# The IMF MARIO Project
## Multi-Analytical Regional Input-Output Model

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# Abstract

Input-output tables represent a unique source of information to understand the relationships between producers and consumers within an economy and their interconnection with: a) the environment through emissions of $CO_2$, other pollutants, the use of land and natural resources, b) energy and physical accounts; c) employment; d) tax gaps as well as fiscal policies related to climate change adaptation and mitigation; e) income distribution; f) trade in value added, and so on. The IMF has started developing a Multi-Analytical Regional Input-Output model (MARIO) to provide a powerful analytical tool and a source of harmonized granular data to better understand the inter-relationships between economies, their impact on climate change, and their economic and social development. Linking domestic input-output tables together in a consistent multi-regional model will help improve data consistency within and across economies.

MARIO's development will take advantage of already available data from different global input-output tables initiatives; statistical offices; and international organizations, including official source data collected by the IMF from its member countries. This will reduce the amount of missing data encountered in the estimation of multi-regional input-output models.

The IMF is in a unique position to develop a model with global geographic coverage while also improving cross-country and global data consistency. Through cooperation with other international organizations, such as the OECD, Eurostat, UNECLAC and the Asian Development Bank and its extensive technical assistance program, MARIO will cover the years from 1990 to 2022 and 209 economies, including all IMF members. The model will encompass 178 products and 144 industries, providing sufficient granularity to perform detailed analysis on themes related to climate change and the environment and will capture international spillovers providing the ability to analyze the energy transition, emissions, material flows, and other questions of strategic importance.

# Introduction

Input-output tables represent a unique source of information to understand the sale and purchase relationships between producers and consumers within an economy and their interconnection, among others, with:

   a) Environment and climate change, like emissions of $CO_2$ and other pollutants, use of land, use of natural resources, energy transition.
   b) Employment and how it relates to gender, age, income group, qualification, green activities, etc..
   c) Tax gaps.
   d) Income distribution.
   e) Global Value Chains (GVCs) and Trade in Value Added (TiVA), and so on.

Over the past decade or so, different initiatives were conducted to estimate global MRIOs, with the main ones being the OECD Inter-Country Input-Output Tables (ICIO) (OECD, 2021), the University of Groningen World Input-Output Database (WIOD) (Timmer et al., 2015 and 2016), the IDE-JETRO's international input-output tables (Meng, Zhang & Inomata, 2013), the University of Sydney EORA (Lenzen et al., 2012 and 2013) and GLORIA (Lenzen et al., 2017 and 2022), the Eurostat FIGARO (Remond-Tiedrez and Rueda-Cantuche, 2019; Eurostat, 2021), the EXIOBASE (Bjelle et al., 2019; Stadler et al., 2018 and 2021), the University of Purdue GTAP-MRIO (Carrico et al, 2020), the Asian Development Bank ADB-MRIO (Asian Development Bank, 2022), the ECLAC MRIO (ECLAC, 2020), and the EMERGING (Huo et al., 2022).

Despite availability of these MRIOs, internal IMF discussions highlighted that the existing databases do not meet IMF needs in terms of coverage of economies and years, detail on commodities and industries, timeliness, flexibility of use, modeling, and analysis. On the modeling and analysis side, given the IMF's new priority areas for surveillance, including climate change and gender, as well as its traditional surveillance and policy formulation, extending domestic input-output tables to an IMF Multi-Regional Input-Output (MRIO) model would constitute a powerful analytical tool and source of harmonized granular data for IMF Departments, member economies, academia, and researches institutes, to better understand the inter-relationships between economies; their role in global value chains; the implications of their production, consumption, and investment activities for climate change; and their economic and social development. It would also help to improve the data and conceptual consistency across individual economies' input-output tables and could also be used to develop or improve Supply-Use Tables (SUTs) for those economies with limited use of the SUT framework in estimation of GDP by the production approach.

Key challenges include the lack of data and the necessity to standardize and harmonize concepts, classifications, and estimates across countries into a single statistical framework. The lack of SUTs or IOTs will require modeling tables for countries which do not produce them using macroeconomic aggregates combined with the structure of tables from countries with a similar economic profile. Although SUTs are frequently prepared for benchmarking purposes, they are not always disseminated. In addition, the availability of IOTs remains limited for various reasons including the conceptual complexities or dissemination issues related to data confidentiality. The IMF has frequent interactions with national statistical offices through its large program of technical assistance on national accounts which covers the production of SUTs and IOTs. Therefore, the IMF is in a unique position to collect official data supporting the compilation of estimates using modeling techniques. The absence of time series will also require extrapolation or interpolation of the tables for missing years.

The need for harmonization will also require significant work. The presentation of the tables and the classifications used by compilers vary significantly across countries because the supply or use of some products and industries are particularly relevant in each country. While the System of National Accounts prescribes statistical treatments in the SUTs and IOTs, statistical offices use different breakdowns of margins, taxes, or different approaches to implement the cost insurance freight/free-on-board adjustment for example. All these differences require time-consuming harmonization tasks which cannot always be automated.

To fulfill these needs, the IMF is developing the Multi-Analytical Regional Input-Output (MARIO) database, a new database which will take advantage of already available data from different global input-output tables initiatives; from statistical offices; and from international organizations, including official source data collected by the IMF from its member countries, which gives the IMF the advantage of early, and sometimes exclusive, access to a broader set of official statistics and which will reduce the amount of missing data encountered in the estimation of MRIOs.

The next section will present an overview of the proposed methodology to be used in MARIO's estimation, following by a discussion of its proposed structure and the main Global MRIOs which will be used as data sources for its estimation. The last section will make some final comments.

# Estimation Methodology

Given the complexity of estimation, the methodological solution proposed allows flexibility, and speed, by breaking down the MARIO's estimation process into 5 major blocks, as show in Figure 1.

1. SNA constraints for the economy.
2. Output, value added, tax, subsidies, and final demand components broken down by products and industries.
3. Technical coefficients for intermediate consumption and final demand.
4. International trade.
5. Estimation of the IMF-MARIO components based on data from the 4 previous blocks.

Despite the block's interdependence, the work is organized in such a way so that the data gathering and the work in each block can take place in parallel.

An overview of the estimation process in each block is presented in the following sub-sections.

Figure 1. Estimation methodology of IMF-MARIO
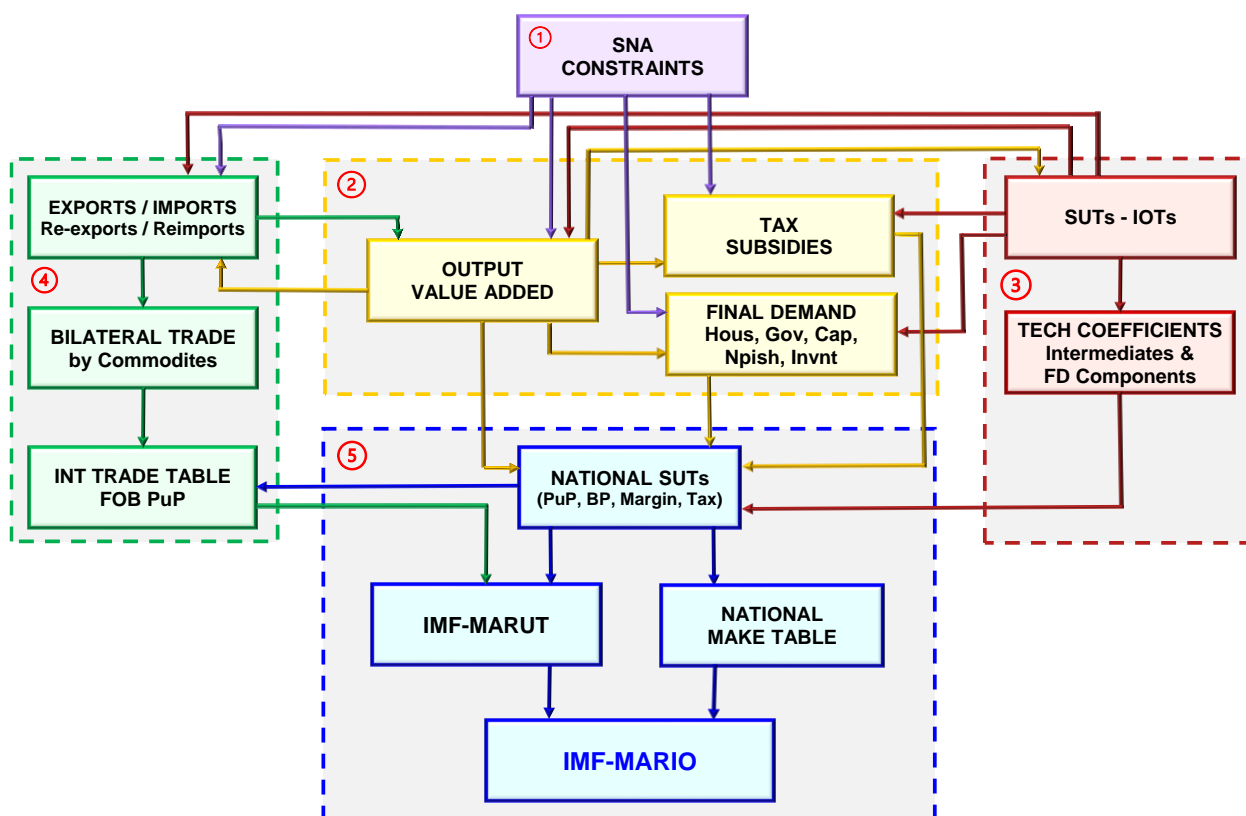


Source: Authors elaboration

## Block 1 – SNA Constraints

The SNA constraints are the base for, and fundamental to, the estimation and to assure consistency in the final system. The estimation of these constraints is mainly based on aggregated data from the United Nations National Accounts Statistics, IMF, Eurostat, World Bank, OECD, and National Statistical Offices. One example of an SNA constraint will be the internationally agreed estimates of GDP by country. Other national accounts aggregates, such as household consumption will be included in these constraints. Due to vintages and adjustments made to meet various requirements it is expected that a full alignment of these constraints amongst participating international organizations will be difficult to achieve, but the best efforts will be made to reduce differences.

To assure consistency in the estimation, it is necessity to express the figures for all countries' SNA constraints in reference to the calendar year, as for some countries the national account figures refers to these countries' fiscal years. This approach will enable revising MARIO to incorporate the latest national accounts updates and maintain a contemporary database.

## Block 2 – Output, value added, tax, subsidies, and final demand components

This block deals with the estimation of output, value added, tax, subsidies and final demand components at the product and industry levels. It assures the broader consistency of the estimated National Supply and Use Tables, the valuation process of going from purchasers' to basic price, and the structure of the final demand components.

The estimation of this block's components will interact with the estimation of exports to assure that exports are consistent with the output being produced. The interaction with the estimation of output and value added will help in the harmonization of the countries SUTs, and the countries SUTs values will be used in the estimation of this block's variables.

The results from this block will be used as constraints for the National SUTs, IMF-MARUT. And IMF-MARIO.

## Block 3 – Technical coefficients for intermediate consumption and final demand

This block will work with the harmonization of the countries SUTs according to the definition of products and industries required for the estimation of MARIO. This block will fill the gaps for years where there is no information for countries' SUTs, including the estimation of SUTs for countries which don't produce them for which we will use coefficients from countries will similar economic profiles. The metadata will inform users about the data sources used to compile MARIO, including where non-official source data have been used.

The result will be technical coefficients matrices that will be used to estimate harmonized national SUTs in Block 5.

## Block 4 – International trade table

Using SNA constraints and the information from the countries' SUTs will be possible to estimate the total exports and imports, FOB at purchasers' prices, by product, excluding reexports and reimports.

Based on bilateral trade information from various sources, and in particular from BACI[1], UN Comtrade[2], OECD-WTO Balanced Trade in Services (BaTIS)[3], and OECD Bilateral Trade Database by Industry and End-Use (BTDIxE)[4], it is possible to estimate for each product a matrix of bilateral trade among the countries. This information is then combined with information from BTDIxE and the National SUTs estimated in block 5, to estimate the International Trade Table containing the bilateral trade by end user of the exports, i.e., if exports are allocated to intermediate use for further processing or if it is a final good allocated to the final demand components.

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[1] http://www.cepii.fr/CEPII/en/bdd_modele/bdd_modele_item.asp?id=37

[2] https://comtradeplus.un.org/

[3] https://www.oecd-ilibrary.org/trade/data/oecd-statistics-on-international-trade-in-services/oecd-wto-balanced-international-trade-in-services-ebops-2010_08dba674-en

[4] https://www.oecd.org/sti/ind/bilateraltradeingoodsbyindustryandend-usecategory.htm

## Block 5 – IMF-MARIO

This first task performed in block 5 is to estimate harmonized National Supply Tables with valuation, Use Tables at purchasers' and basic prices, and the auxiliary tables on margins, tax, and subsidies—based on information from blocks 2 and 3.

The second task is to estimate the Multi-Analytical Regional Use Table (MARUT) based on information from the harmonized National Use Tables and the International Trade Table estimated in block 4. As explained in the next section, the estimation process, will be designed to ensure that the results: a) for EU countries are, as much as possible, the same as the ones presented in Eurostat's FIGARO; b) for the non-EU OECD countries, are in concordance with OECD's ICIO; c) for the Asian economies are in concordance with the ADB-MRIO; and d) for the Latin America economies are in concordance with the ECLAC-MRIO.

The final task in the estimation process is to obtain the IMF-MARIO, industry by industry symmetric square tables, using the information from the National Supply Tables and the IMF-MARUT. This is done by applying the assumption of fixed product sales structure, Eurostat model D (Eurostat, 2008, pp. 347-357), where the share of each industry in the sale of a given product is kept constant[5].

## MARIO Final Outputs

The resulting MARIO database will consist of harmonized national supply and use tables, and global multi-regional use tables and input-output tables.

Figures 2 to 5 show, in a schematic way, the structure of the tables which will constitute MARIO's database and refers to the national economy:

1. Supply table for the economy (Figure 2)
2. Use table in purchasers' prices – economy (Figure 3)
3. Use table at basic prices – economy (Figure 4)
4. Imports table – economy (Figure 5)
5. Wholesale and retail trade and repair services of motor vehicles – economy (Figure 5)
6. Trade margin wholesale trade, except motor vehicles – economy (Figure 5)
7. Trade margin retail trade, except motor vehicles – economy (Figure 5)
8. Transport margin land – economy (Figure 5)
9. Transport margin water – economy (Figure 5)
10. Transport margin air – economy (Figure 5)
11. Tax on products – economy (Figure 5)
12. Subsidies on products – economy (Figure 5)
13. Duty and tax on imports – economy (Figure 5)

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[5] See also Miller and Blair (2022), chapter 5, who refers to this estimation as being "industry-based" technology, industry by industry approach.

Figures 6 and 7 by its turn show the global systems:

1. IMF-MARUT at basic prices (Figure 6)
2. IMF-MARIO at basic prices (Figure 7)

In each one of these Tables, the cells are highlight with rectangles showing the block numbers which are sources of their values. In the case of Figure 2, the Supply Table, has: a) the row of totals for the valuation columns that come from Block 1 (B1); b) the columns of the valuation, values by product, are estimated in Block 2 (B2); c) the row of total output, by industry, estimated in Block 2 (B2); and d) the make matrix which shows the amount of products produced by each industry estimated based on information from Blocks 2 and 3 (B2 & B3). For Figures 3 to 7, the same logic showed for Figure 2 applies to understand which block is responsible for the estimation of the data shown in these tables.

Figure 2. Supply table for the economy



Source: Authors elaboration

Figure 3. Use table in purchasers' prices for the economy



Source: Authors elaboration

Figure 4. Use table at basic prices for the economy

| | | Industry | | | | Final Demand | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | I1 | I2 | I3 | I4 | FD1 | FD2 | FD3 | Total |
| **Product** | P1 | | | | | | | | |
| | P2 | | | | | | | | *B2* |
| | P3 | | *B2 & B3* | | | | *B2 & B3* | | |
| | P4 | | | | | | | | |
| | Imports | | | | | | | | |
| **Value Added Tax & Subsidy** | Tax & Sub Prod. | | | | | | | | *B1* |
| | Labor | | | | | | | | |
| | Capital | | *B2* | | | | | | |
| | Other Tax & Sub | | | | | | | | |
| | Total | | *B2* | | | | *B1* | | |

Source: Authors elaboration

Figure 5. Import, margin, tax and subsidy tables for the economy

| | | Industry | | | | Final Demand | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | I1 | I2 | I3 | I4 | FD1 | FD2 | FD3 | Total |
| **Product** | P1 | | | | | | | | |
| | P2 | | | | | | | | *B2* |
| | P3 | | *B2 & B3* | | | | *B2 & B3* | | |
| | P4 | | | | | | | | |
| | Total | | | | | | | | |

Source: Authors elaboration

In figure 6, the diagonal B5 shows the intermediate consumption of domestically produced inputs while the off diagonal shows the use of imported products. These tables are transformed by removing the net taxes on products and margins to derive basic price estimates.

Figure 6. IMF Multi-Analytical Regional Use Table (IMF-MARUT) at basic prices

| | | Industry | | | | Final Demand | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | I_E1 | I_E2 | I_E3 | I_E4 | FD_E1 | FD_E2 | FD_E3 | FD_E4 | |
| **Product** | P_E1 | B5 | | | B4 & B5 | B5 | | | B4 & B5 | B2 |
| | P_E2 | | B5 | | | | B5 | | | |
| | P_E3 | B4 & B5 | | B5 | | B4 & B5 | | B5 | | |
| | P_E4 | | | | B5 | | | | B5 | |
| **Value Added Tax & Subsidy** | Tax & Sub Prod. | | | B4 & B5 | | | B4 & B5 | | | B1 |
| | Labor | | | | | | | | | |
| | Capital | | | B2 | | | | | | |
| | Other Tax & Sub | | | | | | | | | |
| | Total | | | B2 | | | B1 | | | |

Source: Authors elaboration

In the final tables, Figure 7, the products are allocated by industries to derive symmetric square tables, industry by industry, which are necessary for analytical purposes such as the derivation of the Leontief inverse.

Figure 7. IMF Multi-Analytical Regional Input-Output Table (IMF-MARIO) at basic prices

| | | Industry | | | | Final Demand | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | I_E1 | I_E2 | I_E3 | I_E4 | FD_E1 | FD_E2 | FD_E3 | FD_E4 | |
| **Industry** | I_E1 | | | | | | | | | B2 |
| | I_E2 | | | | | | | | | |
| | I_E3 | | | B5 | | | | B5 | | |
| | I_E4 | | | | | | | | | |
| **Value Added Tax & Subsidy** | Tax & Sub Prod. | | | | | | | | | B1 |
| | Labor | | | | | | | | | |
| | Capital | | | B2 | | | | | | |
| | Other Tax & Sub | | | | | | | | | |
| | Total | | | B2 | | | B1 | | | |

Source: Authors elaboration

# MARIO's Dimensions

An important step in the estimation process is the definition of countries, products, and industries that will be considered in the MARIO model, as these choices will impact the estimation, the results, and the future use of the model. Despite being possible to change the number of components of these 3 key variables, experience shows that changing their definition usually is not so straightforward, and it is highly demanding in time and resources.

Usually, a good strategy to follow is to consider a more granular definition of countries, products, and industries at the start of the estimation process, and after, to work with aggregated versions of the underlining database.

Advantages of working with a more granular version in the estimation is that the assembled system of estimation will be ready to work with more granular data when it becomes available, and the results obtained from the aggregated versions of the underlining system tend to be more consistent than the estimation based on a less granular version of data. The use of granular data also provides flexibility to examine additional products and industries that may become more important later.

Following these premises, the proposed list of countries will consider all the IMF member countries, select territories of member countries, key non-member economies, and the rest of the world (aggregation of the remaining economies). Through its large technical assistance program[6] the IMF has frequent interactions with compilers of SUTs and IOTs. This is a unique opportunity to access data and metadata on SUTs/IOTs and contribute to methodological improvements. The IMF has collected 25 SUTs from national statistical offices either through direct data requests or downloads from published official statistics. In the future the IMF will strengthen its data collection program to support MARIO.

The choice of industries and products is based on data availability and the use of the MARIO to study questions related to economic structural analysis, trade, social and distributional aspects, and at the same time have enough granularity for products and industries which are critical to conduct studies and analysis associated with climate change, energy, and natural resources, which are crucial for the future of our lives and economies.

Annexes I to III present, respectively, the preliminary list of 209 economies, 144 industries, and 178 products which will be initially considered in MARIO's estimation. This choice of industries and products was based on current data availability, and the points raised above.

Another important aspect in the estimation process is the definition of components that will be shown for tax, subsidy, and value added (Tables 1 and 2), final demand (Table 3 and 4), and used in the valuation from purchaser's prices to basic prices (Table 5). Table 1 shows tax, subsidy and value added components on national SUTs at basic prices, MARUT and MARIO, Table 2 shows tax, subsidy and value added components on national SUTs at purchasers' prices, while Table 3 shows final demand components on national SUTs, and Table 4 shows final demand components on MARUT and MARIO.

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[6] The IMF has 15 regional capacity development centers delivering national accounts technical assistance missions and training. These are supplemented by assistance from the IMF's headquarters, totaling more than 250 missions per year.

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Table 1. Tax, subsidy and value added components on national SUTs at basic prices, MARUT and MARIO

| No | Code | Component |
|----|------|-----------|
| 1 | D21 | Taxes on products |
| 2 | D31 | Subsidies on products |
| 3 | D1 | Compensation of employees |
| 4 | B2N | Net operating surplus |
| 5 | B3N | Net mixed income |
| 6 | K1 | Consumption of fixed capital |
| 7 | D29_D39 | Other taxes less subsidies on production |

Table 2. Tax, subsidy and value added components on national SUTs at purchasers' prices

| No | Code | Component |
|----|------|-----------|
| 1 | D1 | Compensation of employees |
| 2 | B2N | Net operating surplus |
| 3 | B3N | Net mixed income |
| 4 | K1 | Consumption of fixed capital |
| 5 | D29_D39 | Other taxes less subsidies on production |

Table 3. Final demand components on national SUTs

| No | Code | Component | SNA Code |
|----|------|-----------|----------|
| 1 | HFCE | Household final consumption expenditure | P3S14 |
| 2 | NPISH | NPISH final consumption expenditure | P3S15 |
| 3 | GGFC | Government final consumption expenditure | P3S13 |
| 4 | GFCF | Gross fixed capita formation | P51 |
| 5 | INVNT | Changes in inventories | P52_53 |
| 6 | P34 | Non-residents final consumption on the territory | P34 |
| 7 | P6 | Exports | P6 |

Table 4. Final demand components on MARUT and MARIO

| No | Code | Component | SNA Code |
|----|------|-----------|----------|
| 1 | HFCE | Household final consumption expenditure | P3S14 |
| 2 | NPISH | NPISH final consumption expenditure | P3S15 |
| 3 | GGFC | Government final consumption expenditure | P3S13 |
| 4 | GFCF | Gross fixed capita formation | P51G |
| 5 | INVNT | Changes in inventories | P52 |
| 6 | P33 | Residents' final consumption abroad | P33 |

Table 5. Valuation components on national SUTs

| No | Code | Component |
|----|------|-----------|
| 1 | P1 | Output at basic prices |
| 2 | P7 | Imports |
| 3 | P33 | Direct purchases abroad by residents |
| 4 | TSBP | Total supply at basic prices |
| 5 | WMV | Trade margin wholesale and retail mv - economy |
| 6 | WST | Trade margin wholesale trade, except mv - economy |
| 7 | RTT | Trade margin retail trade, except mv - economy |
| 8 | LAND | Transport margin land - economy |
| 9 | WATER | Transport margin water - economy |
| 10 | AIR | Transport margin air - economy |
| 11 | D21 | Tax on products - economy |
| 12 | D31 | Subsidies on products - economy |
| 13 | DUTY | Duty and tax on imports |
| 14 | TSPP | Total supply at purchasers' prices |

# Global MRIOs as Data Sources

Since the 2010's, different initiatives were conducted to estimate world MRIOs, and as highlighted in the introduction, these include the OECD-ICIO, WIOD, IDE-JETRO, EORA, GLORIA, FIGARO, EXIOBASE, GTAP-MRIO, ADB-MRIO, ECLAC-MRIO, and EMERGING. Some of these MRIO databases use information from previous databases in their estimation, like ADB-MRIO uses information from WIOD, GLORIA uses information from EORA and OECD-ICIO, FIGARO uses information from OECD-ICIO, the OECD-ICIO uses information from ADB-MRIO, ECLAC-MRIO uses information from ADB-MRIO and OECD-ICIO, EMERGING uses information from ADB-MRIO and OECD-ICIO, and so on. In this way, different databases are sharing data in a way to improve estimation and to decrease estimation costs and time; this process may also lead to a better convergence of results from these different databases in the future.

Following this trend in the estimation of MRIOs, the quality of the data, the publicly available information, the goals of MARIO, including to optimize the use of time and resources, the estimation of MARIO will draw on information from selected MRIOs. As detailed in Table 4, the databases selected are FIGARO, ICIO, GLORIA, EXIOBASE, ADB-MRIO, and ECLAC-MRIO. Some of these databases show different levels of details according to their version and the years selected, which is the case for EXIOBASE, ADB-MRIO, and ECLAC-MRIO.

These databases will be used as inputs into the different blocks defined above; this will be done by splitting these MRIOs in parts to make an initial database which in the future could be updated as new or better information is made available. The idea is to build a system which can be constantly updated as new data and revisions are available, as well as used to nowcast and forecast the MARIO.

The databases estimated by international organization – FIGARO, ICIO, ADB-MRIO, ECLAC-MRIO – will also play a special role in the final balancing of MARIO. In such a way, MARIO estimation will respect FIGARO information for European Union (EU) countries, which will be used as constraints in MARIO's estimation; the same will be true for the non-EU OECD countries shown in the OECD-ICIO, for the Asian non-OECD countries shown in the ADB-MRIO, and for the Latin America non-OECD countries shown in the ECLAC-MRIO.

Table 6. Main Global MRIO Databases, publicly available data

| Database | Release | Years | Economies | SUT | I-O | Products | Industries |
|---|---|---|---|---|---|---|---|
| FIGARO | 2022 | 2010 to 2020 | 46 | X | X | 64 | 64 |
| ICIO | 2021 | 1995 to 2018 | 67 | | X | | 45 |
| GLORIA | 2023 | 1990 to 2027 | 164 | X | X | 120 | 120 |
| EXIOBASE 3.8.2 | 2021 | 1995 to 2022 | 49 | X | X | 200 | 163 |
| EXIOBASE 3rx | 2019 | 1995 to 2015 | 214 | X | X | 200 | 163 |
| ADB-MRIO-1 | 2022 | 2000, 2007-2021 | 63 | | X | | 35 |
| ADB-MRIO-2 | 2022 | 2017-2021 | 73 | | X | | 35 |
| ECLAC-ADB-1 | 2020 | 2007, 2011, 2017 | 73 | | X | | 20 |
| ECLAC-ADB-2 | 2020 | 2011 | 73 | | X | | 38 |
| ECLAC-ADB-3 | 2020 | 2011 | 79 | | X | | 25 |
| ECLAC-ADB-4 | 2020 | 2011 | 79 | | X | | 18 |
| ECLAC-LAC | 2020 | 2014 | 55 | | X | | 40 |

Sources: Eurostat (2022), OECD (2021), Industrial Ecology Virtual Laboratory (2023), EXIOBASE (2021), Asian Development Bank (2022), ECLAC (2020).

# Way Forward

The proposed framework for MARIO's estimation is expected to be flexible enough to make it possible to: a) replace the initial databases used in the estimation process by other better databases or source data as they become available; b) add new databases; c) nowcast and forecast the estimation based on IMF macroeconomic projections; and d) obtain yearly and quarterly estimation of this database. Initial results being expected by the second semester of 2024.

MARIO's estimation will also benefit from the recently formed group of International Organizations - OECD, European Commission / Eurostat, IMF, UN-ECLAC, and ADB – whose goal is to reduce the differences found in the results obtained by the different databases. To do so, the group will share data, methodologies, and information to improve the estimations made by each of these institutions.

As such, to meet the needs of IMF work, it is expected that the proposed MARIO design will allow for estimation flexibility, provide sufficient granularity, address the lack of coverage by country, year, industry, and products details from on existing MRIOs while taking advantage of the IMF ability to collect and improve official SUTs. Furthermore, it will be a powerful analytical tool allowing many applications to be conducted for the estimation of harmonized multidimensional indicators. It will be used for analysis and to measure the impacts of public and private policies on the economy, the environment, employment by gender, as well as social distribution effects, considering not only the implications of these policies on national economies, but also on their trading partners by incorporating interdependencies between economies involved in the global supply chain.

# Annex I. Economies

| Number | Economy | Code | IMF |
|--------|---------|------|-----|
| 1 | Afghanistan | AFG | √ |
| 2 | Albania | ALB | √ |
| 3 | Algeria | DZA | √ |
| 4 | Andorra | AND | √ |
| 5 | Angola | AGO | √ |
| 6 | Antigua and Barbuda | ATG | √ |
| 7 | Argentina | ARG | √ |
| 8 | Armenia | ARM | √ |
| 9 | Australia | AUS | √ |
| 10 | Austria | AUT | √ |
| 11 | Azerbaijan | AZE | √ |
| 12 | The Bahamas | BHS | √ |
| 13 | Bahrain | BHR | √ |
| 14 | Bangladesh | BGD | √ |
| 15 | Barbados | BRB | √ |
| 16 | Belarus | BLR | √ |
| 17 | Belgium | BEL | √ |
| 18 | Belize | BLZ | √ |
| 19 | Benin | BEN | √ |
| 20 | Bhutan | BTN | √ |
| 21 | Bolivia | BOL | √ |
| 22 | Bosnia and Herzegovina | BIH | √ |
| 23 | Botswana | BWA | √ |
| 24 | Brazil | BRA | √ |
| 25 | Brunei Darussalam | BRN | √ |
| 26 | Bulgaria | BGR | √ |
| 27 | Burkina Faso | BFA | √ |
| 28 | Burundi | BDI | √ |
| 29 | Cabo Verde | CPV | √ |
| 30 | Cambodia | KHM | √ |
| 31 | Cameroon | CMR | √ |
| 32 | Canada | CAN | √ |
| 33 | Central African Republic | CAF | √ |
| 34 | Chad | TCD | √ |
| 35 | Chile | CHL | √ |
| 36 | China | CHN | √ |
| 37 | Colombia | COL | √ |
| 38 | Comoros | COM | √ |
| 39 | Democratic Republic of the Congo | COD | √ |
| 40 | Republic of Congo | COG | √ |
| 41 | Costa Rica | CRI | √ |
| 42 | Côte d'Ivoire | CIV | √ |
| 43 | Croatia | HRV | √ |
| 44 | Cyprus | CYP | √ |
| 45 | Czech Republic | CZE | √ |
| 46 | Denmark | DNK | √ |
| 47 | Djibouti | DJI | √ |
| 48 | Dominica | DMA | √ |
| 49 | Dominican Republic | DOM | √ |
| 50 | Ecuador | ECU | √ |
| 51 | Egypt | EGY | √ |
| 52 | El Salvador | SLV | √ |
| 53 | Equatorial Guinea | GNQ | √ |
| 54 | Eritrea | ERI | √ |

Annex I continued

| Number | Economy | Code | IMF |
|--------|---------|------|-----|
| 55 | Estonia | EST | √ |
| 56 | Eswatini | SWZ | √ |
| 57 | Ethiopia | ETH | √ |
| 58 | Fiji | FJI | √ |
| 59 | Finland | FIN | √ |
| 60 | France | FRA | √ |
| 61 | Gabon | GAB | √ |
| 62 | The Gambia | GMB | √ |
| 63 | Georgia | GEO | √ |
| 64 | Germany | DEU | √ |
| 65 | Ghana | GHA | √ |
| 66 | Greece | GRC | √ |
| 67 | Grenada | GRD | √ |
| 68 | Guatemala | GTM | √ |
| 69 | Guinea | GIN | √ |
| 70 | Guinea-Bissau | GNB | √ |
| 71 | Guyana | GUY | √ |
| 72 | Haiti | HTI | √ |
| 73 | Honduras | HND | √ |
| 74 | Hungary | HUN | √ |
| 75 | Iceland | ISL | √ |
| 76 | India | IND | √ |
| 77 | Indonesia | IDN | √ |
| 78 | Iran | IRN | √ |
| 79 | Iraq | IRQ | √ |
| 80 | Ireland | IRL | √ |
| 81 | Israel | ISR | √ |
| 82 | Italy | ITA | √ |
| 83 | Jamaica | JAM | √ |
| 84 | Japan | JPN | √ |
| 85 | Jordan | JOR | √ |
| 86 | Kazakhstan | KAZ | √ |
| 87 | Kenya | KEN | √ |
| 88 | Kiribati | KIR | √ |
| 89 | Korea | KOR | √ |
| 90 | Kosovo | KOS | √ |
| 91 | Kuwait | KWT | √ |
| 92 | Kyrgyz Republic | KGZ | √ |
| 93 | Lao P.D.R. | LAO | √ |
| 94 | Latvia | LVA | √ |
| 95 | Lebanon | LBN | √ |
| 96 | Lesotho | LSO | √ |
| 97 | Liberia | LBR | √ |
| 98 | Libya | LBY | √ |
| 99 | Lithuania | LTU | √ |
| 100 | Luxembourg | LUX | √ |
| 101 | Madagascar | MDG | √ |
| 102 | Malawi | MWI | √ |
| 103 | Malaysia | MYS | √ |
| 104 | Maldives | MDV | √ |
| 105 | Mali | MLI | √ |
| 106 | Malta | MLT | √ |
| 107 | Marshall Islands | MHL | √ |
| 108 | Mauritania | MRT | √ |
| 109 | Mauritius | MUS | √ |
| 110 | Mexico | MEX | √ |

Annex I continued

| Number | Economy | Code | IMF |
|---|---|---|---|
| 111 | Micronesia | FSM | √ |
| 112 | Moldova | MDA | √ |
| 113 | Mongolia | MNG | √ |
| 114 | Montenegro | MNE | √ |
| 115 | Morocco | MAR | √ |
| 116 | Mozambique | MOZ | √ |
| 117 | Myanmar | MMR | √ |
| 118 | Namibia | NAM | √ |
| 119 | Nauru | NRU | √ |
| 120 | Nepal | NPL | √ |
| 121 | The Netherlands | NLD | √ |
| 122 | New Zealand | NZL | √ |
| 123 | Nicaragua | NIC | √ |
| 124 | Niger | NER | √ |
| 125 | Nigeria | NGA | √ |
| 126 | North Macedonia | MKD | √ |
| 127 | Norway | NOR | √ |
| 128 | Oman | OMN | √ |
| 129 | Pakistan | PAK | √ |
| 130 | Palau | PLW | √ |
| 131 | Panama | PAN | √ |
| 132 | Papua New Guinea | PNG | √ |
| 133 | Paraguay | PRY | √ |
| 134 | Peru | PER | √ |
| 135 | Philippines | PHL | √ |
| 136 | Poland | POL | √ |
| 137 | Portugal | PRT | √ |
| 138 | Qatar | QAT | √ |
| 139 | Romania | ROU | √ |
| 140 | Russian Federation | RUS | √ |
| 141 | Rwanda | RWA | √ |
| 142 | Samoa | WSM | √ |
| 143 | San Marino | SMR | √ |
| 144 | São Tomé and Príncipe | STP | √ |
| 145 | Saudi Arabia | SAU | √ |
| 146 | Senegal | SEN | √ |
| 147 | Serbia | SRB | √ |
| 148 | Seychelles | SYC | √ |
| 149 | Sierra Leone | SLE | √ |
| 150 | Singapore | SGP | √ |
| 151 | Slovak Republic | SVK | √ |
| 152 | Slovenia | SVN | √ |
| 153 | Solomon Islands | SLB | √ |
| 154 | Somalia | SOM | √ |
| 155 | South Africa | ZAF | √ |
| 156 | South Sudan | SSD | √ |
| 157 | Spain | ESP | √ |
| 158 | Sri Lanka | LKA | √ |
| 159 | St. Kitts and Nevis | KNA | √ |
| 160 | St. Lucia | LCA | √ |
| 161 | St. Vincent and the Grenadines | VCT | √ |
| 162 | Sudan | SDN | √ |
| 163 | Suriname | SUR | √ |
| 164 | Sweden | SWE | √ |
| 165 | Switzerland | CHE | √ |

Annex I continued

| Number | Economy | Code | IMF |
|---|---|---|---|
| 166 | Syria | SYR | √ |
| 167 | Tajikistan | TJK | √ |
| 168 | Tanzania | TZA | √ |
| 169 | Thailand | THA | √ |
| 170 | Timor-Leste | TLS | √ |
| 171 | Togo | TGO | √ |
| 172 | Tonga | TON | √ |
| 173 | Trinidad and Tobago | TTO | √ |
| 174 | Tunisia | TUN | √ |
| 175 | Türkiye | TUR | √ |
| 176 | Turkmenistan | TKM | √ |
| 177 | Tuvalu | TUV | √ |
| 178 | Uganda | UGA | √ |
| 179 | Ukraine | UKR | √ |
| 180 | United Arab Emirates | ARE | √ |
| 181 | United Kingdom | GBR | √ |
| 182 | United States | USA | √ |
| 183 | Uruguay | URY | √ |
| 184 | Uzbekistan | UZB | √ |
| 185 | Vanuatu | VUT | √ |
| 186 | Venezuela | VEN | √ |
| 187 | Vietnam | VNM | √ |
| 188 | Yemen | YEM | √ |
| 189 | Zambia | ZMB | √ |
| 190 | Zimbabwe | ZWE | √ |
| 191 | Hong Kong SAR | HKG | § |
| 192 | Macao SAR | MAC | § |
| 193 | French Polynesia | PYF | § |
| 194 | New Caledonia | NCL | § |
| 195 | Aruba | ABW | § |
| 196 | Curaçao | CUW | § |
| 197 | Sint Maarten | SXM | § |
| 198 | Anguilla | AIA | § |
| 199 | Bermuda | BMU | § |
| 200 | Cayman Islands | CYM | § |
| 201 | Montserrat | MSR | § |
| 202 | Turks and Caicos Islands | TCA | § |
| 203 | Puerto Rico | PRI | § |
| 204 | Cuba | CUB | ‡ |
| 205 | Liechtenstein | LIE | ‡ |
| 206 | Democratic People's Republic of Korea | PRK | ‡ |
| 207 | Taiwan Province of China | TWN | ‡ |
| 208 | West Bank and Gaza | WBG | ‡ |
| 209 | Rest of the World | ROW | & |

| Note: | |
|---|---|
| √ | IMF member country |
| § | IMF member country territory |
| ‡ | Non-IMF member country |
| & | Rest of the World |

# Annex II. Industries

| No. | Code | Industry | ISIC 4 | Name |
|---|---|---|---|---|
| 1 | I01.a | Paddy rice production | A | Agriculture, forestry and fishing |
| 2 | I01.b | Oil seeds production | | |
| 3 | I01.c | Sugar cane and sugar beet production | | |
| 4 | I01.d | Other crops production | | |
| 5 | I01.e | Cattle and sheep production | | |
| 6 | I01.f | Others animal production and hunting | | |
| 7 | I02.a | Silviculture | | |
| 8 | I02.b | Extraction and gathering of forest products | | |
| 9 | I03 | Fishing and aquaculture | | |
| 10 | I05 | Mining of coal and lignite | B | Mining and quarrying |
| 11 | I06.a | Extraction of crude petroleum | | |
| 12 | I06.b | Extraction of natural gas | | |
| 13 | I07.a | Mining of uranium and thorium ores | | |
| 14 | I07.b | Mining of iron ores | | |
| 15 | I07.c | Mining of copper ores and concentrates | | |
| 16 | I07.d | Mining of nickel ores and concentrates | | |
| 17 | I07.e | Mining of aluminium ores and concentrates | | |
| 18 | I07.f | Mining of precious metal ores and concentrates | | |
| 19 | I07.g | Mining of lead, zinc and tin ores and concentrates | | |
| 20 | I07.h | Mining of Lithium ores and concentrates | | |
| 21 | I07.i | Mining of Cobalt ores and concentrates | | |
| 22 | I07.j | Mining of Manganese ores and concentrates | | |
| 23 | I07.k | Mining of Graphite ores and concentrates | | |
| 24 | I07.l | Mining of Rare earth ores and concentrates | | |
| 25 | I07.m | Mining of other non-ferrous metal ores and concentrates | | |
| 26 | I08.a | Quarrying of stone, sand and clay | | |
| 27 | I08.b | Mining of chemical and fertilizer minerals, production of salt, other mining and quarrying n.e.c. | | |
| 28 | I09 | Mining support service activities | | |
| 29 | I10.a | Manufacture of vegetable oils and fats | C | Manufacturing |
| 30 | I10.b | Manufacture of food products n.e.c. | | |
| 31 | I11 | Manufacture of beverages | | |
| 32 | I12 | Manufacture of tobacco products | | |
| 33 | I13 | Manufacture of textiles | | |
| 34 | I14 | Manufacture of wearing apparel | | |
| 35 | I15 | Manufacture of leather and related products | | |
| 36 | I16 | Manufacture of wood and of products of wood and cork, etc. | | |
| 37 | I17 | Manufacture of paper and paper products | | |
| 38 | I18 | Printing and reproduction of recorded media | | |
| 39 | I19.a | Manufacture of coke oven products | | |
| 40 | I19.b | Manufacture of refined petroleum products | | |
| 41 | I20.a | Manufacture of fuel elements for nuclear reactors | | |
| 42 | I20.b | Manufacture of basic plastics | | |
| 43 | I20.c | Manufacture of nitrogenous fertilizers | | |
| 44 | I20.d | Manufacture of non-nitrogenous and mixed fertilizers | | |
| 45 | I20.e | Manufacture of biofuels | | |
| 46 | I20.f | Manufacture of hydrogen, green | | |
| 47 | I20.g | Manufacture of hydrogen, non-green | | |
| 48 | I20.h | Manufacture of other chemical products n.e.c. | | |
| 49 | I21 | Manufacture of basic pharmaceutical products and preparations | | |
| 50 | I22 | Manufacture of rubber and plastics products | | |

Annex II continued

| No. | Code | Industry | ISIC 4 | Name |
|-----|------|----------|--------|------|
| 51 | I23.a | Manufacture of glass and glass products | C | Manufacturing |
| 52 | I23.b | Manufacture of clay building materials | | |
| 53 | I23.c | Manufacture of cement, lime and plaster | | |
| 54 | I23.d | Manufacture of other non-metallic mineral products | | |
| 55 | I24.a | Manufacture of iron and steel - Electric Arc Furnace (EAF) | | |
| 56 | I24.b | Manufacture of iron and steel - Basic Oxygen Furnace (BOF) | | |
| 57 | I24.c | Manufacture of copper | | |
| 58 | I24.d | Manufacture of nickel | | |
| 59 | I24.e | Manufacture of aluminium | | |
| 60 | I24.f | Manufacture of precious metal | | |
| 61 | I24.g | Manufacture of lead, zinc and tin | | |
| 62 | I24.h | Manufacture of Lithium | | |
| 63 | I24.i | Manufacture of Cobalt | | |
| 64 | I24.j | Manufacture of Manganese | | |
| 65 | I24.k | Manufacture of Graphite | | |
| 66 | I24.l | Manufacture of rare earth metal | | |
| 67 | I24.m | Manufacture of other non-ferrous metal | | |
| 68 | I25 | Manufacture of fabricated metal products, except machinery & equipment | | |
| 69 | I26.a | Manufacture of semiconductors | | |
| 70 | I26.b | Manufacture of computer, electronic and optical products n.e.c. | | |
| 71 | I27.a | Manufacture of batteries and accumulators | | |
| 72 | I27.b | Manufacture of solar panels | | |
| 73 | I27.c | Manufacture of electrical equipment n.e.c. | | |
| 74 | I28.a | Manufacture of wind turbines | | |
| 75 | I28.b | Manufacture of machinery and equipment n.e.c. | | |
| 76 | I29.a | Manufacture of electric vehicles | | |
| 77 | I29.b | Manufacture of hybrid electric vehicles | | |
| 78 | I29.c | Manufacture of internal combustion engine vehicles | | |
| 79 | I30 | Manufacture of other transport equipment | | |
| 80 | I31T32 | Manufacture of furniture, other manufacturing | | |
| 81 | I33 | Repair and installation of machinery and equipment | | |
| 82 | I35.a | Production of electricity by coal | D | Electricity, gas, steam and air conditioning supply |
| 83 | I35.b | Production of electricity by gas | | |
| 84 | I35.c | Production of electricity by nuclear | | |
| 85 | I35.d | Production of electricity by hydro | | |
| 86 | I35.e | Production of electricity by wind | | |
| 87 | I35.f | Production of electricity by petroleum and other oil derivatives | | |
| 88 | I35.g | Production of electricity by biomass and waste | | |
| 89 | I35.h | Production of electricity by solar photovoltaic | | |
| 90 | I35.i | Production of electricity by solar thermal | | |
| 91 | I35.j | Production of electricity by tide, wave, ocean | | |
| 92 | I35.k | Production of electricity by Geothermal | | |
| 93 | I35.l | Production of electricity nec | | |
| 94 | I35.m | Transmission and distribution of electricity | | |
| 95 | I35.n | Manufacture of gas; distribution of gaseous fuels through mains | | |
| 96 | I35.o | Steam and air conditioning supply | | |
| 97 | I36 | Water collection, treatment and supply | E | Water supply, sewerage, waste management and remediation activities |
| 98 | I37 | Sewerage | | |
| 99 | I38.a | Recycling of waste | | |
| 100 | I38.b | Incineration of waste | | |
| 101 | I38.c | Treatment and disposal of waste nec | | |
| 102 | I39 | Remediation activities and other waste management services | | |

Annex II continued

| No. | Code | Industry | ISIC 4 | Name |
|---|---|---|---|---|
| 103 | I41T43 | Construction | F | Construction |
| 104 | I45 | Wholesale and retail trade and repair of motor vehicles and motorcycles | G | Wholesale and retail trade, repair of motor vehicles and motorcycles |
| 105 | I46 | Wholesale trade, except of motor vehicles and motorcycles | | |
| 106 | I47 | Retail trade, except of motor vehicles and motorcycles | | |
| 107 | I49.a | Land transport, passengers | H | Transportation and storage |
| 108 | I49.b | Land and pipelines transport, freight | | |
| 109 | I50.a | Water transport, passengers | | |
| 110 | I50.b | Water transport, freight | | |
| 111 | I51.a | Air transport, passengers | | |
| 112 | I51.b | Air transport, freight | | |
| 113 | I52 | Warehousing and support activities for transportation | | |
| 114 | I53 | Postal and courier activities | | |
| 115 | I55 | Accommodation | I | Accommodation and food service activities |
| 116 | I56 | Food and beverage service activities | | |
| 117 | I58 | Publishing activities | J | Information and communication |
| 118 | I59T60 | Audiovisual and broadcasting activities | | |
| 119 | I61 | Telecommunications | | |
| 120 | I62T63 | IT and other information services | | |
| 121 | I64 | Financial service activities, except insurance and pension funding | K | Financial and insurance activities |
| 122 | I65 | Insurance, reinsurance and pension funding, except compulsory S.S. | | |
| 123 | I66 | Activities auxiliary to financial service and insurance activities | | |
| 124 | I68.a | Imputed rents of owner-occupied dwellings | L | Real estate activities |
| 125 | I68.b | Real estate activities excluding imputed rents | | |
| 126 | I69T70 | Legal, accounting, head offices, management consultancy activities | M | Professional, scientific and technical activities |
| 127 | I71 | Architectural and engineering activities, technical testing & analysis | | |
| 128 | I72 | Scientific research and development | | |
| 129 | I73 | Advertising and market research | | |
| 130 | I74T75 | Other professional, scientific and tech. activities, veterinary activ. | | |
| 131 | I77 | Rental and leasing activities | N | Administrative and support service activities |
| 132 | I78 | Employment activities | | |
| 133 | I79 | Travel agency, tour operator, reservation service & related activities | | |
| 134 | I80T82 | Security, services to buildings and other business support activities | | |
| 135 | I84 | Public administration and defense, compulsory social security | O | Public administration and defense, compulsory social security |
| 136 | I85 | Education | P | Education |
| 137 | I86 | Human health activities | Q | Human health and social work activities |
| 138 | I87T88 | Residential care and social work activities | | |
| 139 | I90T92 | Arts, cultural activities, gambling and betting activities | R | Arts, entertainment and recreation |
| 140 | I93 | Sports activities and amusement and recreation activities | | |
| 141 | I94 | Activities of membership organizations | S | Other service activities |
| 142 | I95 | Repair of computers and personal and household goods | | |
| 143 | I96 | Other personal service activities | | |
| 144 | I97T98 | Act. of HH as employers, undif. G&S-prod. activities of HH for own use | T | Act. of HH as employers, undif. G&S-prod. activities of HH for own use |

# Annex III. Products

| No | Code | Product | ISIC 4 | Name |
|---|---|---|---|---|
| 1 | P01.a | Paddy rice | A | Agriculture, forestry, and fishing |
| 2 | P01.b | Oil seeds | | |
| 3 | P01.c | Sugar cane and sugar beet | | |
| 4 | P01.d | Other crops | | |
| 5 | P01.e | Cattle and sheep | | |
| 6 | P01.f | Others animal production and hunting | | |
| 7 | P02.a | Silviculture products | | |
| 8 | P02.b | Extraction and gathering of forest products | | |
| 9 | P03 | Fishing products and aquaculture | | |
| 10 | P05.a | Anthracite | B | Mining and quarrying |
| 11 | P05.b | Coking coal | | |
| 12 | P05.c | Other bituminous coal | | |
| 13 | P05.d | Sub-bituminous coal | | |
| 14 | P05.e | Lignite | | |
| 15 | P05.f | Peat | | |
| 16 | P05.g | Other coal products nec | | |
| 17 | P06.a | Crude petroleum | | |
| 18 | P06.b | Natural gas | | |
| 19 | P07.a | Uranium and thorium ores | | |
| 20 | P07.b | Iron ores | | |
| 21 | P07.c | Copper ores and concentrates | | |
| 22 | P07.d | Nickel ores and concentrates | | |
| 23 | P07.e | Aluminium ores and concentrates | | |
| 24 | P07.f | Precious metal ores and concentrates | | |
| 25 | P07.g | Lead, zinc and tin ores and concentrates | | |
| 26 | P07.h | Lithium ores and concentrates | | |
| 27 | P07.i | Cobalt ores and concentrates | | |
| 28 | P07.j | Manganese ores and concentrates | | |
| 29 | P07.k | Graphite ores and concentrates | | |
| 30 | P07.l | Rare earth ores and concentrates | | |
| 31 | P07.m | Other non-ferrous metal ores and concentrates | | |
| 32 | P08.a | Stone, sand and clay | | |
| 33 | P08.b | Chemical and fertilizer minerals, production of salt, other mining and quarrying n.e.c. | | |
| 34 | P09 | Mining support services | | |
| 35 | P10.a | Vegetable oils and fats products | C | Manufacturing |
| 36 | P10.b | Food products n.e.c. | | |
| 37 | P11 | Beverages | | |
| 38 | P12 | Tobacco products | | |
| 39 | P13 | Textiles | | |
| 40 | P14 | Wearing apparel | | |
| 41 | P15 | Leather and related products | | |
| 42 | P16 | Wood & prod. of wood & cork, exc. furniture, of straw & plaiting mat. | | |
| 43 | P17 | Paper and paper products | | |
| 44 | P18 | Printing and recording services | | |
| 45 | P19.a.1 | Coke Oven Coke | | |
| 46 | P19.a.2 | Gas Coke | | |
| 47 | P19.a.3 | Coal Tar | | |
| 48 | P19.b.1 | Motor Gasoline | | |
| 49 | P19.b.2 | Aviation Gasoline | | |
| 50 | P19.b.3 | Gasoline Type Jet Fuel | | |

Annex III continued

| No | Code | Product | ISIC 4 | Name |
|----|------|---------|--------|------|
| 51 | P19.b.4 | Kerosene Type Jet Fuel | | |
| 52 | P19.b.5 | Kerosene | | |
| 53 | P19.b.6 | Gas/Diesel Oil | | |
| 54 | P19.b.7 | Heavy Fuel Oil | | |
| 55 | P19.b.8 | Refinery Gas | | |
| 56 | P19.b.9 | Liquefied Petroleum Gases (LPG) | | |
| 57 | P19.b.10 | Refinery Feedstocks | | |
| 58 | P19.b.11 | Ethane | | |
| 59 | P19.b.12 | Naphtha | | |
| 60 | P19.b.13 | White Spirit & SBP | | |
| 61 | P19.b.14 | Lubricants | | |
| 62 | P19.b.15 | Bitumen | | |
| 63 | P19.b.16 | Paraffin Waxes | | |
| 64 | P19.b.17 | Petroleum Coke | | |
| 65 | P19.b.18 | Non-specified Petroleum Products | | |
| 66 | P20.a | Nuclear fuel | | |
| 67 | P20.b | Plastics, basic | | |
| 68 | P20.c | Nitrogenous fertilizers | | |
| 69 | P20.d | Non-nitrogenous and mixed fertilizers | | |
| 70 | P20.e.1 | Charcoal | | |
| 71 | P20.e.2 | Additives/Blending Components | | |
| 72 | P20.e.3 | Biogasoline | | |
| 73 | P20.e.4 | Biodiesels | | |
| 74 | P20.e.5 | Other Liquid Biofuels | | |
| 75 | P20.f | Hydrogen, green | C | Manufacturing |
| 76 | P20.g | Hydrogen, non-green | | |
| 77 | P20.h | Other chemical products nec | | |
| 78 | P21 | Basic pharmaceutical products and pharmaceutical preparations | | |
| 79 | P22 | Rubber and plastics products | | |
| 80 | P23.a | Glass and glass products | | |
| 81 | P23.b | Clay building materials | | |
| 82 | P23.c | Cement, lime and plaster | | |
| 83 | P23.d | Other non-metallic mineral products | | |
| 84 | P24.a | Iron and steel - Electric Arc Furnace (EAF) | | |
| 85 | P24.b | Iron and steel - Basic Oxygen Furnace (BOF) | | |
| 86 | P24.c | Copper | | |
| 87 | P24.d | Nickel | | |
| 88 | P24.e | Aluminium | | |
| 89 | P24.f | Precious metal | | |
| 90 | P24.g | Lead, zinc and tin | | |
| 91 | P24.h | Lithium | | |
| 92 | P24.i | Cobalt | | |
| 93 | P24.j | Manganese | | |
| 94 | P24.k | Graphite | | |
| 95 | P24.l | Rare earth metal | | |
| 96 | P24.m | Other non-ferrous metal | | |
| 97 | P25 | Fabricated metal products, except machinery and equipment | | |
| 98 | P26.a | Semiconductors | | |
| 99 | P26.b | Computer, electronic and optical products n.e.c. | | |
| 100 | P27.a | Batteries and accumulators | | |

Annex III continued

| No | Code | Product | ISIC 4 | Name |
|---|---|---|---|---|
| 101 | P27.b | Solar panels | C | Manufacturing |
| 102 | P27.c | Electrical equipment n.e.c. | | |
| 103 | P28.a | Wind turbines | | |
| 104 | P28.b | Machinery and equipment n.e.c. | | |
| 105 | P29.a | Electric vehicles | | |
| 106 | P29.b | Hybrid electric vehicles | | |
| 107 | P29.c | Internal combustion engine vehicles | | |
| 108 | P30 | Other transport equipment | | |
| 109 | P31T32 | Furniture and other manufacturing | | |
| 110 | P33 | Repair and installation of machinery and equipment | | |
| 111 | P35.a | Electricity by coal | D | Electricity, gas, steam and air conditioning supply |
| 112 | P35.b | Electricity by gas | | |
| 113 | P35.c | Electricity by nuclear | | |
| 114 | P35.d | Electricity by hydro | | |
| 115 | P35.e | Electricity by wind | | |
| 116 | P35.f | Electricity by petroleum and other oil derivatives | | |
| 117 | P35.g | Electricity by biomass and waste | | |
| 118 | P35.h | Electricity by solar photovoltaic | | |
| 119 | P35.i | Electricity by solar thermal | | |
| 120 | P35.j | Electricity by tide, wave, ocean | | |
| 121 | P35.k | Electricity by Geothermal | | |
| 122 | P35.l | Electricity nec | | |
| 123 | P35.m | Transmission and distribution services of electricity | | |
| 124 | P35.n.1 | Coke oven gas | | |
| 125 | P35.n.2 | Blast Furnace Gas | | |
| 126 | P35.n.3 | Oxygen Steel Furnace Gas | | |
| 127 | P35.n.4 | Gas Works Gas | | |
| 128 | P35.n.5 | Biogas | | |
| 129 | P35.n.6 | Distribution services of gaseous fuels through mains | | |
| 130 | P35.o | Steam and air conditioning supply | | |
| 131 | P36 | Natural water, water treatment and supply services | E | Water supply, sewerage, waste management and remediation activities |
| 132 | P37 | Sewerage | | |
| 133 | P38.a | Recycling of waste | | |
| 134 | P38.b | Incineration of waste | | |
| 135 | P38.c | Treatment and disposal of waste nec | | |
| 136 | P39 | Remediation activities and other waste management services | | |
| 137 | P41T43 | Constructions and construction works | F | Construction |
| 138 | P45 | Wholesale and retail trade and repair serv. of motor vehicles & cycles | G | Wholesale and retail trade, repair of motor vehicles and motorcycles |
| 139 | P46 | Wholesale trade services, except of motor vehicles and motorcycles | | |
| 140 | P47 | Retail trade services, except of motor vehicles and motorcycles | | |
| 141 | P49.a | Land transport services, passengers | H | Transportation and storage |
| 142 | P49.b | Land and pipelines transport services, freight | | |
| 143 | P50.a | Water transport services, passengers | | |
| 144 | P50.b | Water transport services, freight | | |
| 145 | P51.a | Air transport services, passengers | | |
| 146 | P51.b | Air transport services, freight | | |
| 147 | P52 | Warehousing and support services for transportation | | |
| 148 | P53 | Postal and courier services | | |
| 149 | P55 | Accommodation services | I | Accommodation and food service activities |
| 150 | P56 | Food and beverage serving services | | |

Annex III continued

| No | Code | Product | ISIC 4 | Name |
|----|------|---------|--------|------|
| 151 | P58 | Publishing services | J | Information and communication |
| 152 | P59T60 | Audiovisual and broadcasting services | | |
| 153 | P61 | Telecommunications services | | |
| 154 | P62T63 | Computer programming, consultancy and related serv., Information serv. | | |
| 155 | P64 | Financial services, except insurance and pension funding | K | Financial and insurance activities |
| 156 | P65 | Insurance, reinsurance & pension funding services, exc. compulsory S.S. | | |
| 157 | P66 | Services auxiliary to financial services and insurance services | | |
| 158 | P68.a | Imputed rents of owner-occupied dwellings | L | Real estate activities |
| 159 | P68.b | Real estate activities excluding imputed rents | | |
| 160 | P69T70 | Legal, accounting, head offices services, management consultancy serv. | M | Professional, scientific and technical activities |
| 161 | P71 | Architectural, engineering, tech. testing and analysis services | | |
| 162 | P72 | Scientific research and development services | | |
| 163 | P73 | Advertising and market research services | | |
| 164 | P74T75 | Other professional, scientific, technical and veterinary services | | |
| 165 | P77 | Rental and leasing services | N | Administrative and support service activities |
| 166 | P78 | Employment services | | |
| 167 | P79 | Travel agency, tour operator & other reservation services & related | | |
| 168 | P80T82 | Security & investigation serv., serv. to buildings & other bus. Support | | |
| 169 | P84 | Public administration and defense services, compulsory S.S. services | O | Public administration and defense, compulsory social security |
| 170 | P85 | Education services | P | Education |
| 171 | P86 | Human health services | Q | Human health and social work activities |
| 172 | P87T88 | Residential care services, social work services without accommodation | | |
| 173 | P90T92 | Creative, arts, entmnt, library, museum, other cult. serv., gambling | R | Arts, entertainment and recreation |
| 174 | P93 | Sporting services and amusement and recreation services | | |
| 175 | P94 | Services furnished by membership organisations | S | Other service activities |
| 176 | P95 | Repair services of computers and personal and household goods | | |
| 177 | P96 | Other personal services | | |
| 178 | P97T98 | Services of HH as employers, undif. G&S prod. by HH for own use | T | Act. of HH as employers, undif. G&S-prod. activities of HH for own use |

# References

Asian Development Bank (2022). *Economic Insights from Input–Output Tables for Asia and the Pacific.* DOI: http://dx.doi.org/10.22617/TCS220300-2.

Bjelle, E.L., K. Stadler, and R. (2019). *EXIOBASE 3rx (1.0) [Data set]*. Zenodo. https://doi.org/10.5281/zenodo.2654460.

Carrico, C., E. Corong, and D. van der Mensbrugghe (2020). "The GTAP version 10A Multi-Region Input Output (MRIO) Data Base". *GTAP Memorandum 34*. Center for Global Trade Analysis, Purdue University.

ECLAC (2020). *Economic Insights from Input–Output Tables for Asia and The Pacific.* https://www.cepal.org/en/events/global-input-output-tables-tools-analysis-integration-latin-america-world.

Eurostat (2008) *Eurostat Manual of Supply, Use and Input-Output Tables*. KS-RA-07-013-EN-N. https://ec.europa.eu/eurostat/documents/3859598/5902113/KS-RA-07-013-EN.PDF/b0b3d71e-3930-4442-94be-70b36cea9b39.

Eurostat (2021). *FIGARO Methodology*. https://ec.europa.eu/eurostat/documents/51957/12767369/Figaro-methodology.pdf/487255c9-903a-0cb7-f5e2-73f37e35f196?t=1620750704022.

Eurostat (2022). *Eurostat FIGARO*. https://ec.europa.eu/eurostat/web/esa-supply-use-input-tables/figaro.

EXIOBASE (2021). *EXIOBASE Database*. https://www.exiobase.eu/index.php.

Huo, J., P. Chen, K. Hubacek, H. Zheng, J. Meng, D. Guan (2022). "Full-scale, near real-time multi-regional input–output table for the global emerging economies (EMERGING)". *Journal of Industrial Ecology* 2022;26:1218–1232, https://doi.org/10.1111/jiec.13264.

Industrial Ecology Virtual Laboratory (2023). *GLORIA Database*. https://ielab.info/resources/gloria/about.

Lenzen, M., A. Geschke, M.D. Abd Rahman, Y. Xiao, J. Fry, R. Reyes, E. Dietzenbacher, S. Inomata, K. Kanemoto, B. Los, D. Moran, H. Schulte in den Bäumen, A. Tukker, T. Walmsley, T. Wiedmann, R. Wood and N. Yamano (2017). "The Global MRIO Lab charting the world economy". *Economic Systems Research* 29, 158-186.

Lenzen, M., A. Geschke, J. West, J. Fry, A. Malik, S. Giljum, L.M.i. Canals, P. Piñero, S. Lutter, T. Wiedmann, M. Li, M. Sevenster, J. Potočnik, I. Teixeira, M.V. Voore, K. Nansai and H. Schandl (2022). "Implementing the Material Footprint to measure progress towards SDGs 8 and 12". *Nature Sustainability*, 5, 157-166, https://doi.org/10.1038/s41893-021-00811-6.

Lenzen, M., K. Kanemoto, D. Moran, and A. Geschke (2012). "Mapping the structure of the world economy". *Environmental Science & Technology* 46(15) pp 8374–8381. DOI: 10.1021/es300171x. Supplementary Information.

Lenzen, M., D. Moran, K. Kanemoto, A. Geschke (2013). "Building EORA: A Global Multi-regional Input-Output Database at High Country and Sector Resolution". *Economic Systems Research*, 25:1, 20-49, DOI:10.1080/09535314.2013.769938

Meng, B., Y. Zhang, and S. Inomata (2013). "Compilation and Applications of IDE-JETRO's International Input–Output Tables", *Economic Systems Research*, 25:1, 122-142, DOI: 10.1080/09535314.2012.761597

Miller, R.E., and P.D. Blair (2022). *Input-output analysis: Foundations and extensions* (3rd ed.). Cambridge University Press.

OECD (2021), *OECD Inter-Country Input-Output Database*, http://oe.cd/icio

Remond-Tiedrez, I., and J. M.Rueda-Cantuche (ed.) (2019). *EU inter-country supply, use and input-output tables: Full international and global accounts for research in input-output analysis (FIGARO).* Eurostat Statistical Working Papers. https://ec.europa.eu/eurostat/web/products-statistical-working-papers/-/ks-tc-19-002.

Stadler, K. et al. (2018) "EXIOBASE 3: Developing a Time Series of Detailed Environmentally Extended Multi-Regional Input-Output Tables". *Journal of Industrial Ecology* 22, 502-515, doi:10.1111/jiec.12715 (2018).

Stadler, K. et al. (2021). *EXIOBASE 3 (3.8.2) [Data set]*. Zenodo. https://doi.org/10.5281/zenodo.5589597.

Timmer, M.P., E. Dietzenbacher, B. Los, R. Stehrer, and G.J. de Vries (2015), "An Illustrated User Guide to the World Input–Output Database: the Case of Global Automotive Production", *Review of International Economics*., 23: 575–605

Timmer, M.P., B. Los, R. Stehrer, and G.J. de Vries, G. J. (2016), "An Anatomy of the Global Trade Slowdown based on the WIOD 2016 Release", *GGDC research memorandum number 162*, University of Groningen