

## ***F Democratic Republic of the Congo***

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### **F.1 Introduction**

This input-output table for the Democratic Republic of Congo was constructed from the supply and use table (SUT) provided by the National Institute of Statistics (INS). The data provided comes from the national accounts of the DRC for the year 2019. The official data from the accounts for the year 2019 have been transformed to meet the requirements of the GTAP database, by disaggregating the 32 sectors of the official SUT into 65 GTAP<sup>22</sup> sectors based on basic data on nearly 600 products. The resulting SUT of 65 sectors was then transformed to produce the input-output table (IOT) as well as the various other matrices required by GTAP.

This document describes the construction of the DRC input-output table for the GTAP 10 database. The provision of data for the DRC was made possible by the Central Africa Sub-Regional Office (BSR-AC) of the Economic Commission for United Nations for Africa (UNECA), as part of its objective to support the countries of the Economic Community of Central African States (ECCAS) in the implementation of the Continental Free Trade Area (AfCFTA). In this context, the BSR-AC plans to ensure the completeness of the ECCAS countries in the GTAP database. This integration will allow it to be able to carry out a comprehensive analysis of the AfCFTA which takes into account trade and industrial policies, with the implementation of a computable general equilibrium (CGE) model which takes into account international trade links and capacity of production, potential economic impacts of the AfCFTA on all countries in the Central African region.

In accordance with the unified format requirements of the GTAP database, as described in Huff, McDougall and Walmsley (2000), data for the DRC were provided in four matrices:

- UF matrix: The table of supplies and uses of 65 domestic and imported GTAP products excluding product taxes, and three production factors (Land, Labor and Capital);
- UP Matrix: The table of supplies and uses of 65 domestic and imported GTAP products with taxes on products, and three production factors (Land, Labor and Capital);
- MF Vector: The vector of imports of 65 GTAP products;
- OP Vector: The vector of outputs of 65 GTAP products.

We took an incremental approach to arrive at the final GTAP-compliant IOT format starting from the most basic level to reconstruct the detailed SUT of 65 sectors instead of 32 as in official SUT. This exercise made it possible to guarantee the conformity of the disaggregated data with the actual data of the elementary products used to constitute the national accounts.

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<sup>22</sup>GTAP sectors.

Section 1 describes the main data sources used, while section 2 describes the processing of the source data to arrive at a disaggregated supply and use table; Section 3 describes how we converted this detailed SUT into IOT required by GTAP; The last section discusses the adaptation of the SUT to the GTAP model as well as the data consistency tests.

## **F.2 Source data**

The main data sources used to construct the DRC input-output table for GTAP 10 were all provided by the National Institute of Statistics mainly and the Central Bank for certain secondary data, including:

- Tax and statistical declarations for 2019, 2013, 2010, 2006 and 2005 which allow in particular the estimation of labor and capital, and household survey data for the estimation of household consumption and sector production informal;
- Data on international trade in the DRC for the year 2019;
- The table of product resource-use balances for the year 2019;
- The 2019 intermediate production and consumption matrices;
- Detailed price statistics;
- The aggregated table of supplies and uses of 32 Products by 32 Industries for the year 2019;
- Tables of supplies and uses from previous years.

The national accounts from 2005 to 2019 of the DRC are all drawn up in accordance with the National Accounting System 1993 (SNA 1993), the main part of our work was to reconstruct a detailed SUT based on these sources. The format of the official aggregated supply and use table is given in the appendix. The production of industries is first evaluated at the base price, imports are expressed on a CIF basis, intermediate consumption and final demand are evaluated at purchasers' prices. Transport and trade margins, non-deductible VAT, taxes on imports and exports, other taxes and duties on products are provided separately. The production factors Labor and Capital are also provided. All amounts are expressed in millions of Congolese francs.

## **F.3 Processing of source data and construction of the disaggregated SUT**

Since 2005, the National Institute of Statistics has used a VBA Excel tool to prepare national accounts and SUTs. This requires as input, among other things:

- price statistics;

- the vectors of production and demand (Intermediate consumption and final demands) of 5 main modes of production (Formal, Informal, Households, Public administrations, Non-profit institutions serving households);
- Data on imports and exports;
- Data on taxes and duties;
- The intermediate production and consumption matrices of the previous year in order to serve as an estimation basis for the matrices of the current year if these are not yet available.
- The resource-employment balance matrix of the previous year to serve as an estimation basis for that of the current year if it is not yet available.

In order to achieve a SUT that best covers the 65 GTAP sectors, we have an iterative process with 3 major stages which can be schematized as in Figure 1 below.

### **Mapping of sectors**

Firstly, we grouped the elementary products (593) within the GTAP sectors based on:

- The correspondence between the sectoral classification of GTAP 10 and the ISIC, Rev.4 on the one hand and the CPC v.2.1 on the other hand as indicated on the GTAP project website.
- The grouping of 593 elementary products in the 32 aggregated national sectors and in the ISIC, Rev.4 and CPC v.2.1 classifications.

This exercise resulted in the following correspondence between the official SUT sectors and the GTAP sectors. Note the absence of two sectors (wol and gas), which are in fact non-existent in the DRC. This exercise therefore resulted in data from 63 sectors out of the 65 in GTAP.

### **Data aggregation in GTAP sectors**

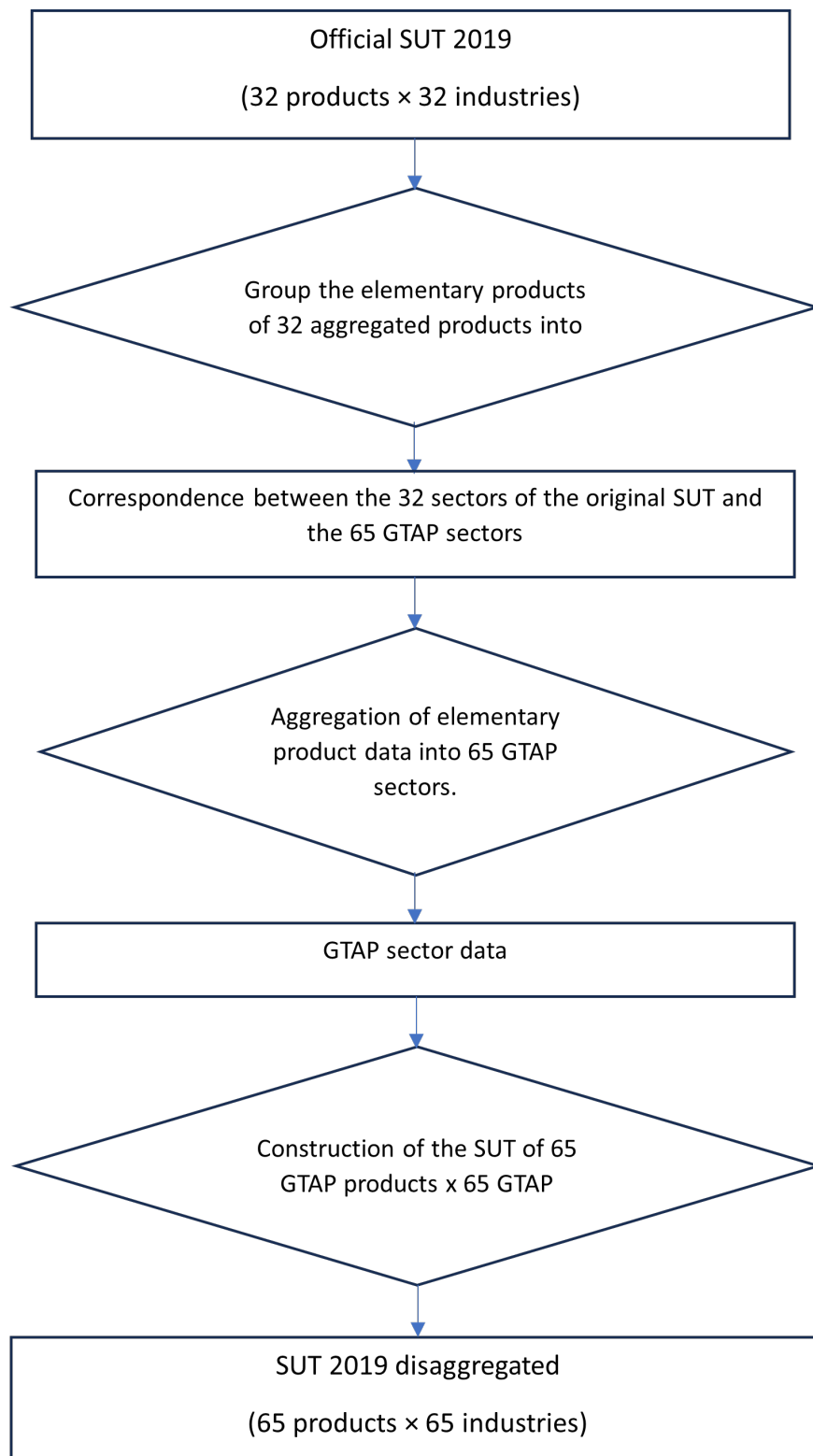
The second step consisted of the aggregation of elementary product data into 63 GTAP sectors. This allowed us to have, among other things, the intermediate consumption matrix detailed by mode of production, the production matrix detailed by mode of production and the matrix of resource-employment balances for 63 sectors.

Table 8.12: Correspondence between the official SUT sectors and GTAP sectors

| N° | Official SUT Sectors (32) |                                                       | GTAP Sectors (65)               |
|----|---------------------------|-------------------------------------------------------|---------------------------------|
| 1  | 10                        | Subsistence farming products                          | pdr wht gro v_f osd ocr         |
| 2  | 20                        | Products of industrial agriculture and export         | v_f osd c_b ocr                 |
| 3  | 30                        | Livestock products, fishing, fish farming             | ctl oap rmk wol fsh             |
| 4  | 40                        | Forest products, logging,...                          | frs                             |
| 5  | 51                        | Hydrocarbons, coal, ..                                | coa oil gas oxt                 |
| 6  | 52                        | Non-metallic minerals                                 | oxt                             |
| 7  | 53                        | Clays, stones. . .                                    | oxt                             |
| 8  | 54                        | Diamonds and precious stones                          | oxt                             |
| 9  | 60                        | Food products, beverages tobacco                      | cmt omt vol mil pcr sgr ofd b.t |
| 10 | 70                        | Textiles and leather                                  | pfb tex wap lea                 |
| 11 | 80                        | Wood and articles of wood                             | lum                             |
| 12 | 90                        | Papers, publishing products, recordings               | ppp                             |
| 13 | 100                       | Pd. Oil. Raf.; cokes; prd. industries Nuclea.         | p_c chm bph                     |
| 14 | 110                       | Rubber or plastic products                            | rpp                             |
| 15 | 120                       | Other non-metallic mineral products                   | nmm                             |
| 16 | 130                       | Machinery, equipment                                  | i.s nfm fmp ele eeq ome omf     |
| 17 | 140                       | transport equipment                                   | mvh otn                         |
| 18 | 150                       | Furniture industries and miscellaneous products       | omf                             |
| 19 | 160                       | Electricity, water, gas, . . .                        | ely gdt wtr                     |
| 20 | 170                       | Construction and public works                         | cns                             |
| 21 | 180                       | Sales                                                 | trd                             |
| 22 | 190                       | Vehicle and motorcycle repair service                 | trd                             |
| 23 | 200                       | Hotel and restaurant services                         | afs                             |
| 24 | 210                       | Transport services and transport auxiliaries          | otp wtp atp whs                 |
| 25 | 220                       | Postal and telecommunication services                 | cmn                             |
| 26 | 230                       | Banking and insurance services                        | ofi ins                         |
| 27 | 240                       | Real estate service, business service                 | cmn rsa obs dwe                 |
| 28 | 250                       | Public administration service                         | osg                             |
| 29 | 260                       | Educational services                                  | edu                             |
| 30 | 270                       | Health and social work services                       | hht                             |
| 31 | 280                       | Other community, social and personal services         | wtr cmn ros                     |
| 32 | 290                       | Financial intermediation services indirectly measured |                                 |

Source: Contributor

Figure 8.1: Detailed SUT development process



Source: Contributor

## Construction of the detailed supplies and uses table

The third stage consisted of the reconstruction of the table of supplies and uses for the 63 sectors, scrupulously following the same procedures used within the National Institute of Statistics, ensuring at each stage, consistency with the official aggregate supply and use table.

Note that of the 63 sectors taken into account in the disaggregated SUT, 8 industries do not produce, the corresponding products being produced secondarily by other industries or imported, these are:

Table 8.13: GTAP sectors with zero production

| Non-producing industries |                                      |                                   |
|--------------------------|--------------------------------------|-----------------------------------|
| GTAP code                | Resources as secondary production of | Part of the resources is imported |
| pfb                      | tex                                  | Yes                               |
| rmk                      | ctl                                  | Yes                               |
| coa                      | oxt                                  | Yes                               |
| pcr                      | ofd                                  | Yes                               |
| i_s                      | nfm                                  | Yes                               |
| eeq                      | ome                                  | Yes                               |
| mvh                      | otn                                  | Yes                               |
| gdt                      | fmp                                  | Yes                               |

Source: Contributor

This detail is important since during the conversion to IOT, the operational constraints of the mathematical process to be used will force us to delete empty rows by merging these sectors with similar sectors, for example coa will be aggregated with oil.

## F.4 Conversion of disaggregated SUT to IOT

The last step to take before moving the data to GTAP format was to convert our detailed 63 sector SUT to IOT, the latter being easily convertible to GTAP format. To do this, we have the guidelines of the Handbook on Supply and Use Tables and Input Output-Tables of the Nations-Unions.

- So firstly, we made sure to value supplies and uses at the appropriate price, i.e. the base price. Secondly, we split the demand into:
- Demand (intermediate and final) for domestic products and
- Demand (intermediate and final) for imported products.

### Valuation at base price

In the detailed SUT of 63 sectors, production is valued at the base price, imports at the CIF price, intermediate consumption and the components of final demand at the acquisition price. However,

IOTs are generally established at the base price and not at the acquisition price, for this we must have: - The table of supplies for domestic products at the base price; - The vector of imports at the CIF price; - The table of uses of domestic supplies at the base price; - The table of uses of supplies imported at the base price. The supplies of our SUT being already at the base price, we were left with the valorization of uses at the base price. The base price was calculated using the formula below: Base price = purchasers' price – (Taxes on products excluding VAT charged + non-deductible VAT or similar tax payable by the purchaser - Subsidies on products + Transport margins + Commercial margins ) Given that for each component of demand, we arrange the elements of the parentheses of this formula for the products of our detailed SUT<sup>23</sup> in the form of vectors in the matrix of use-resource balances, we were able to estimate the use tables at the base price.

To value the final demand at the base price, the operation was simple, it was enough to subtract from the vector of each component, the vectors of the additional costs listed above.

On the other hand, for intermediate consumption the process was a little more laborious. It was first necessary to break down the vectors of additional costs of intermediate consumption by industry in order to obtain matrices which could then be subtracted from the matrix of intermediate consumption to value it at the base price. In the absence of additional information that would allow us to have this breakdown precisely, we had to make an estimate by making a pro rata distribution of the intermediate consumption of products by industries.

So, for example, the share of trade margins  $m_{ij}$  supported by industry j is equal to the trade margins  $m_i$  due to the intermediate consumption of product i, multiplied by the intermediate consumption  $c_{ij}$  of industry j of product i, all divided by the total intermediate demand  $c_i$  in product i.

$$m_{ij} = m_i c_{ij} / c_i$$

## **Table of use of domestic products and table of use of imported products**

We first established the table of use of imports which we then subtracted from the table of uses. Given that we did not have information that could tell us how imports were distributed between the different components of demand, we carried out a pro rata distribution similar to the previous point, this time taking into account the components of the final request.

The following figures borrowed from the United Nations manual<sup>24</sup> illustrate the formats of two use tables required for the transition to IOT at base price.

## **Switching to the inputs - outputs table**

The ideal input – output table for the contribution to GTAP is an IOT product by product at the base price. Given that we already had at this stage various tables necessary for this conversion, we

<sup>23</sup>See the SUT official format.

<sup>24</sup>Handbook on Supply and Use Tables and Input Output-Tables with Extensions and Applications.

Figure 8.2: Structure of the domestic use table

| Products \ Industries                  | Industries                                                     |               |     |          |       | Final uses                                       |                         |         |       | Total use at basic prices |
|----------------------------------------|----------------------------------------------------------------|---------------|-----|----------|-------|--------------------------------------------------|-------------------------|---------|-------|---------------------------|
|                                        | Agriculture                                                    | Manufacturing | ... | Services | Total | Final Consumption                                | Gross capital formation | Exports | Total |                           |
| Agriculture                            | Domestic products for intermediate consumption at basic prices |               |     |          |       | Domestic products for final uses at basic prices |                         |         |       | Total use by product      |
| Manufacturing                          |                                                                |               |     |          |       |                                                  |                         |         |       |                           |
| ...                                    |                                                                |               |     |          |       |                                                  |                         |         |       |                           |
| Other services                         |                                                                |               |     |          |       |                                                  |                         |         |       |                           |
| Total at basic prices                  | Domestic intermediate inputs at basic prices                   |               |     |          |       | Final uses at basic prices                       |                         |         |       |                           |
| Use of imported products, CIF          | Total imported products for intermediate consumption           |               |     |          |       | Total imported products for final uses           |                         |         |       |                           |
| Taxes less subsidies on products       | Net taxes on products for intermediate consumption             |               |     |          |       | Net taxes on products for final use              |                         |         |       |                           |
| Adjustments                            |                                                                |               |     |          |       | Adjustments on final uses                        |                         |         |       |                           |
| Total at purchasers' prices            | Intermediate inputs at purchasers' prices                      |               |     |          |       | Final uses at purchasers' prices                 |                         |         |       |                           |
| Compensation of employees              | Value added by component and by industry                       |               |     |          |       |                                                  |                         |         |       |                           |
| Other net taxes on production          |                                                                |               |     |          |       |                                                  |                         |         |       |                           |
| Consumption of fixed capital           |                                                                |               |     |          |       |                                                  |                         |         |       |                           |
| Net operating surplus/net mixed income |                                                                |               |     |          |       |                                                  |                         |         |       |                           |
| Value added at basic prices            | Total value added by industry                                  |               |     |          |       |                                                  |                         |         |       |                           |
| Total inputs at basic prices           | Total input by industry                                        |               |     |          |       |                                                  |                         |         |       |                           |

Empty cells

Source: United Nations

Figure 8.3: Structure of the domestic use table

| Products \ Industries | Industries                                                   |               |     |          |                                                      | Final uses                                     |                         |         |                                        | Total use at basic prices |
|-----------------------|--------------------------------------------------------------|---------------|-----|----------|------------------------------------------------------|------------------------------------------------|-------------------------|---------|----------------------------------------|---------------------------|
|                       | Agriculture                                                  | Manufacturing | ... | Services | Total                                                | Final Consumption                              | Gross capital formation | Exports | Total                                  |                           |
| Agriculture           | Imported products for intermediate consumption at CIF values |               |     |          | Total imported products for intermediate consumption | Imported products for final uses at CIF values |                         |         | Total imported products for final uses | Imported total use        |
| Manufacturing         |                                                              |               |     |          |                                                      |                                                |                         |         |                                        |                           |
| ...                   |                                                              |               |     |          |                                                      |                                                |                         |         |                                        |                           |
| Other services        |                                                              |               |     |          |                                                      |                                                |                         |         |                                        |                           |
| Total                 | Intermediate consumption by industry                         |               |     |          |                                                      | Total final uses by category                   |                         |         |                                        |                           |

Source: United Nations

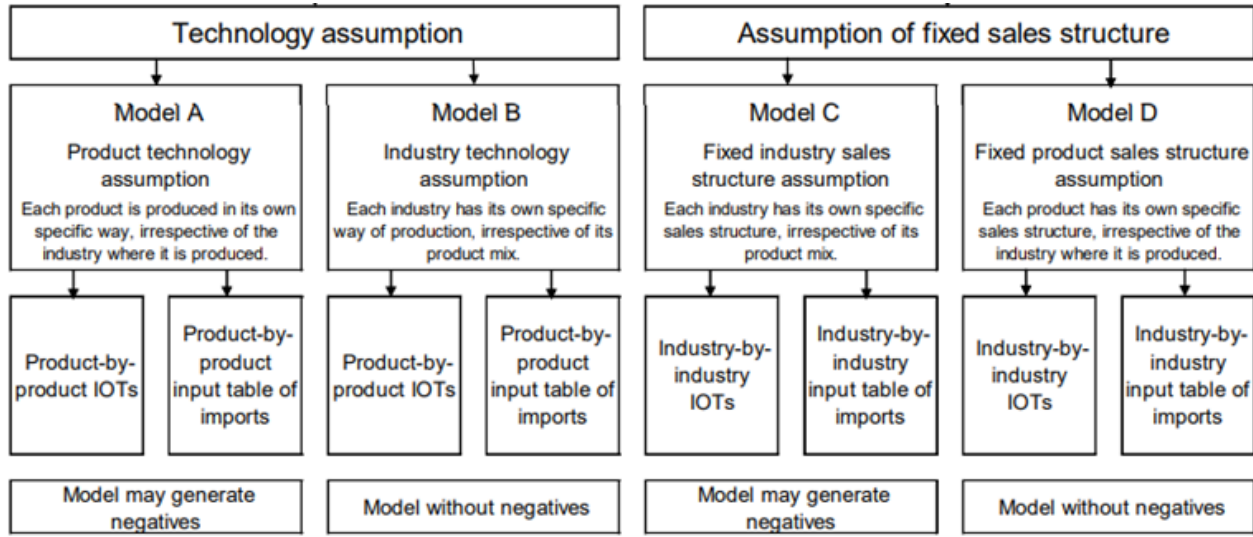
once again based ourselves on the Nations manual on SUTs and IOTs. However, before carrying out this conversion, we had to aggregate the 8 non-producing industries with similar industries to finally have 55 sectors instead of 63 of the SUT, this is necessary since there is an inversion of the diagonal matrix of production total industries thereafter.

There are generally 4 models for converting a SUT into an IOT, each based on a hypothesis:

Our choice to obtain a product-by-product IOT was based on model B given that with model A, there is a risk of obtaining negative values in the IOT.

The complete procedure for applying Model B is explained in the United Nations manual (P. 379 - 388).

Figure 8.4: Models for converting SUTs to IOTs



Source: United Nations

## F.5 Conversion of IOT to GTAP format and data validity tests

This conversion was easy, the matrices UF, UM, OP, UP were simply extracted from different matrices obtained in the establishment of the IOT. The most important thing during this step was to ensure the consistency of the data. To do this, we carried out four checks:

- Sign check: checks that all values are of the correct sign;
- Balance check: checks that the table balances;
- Tax: checks that there are no ridiculous tax rates;
- Entropy: checks for unusual shares (Walmsley and McDougall 2007).

The data passed the first three tests without major problems. Concerning the fourth test on entropy values, we had to explain certain differences between the global averages and the values calculated on the data we provided. This was mainly due to the very high shares of capital in certain sectors and the very high share of the mining sector in exports.

For the first case, various possible explanations can justify the significant share of capital in value added in the DRC. There is, among other things, the general low level of wages in the DRC due largely to the exploitation of workers by expatriate companies and multinationals (mainly in primary industries), a significant lack of protection of workers by the state.

For the second case, it should be remembered here that the economy of the DRC is ex-troverted and highly dependent on raw materials. In 2021, for example, mining exports alone still represented 95% according to Central Bank statistics. Combined with those of hydrocarbons, we reached 99%.

|          | Total of supplies at purchasers prices | Trade margins | Transport margins | Non-deductible VAT | Subsidies on products | Other taxes on products | Export taxes | Import taxes | Total of supplies at basic price | Industries    | Total of production | CIFFOB adjustment | Imports CIF |
|----------|----------------------------------------|---------------|-------------------|--------------------|-----------------------|-------------------------|--------------|--------------|----------------------------------|---------------|---------------------|-------------------|-------------|
| Supplies |                                        |               |                   |                    |                       |                         |              |              |                                  |               |                     |                   |             |
| Products | ...                                    | ...           | ...               | ...                | ...                   | ...                     | ...          | ...          | ...                              | -<br>...<br>- | ...                 | ...               | ...         |

Figure 8.5: Annex: Format of the official SUT of the DRC

| Use of products     | Total uses at acquisition price | Trade margins | Transport margins | Non-deductible VAT | Subsidies on products | Other taxes on products | Export taxes | Import taxes | Total uses at base price | Industries | Total of intermediate consumption | Exports | Final consumption |            |            | Gross fixed capital formation | Inventory changes |      |
|---------------------|---------------------------------|---------------|-------------------|--------------------|-----------------------|-------------------------|--------------|--------------|--------------------------|------------|-----------------------------------|---------|-------------------|------------|------------|-------------------------------|-------------------|------|
| Products            | ....                            |               |                   |                    |                       |                         |              |              |                          | Industries | ....                              | ....    | ....              | Households | Government | NPIS H                        | ....              | .... |
|                     |                                 |               |                   |                    |                       |                         |              |              |                          |            |                                   |         |                   |            |            |                               |                   |      |
|                     |                                 |               |                   |                    |                       |                         |              |              |                          |            |                                   |         |                   |            |            |                               |                   |      |
|                     |                                 |               |                   |                    |                       |                         |              |              |                          |            |                                   |         |                   |            |            |                               |                   |      |
|                     |                                 |               |                   |                    |                       |                         |              |              |                          |            |                                   |         |                   |            |            |                               |                   |      |
| GVA                 |                                 |               |                   |                    |                       |                         |              |              |                          |            |                                   |         |                   |            |            |                               |                   |      |
| Labor               |                                 |               |                   |                    |                       |                         |              |              |                          |            |                                   |         |                   |            |            |                               |                   |      |
| Taxes on production |                                 |               |                   |                    |                       |                         |              |              |                          |            |                                   |         |                   |            |            |                               |                   |      |
| Subsidies           |                                 |               |                   |                    |                       |                         |              |              |                          |            |                                   |         |                   |            |            |                               |                   |      |
| Capital             |                                 |               |                   |                    |                       |                         |              |              |                          |            |                                   |         |                   |            |            |                               |                   |      |

Source: Contributor

## ***References***

Walmsley, Terrie and Robert McDougall (2007). *Using Entropy to Compare IO tables*. GTAP Research Memorandum 09. Department of Agricultural Economics, Purdue University, West Lafayette, IN: Global Trade Analysis Project (GTAP). URL: <https://doi.org/10.21642/GTAP.RM09>.