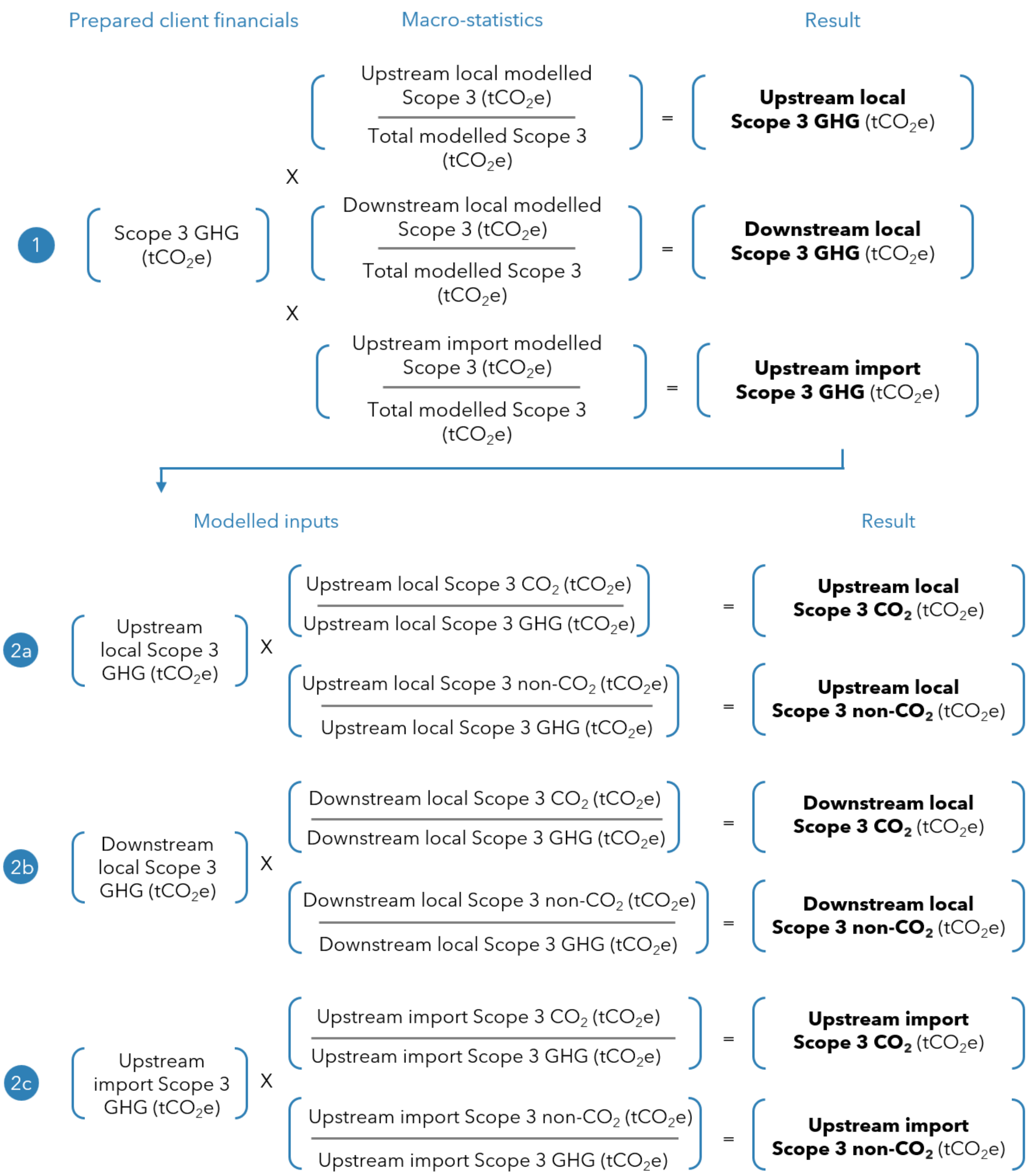

Exhibit 38: Calculation of absolute scope 3 impact with provided input

Note that, even though the GHG Protocol does not distinguish between Scope 3 local and import emissions, the JIM's geographic split is made to provide additional granularity. Finally, Scope 3 as reported by the model is assumed to only include supply chain emissions, not enabled emissions (i.e. category 15). It is calculated separately, as shown in Section 6.

In the case of client of the type "project under construction" the downstream emissions of that client are set to zero. This is due to a project under construction not being in operations and therefore not providing neither services nor goods. For a client in an electricity generating sectors (46-57) the downstream emissions are also set to zero. This is because there are no direct emissions that arise from the use of electricity.

4.3.4 Employment

4.3.4.1 Total jobs

Total supply chain jobs are calculated by multiplying the related local supply chain output (Section 4.3.1.2) with the employment intensity in the specific sector and country (Section 2.1.4).

Model inputs		Macro-statistics		Result
Related upstream local supply chain output ($)	X	Employment intensity (#/$)	=	**Local supply chain jobs (#)**

Exhibit 39: Calculation of supply chain jobs

4.3.4.2 Female jobs

Female jobs are calculated by multiplying the related supply chain jobs per country and sector (Section 4.3.4.1) with the share of employed women in the specific country and sector (Section 2.1.5).

Model inputs		Macro-statistics		Result
Local supply chain jobs (#)	X	Female employment %	=	**Local female supply chain jobs (#)**

Exhibit 40: Calculation of female supply chain jobs

4.3.4.3 Formal/informal jobs

Formal and informal jobs are calculated by multiplying the related supply chain jobs per country and sector (Section 4.3.4.1) with the share of formal and informal employment in the specific country and sector (Section 2.1.6).

Model inputs		Macro-statistics		Result
Local supply chain jobs (#)	X	Formal employment %	=	**Local formal supply chain jobs (#)**
		Informal employment %	=	**Local informal supply chain jobs (#)**

Exhibit 41: Calculation of formal and informal supply chain jobs

4.3.4.4 Youth employment

For youth employment, the share from total employment is always provided as a percentage but not applied to the estimated results. This share is based on the percentage of jobs for youth in a particular country and does not have sectorial breakdown (Section 11).

4.3.4.5 Job results annualization adjustments

For some projects and investments, the client data available may not correspond to a 12-month fiscal year. If these non-annualized financials are inserted, the quantified jobs will be in job-years instead of people employed during the project lifetime (i.e. the desired impact indicator in the JIM).

To avoid this unit mismatch and any double counting of jobs (e.g. two job years is equivalent to one person employed over the two years of the project's lifetime), job results will be annualized using the "Project timeline" input column.

Intermediary output		Adjustment		Result
Jobs per sector (job-years)	X	12 / # of months	=	**Jobs per sector** (jobs)

Exhibit 42: Adjustment to jobs result (if necessary)

4.3.5 Value-added

Value-added sub-indicators (i.e. wages, taxes and net income) are calculated by multiplying the related supply chain output per country and sector (Section 4.3.1.2) with the average share of output spent in wages, taxes and net income, in the specific country and sector (Section 2.1.2).

Model input		Macro-statistics		Result
Related upstream local supply chain output ($)	X	Share of output spent in wages (%)	=	**Local supply chain wages ($)**
	X	Share of output spent in taxes (%)	=	**Local supply chain taxes ($)**
	X	Share of output spent in net income (%)	=	**Local supply chain net income ($)**

Exhibit 43: Calculation of supply chain value-added sub-indicators

5 Induced impact

5.1 Methodology overview

Through direct and supply chain impact, employees (or households) earn salaries. These are subsequently spent on consumption (e.g. groceries, leisure activities), which leads to induced money flows.

Compared to supply chain impact, the model uses an additional input: "direct wages". Exhibit 44 shows how the JIM combines client financial data and statistics to derive induced impacts.

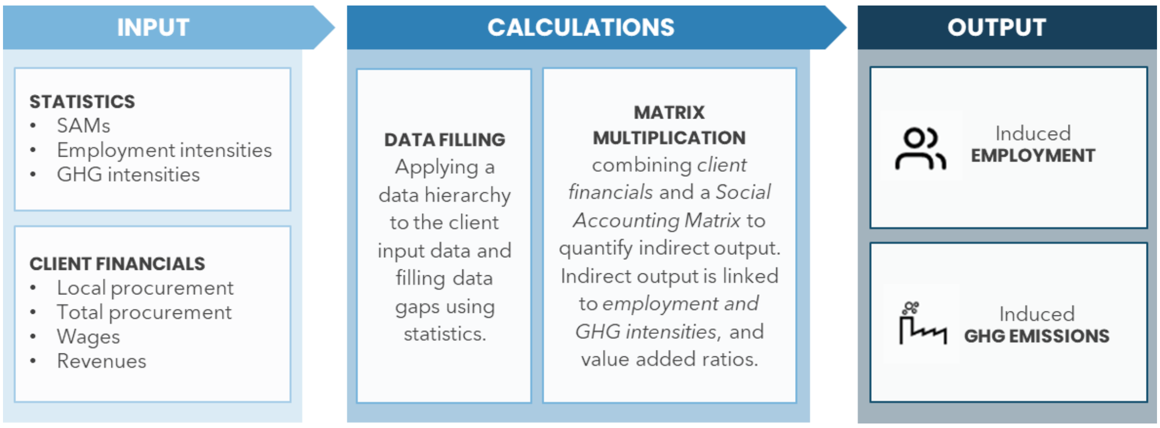

Exhibit 44: Overview methodology induced impact

Note that 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).

5.2 Impact calculations

5.2.1 Preliminary steps

5.2.1.1 Estimation of key model inputs

The induced impact module relies on two key data quantified by the direct and supply chain modules, namely direct wages (Section 3.3.4.1) and local procurement per sector (Section 4.3.1.1).

5.2.1.2 Matrix multiplications

Like for supply chain impact (Section 4.3.1.2), the local procurement expenditures per sector of a client are routed through the relative IO table using a Leontief matrix calculation. It allows us to derive the local supply chain output generated in other economic sectors.

Simultaneously, the local expenditures, together with direct wages, are processed using the same approach. By doing so we derive the total local supply chain output including the effect of salary re-spending.

Ultimately, the two outputs are subtracted to quantify induced output (i.e. total local supply chain output from the re-spending of salaries only) (Exhibit 45).

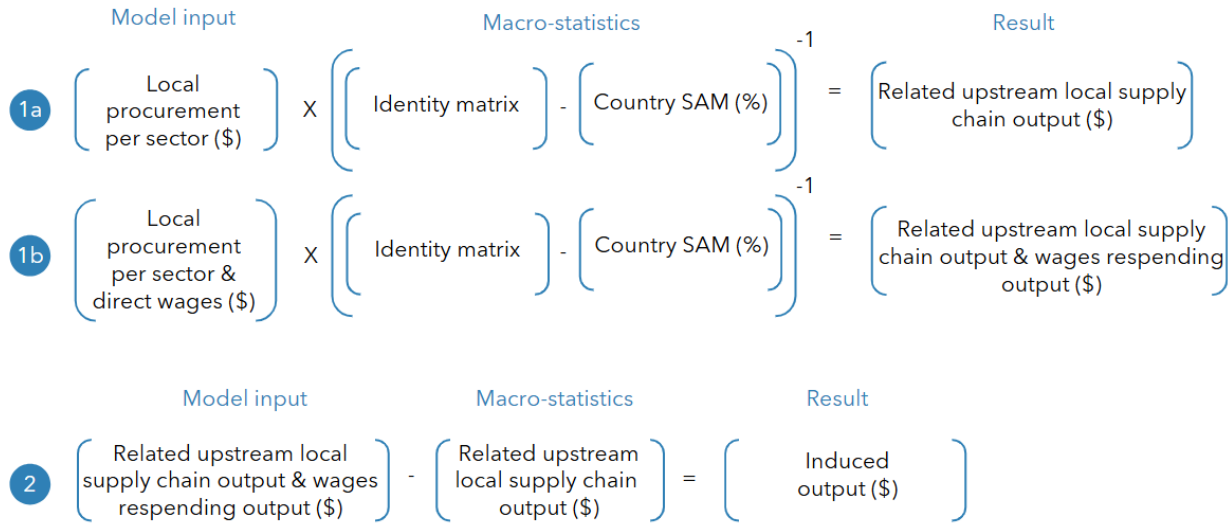

Exhibit 45: Calculation of induced output

5.2.2 Absolute emissions - Other

The emissions are estimated by multiplying the induced output with the CO_2 and non-CO_2 emission intensity in the specific sector and country (Section 2.1.3).

Prepared client financials		Macro-statistics		Result
Induced output ($)	X	CO_2 intensity (tCO_2e/$), country	=	**Induced CO_2** (tCO_2e)
		Non-CO_2 intensity (tCO_2e/$), country	=	**Induced non-CO_2** (tCO_2e)

Exhibit 46: Calculation of induced GHG emissions

5.2.3 Employment

5.2.3.1 Total induced jobs

Total induced jobs are calculated by multiplying the related induced output (Section 5.2.1.2) with the employment intensity in the specific sector and country (Section 2.1.4).

Model inputs		Macro-statistics		Result
Induced output ($)	X	Employment intensity (#/$)	=	**Total induced jobs (#)**

Exhibit 47: Calculation of induced total jobs

5.2.3.2 Female jobs

Female jobs are calculated by multiplying the related induced jobs per country and sector (Section 5.2.3.1) with the share of employed women in the specific country and sector (Section 2.1.5).

Model inputs		Macro-statistics		Result
Induced total jobs (#)	X	Female employment %	=	**Female induced jobs (#)**

Exhibit 48: Calculation of female induced jobs

5.2.3.3 Formal/informal jobs

Formal and informal induced jobs are calculated by multiplying the related induced jobs per country and sector (Section 5.2.3.1) with the share of formal and informal employment in the specific country and sector (Section 2.1.6).

Model inputs		Macro-statistics		Result
Induced total jobs (#)	X	Formal employment %	=	**Formal induced jobs (#)**
		Informal employment %	=	**Informal induced jobs (#)**

Exhibit 49: Calculation of formal and informal induced jobs

5.2.3.4 Youth employment

For youth employment, the share from total employment is always provided as a percentage but not applied to the estimated results. This share is based on the percentage of jobs for youth in a particular country and does not have sectorial breakdown (Section 11.1.2).

5.2.3.5 Job results annualization adjustments

For some projects and investments, the client data available may not correspond to a 12-month fiscal year. If these non-annualized financials are inserted, the quantified jobs will be in job-years instead of people employed during the project lifetime (i.e. the desired impact indicator in the JIM).

To avoid this unit mismatch and any double counting of jobs (e.g. two job years is equivalent to one person employed over the two years of the project's lifetime), job results will be annualized using the "Project timeline" input column.

Intermediary output		Adjustment		Result
Jobs per sector (job-years)	x	$\frac{12}{\#\text{ of months}}$	=	**Jobs per sector** (jobs)

Exhibit 50: Adjustment to jobs result (if necessary)

6 Finance enabling impact

IFIs and other investors do not always invest directly into companies or projects, sometimes they invest indirectly through financial intermediaries. The financial intermediaries they invest in use these investments to increase their company lending, thereby enabling companies (i.e. end-beneficiaries) to increase capacity/economic activity. However, it is difficult to gain insights into the enabled revenues of on-lending by Fis, as these institutions lack observable data. The JIM overcomes this lack of observable data by combining data on capital invested by FIs with economic modelling and statistics to provide insights into the enabled impacts at end-beneficiaries.

6.1 Methodology overview

The FI enabling methodology described below explains how the JIM determines the supported revenues (i.e. output) of the companies receiving financing from financial intermediaries. Once the enabled revenues are determined, the JIM applies IO modelling to derive the enabled direct, supply chain and induced employment, value-added and GHG emissions.

To estimate the revenues supported by financial intermediaries' capital, the JIM leverages asset turnover ratios (capital-to-output ratios). In the JIM version 4.0, average asset turnover ratios are applied, which reflect the average amount of output supported per unit of private sector capital in a particular region and/or sector. These asset turnover ratios do not distinguish new capital from existing capital and are therefore most appropriate for impact accounting.

The methodology to quantify all enabled impacts is similar to the one described in Sections 3, 4 and 5.

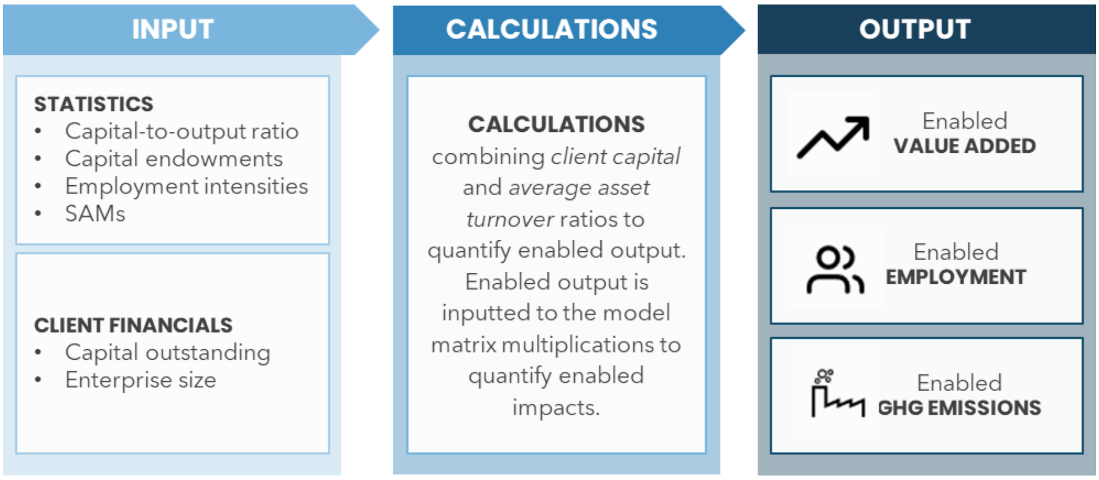

Exhibit 51: Overview methodology finance enabling impact

6.2 Preliminary mapping

Before the JIM can calculate the finance enabling impacts client financials must be mapped to the model sectors and countries. The client's economic activity is mapped to corresponding GTAP sub-sectors according to a mapping list between NACE, ISIC and GICS sectors and GTAP sectors (see Appendix 2). If the client's economic activity maps to several GTAP sectors, the outstanding (or committed, depending on availability) amount will be distributed across GTAP sub-sectors based on the proportion of the corresponding sectors in total capital endowments.

Client financials		Statistics		Prepared client financials
Outstanding amount ($)	X	Capital endowments sub-sector 1 ($) / ∑ capital endowments sub-sector 1 + 2 ($)	=	Outstanding amount in sub-sector 1 ($)
Outstanding amount ($)	X	Capital endowments sub-sector 2 ($) / ∑ capital endowments sub-sector 1 + 2 ($)	=	Outstanding amount in sub-sector 2 ($)

Exhibit 52: Example of how outstanding amount is divided over 2 GTAP sectors

6.3 Impact calculations

6.3.1 Preliminary steps

6.3.1.1 Estimation of key model inputs

The first key input missing is the direct output enabled by the FIs. To quantify it the distributed outstanding amount per sector is multiplied by the average asset turnover ratio (which depends on the sector and region) (Section 2.1.9). Additionally, if the firm size of the investees benefiting from the outstanding amount is known, the amount is split, and an adjustment is applied depending on the firm size (Section 2.1.10). The enabled output reflects the expected average revenue of firms who were provided capital by FIs.

Prepared client financials				Macro-statistics				Result
Outstanding amount per sector ($)	X	Share of capital in specific firm size (%) *(if known)*	X	Average asset turnover ratios	X	Relevant size adjustment value (#) *(if known)*	=	Enabled direct output ($)

Exhibit 53: Calculating enabled output

The second key input missing is the enabled local procurement. It is estimated by multiplying the enabled direct output calculated in Exhibit 53 with the relative IO table's data on intermediary demand (i.e. local procurement).

Model input — Macro-statistics — Result

$$\left(\text{Enabled direct output (\$)}\right) \times \left(\frac{\text{Intermediary demand on each domestic sector (\$)}}{\text{Total output (\$)}}\right) = \left(\text{Enabled local procurement per sector (\$)}\right)$$

Exhibit 54: Calculation of enabled local procurement

Finally, the last missing key input is enabled import procurement, which will be used to calculate enabled import GHG emissions.

Model input — Macro-statistics — Result

$$\left(\text{Enabled direct output (\$)}\right) \times \left(\frac{\text{Intermediary demand on each foreign sector (\$)}}{\text{Total output (\$)}}\right) = \left(\text{Enabled import procurement per sector (\$)}\right)$$

Exhibit 55: Calculation of enabled import procurement

6.3.1.2 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. Exhibit 56 shows how Leontief modelling (Section 4.3.1.2) is also used in this module to quantify the enabled supply chain output.

Model input — Macro-statistics — Result

$$\left(\text{Enabled local procurement per sector (\$)}\right) \times \left(\left(\text{Identity matrix}\right) - \left(\text{Country SAM (\%)}\right)\right)^{-1} = \left(\text{Related enabled upstream local supply chain output (\$)}\right)$$

Exhibit 56: Calculation of enabled upstream local supply chain output

Similarly, total import supply chain output is derived by running the import procurement expenditures per sector through the World IO table. The output is later used to derive import GHG emissions.

Model input — Macro-statistics — Result

$$\left(\text{Enabled import procurement per sector (\$)}\right) \times \left(\left(\text{Identity matrix}\right) - \left(\text{World SAM (\%)}\right)\right)^{-1} = \left(\text{Related enabled upstream import supply chain output (\$)}\right)$$

Exhibit 57: Calculation of enabled upstream import supply chain output

Third, total downstream local supply chain output is derived by running the local procurement expenditures per sector through the relative transposed IO table (see end of Section 2.1.1.3), using the same approach. The output is later used to derive downstream GHG emissions.

Model input: (Enabled local procurement per sector ($)) X ((Identity matrix) - (Country transposed SAM (%)))^-1 [Macro-statistics] = (Related enabled downstream local supply chain output ($)) [Result]

Exhibit 58: Calculation of enabled downstream local supply chain output

Finally, the approach of Section 5.2.1.2 is applied to calculate enabled induced output.

Model input / Macro-statistics / Result

1a (Enabled local procurement per sector ($)) X ((Identity matrix) - (Country SAM (%)))^-1 = (Related enabled upstream local supply chain output ($))

1b (Enabled local procurement per sector & direct wages ($)) X ((Identity matrix) - (Country SAM (%)))^-1 = (Related enabled upstream local supply chain output & wages respending output ($))

Model input / Macro-statistics / Result

2 (Related enabled upstream local supply chain output & wages respending output ($)) - (Related upstream enabled local supply chain output ($)) = (Enabled induced output ($))

Exhibit 59: Calculation of enabled induced output

6.3.2 Enabled direct impact

6.3.2.1 GHG emissions

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

Model input / Macro-statistics / Result

(Enabled direct output ($)) X (CO$_2$ intensity (tCO_2e/$)) = (Enabled direct CO$_2$ emissions (tCO_2e))

(Enabled direct output ($)) X (Non-CO$_2$ intensity (tCO_2e/$) = (Enabled direct non-CO$_2$ emissions (tCO_2e))

Exhibit 60: Calculation of enabled direct GHG emissions

6.3.2.2 Employment

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.

Female employment is calculated by applying the female employment share (Section 2.1.5).

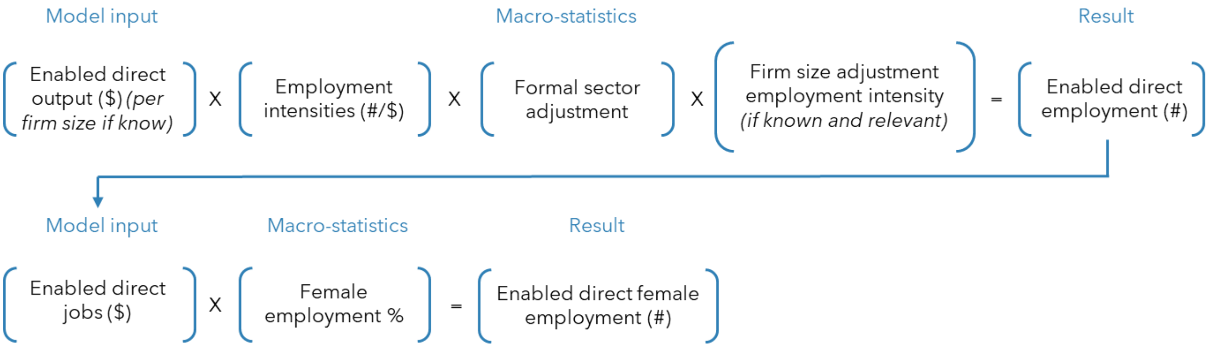

Exhibit 61: Calculations of enabled direct employment

6.3.2.3 Value-added

The JIM estimates the enabled direct value-added by multiplying the direct enabled output by the average proportion of output spent on wages/taxes/net income derived from the client's sector in the IO table (as explained in Section 4.3.5).

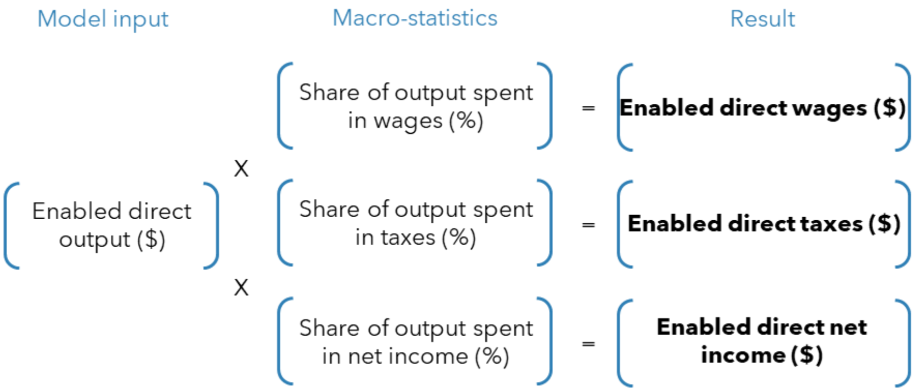

Exhibit 62: Calculations of enabled direct value-added

6.3.3 Enabled supply chain impact

6.3.3.1 GHG emissions

Following the methodology of Section 4.3.2, enabled Scope 2 GHG emissions are calculated using enabled local procurement (Section 6.3.1.1).

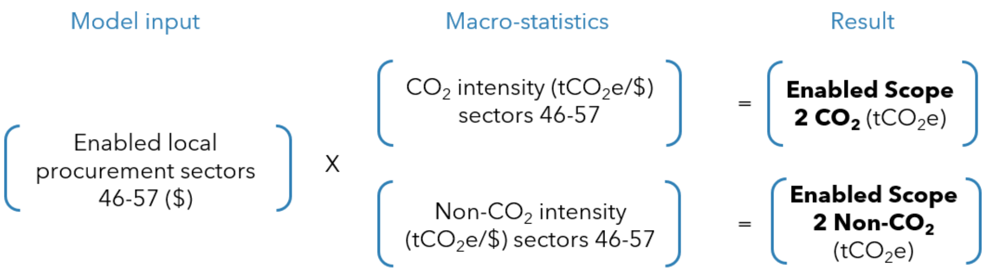

Exhibit 63: Calculations of enabled Scope 2 GHG emissions

Similar to what is applied in Section 4.3.2 and 4.3.3, the enabled supply chain output (Section 6.3.1.2) can be linked to GHG (CO_2 and non-CO_2) intensities for each sector to quantify the enabled supply chain GHG emissions. Then, enabled Scope 2 emissions are later used to calculated enabled Scope 3 emissions, as shown in Exhibit 64.

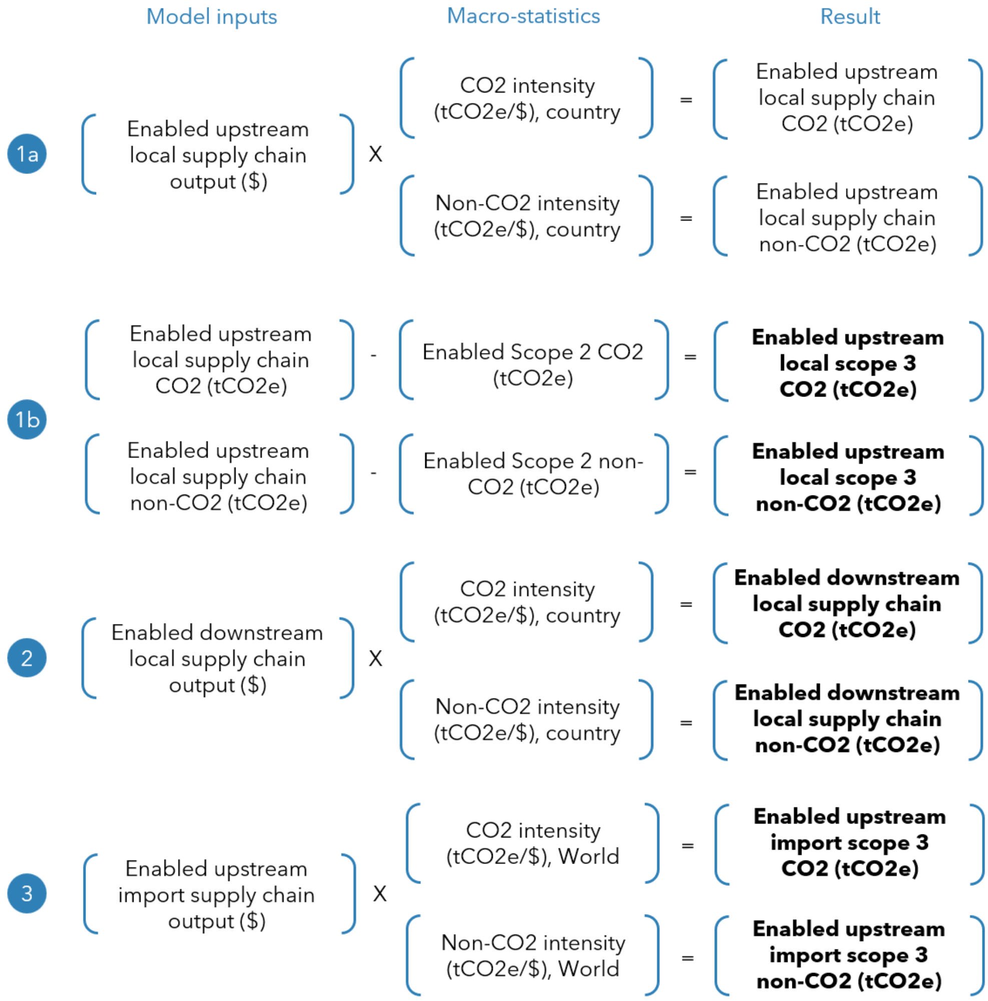

Exhibit 64: Calculations of enabled Scope 3 GHG emissions

Similar to section 4.3.3, in the case of client of the type "project under construction" the downstream emissions of that client are set to zero. This is due to a project under construction not being in operations and therefore not providing neither services nor goods. And for a client in an electricity generating sectors (46-57) the downstream emissions are also set to zero. This is because there are no direct emissions that arise from the use of electricity.

6.3.3.2 Employment

Similar to what is applied in Section 0, the enabled supply chain output (Section 6.3.1.2) can be linked to employment intensities and ratios for each sector to quantify the enabled supply chain employment.

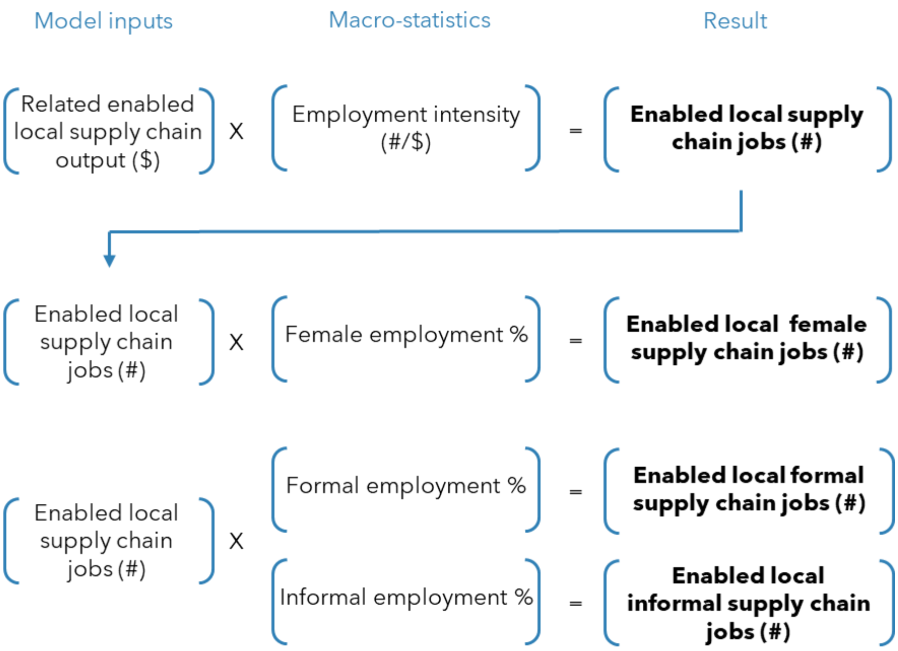

Exhibit 65: Calculations of enabled supply chain jobs

6.3.3.3 Value-added

For enabled value-added impact, the enabled local supply chain output (Section 6.3.1.2) is multiplied with the average share of output spent in wages, taxes and net income, in the specific country and sector (Section 2.1.2).

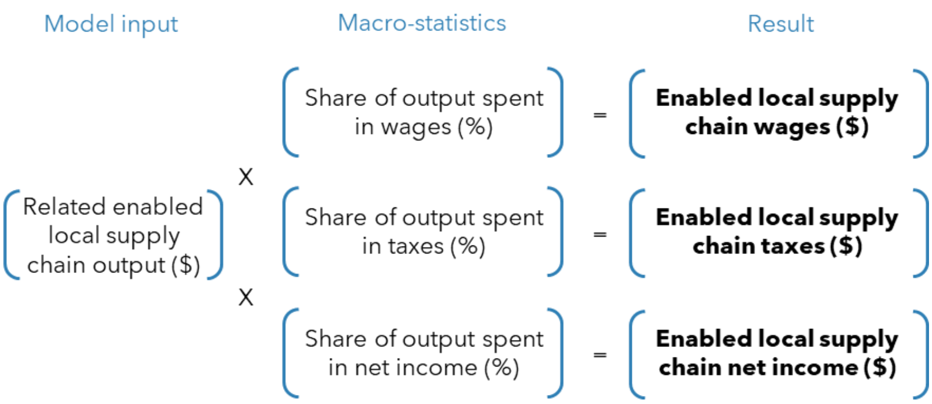

Exhibit 66: Calculations of enabled supply chain value-added

6.3.4 Enabled induced impact

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

6.3.4.1 Absolute emissions – Other

The enabled induced emissions are estimated by multiplying the enabled induced output (Section 6.3.1.2) with the CO_2 and non-CO_2 emission intensity in the specific sector and country (Section 2.1.3).

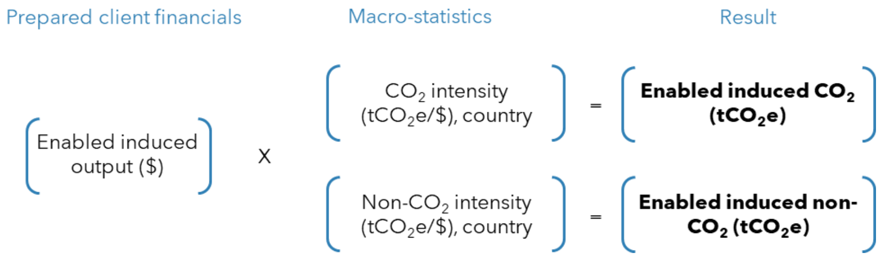

Exhibit 67: Calculation of enabled induced GHG emissions

6.3.4.2 Employment

Similar to what is applied in Section 5.2.3, the enabled induced output (Section 6.3.1.2) can be linked to employment intensities and ratios (Section 2.1) for each sector to quantify the enabled induced employment.

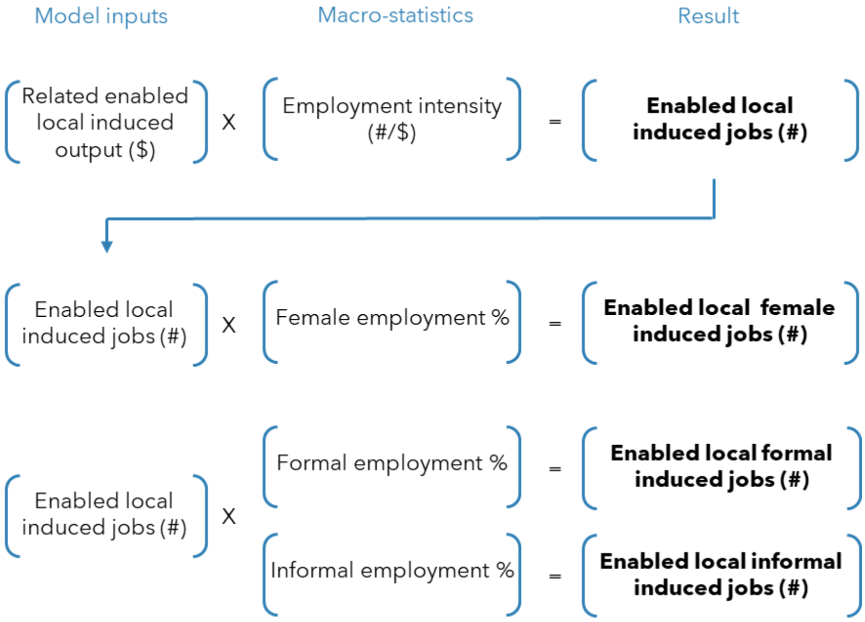

Exhibit 68: Calculation of enabled induced impact

7 Power enabling impact

7.1 Methodology overview

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.

Numerous impact studies have investigated the connection between power and economic growth in developing countries. The JIM aligns with the IFC and applies a single power translation factor to all manufacturing sectors and all countries.

These studies analysed the relationship between power and economic growth is analysed and focused on the impact of power investments. Researchers created power supply and demand curves to illustrate how increased power supply affects electricity affordability and reliability. Improved power reliability results in businesses operating for longer hours, contributing to increased output and higher company revenues. These findings, combined with statistical data, are used to estimate the overall impact of power investments.

To calculate power enabled impacts the JIM combines two main factors to model the effect of added 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 0.022 for all countries. This is a direct 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. Note that the factor is only applied to the manufacturing sector, as explained in Section 2.1.11 and the related IFC research paper.

Combining the power-to-output translation factor with the share of power contributed to a country determines the percentage output increase supported. This is combined with IO table 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.

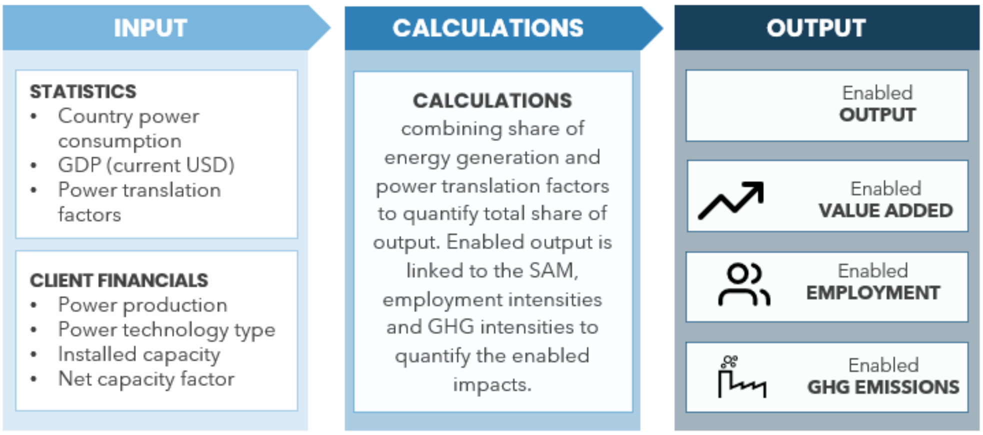

Exhibit 69: Power enabling methodology

7.2 Impact calculations

7.2.1 Estimation of key model inputs

7.2.1.1 Power production

The model identifies the best-available client input data using a fixed data hierarchy and implements modelling to fill data gaps. For the power enabling calculations, the model requires an input of power production. If power production is unavailable, power enabling calculations can rely on inputted installed capacity and power technology types. It is estimated by multiplying the net capacity factor with the technology type and the total potential operations time. Net capacity can be either provided as an optional input or based on the average for the power technology type. Potential operations time is defined as the total number of hours a power company/plant could theoretically be in operation. The JIM assumes a fixed number calculated as total hours in a year, which is equal to 24 hours per day times 365 days a year.

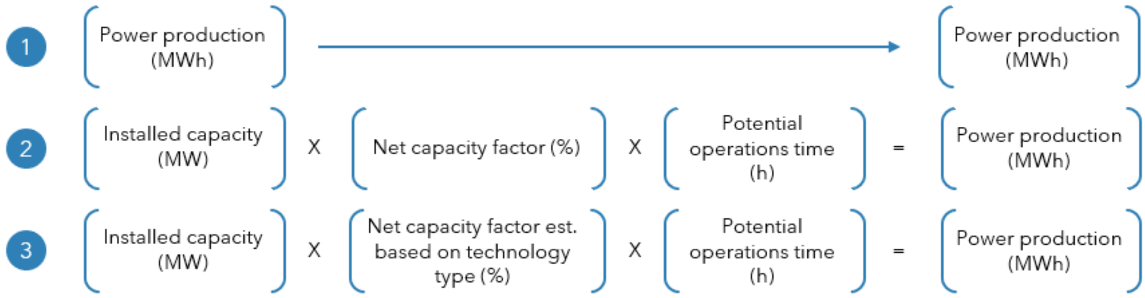

Exhibit 70: Data hierarchy for calculation of power production

7.2.1.2 Enabled output

To quantify the output enabled by the power production, the JIM follows these steps (Exhibit 71):

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 share. 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. *Calculation of total enabled output:* the effective output share is 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 2017.

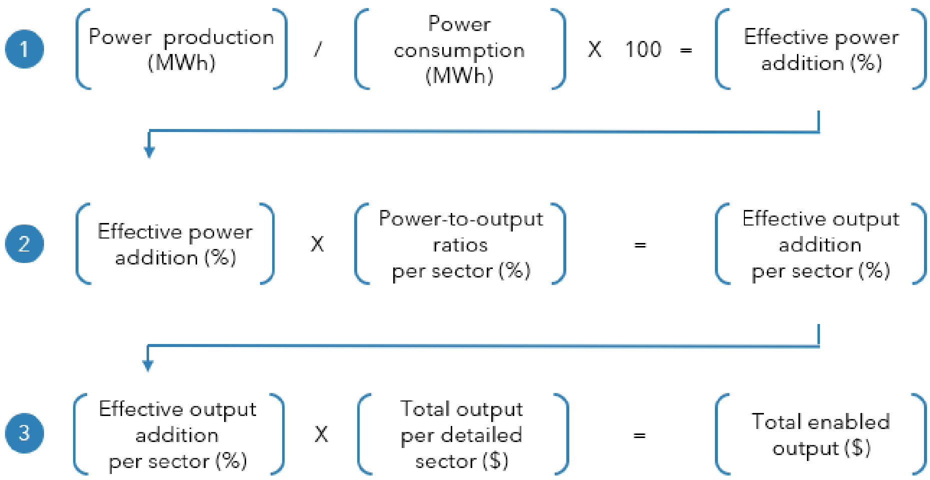

Exhibit 71: Calculation of total enabled output

7.2.2 Enabled GHG

The total enabled output can be used to quantify the enabled GHG impacts from the power plant, following the methods used in Section 6.3.2.1. The enabled output is multiplied by the CO_2 and non-CO_2 intensities to derive the enabled GHG emissions.

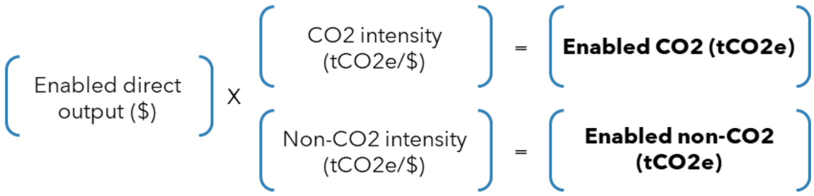

Exhibit 72: Calculation of enabled GHG emissions

7.2.3 Enabled employment

The enabled output is multiplied by the employment intensities and by breakdown shares to derive the enabled employment. The different sub-indicators of employment impact are calculated as shown in Exhibit 73.

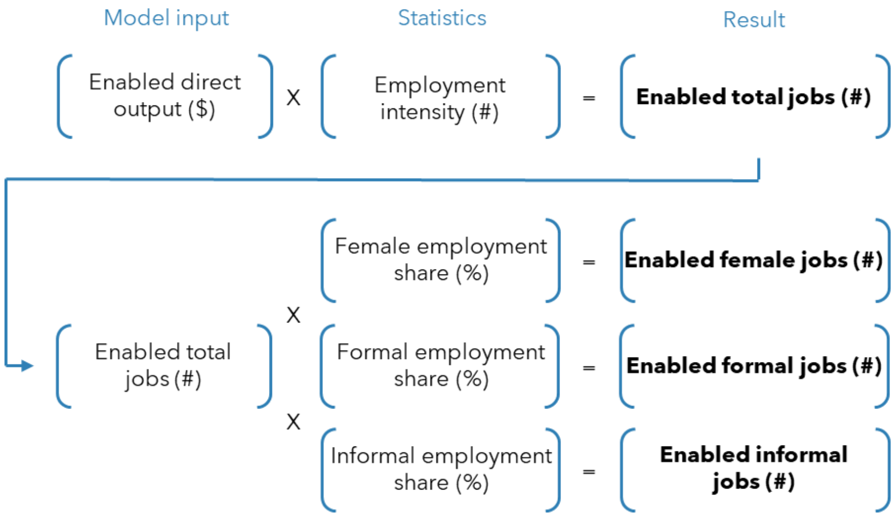

Exhibit 73: Calculations of enabled employment sub-indicators

7.2.4 Enabled value-added

The enabled output is multiplied with the average share of output spent in wages, taxes and net income, in the specific country and sector (Section 2.1.2).

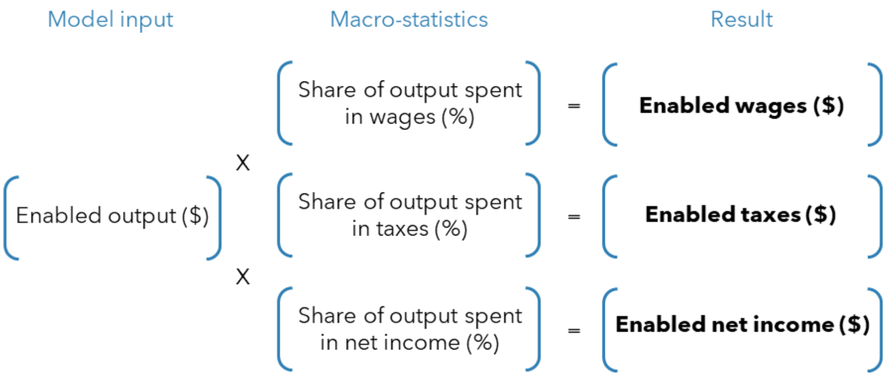

Exhibit 74: Calculations of enabled value-added

8 Attribution

8.1 Methodology overview

Prorating is the allocation of a part of the results to an investor based on its capital invested, i.e. determining how much of a company's results can be "claimed" by the investor. The advantage of this methodology is that it is a simple, quantitative, and objective way to measure attribution, and data is relatively easy to collect. The prorating methodology determines the prorating share and subsequently applies this to the client's impacts.

The model distinguishes two attribution approaches:

- *Commitment approach*. Users can use this approach for ex-ante impact estimations at time of commitment.
- *Outstanding approach*. Users can use this approach for ex-post impact estimations.

The JIM addresses this by using prorating to attribute a portion of the impact to the investor, following the PCAF Global GHG Accounting and Reporting Standard for the Financial Industry.

For listed clients, it is calculated as follow:

$$Attribution\ factor_c = \frac{Outstanding\ amount_c}{Enterprise\ Value\ Including\ Cash_c}$$

Exhibit 75: PCAF attribution methodology for listed clients

For unlisted clients, it is calculated this way:

$$Attribution\ factor_c = \frac{Outstanding\ amount_c}{Total\ equity + debt_c}$$

Exhibit 76: PCAF attribution methodology for unlisted clients

8.2 Calculation

To calculate the attribution share of an investment, the model combines two types of information:

- *Investment data*. It corresponds to the JIM user's ownership of the client/investee, or the investment/financing amount the user has in the client. In the calculation, it is used as the numerator.
- *Client/investee data*. It relates to the size of the client/investee being invested in/financed. In the calculation, it is used as the denominator.

The model calculates the attribution for both individual client data and sector exposure when the data has the same information (name, year).

8.2.1 Attribution of listed clients

For listed clients, the preferred client data is the Enterprise Value Including Cash (EVIC). Alternative inputs are shown in Exhibit 77.

	Investment data		Client data		
1	((Outstanding amount - Debt ($)) + (Outstanding amount – Listed equity ($)))	/	(Enterprise Value Including Cash ($))	=	(Attribution share (%))
2	((Outstanding amount - Debt ($)) + (Outstanding amount – Listed equity ($)))	/	((Total equity ($)) + (Total debt ($)))	=	(Attribution share (%))
3	((Outstanding amount - Debt ($)) + (Outstanding amount – Listed equity ($)))	/	(Total balance sheet value ($))	=	(Attribution share (%))

Exhibit 77: Data hierarchy for calculating attribution share for listed clients

For the commitment approach, users also have the option to include capital mobilized, which would be added to the numerator of the formulas in Exhibit 77.

8.2.2 Attribution of unlisted clients

For unlisted clients, Enterprise Value Including Cash (EVIC) is not applicable. The sum of total equity and total debt is the preferred option here. Alternative inputs are shown in Exhibit 78.

	Investment data		Client data		
1	((Outstanding amount - Debt ($)) + (Relative equity share (%)) X (Total equity ($)))	/	((Total equity ($)) + (Total debt ($)))	=	(Attribution share (%))
2	((Outstanding amount - Debt ($)) + (Relative equity share (%)) X (Total equity ($)))	/	(Total balance sheet value ($))	=	(Attribution share (%))

Exhibit 78: Data hierarchy for calculating attribution share for unlisted clients

For the commitment approach, users also have the option to include capital mobilized, which would be added to the numerator of the formulas in Exhibit 78.

If "Total equity" is missing but "Relative equity share" is provided, the attribution share will be as follow. Note that due to incomplete data, the model will ignore "Total debt" data even if provided as both "Total equity" and "Total debt" are needed for them to be used.

Investment data		Client data		Investment data		
(Outstanding amount – Debt ($))	/	(Total balance sheet value ($))	+	(Relative equity share (%))	=	(Attribution share (%))

Exhibit 79: Calculation of attribution share with incomplete data

8.2.3 Attributed impact

Once the attribution share is quantified, the client's attributed impact can be calculated as shown in Exhibit 80.

(Attribution share (%)) X (Client total impact) = (Attribution share (%))

Exhibit 80: Calculation of attributed impact

Please note that only impact attributed from outstanding amounts is calculated in the JIM and returned in the output file. While committed attribution share is calculated by the model, attributed commitment impact must be manually calculated.

8.2.4 Edge cases

If both "Outstanding amount - Listed equity" and "Relative equity share" are provided, the calculation will assume that the company is listed and calculate following the guidelines from Section 8.2.1. As a result, the "Relative equity share" will not be used in the calculation.

9 Principal Adverse Impact (PAIs) indicators

9.1 Methodology overview

The JIM can be used to comply with the sustainable finance disclosure requirements (SFDR) set forth in the EU's Taxonomy Regulation[23]. Additional provisions, known as "principal adverse impacts" (PAIs), require financial institutions to disclose the impacts of their investments on the environment, society, and good governance, as well as the risks associated with those impacts.

Thus, the JIM has implemented an SFDR module. This module allows financial institutions to input their JIM results and obtain SFDR values that can then be used to meet the PAI requirements set forth in the EU's Taxonomy Regulation. It is important to note that as the current regulation is not clear on how to assess the impact of financial institutions, this tool is on a best-effort basis.

The JIM currently has coverage for:

- GHG Emissions (PAI 1).
- Carbon Footprint (PAI 2).
- GHG Intensity (PAI 3).
- Exposure to companies active in the fossil fuel sector (PAI 4).
- Share of non-renewable energy consumption and production (PAI 5).
- Energy consumption intensity per high impact climate sector (PAI 6).

As explained in Section 2.2 the JIM uses a parsimonious approach in which there are only a few "required inputs" for the model to be able to run. These inputs are revenue or project value, country, economic activity, and power production (only for energy producing assets (PAI 5)).

For the PAI module it is required to also input the current outstanding and total assets (possible as total equity and total debt) in the Attribution tab of the input template. Some optional inputs that improve the estimation of the PAIs are:

- Absolute emissions - Scope 1, 2 and 3 (PAIs 1-3): GHG emissions inputted by users replace the estimations from revenue or outstanding amount.
- Total consumption of energy (PAI 5-6): total energy consumption in KWh.
- Total consumption of purchased electricity (PAI 5-6): total consumption of energy purchased in KWh, excluding any self-generated electricity.

[23] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019R2088

- Consumption of purchased electricity from renewable sources (PAI 5-6): consumption of purchased electricity from renewable sources[24] in KWh, excluding any energy from non-renewable sources.

9.2 Calculations

9.2.1 PAI 1 – GHG Emissions

The greenhouse gas (GHG) emissions estimated by the JIM refers to the amount of GHGs emitted through the organization's operations from direct emissions sources during the reporting period. The GHG Protocol defines direct emissions as emissions from sources that are owned or controlled by the reporting entity.

The JIM calculates attributed Scope 1, 2 and 3 emissions by dividing the current value of investment by the investee company's enterprise value multiplied by GHG emissions from the investee company. Both CO_2 and non-CO_2 are included. The use of enterprise value to calculate the "fair share" or "attributed amount" is in line with the PCAF standard. For non-listed companies, JIM users can use either total balance sheet value or the sum of total debt and equity to calculate the total value.

$$\sum_{n}^{i}\left(\frac{current\ value\ of\ investment_i}{investee\ company's\ enterprise\ value_i} x\ investee\ company's\ scope(x)\ GHG\ emissions_i\right)$$

Exhibit 81: PAI 1 formula according to the SFDR

Using JIM input and output data, the formula can be rephrased as follow:

$$\left(\text{Outstanding amount (€)}\right) / \left[\left(\text{Total debt (€)}\right) + \left(\text{Total equity (€)}\right)\right] \text{ x } \left(\text{GHG emissions scope 1, 2 OR 3}\right) = \left(\text{GHG emissions (PAI 1)}\right)$$

Exhibit 82: PAI 1 formula GHG emissions calculation with JIM inputs

As previously mentioned, Development financial institutions (DFIs) and other investors sometimes invest indirectly through financial intermediaries. The JIM combines data on capital invested by financial institutions with economic modelling and statistics to provide insights into the enabled impacts at end-beneficiaries. The GHG emission of financial institutions are estimated using the finance enabling module in JIM, this is reflected in the Scope 3 effects.

9.2.2 PAI 2 – Carbon Footprint

The carbon footprint corresponds to attributed emissions of an investee company (see PAI 1) expressed as tonnes of CO2eq (Scope 1, 2 and 3 emissions) per million EUR invested.

The JIM calculates the carbon footprint using the formula required by SFDR. The JIM takes the ratio of the current investment value and the enterprise value of the investee company. This ratio is then multiplied by the sum of the attributed Scope 1, 2, and 3 GHG emissions of the investee company.

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[24] Renewable energy sources refer to renewable non-fossil sources, namely wind, solar (solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas. https://www.eiopa.europa.eu/publications/principal-adverse-impact-and-product-templates-sustainable-finance-disclosure-regulation_en#details

Finally, this product is divided by the total current value of all investments, all of which are measured in million euros.

According to the SFDR regulation, PAI 2 should be calculated as follow:

$$\frac{\sum_{n}^{i}\left(\frac{current\ value\ of\ investment_i}{investee\ company's enterprise\ value_i} x\ investee\ company' scope\ 1,2\ and\ 3\ GHG\ emissions_i\right)}{current\ value\ of\ all\ investments\ (€M)}$$

Exhibit 83: PAI 2 formula according to the SFDR

The current value of all investments corresponds to the current outstanding amount of the portfolio. For listed companies enterprise value is used to calculate the "fair share" or "attributed amount". For non-listed companies, the sum of total debt and equity (or total assets) can be used instead.

Using JIM input and output data, the formula can be rephrased as follow:

$$\frac{\left(\text{Outstanding amount (€)}\right) / \left(\left(\text{Total debt (€)}\right) + \left(\text{Total equity (€)}\right)\right) \text{ x } \left(\text{GHG emissions scope 1, 2 and 3}\right)}{\left(\text{Total portfolio outstanding (€M)}\right)} = \left(\text{Carbon footprint (PAI 2)}\right)$$

Exhibit 84: PAI 2 formula with JIM input data

9.2.3 PAI 3 – GHG Intensity

This PAI refers to the unattributed amount of GHG emissions expressed in tCO_2e divided by the investee company's revenue in million EUR. The GHG intensity of investee companies is calculated using the formula required by SFDR.

$$\sum_{n}^{i}\left(\frac{current\ value\ of\ investment_i}{current\ value\ of\ all\ investments\ (€M)} x \frac{investee\ company's\ scope\ 1,2\ and\ 3\ GHG\ emissions_i}{investee\ company's\ €M\ revenue_i}\right)$$

Exhibit 85: PAI 3 formula according to the SFDR

This formula calculates the contribution of each investment to the portfolio's total value and then multiplies it by the investee company's GHG intensity. The intensity corresponds to a company's environmental efficiency, given its GHG emissions and revenue.

Translated to JIM inputs, the formula would look like the following:

$$\left(\frac{\text{Outstanding amount (€)}}{\text{Total portfolio outstanding (M€)}}\right) \text{ X } \left(\frac{\text{GHG emissions client}}{\text{Revenue (€)}}\right) = \left(\text{GHG intensity (PAI 3)}\right)$$

Exhibit 86: PAI 3 formula with JIM input data

9.2.4 PAI 4 – Exposure to companies active in the fossil fuel sector

'Companies active in the fossil fuel sector' refers to companies that derive any revenues from exploration, mining, extraction, production, processing, storage, refining or distribution, including transportation, storage, and trade, of fossil fuels. The list of sectors active in fossil fuel is available in Annex 6.

The SFDR formula to calculate PAI 4 is the following:

$$\sum_{n}^{i}\left(\frac{current\ value\ of\ investments\ exposed\ to\ fossil\ fuels_i}{current\ value\ of\ all\ investments\ (€M)}\right)$$

Exhibit 87: PAI 4 formula according to the SFDR

Which, using JIM inputs, translates to:

$$\left(\frac{\text{Outstanding amount if sector exposed to fossil fuels (€)}}{\text{Total portfolio outstanding (M€)}}\right) = \left(\text{Fossil fuel exposure (PAI 4)}\right)$$

Exhibit 88: PAI 4 formula with JIM input data

9.2.5 PAI 5 – Shares of non-renewable energy consumption and production

This indicator corresponds to the shares of non-renewable energy consumption and production over total energy consumed or produced per investee companies. These shares are expressed as percentages of the total energy sources consumed or produced.

9.2.5.1 PAI 5 – Share of non-renewable energy production

Data on energy production is typically readily available from the investee companies, together with the power technology type produced. The latter allows us to distinguish between renewable and non-renewable energy. The following formula shows how this aspect of PAI 5 can be calculated:

$$\frac{Non-renewable\ energy\ produced}{Total\ energy\ produced} \times 100$$

Exhibit 89: PAI 5 formula for energy production

9.2.5.2 PAI 5 – Share of non-renewable energy consumed

PAI 5 relates to energy consumption and is calculated for both direct effects from the investee and direct financed effects via the finance enabling module. In practice, the share of non-renewable energy consumed can be quantified through the following formula:

$$\frac{Non-renewable\ energy\ consumed}{Total\ energy\ consumed} \times 100$$

Exhibit 90: PAI 5 formula for energy production

GTAP data on energy consumption (see Section 2.1.14) is used for this calculation. GTAP's electricity technology types' breakdown allows the tracking of specific non-renewable energy production. This statistic data can be complemented using observed data from JIM users. Some financial institutions can, using monitoring and reporting systems, track part of their investees' renewable energy consumption. While the investees' may consume more renewable energy than what was tracked by the FI, their consumption it cannot be precisely quantified in its entirety. Consequently, some calculations are necessary to estimate this additional "unclear" renewable energy consumption, using country and sector average data.

The analysis also delved into the realm of electricity consumption, involving the aggregation of data and subsequent division by total energy consumption per sector, revealing the proportion of energy consumed in the form of electricity. Additionally, this approach was extended to renewable electricity consumption data, allowing for the determination of the share of electricity consumption that is derived from renewable sources.

Calculation of PAI 5 – Share of non-renewable energy consumed, with no optional input provided:

- Converting the client input from KWh to GWh to align with the statistic data's unit.

1. Applying the right energy intensities given the client' sector and country of activity, to estimate client-level renewable and total energy consumption.
2. Dividing client-level renewable and total energy consumption data to get the share of renewable energy consumed.
3. Estimating the renewable and total electricity consumed by multiplying total energy (step 2) by the renewable and total electricity shares in total energy respectively.
4. Estimating the total non-renewable energy consumed by subtracting the total energy consumed by the total renewable electricity consumed.
5. Calculating PAI 5 by dividing the total non-renewable energy with total energy consumed.

PAI 5 will be calculated for both direct "backward" and "finance enabled" effects, excluding "supply chain." For portfolio-level insights the total non-renewable energy consumed is divided by the total energy consumed, across all sectors and countries.

Depending on the optional inputs provided by the user, the calculation method may vary. For instance, if renewable electricity consumed is provided, it is assumed to not fully capture the renewable electricity (due to monitoring limitations for instance). In this specific case an adjustment is necessary:

- Provided renewable electricity is deducted from total electricity consumed. The difference is assumed to be a mix of non-renewable and "non-reported" renewable electricity.
- The "unclear" electricity is multiplied by the share of renewable electricity in total electricity to estimate the amount of "non-reported" renewable electricity consumed.
- The newly quantified "non-reported" renewable electricity is added to the provided renewable electricity to get the total renewable electricity. It is in turn used in step 5 above.

9.2.6 PAI 6 – Energy consumption intensity per high impact climate sector

This indicator is set forth by the SFDR as the energy consumed in GWh per million EUR of revenue of investee companies, per high impact climate sector (see Annex 7). The latter refers to the sectors listed in Sections A to H and Section L of Annex I to Regulation (EC) No 1893/2006 of the European Parliament and of the Council.

The following formula reflects how this PAI can be estimated, per high impact climate sector:

$$\frac{Total\ energy\ consumption\ (in\ GWh)}{Total\ revenue\ of\ investee\ companies\ (in\ mEUR)}$$

Exhibit 91: PAI 6 formula

The total energy consumption is quantified using GTAP data (see Section 9.2.5.2, on PAI 5). The revenue data is provided by the users. Energy consumption is then divided by the revenue figure. These intensities are only calculated for the so-called "high impact climate sectors".

PAI 6 is calculated for both direct "backward" and "finance enabled" effects, but it excludes "supply chain." For portfolio-level insights, the previous activities remain unchanged with one exception: the intensities must be calculated using total energy and output data aggregated for all the portfolio's companies.

10 Assumptions and limitations

10.1 IO modelling

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, IO modelling requires little data on the studied intervention. This makes it 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.[25] However, IO modelling also has clear limitations, as it depends on these simplistic assumptions:

1. *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.
2. *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.[26] 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[27].
3. *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.
4. *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 IFIs are likely to be atypical of their sectors (they may be more capital intensive, for example).
5. *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)[28].

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[25] 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.

[26] 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

[27] 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.

[28] 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

6. *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.[29,30] 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 accurate 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 considers responses in investment, land supply, population and (commodity and factor) prices.[31] This reactivity to supply-side adjustments makes CGE models, in principle, capable of capturing both positive gross multiplier and negative displacement effects from external influences. As a result, CGE modelling is theoretically superior to IO modelling.

Nevertheless, CGE modelling also has disadvantages. It is comparatively data intensive. The model relies on a large amount of price elasticities, 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 undergoing 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.

10.2 Finance enabling impact

The limitations of IO modelling also apply to the financial intermediaries enabling impacts, as the financial intermediaries enabling approach uses additional assumptions, further reducing 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 financial intermediaries enabling impacts are based on modelled company data (using average asset turnover ratios).

The current approach – using different average asset turnover ratios per sector (76) and region (7) to calculate enabled firm output in response to a capital financing – was applied to align methodologies with PCAF's Global GHG Standard[32]. These ratios correspond to the lowest level of data quality endorsed by the Standard.

Average asset turnover ratios (ATR) enable FIs to account for the impacts of their portfolio. However, these ratios do not provide insights into the incremental impact (impact change) due to the capital

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[29] 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.

[30] 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.

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

[32] https://carbonaccountingfinancials.com/files/downloads/PCAF-Global-GHG-Standard.pdf page 65.

provided by the financial intermediaries. For those estimates of impact change, marginal ATRs can be used. Typically, marginal ratios will generate more conservative results than average ATRs. FIs should therefore carefully communicate the assumptions behind these results based on the average ATRs, especially for employment and value-added impacts.

10.3 Power enabling impact

There are several 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 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.

The current approach – using a constant power-to-output translation factor for all manufacturing sectors and countries to calculate changes in firm output in response to an increase in power – was based on a research paper from the IFC.

Further collaborations with new partners can improve upon the current approach. We could conduct 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.

10.4 Direct impact

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 practice, each business has a unique way of producing its goods and services, and businesses backed by IFIs are likely unrepresentative of their sectors (they may be more capital intensive, for example). Preferably, direct impacts should be based on observed data only.

10.5 Statistic data

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.[33] This is a well-known problem, especially in Africa. Although the JIM uses best-available

[33] 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

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.

10.6 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 data. 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 1 are the same jobs as the gross jobs quantified for that company in year 2.

Regarding direct employment estimates (except power enabled), the JIM employment intensities account for all employed persons, including people in informal employment. However, while it is assumed that companies that receive financing from FIs are likely to be formal sector firms in most sectors. Consequently, 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 output. The JIM therefore applies a formal sector adjustment ratio to quantify the direct jobs.

10.7 Attribution

Many impact investors recognize these relatively straightforward rules of prorating. However, the simplicity of the rule is also a weakness; it omits several 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.[34]

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

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[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

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.[35] 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 future developments, we will explore further refinements of the attribution approach.

11 Data

11.1 Statistical data

11.1.1 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. These inputs are coordinated by the Center for Global Trade Analysis in Purdue University's Department of Agricultural Economics. Some of the data used by GTAP is originally not consistent in terms of sources, methodology, base years and sectoral detail.[36] 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 4.0 uses the GTAP 11C-Power database.

On the one hand, the significant geographical and sectoral scope of the GTAP database and harmonization efforts of GTAP make the database well-suited for economic simulation models like the JIM.[37] Compared to other databases for IO tables such as WIOD and EORA, GTAP has the best coverage of geographies and sectors.[38] While other databases may have a larger sectorial disaggregation GTAP is the best in terms of country-specific data, making it a fit for emerging economies. On the other hand, GTAP also has a few disadvantages:

[35] 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

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

[37] https://www.gtap.agecon.purdue.edu/databases/v10/index.aspx

[38] World Input-Output Tables (WIOD) covers 43 countries and 56 sectors. EORA covers 190 countries and 26 sectors.

- *Outdated data:* the reference year of GTAP is a few years off, and the original datasets in GTAP are often even further behind.
- *Limited 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.

The JIM uses GTAP data for 93 countries, 76 sectors and for the base years 2017, 2014, 2011, 2007 and 2004.

Table 7: GTAP data used in JIM[39]

Data code	Description	Data code	Description
VDFB	Domestic purchases, by firms, at basic prices	EVFP	Primary factor purchases, by firms, at purchasers' prices
VDFP	Domestic purchases, by firms, at producers' prices	EVOS	After (income) tax value of endowment supply
VMFB	Import purchases, by firms, at basic prices	VXSB	Non-margin exports, at basic prices
VMFP	Import purchases, by firms, at producers' prices	VFOB	Non-margin exports, at FOB prices
VDPB	Domestic purchases, by households, at basic prices	VCIF	Imports, at CIF prices
VDPP	Domestic purchases, by households, at producers' prices	VST	Margin exports, at basic prices
VMPB	Import purchases, by households, at basic prices	SAVE	Net saving, by region
VMPP	Import purchases, by households, at producers' prices	VDEP	Capital depreciation
VDGB	Domestic purchases, by government, at basic prices	VKB	Capital stock
VDGP	Domestic purchases, by government, at producers' prices	MAKS	Pre-tax make matrix
VMGB	Import purchases, by government, at basic prices	MAKB	Post-tax make matrix, at basic prices
VMGP	Import purchases, by government, at producers' prices	MDF	Emissions from domestic product in current production (CO_2 emissions)
VDIB	Domestic purchases, by investment, at basic prices	MMF	Emissions from imported product in current production (CO_2 emissions)

[39] Aguiar, A., Chepeliev, M., Corong, E., & van der Mensbrugghe, D. (2023). The Global Trade Analysis Project (GTAP) Data Base: Version 11. Journal of Global Economic Analysis, 7(2). https://doi.org/10.21642/JGEA.070201AF (Original work published December 19, 2022). Retrieved from https://www.jgea.org/resources/jgea/ojs/index.php/jgea/article/view/77

VDIP	Domestic purchases, by investment, at producers' prices	EMIO	Emissions linked to fossil fuel combustion in production (non-CO_2 emissions)
VMIB	Import purchases, by investment, at basic prices	EMEN	Endowment-based emissions (non-CO_2 emissions)
VMIP	Import purchases, by investment, at producers' prices	EMIP	Process emissions linked to intermediate demand (non-CO_2 emissions)
EVFB	Primary factor purchases, by firms, at basic prices		

11.1.2 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 modelled estimates.

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 reduces 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.

Table 8: ILO data used in the JIM

Data	**Description**	**Geographies**	**Sectors**	**Base year**
Employment data per economic activity and gender (EMP_SEX_ECO)	Number of working age people who are engaged in any activity to produce goods or provide services for pay or profit	189 countries	14 sectors (ISIC level 1 aggregated)	2004 to 2022
Employment per gender and per age group (EMP_SEX_AGE)	Number of working age people per age group (i.e. +15, 15-24 and +24 years old)	189 countries	n/a	2004 to 2025

11.1.3 World Bank Development Indicators Databank

The WBDI databank is the primary World Bank collection of development indicators. These indicators 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.

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.

Table 9: WBDI data used in the JIM

Data	Description	Geographies	Base years
Gross fixed capital formation (in % of GDP)	Total value of fixed assets in a country/region. It includes land improvements; plant, machinery, and equipment purchases; and the construction of roads, railways, schools, offices, hospitals, private residences, and commercial and industrial buildings.	179 countries	2000 to 2023
Gross fixed capital formation, private sector (in % of GDP)	Total value of private sector investments (including private non-profit agencies) on additions to its fixed domestic assets.	99 countries	2000 to 2023
GDP (in current USD)		214 countries	2000 to 2023

11.1.4 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.

Data	Description	Geographies	Base years
Energy consumption	Expressed in MW	166 countries	2023, 2017, 2014, 2011, 2007 and 2004

11.1.5 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.

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.

Data	Description	Geographies	Base years
Energy consumption	Expressed in MW	230 countries /regions	2017, 2014, 2011, 2007 and 2004
Capacity Factors for Utility Scale Generators Primarily Using Non-Fossil Fuels	Only available per energy source	n/a	2023 and 2017

11.1.6 IMF

Data on formal employment share and formal gross domestic product was obtained from the regional economic outlook for Sub-Saharan Africa, published by the IMF (2017). It has unweighted estimates available for 6 regions worldwide. The base year of the data is 2010-2014.

11.1.7 IFC

The IFC commissions various studies, trying to assess the efficiency and relevance of private-sector development in less developed countries. Among those studies, the findings of two of them are used in the JIM to help quantify impact:

1. The study "Scaling-Up SME Access to Financial Services in the Developing World" (IFC, 2010), as mentioned in Section 2.1.8. 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". This means SMEs require 1.36 x (45/33) the people to produce the output while corporates need 0.82 x (55/67) the people to produce the output.
2. The study "Sectoral Value Added—Electricity Elasticities across Countries" (IFC & World Bank, 2021), as mentioned in Section 2.1.11.

11.1.8 Outliers management

11.1.8.1

Over the last few years, with the increasing amount of data collected from ILO and GTAP (multiple years and an improved geographic coverage), slight discrepancies and inconsistencies in the data were flagged. To systematically spot and handle those outliers, we performed an outlier analysis using the following 2 statistical methods and the following outlier treatment:

The statistical methods used to identify outliers:

A) The interquartile range (IQR) statistical analysis, consisting of the following steps:

1. Determine the 1st and 3rd quartile of a given data sample.
2. Substrate the 3rd quartile by the 1st quartile to get the interquartile range.
3. Calculate the upper fence, as 3rd quartile + 1.5 x IQR.
4. Any values outside of that threshold are identified as outliers.
5. Outliers are treated. Then world, regional and subregional intensities are recalculated.

B) The 99th percentile statistical analysis, consisting of the following steps:

1. Determine the 99th percentile of a given data sample.
2. Any values outside of that thresholds are identified as outliers.
3. Outliers are treated. Then world, regional and subregional intensities are recalculated.

The outlier treatment for identified outliers, consists of the following steps:

1. Country outliers are replaced by the corresponding sub-regional factors.
2. Sub-regional outliers are replaced by the corresponding regional factors.
3. Regional outliers are replaced by the responding world factors.

The data from 2017 at our disposal can be split into two main samples: 24,3 observations for the GHG intensities (76 sectors and 162 countries for CO2 and Non-CO2) of which approximately 10%

are treated as outliers, and 2,268 observations for the employment intensities (14 sectors and 162 countries) of which approximately 1% are treated as outliers.

Due to the large spread per sector in the CO_2 and non-CO_2 intensities the IQR statistical method was performed per economic sector, to identify sectoral outliers and to take into account the economic characteristics of each sector. In addition, the non-CO_2 intensities still show a large upper tail at global level, therefore, to account for this, the 99th percentile method was performed at global level (one sample with all sectors). For the employment intensities, due to the small spread between the first and third quartiles at sectoral level the IQR method is too strict, therefore the 99th percentile method was performed at global level.

While the JIM focuses on developing countries, we included data on high-income countries when performing the outlier analysis to have a more accurate representation of the global economy and capture the specificities of a larger sample of countries.

11.1.8.2 Asset turnover ratios

The asset turnover ratios (ATR) have also been treated for outliers. ATRs above the cutoff are replaced by the world ATR of the corresponding sector. To systematically spot and handle those outliers, we performed an outlier analysis using the following statistical method.

The 98th percentile statistical analysis, consisting of the following steps:

4. Determine the 98th percentile of a given data sample.
5. Any values outside of that thresholds are identified as outliers.
6. Outliers are replaced by the corresponding World ATR.

There are 304 observations for the ATRs (76 sectors and 4 regions) of which approximately 2% are treated as outliers.

11.2 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 which the model does not run) and optional data (which improve the calculations).

Getting reliable year-on-year financial data for hundreds of businesses is a challenging process, particularly if they are held through financial intermediaries. It is therefore necessary that organisations have data quality assurance processes in place to spot 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 < revenue
    - Payments to supplier organisations and individuals: total < revenue
    - Payments to supplier organisations and individuals: local < Payments to supplier organisations and individuals: total
    - Payments to government < revenue
    - Net income < revenue
    - Permanent employee wages: total < revenue
    - 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
    - Revenue ≥ (Payments to supplier organisations and individuals: total + Payment to government + Net income + Permanent employee wages: total)
    - Outstanding amount – Debt < Total Balance Sheet Value, or Total debt + Total equity
    - Outstanding amount – Listed equity < Total Balance Sheet Value, or Total debt + Total equity)

Appendix

Appendix 1: Coverage IO tables in JIM

Sectors			
1	Paddy rice	39	Metal products
2	Wheat	40	Computer, electronic and optical products
3	Cereal grains nec	41	Electrical equipment
4	Vegetables, fruit, nuts	42	Machinery and equipment nec
5	Oil seeds	43	Motor vehicles and parts
6	Sugar cane, sugar beet	44	Transport equipment nec
7	Plant-based fibers	45	Manufactures nec
8	Crops nec	46	Transmission and distribution
9	Bovine cattle, sheep and goats, horses	47	Nuclear base load
10	Animal products nec	48	Coal base load
11	Raw milk	49	Gas base load
12	Wool, silk-worm cocoons	50	Wind base load
13	Forestry	51	Hydro base load
14	Fishing	52	Oil base load
15	Coal	53	Other base load
16	Oil	54	Gas peak load
17	Natural gas extraction	55	Hydro peak load
18	Other Extraction	56	Oil peak load
19	Bovine meat products	57	Solar peak load
20	Meat products nec	58	Gas manufacturing, distribution
21	Vegetable oils and fats	59	Water
22	Dairy products	60	Construction[40]
23	Processed rice	61	Trade
24	Sugar	62	Accommodation, Food and service activities
25	Food products nec	63	Transport nec
26	Beverages and tobacco products	64	Water transport
27	Textiles	65	Air transport
28	Wearing apparel	66	Warehousing and support activities
29	Leather products	67	Communication
30	Wood products	68	Financial services nec
31	Paper products, publishing	69	Insurance
32	Petroleum, coal products	70	Real estate activities
33	Chemical products	71	Business services nec
34	Basic pharmaceutical products	72	Recreational and other services
35	Rubber and plastic products	73	Public Administration and defence
36	Mineral products nec	74	Education
37	Ferrous metals	75	Human health and social work activities
38	Metals nec	76	Dwellings

[40] Sector 60 construction returns 0 emissions for scope 1 non-CO2 because the emissions are negligible find more here: Estimating the amount of CO2 emissions that the construction industry can influence - Supporting material for the Low Carbon Construction IGT Report - Autumn 2010 (publishing.service.gov.uk)

Countries that can be run in the JIM[41]			
1	**Afghanistan**	82	**Malawi**
2	**Albania**	83	**Malaysia**
3	**Algeria**	84	Maldives
4	Angola	85	**Mali**
5	Anguilla	86	Marshall Islands
6	**Argentina**	87	Mauritania
7	**Armenia**	88	**Mauritius**
8	**Azerbaijan**	89	Mayotte
9	**Bangladesh**	90	**Mexico**
10	**Belarus**	91	Micronesia, Federated States of
11	Belize	92	Moldova, Republic of
12	**Benin**	93	**Mongolia**
13	Bhutan	94	Montenegro
14	**Bolivia**	95	Montserrat
15	Bonaire, Sint Eustatius, Saba	96	**Morocco**
16	Bosnia and Herzegovina	97	**Mozambique**
17	**Botswana**	98	Myanmar
18	**Brazil**	99	**Namibia**
19	**Bulgaria**	100	Nauru
20	**Burkina Faso**	101	**Nepal**
21	Burundi	102	**Nicaragua**
22	Cabo Verde	103	**Niger**
23	**Cambodia**	104	**Nigeria**
24	**Cameroon**	105	Niue
25	**Central African Republic**	106	North Macedonia
26	**Chad**	107	**Pakistan**
27	**Chile**	108	**Panama**
28	**China**	109	Papua New Guinea
29	**Colombia**	110	**Paraguay**
30	**Comoros**	111	**Peru**
31	**Congo, The DRC**	112	**Philippines**
32	**Congo-Brazzaville**	113	Pitcairn
33	Cook Islands	114	**Romania**
34	**Costa Rica**	115	**Russia**
35	**Côte d'Ivoire**	116	**Rwanda**
36	Cuba	117	Saint Barthélemy
37	Djibouti	118	Saint Lucia
38	Dominica	119	Saint Vincent and the Grenadines
39	**Dominican Republic**	120	Samoa
40	East Timor	121	São Tomé and Príncipe
41	**Ecuador**	122	Sark
42	**Egypt**	123	**Senegal**
43	**El Salvador**	124	**Serbia**
44	**Equatorial Guinea**	125	Seychelles
45	Eritrea	126	Sierra Leone
46	**Eswatini**	127	Solomon Islands

[41] Countries in bold have their own IO table.

47	**Ethiopia**	128	Somalia
48	Falkland Islands	129	**South Africa**
49	Fiji	130	South Georgia and South S.S.
50	French Guiana	131	South Sudan
51	**Gabon**	132	**Sri Lanka**
52	Gambia	133	St. Helena
53	**Georgia**	134	St. Pierre and Miquelon
54	**Ghana**	135	**State of Palestine**
55	Grenada	136	**Sudan**
56	**Guatemala**	137	Suriname
57	**Guinea**	138	Svalbard and Jan Mayen Islands
58	Guinea-Bissau	139	**Syrian Arab Republic**
59	Guyana	140	**Tajikistan**
60	**Haiti**	141	**Tanzania, United Republic of**
61	Holy See	142	**Thailand**
62	**Honduras**	143	**Togo**
63	**India**	144	Tokelau
64	**Indonesia**	145	Tonga
65	**Iran (Islamic Republic of)**	146	**Tunisia**
66	**Iraq**	147	**Turkey**
67	**Jamaica**	148	Turkmenistan
68	Jersey	149	Tuvalu
69	**Jordan**	150	U.S. Minor Islands
70	**Kazakhstan**	151	**Uganda**
71	**Kenya**	152	**Ukraine**
72	Kiribati	153	**Uruguay**
73	Korea, D.P.R.O.	154	**Uzbekistan**
74	Kosovo	155	Vanuatu
75	**Kyrgyzstan**	156	**Venezuela**
76	**Laos**	157	**Vietnam**
77	**Lebanon**	158	Wallis and Futuna Islands
78	Lesotho	159	Western Sahara
79	Liberia	160	Yemen
80	Libya	161	**Zambia**
81	**Madagascar**	162	**Zimbabwe**

Regions		Countries used to derive regional intensities[42]
1	World	Includes all countries included in Africa, Americas, Asia, Europe and Oceania, plus British Indian Ocean Territory, French Southern Territories, Bouvet Island, Antarctica
2	Africa	Includes all countries included in Northern Africa, Eastern Africa, Middle Africa, Southern Africa and Western Africa
3	Northern Africa	Algeria, Egypt, Morocco, Sudan, Tunisia and Rest of Northern Africa
4	Eastern Africa	Comoros, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Uganda, Tanzania, Zambia, Zimbabwe and Rest of Eastern Africa
5	Middle Africa	Cameroon, Central African Republic, Chad, Congo, Democratic republic of Congo, Equatorial Guinea, Gabon and Rest of South and Central Africa
6	Southern Africa	Botswana, Eswatini, Namibia, South Africa and Rest of Southern Africa
7	Western Africa	Benin, Burkina Faso, Cote d'Ivoire, Ghana, Guinea, Mali, Niger, Nigeria, Senegal, Togo and Rest of Western Africa
8	Caribbean	Dominican Republic, Haiti, Jamaica, Puerto Rico, Trinidad and Tobago and Rest of Caribbean
9	Central America	Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama and Rest of Central America
10	South America	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela and Rest of South America
11	Asia	Includes all countries included in Central Asia, Eastern Asia, South-eastern Asia, Southern Asia, and Western Asia
12	Central Asia	Kazakhstan, Kyrgyz Republic, Tajikistan, Uzbekistan and Rest of former Soviet Union
13	South-eastern Asia	Brunei, Cambodia, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand, Vietnam and Rest of South-eastern Asia
14	Southern Asia	Afghanistan, Bangladesh, India, Iran, Nepal, Pakistan, Sri Lanka, Rest of Southern Asia
15	Melanesia, Micronesia, Polynesia	Rest of Oceania
16	Eastern Europe	Belarus, Bulgaria, Czechia, Hungary, Poland, Romania, Russia, Slovakia, Ukraine, and Rest of Eastern Europe

[42] There could be slight deviations from UN Geoscheme. 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 have their own IO table, the rest of countries use regional averages for impact estimation.

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 49 50 51 52 53 54 55 56 57 58 59
F	Construction	60
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	61
H, J	Transport; storage and communication	63 64 65 66 67
I	Accommodation and food service activities	62
K	Financial and insurance activities	68 69
L, M, N	Real estate; business and administrative activities	70 71 76
O	Public administration and defence; compulsory social security	73
P	Education	74
Q	Human health and social work activities	75
R, S, T, U	Other services	72

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 48 49 50 51 52 53 54 55 56 57 58
E	Water supply; sewerage, waste management and remediation activities	59
F	Construction	60
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	61
H	Transportation and storage	63 64 65 66
I	Accommodation and food service activities	62
J	Information and communication	67
K	Financial and insurance activities	68 69
L	Real estate activities	70 76
M	Professional, scientific and technical activities	71
N	Administrative and support service activities	71
O	Public administration and defence; compulsory social security	73

P	Education	74
Q	Human health and social work activities	75
R	Arts, entertainment and recreation	72
S	Other service activities	72
T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	72
U	Activities of extraterritorial organisations and bodies	73

GICS Sector	GTAP Sector
Energy Equipment & Services	16 17
Oil, Gas & Consumable Fuels	15 16 17 18 32
Chemicals	32 33 35
Construction Materials	18 36
Containers & Packaging	30 31 35 36 39
Metals & Mining	18 37 38 39
Paper & Forest Products	13 30 31
Aerospace & Defense	39 44 45 73
Building Products	35 36 39 42
Construction & Engineering	60 71
Electrical Equipment	36 39 41
Industrial Conglomerates	68
Machinery	39 42 43 44 45
Trading Companies & Distributors	61 71
Commercial Services & Supplies	31 45 66 71
Professional Services	71
Air Freight & Logistics	65
Passenger Airlines	65
Marine Transportation	64
Ground Transportation	63
Transportation Infrastructure	63
Automobile Components	35 43
Automobiles	43
Household Durables	27 35 40 41 60
Leisure Products	27 29 45
Textiles, Apparel & Luxury Goods	27 28 29
Hotels, Restaurants & Leisure	62
Diversified Consumer Services	71
Distributors	61
Broadline Retail	61
Specialty Retail	61
Consumer Staples Distribution & Retail	61
Beverages	26
Food Products	1 2 3 4 5 6 7 8 9 10 11 12 14 19 20 21 22 23 24 25 61 71
Tobacco	26
Household Products	27 33

Personal Care Products	33
Health Care Equipment & Supplies	40 45
Health Care Providers & Services	61 71 75
Health Care Technology	71
Biotechnology	71
Pharmaceuticals	34
Life Sciences Tools & Services	34
Banks	68
Financial Services	68
Consumer Finance	68
Capital Markets	68
Mortgage Real Estate Investment Trusts (REITs)	68
Insurance	69
IT Services	67 71
Software	71
Communications Equipment	40 41
Technology Hardware, Storage & Peripherals	40
Electronic Equipment, Instruments & Components	40
Semiconductors & Semiconductor Equipment	40
Diversified Telecommunication Services	67
Wireless Telecommunication Services	67
Media	31 71
Entertainment	72
Interactive Media & Services	72
Electric Utilities	46 47 48 49 50 51 52 53 54 55 56 57
Gas Utilities	58
Multi-Utilities	46 47 48 49 50 51 52 53 54 55 56 57 58 59
Water Utilities	59
Independent Power and Renewable Electricity Producers	46 47 48 49 50 51 52 53 54 55 56 57
Diversified REITs (New Name)	70
Industrial REITs (New)	70
Hotel & Resort REITs (New)	62 70
Office REITs (New)	70
Health Care REITs (New)	70
Residential REITs (New)	70
Retail REITs (New)	70
Specialized REITs (New)	70
Real Estate Management & Development	70

Appendix 3: Definition of Micro, Small & Medium Enterprises (MSMEs)

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

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: Energy sources

Energy sources			
1	Coal	9	Hydro base load
2	Oil	10	Oil base load
3	Natural gas	11	Other base load
4	Petroleum and coke products	12	Gas peak load
5	Nuclear base load	13	Hydro peak load
6	Coal base load	14	Oil peak load
7	Gas base load	15	Solar peak load
8	Wind base load	16	Distributed gas

Appendix 6: Sectors active in fossil fuel

Classification	Sector code	Sector name
GTAP	15	Coal
GTAP	16	Oil
GTAP	17	Gas
GTAP	18	Other Extraction
GTAP	46	Electricity: Transmission and distribution
GTAP	48	Coal power baseload
GTAP	49	Gas power baseload
GTAP	52	Oil power baseload
GTAP	53	Other baseload
GTAP	54	Gas power peakload
GTAP	56	Oil power peakload
GTAP	58	Gas manufacture, distribution
GTAP	61	Trade
GICS	GICS-101010	Energy Equipment & Services
GICS	GICS-101020	Oil, Gas & Consumable Fuels
GICS	GICS-151040	Metals & Mining
GICS	GICS-255010	Distributors
GICS	GICS-255040	Specialty Retail
GICS	GICS-551010	Electric Utilities
GICS	GICS-551020	Gas Utilities
GICS	GICS-551030	Multi-Utilities
ISIC	ISIC-05	Mining of coal and lignite
ISIC	ISIC-0510	Mining of hard coal
ISIC	ISIC-0520	Mining of lignite
ISIC	ISIC-06	Extraction of crude petroleum and natural gas
ISIC	ISIC-0610	Extraction of crude petroleum
ISIC	ISIC-0620	Extraction of natural gas
ISIC	ISIC-09	Mining support service activities
ISIC	ISIC-0910	Support activities for petroleum and natural gas extraction
ISIC	ISIC-35	Electricity, gas, steam and air conditioning supply
ISIC	ISIC-351	Electric power generation, transmission and distribution
ISIC	ISIC-3510	Electric power generation, transmission and distribution
ISIC	ISIC-352	Manufacture of gas; distribution of gaseous fuels through mains
ISIC	ISIC-3520	Manufacture of gas; distribution of gaseous fuels through mains
ISIC	ISIC-46	Wholesale trade, except of motor vehicles and motorcycles
ISIC	ISIC-466	Other specialized wholesale
ISIC	ISIC-4661	Wholesale of solid, liquid and gaseous fuels and related products
ISIC	ISIC-49	Land transport and transport via pipelines
ISIC	ISIC-493	Transport via pipeline
ISIC	ISIC-4930	Transport via pipeline
ISIC	ISIC-B	Mining and quarrying
ISIC	ISIC-D	Electricity, gas, steam and air conditioning supply
ISIC	ISIC-G	Wholesale and retail trade; repair of motor vehicles and motorcycles

ISIC	ISIC-H	Transportation and storage
NACE	NACE-05	Mining of coal and lignite
NACE	NACE-05.1	Mining of hard coal
NACE	NACE-05.10	Mining of hard coal
NACE	NACE-05.2	Mining of lignite
NACE	NACE-5.20	Mining of lignite
NACE	NACE-06	Extraction of crude petroleum and natural gas
NACE	NACE-06.1	Extraction of crude petroleum
NACE	NACE-06.10	Extraction of crude petroleum
NACE	NACE-06.2	Extraction of natural gas
NACE	NACE-06.20	Extraction of natural gas
NACE	NACE-09	Mining support service activities
NACE	NACE-9.1	Support activities for petroleum and natural gas extraction
NACE	NACE-09.10	Support activities for petroleum and natural gas extraction
NACE	NACE-35	Electricity, gas, steam and air conditioning supply
NACE	NACE-35.1	Electric power generation, transmission and distribution
NACE	NACE-35.11	Production of electricity from non-renewable sources
NACE	NACE-35.13	Transmission of electricity
NACE	NACE-35.14	Distribution of electricity
NACE	NACE-35.15	Trade of electricity
NACE	NACE-35.16	Storage of electricity
NACE	NACE-35.2	Manufacture of gas, and distribution of gaseous fuels through mains
NACE	NACE-35.21	Manufacture of gas
NACE	NACE-35.22	Distribution of gaseous fuels through mains
NACE	NACE-35.23	Trade of gas through mains
NACE	NACE-35.24	Storage of gas as part of network supply services
NACE	NACE-35.4	Activities of brokers and agents for electric power and natural gas
NACE	NACE-35.40	Activities of brokers and agents for electric power and natural gas
NACE	NACE-46	Wholesale trade
NACE	NACE-46.8	Other specialised wholesale
NACE	NACE-46.81	Wholesale of solid, liquid and gaseous fuels and related products
NACE	NACE-47	Retail trade
NACE	NACE-47.3	Retail sale of automotive fuel
NACE	NACE-47.30	Retail sale of automotive fuel
NACE	NACE-52	Warehousing, storage and support activities
NACE	NACE-B	Mining and quarrying
NACE	NACE-D	Electricity, gas, steam and air conditioning supply
NACE	NACE-G	Wholesale and retail trade; repair of motor vehicles and motorcycles
NACE	NACE-H	Transportation and storage

Appendix 7: High impact climate sectors

NACE rev. 2 sectors	GTAP sectors
Agriculture, forestry and fishing	1 – 14
Mining and quarrying	15 – 18
Manufacturing	19 - 45
Electricity, gas, steam and air conditioning supply	46 – 58
Water supply; sewerage, waste management and remediation activities	59
Construction	60
Wholesale and retail trade; repair of motor vehicles and motorcycles	31
Transportation and storage	63 - 66
Real estate activities	70 - 76