National Accounts

Input-output tables

The status of the input-output tables for South Africa

Discussion document: D0404
March 2012

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The status of the input-output tables for South Africa

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Discussion document: D0404
Statistics South Africa
March 2012

The status of the input-output tables for South Africa / Statistics South Africa

Published by Statistics South Africa, Private Bag X44, Pretoria 0001

Discussion document: The status of the input-output tables for South Africa
Discussion document (D0404) Statistics South Africa
Pretoria: Statistics South Africa, March 2012
Title continuous in English only

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List of abbreviations

cif	Cost, insurance and freight
CPA	Classification of products by activity
CPC	Central product classification
COFOG	Classification of the functions of the government
COICOP	Classification of individual consumption by purpose
COPNI	Classification of the purpose of non-profit institutions serving households
EU	European Union
Eurostat	Statistical office of the European Communities
ESA 1995	European System of National Accounts
fob	Free on board
GDP	Gross domestic product
I-O tables	Input-output tables
ISIC	International Standard Industrial Classification of all Economic Activities
NACE	General Industrial Classification of Economic Activities within European Communities
NPISH	Non-profit institutions serving households
RAS	Bi-proportional matrix balancing
SARB	South African Reserve Bank
SARS	South African Revenue Service
SIC	Standard Industrial Classification of all Economic Activities
1993 SNA	The System of National Accounts 1993
Stats SA	Statistics South Africa
SU-tables	Supply and use tables
UN	United Nations
VAT	Value added tax

1. Introduction

An input-output table (I-O table) is a theoretical framework that focuses on the relationship between industries and their production and use of products. It represents the economy in a matrix form by listing the consuming industries as columns, and the supplying industries as rows[1].

I-O tables were initially developed by Wassily Leontief and published in 1936. These pioneering I-O tables described the United States' economy for the years 1919 and 1929. Since then, further development was made, including notable contributions from Professor Richard Stone and Francois Quesnay, who have advanced input and output theory to what is currently used[2].

Supply and use tables (SU-tables) are used in the 1993 System of National Accounts (1993 SNA) and these tables are regarded as a cornerstone of the National Accounts framework. SU-tables can be used to compile the gross domestic product (GDP) at both constant and current prices. SU-tables allow for detailed analysis of industries and products, although it uses separate classifications for products and industries. The classifications used in the symmetric I-O tables must coincide with the classifications used in the SU-tables (however, only one classification form needs to be used for each type of I-O table). There are two types of I-O tables[3]:

- Product-by-product; and
- Industry-by-industry (this I-O table is the current priority because of the analytical advantages it holds which will be discussed further in this document.)

The industry-by-industry I-O table will use the industry classification of the country's SU-tables. In the case of South Africa, this will be the Standard Industrial Classification of all Economic Activities (SIC). The industry-by-industry I-O table allows for the analysis of industries within an economy, and shows the dependency of industries in relation to each other.

Differences between SU-tables and I-O tables:[4]

- SU-tables are industry-by-product matrices using both industry and product classifications;
- SU-tables are two separate tables, one describing the use of commodities and the other describing the supply of commodities;
- I-O tables are either produced as a product-by-product, or an industry-by-industry matrix (not mixed); and
- An I-O table has both supply and use data in a single matrix, using either industry or product classifications in the rows and columns.

[1] United Nations – Studies in Methods, Handbook of Input-Output table compilation and analysis, 1999
[2] United Nations – Studies in Methods, Handbook of Input-Output table compilation and analysis, 1999
[3] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[4] Turkish Statistical Institute – Supply –Use and Input-Output tables, backward and forward linkages of the Turkish economy

The purpose of this discussion document is to:

- Examine the statistical office of the European Communities (Eurostat) manual on I-O tables to provide recommendations for the compilation of I-O tables for South Africa;
- Examine other countries' experiences in the compilation of I-O tables;
- Provide the current progress of the compilation of I-O tables for South Africa; and
- Provide recommendations for the way forward regarding the compilation of I-O tables by Statistics South Africa (Stats SA).

2. An examination of the Eurostat manual for the development of input-output tables

In order to develop I-O tables for South Africa, it is necessary to examine other countries' experiences in I-O table compilation first to gain experience and prepare guidelines to assist with the compilation of the draft I-O tables for South Africa. In this section, Eurostat's guidelines will be examined along with two countries, namely Scotland and Turkey. These two countries have research available detailing their I-O table development. Eurostat is the statistical organisation that represents the European Union (EU) and offers guidelines for the development of National Accounts and I-O table compilation to its member countries. It is Eurostat's goal to develop quality data for the European System of National Accounts (ESA 1995)[5].

2.1 Background on input-output tables

Eurostat represents the EU member countries and although these countries possess their own national statistics agencies, it is generally accepted that, where possible, they will conform to the Eurostat recommendations and guidelines. This is to remain compliant with the ESA 1995. The Eurostat recommendations and guidelines will be examined and because they represent the EU, it will provide an overview of European countries' compilation methods.

The input-output framework of the ESA 1995 consists of three different types of tables, namely[6]:

- Supply tables;
- Use tables; and
- Symmetric I-O tables.

The three different types of tables all use the same definitions and classifications and all conform to the ESA 1995. All these tables form the input-output framework. The classifications used in the symmetric I-O tables are compatible with those used within the United Nations (UN). The classification systems used are the[7]:

- General Industrial Classification of Economic Activities within European Communities (NACE); and
- Classification of Products by activity (CPA).

The current focus of Stats SA is to develop the industry-by-industry I-O tables. Product-by-product I-O tables will, however, also be examined and will be investigated and developed if possible. According to Eurostat, SU-tables can be used to form a basis which, once certain assumptions are applied, will allow symmetric I-O tables to be compiled[8].

[5] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[6] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[7] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[8] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

The industry-by-industry I-O tables are regarded as symmetric I-O tables because of the matrix form used. The row and column totals of the corresponding industry or product are equal. This implies that for each product or industry, input must equal output; hence total supply must equal total use. The total supply and use figures will therefore equal those within the existing SU-tables[9].

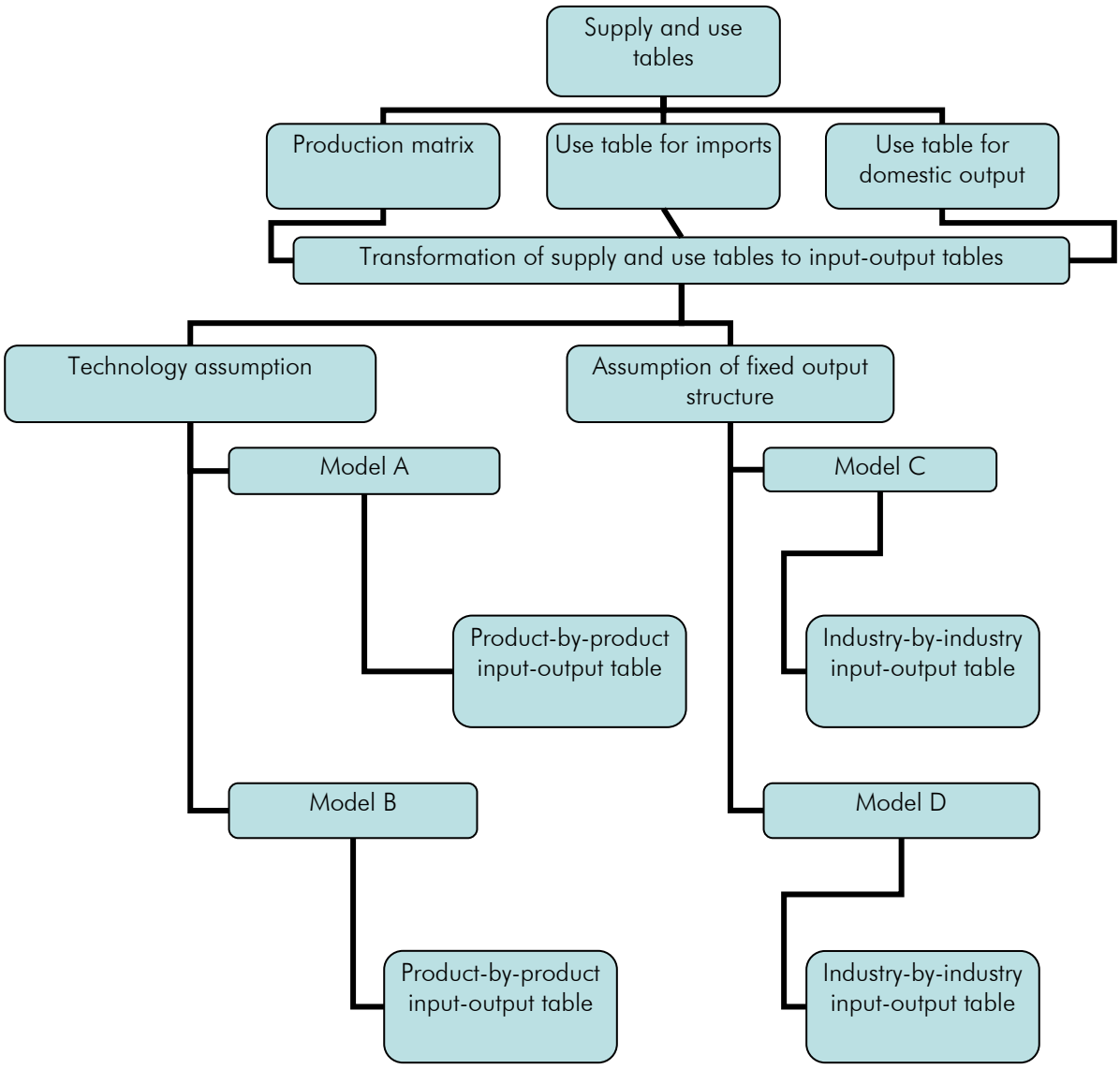
In order to transform SU-tables into I-O tables[10], certain assumptions need to be applied to SU-table data. According to Eurostat, the transformation can be based on four different core assumptions. Two of the assumptions focus on the transformation of SU-tables into a product-by-product I-O table, while the other two assumptions focus on transforming SU-tables into an industry-by-industry I-O table. It is also possible to use a combination of the two industry-based assumptions, or the two product-based assumptions to better fit an economy's output or production structure. The four core assumptions used by Eurostat are[11]:

- *Product technology assumption Model A* - this model assumes that each product is produced in its own specific way, irrespective of the industry where it is produced. Negative values may occur;
- *Industry technology assumption Model B* - this model assumes that individual industries have unique ways of production, irrespective of any product mix produced. Negative values will not occur;
- *Fixed industry-output structure assumption Model C* - this model assumes each industry, despite its product mix, has a unique output structure. Negative values may occur; and
- *Fixed product-output structure assumption Model D* - this model assumes that each product has its own specific output structure, regardless of which industry produces it. Negative values will not occur

Models A and B are used for the compilation of a product-by-product I-O table. The transformation to an industry-by-industry I-O table is primarily based on the output structure and models C and D are used. According to Eurostat, industry-by-industry I-O tables are closer to statistical sources and market transactions. Eurostat acknowledges that Model D represents a more reasonable assumption than Model C when compiling an industry-by-industry I-O table[12]. According to Eurostat, in real-world scenarios, the Model A assumption is favoured to Model B when compiling a product-by-product I-O table. The transformation of SU-tables into I-O tables is demonstrated in Figure 1 below:

[9] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[10] Either product-by-product or industry-by-industry
[11] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[12] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Figure 1: A visual representation of supply and use tables being converted to input-output tables



Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

When compiling an I-O table from SU-tables, the transformation of the use table is not necessary if there are no off-diagonal outputs. In this case, the intermediate consumption requirements are determined by only activity per industry. The effect of not having any off-diagonal outputs is that the production matrix of the supply table only has on-diagonal outputs and the use table is thus equal to an I-O table. In practice, however, most SU-tables (South Africa included) have multiple off-diagonal outputs, thus requiring transformation. The table below is a simplified product-by-product I-O table showing the relationship between input and output[13].

[13] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 1: A simplified product-by-product input-output table

Products	Units of productions[14]			Final uses			Total uses
	Agricultural products	Industrial products	Services	Final consumption	Gross capital formation	Exports	
Agricultural products	Intermediate consumption by product and by units of production			Final uses by products and by category			Total use by product
Industrial products							
Services							
Value added	Value added by component and by units of production						
Imports for similar products	Total imports by products						
Supply	Total supply by units of production			Total final uses by category			

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 2 below is an example of a simplified industry-by-industry I-O table. The layout remains the same as the product-by-product I-O tables. The most notable change is the columns and rows reflecting industries instead of units of productions and products.

Table 2: A simplified industry-by-industry input-output table

Industry	Industry			Final uses			Total uses
	Agriculture	Industry	Service activities	Final consumption	Gross capital formation	Exports	
Agriculture							
Industry							
Service activities							
Value added							
Imports of similar products							
Supply							

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

The total supply and total use by product is still the same in the I-O tables when compared to the SU-tables. For the product-by-product I-O tables, the industry-based structures are transformed into a product-based one. However, final use data is left unchanged. The transformation only changes the intermediate use table and the production matrix by applying one of the assumptions (Model A or Model B, in the case of a product-by-product I-O table) to the relationship between the on and off diagonal outputs[15].

[14] Homogeneous in nature
[15] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

The major conceptual difference between I-O tables and the SU-tables framework is that, within a SU-table framework, the relationship between industries and products is examined, whereas the I-O table framework links industries to industries (or industry-production output), or in the case of a product-by-product I-O table, it links products to products (examining similar production units)[16].

SU-tables contain supplementary information for each sector examined. This supplementary information allows for productivity analysis to be performed. The supplementary information typically contains the following[17]:

- Fixed capital formation;
- Fixed capital stock; and
- Labour inputs

According to Eurostat, the ESA 1995 has certain conceptual requirements for the SU-table framework, as well as the I-O table framework. The ESA 1995 requirements focus primarily on transaction definitions, classification concepts and methods of valuations. Table 3 below shows what the main features of the ESA 1995 SU-table framework are, and Table 4 shows the main features of I-O tables according to the ESA 1995.

[16] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[17] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 3: Main features of the European System of National Accounts 1995 supply and use tables[18]

Supply tables		
	Industry classification	• General Industrial Classification of Economic Activities within the European Communities (NACE)
	Product classification	• Classification of products by activity (CPA)
Intermediate use table		
	Industry classification	• General Industrial Classification of Economic Activities within the European Communities (NACE)
	Product classification	• Classification of products by activity (CPA)
Final uses		
	Final consumption expenditure	• By households • By non-profit institutions serving households (NPISH) • By governments
	Gross capital formulation	• Gross fixed capital formation and valuables • Changes in inventories
	Exports	
Value added		
	Compensation of employees	
	Other net taxes on production	
	Consumption of fixed capital	
	Gross operating surplus	
	Net operating surplus	
Valuation		
	Supply table	• Basic prices including a transformation to purchasers' prices
	Use table	• Purchasers' prices
Statistical units		
	Local kind of activity units	
Supplementary information by industry for the use table		
	Fixed capital formation	
	Fixed capital stock	
	Labour inputs	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

[18] Table 30 shows this within a South African context

Table 4: The main features of the European System of National Accounts 1995 input and output tables[19]

Kind of table		
	Product-by-product input and output table	
	Industry-by-industry input and output table	
Transformation method		
	Product technology assumption	
	Fixed product-output structure assumption	
Classifications		
	Products	• Classification of products by activity (CPA)
	Industries	• General Industrial Classification of Economic Activities within the European Communities (NACE)
Valuation		
	Basic prices	
Domestic outputs and imports		
	Product-by-product input and output tables for domestic output and for imports	
	Industry-by-industry input and output tables for domestic output and for imports	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

The ESA 1995 recommends the compilation of product-by-product I-O tables, which is in line with the recommendations within the 1993 SNA. According to the ESA 1995, industry-by-industry I-O tables are also recommended, as long as the industries are close to homogeneous units of production[20]. The current ESA 1995 programme recommends the following data sets for the I-O framework[21]:

- Annual supply table at basic prices, which includes a transformation into purchasers' prices, at both current and constant prices;
- Annual use table at purchasers' prices, at both current and constant prices; and
- I-O tables which include I-O tables for domestic output and imports, at current prices.

[19] Table 31 shows this within a South African context
[20] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[21] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

2.2 Recommended compilation methods of input-output tables

According to Eurostat, the compilation of I-O tables is considerably different to the compilation of SU-tables. I-O tables are not compiled in the strict sense of the word; they are in fact the result of the transformation of the compiled SU-tables. There are aspects to consider before the transformation of SU-tables can begin[22]:

- Layout of the I-O tables;
- Classifications used in the I-O tables; and
- Level of detail used within the I-O tables

The classifications for products and industries used within I-O tables must comply with the SU-tables framework. However, there may be a number of different classifications used within the I-O framework that are not directly linked to SU-tables and these need to be integrated into the I-O framework, for example[23]:

- Classification of individual consumption by purpose (COICOP);
- Classification of the functions of the government (COFOG); and
- Classification of the purpose of non-profit institutions serving households (COPNI).

Generally, the level of detail available in published SU-tables is less than the level of detail in SU-tables that are unpublished. Eurostat identified certain elements that influence the level of detail available for the compilation of I-O tables[24]:

- The homogeneity of price indices and values for deflation;
- Matching value added tax (VAT) rates to products;
- Availability of source data;
- Quality of source data;
- Benchmarking;
- Staff resources, time schedules for production and publication; and
- System infrastructure

Eurostat recommends the use of rectangular SU-tables; this implies more products than industries. The advantage of rectangular SU-tables is that they allow more product detail; this can assist in the distribution of disaggregated homogenous products across various industries and final demand, using the commodity flow method of estimation. More product detail will also assist in balancing I-O tables, as single product imbalances can easier be dealt with than imbalances within groups of products. Better quality data will also result from using rectangular SU-tables; this is due to more data being required for products when compared to symmetric SU-tables[25].

[22] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[23] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[24] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[25] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

In order to compile the I-O table framework from SU-tables the following data is required[26]:

- Supply table at basic prices;
- Use table at basic prices;
- Use table for domestic output at basic prices; and
- Use table for imports at basic prices

The use table at basic prices is critical for the transformation and compilation of the I-O framework. The use table is typically reflected in purchasers' prices. Hence, in order to continue with the transformation of SU-tables into I-O tables, the use table needs to be converted back to basic prices. This presents a problem due to a lack of available data; therefore certain assumptions need to be made in order for the conversion back to basic prices to take place. This is dealt with in Chapter 3.

The 1993 SNA defines purchasers' prices as `the amount paid by the purchaser, excluding any deductible VAT or similar deductible tax, in order to take delivery of a unit of a good or service at the time and place required by the purchaser; the purchaser's price of a good includes any transport charges paid separately by the purchaser to take delivery at the required time and place[27].' The 1993 SNA defines basic prices as `the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, plus any subsidy receivable on that unit as a consequence of its production or sale; it excludes any transport charges invoiced separately by the producer[28].'

Basically, to convert the use table from purchasers' prices to basic prices, the following must be subtracted from the purchasers' prices:

- Taxes on products;
- Subsidies on products[29];
- Trade margins; and
- Transport margins

The process described above would result in the purchasers' price data being reduced to basic price levels. Once the use table has been reduced back to basic prices, it can be transformed mathematically into an I-O table. In order to proceed, it is recommend to perform the conversion to basic prices in systematic steps, as this will highlight data shortages at each given step (if any), but also allow the application of assumptions that address data gaps; thereby allowing the step to be completed.

[26] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[27] Organisation for Economic Cooperation and Development - System of National Accounts 1993
[28] Organisation for Economic Cooperation and Development - System of National Accounts 1993
[29] Subsidies are added to the purchasers' prices

To compile I-O tables comprehensively, it is recommended that domestic output and import data be split into two separate use tables, and to transform these matrices separately. Unfortunately, the data requirements for such a separation are considerable, and a data audit would need to be undertaken to investigate the feasibility of using this method for South Africa. The reason for this is that while import data on the products is available, the import data per industry is not known. Therefore it is not possible, without assumptions, to accurately create a SU-table with the intermediate matrix consisting of only import data. The benefit of separate domestic production and imports is a greater flexibility in analysis. On the supply table the trade and transport margins, as well as net taxes on products become irrelevant, because they have been deducted at the use tables, assuming it is still at purchasers' prices[30].

A product-by-product I-O table describes the relationship between products and homogeneous units of production. This describes, for each given product, what was required from other products to produce the given product. This does not consider the producing industry. This makes a product-by-product I-O table ideal for analysis of production units, comparing cost structures, the employment effect, energy and environmental policy impact. An industry-by-industry I-O table differs in that it describes the relationships between industries and which products are used in production for that industry. The result of these two different I-O tables implies that a product-by-product I-O table is better suited for productivity analysis, or a sensitivity analysis of a new technology entering the production market. The industry-by-industry I-O table is better suited for the analysis of the economic impacts related to industries, such as tax reforms or adjustments, and fiscal and monetary policy implications[31].

Table 5 shows a detailed product-by-product I-O table. The valuation used is basic prices, and therefore the trade and transport margins are not shown in the prices, but rather in the `trade, hotel and transport services' product rows. Table 5 shows the use of products without indicating whether they are domestic or an import. Taxes less subsidies on products are also shown separately in row 10. The sum of each column will equal output at basic prices; this includes imports (row 18). The total product supply for each product is thus determined[32].

It is recommended to transform domestic output and imports as two separate I-O tables, as this allows for greater flexibility. The completed I-O table will be the summation of both domestic output and imports. The `imports cost, insurance and freight (cif)' row 18 would therefore equal the total column on an imports only I-O table. An alternative solution would be to include the imports as a negative vector column under final uses; this would result in the row and column totals equalling domestic output[33]. If the column totals on an imports I-O table where included on a domestic output I-O table, it would imply that these imports where used in the production of those products.

[30] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[31] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[32] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[33] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 5: A detailed product-by-product input-output table

		Homogeneous branches							Final uses								
Products		Agriculture	Industry	Construction	Trade, hotel, transport	Private services	Other services	Total	Final consumption expenditure by households	Final consumption by non-profit organisations	Final consumption by government	Gross fixed capital formation	Change in valuables	Change in inventories	Exports	Total	Total use at purchasers' prices
No		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Products of agriculture	Intermediate consumption at basic prices							Final demand at basic prices								
2	Products of industry																
3	Construction work																
4	Trade, hotel, transport services																
5	Private services																
6	Other services																
7	**Total at basic prices**																
8	Direct purchases abroad by residents																

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 5: A detailed product-by-product input-output table (concluded)

		Homogeneous branches							Final uses								
Products		Agriculture	Industry	Construction	Trade, hotel, transport	Private services	Other services	Total	Final consumption expenditure by households	Final consumption by non-profit organisations	Final consumption by government	Gross fixed capital formation	Change in valuables	Change in inventories	Exports	Total	Total use at purchaser s' prices
No		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
9	Purchases by non-residents																
10	Taxes less subsidies on products																
11	**Total at purchasers' prices**																
12	Compensation of employees	Value added at basic prices							No values are required here								
13	Other net taxes on production																
14	Consumption of fixed capital																
15	Operating surplus, net																
16	**Value at basic prices**																
17	**Output at basic prices**																
18	**Imports cif**																
19	**Supply at basic prices**																

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

2.2.1 Compilation of a product-by-product input-output table using the product technology assumption (Model A)

According to Eurostat, the most common method for deriving product-by-product I-O tables is to use Model A, which is defined as `each product is produced in its own specific way, irrespective of the industry where it is produced'. It should be noted that this method can cause negative values to occur. Model A assumes that each homogenous product can only be produced in one way, irrespective of the industry that this product is originally produced in; this implies that all homogenous products require the same inputs and input structure for production.

The disadvantage of this method is that it does not take into account situations where products are produced using different methods or technologies, and cases where two or more products use the same technological process. However, despite this disadvantage, the product technology assumption (Model A) is still the most suitable for a product-by-product I-O table, since in most cases, the technology and production processes for primary and secondary production in industries are separate[34].

To calculate a product-by-product I-O table using Model A, secondary products must be transferred from the industry that they are produced in to the industry that is their primary producer. This requires each product to have a primary industry defined. The input structure of the primary industry then becomes the input structure of the product.

Table 6: Model A - product-by-product input-output table compilation (example)

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	0	70	50	120	120	0	120
Manufacturing products	62	40	140	242	22	220	242
Wages and salaries	50	30		80			
Operating surplus	30	80		110			
Total	142	220	190		142	220	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

[34] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 6 above shows an example of a SU-table[35]. This simplified example shows that the agricultural industry produces 22 manufacturing products. To transform this SU-table using the product technology model (Model A), the manufacturing products must be removed from the agricultural industry and added to the manufacturing industry. The input cost of the primary industry (manufacturing in this case) will then be used for the input cost of the product, even though it is produced in the agricultural industry. Final demand is not affected, since it is already represented in products[36]. Table 7 demonstrates this transformation.

Table 7: Model A - product-by-product input-output table compilation (example)

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	-7	+7	0		0	0	0
Manufacturing products	-4	+4	0		-22	+22	0
Wages and salaries	-3	+3					
Operating surplus	-8	+8					
Total	-22	22	0		-22	22	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Mathematically, it can be represented as `the use table equal to the I-O coefficient table multiplied by the supply table'. Once the results of Table 7 are added back to the original SU-table in Table 6, the columns of the supply and use tables will equal total output per product. Each column now describes the input structure of their primary product; therefore the transformed use table is now effectively a product-by-product I-O table[37]. An example of this is shown in Table 8.

[35] See Annexure 1 for the conversion of the South African supply and use tables into the simplified supply and use tables used throughout this discussion document.
[36] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[37] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 8: Model A - product-by-product input-output table compilation (example)

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	-7	77	50		120	0	120
Manufacturing products	58	44	140		0	242	242
Wages and salaries	47	33					
Operating surplus	22	88					
Total	120	242	190		120	242	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

The mathematical steps for Model A are represented in the three tables below. The tables below show the algebraic representations of the compilation examples above (Tables 6, 7 and 8). The example shows the transformation of only one product (manufacturing) being transferred to its primary producing industry. However, the same methodology is applied to multiple products, albeit on a larger scale than seen above and below.

Table 9: A simplified supply and use table

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	A	B	C	D	Q	R	S
Manufacturing products	E	F	G	H	T	U	V
Wages and salaries	I	J	K	L	ZB	ZC	ZD
Operating surplus	M	N	O	P	ZE	ZF	ZG
Total	W	X	Y		Z	ZA	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Transformations to the SU-table above are shown in Table 10 below. These adjustments allow for the creation of coefficients which allow for SU-tables to be activity transformed. The transformation is the movement of amount `T', which are `manufacturing products' produced in the `agriculture industry' to the `manufacturing industry'. Once this transfer is complete using Model A, the `manufacturing products' input costs structure, which in Model A is based on the primary producing industry, is then extracted for the secondary producing industry, which in this case is `agriculture'.

Table 10: The transformation matrix for Model A

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	-(B/X)*T	+(B/X)*T	No effect	No effect	No effect	No effect	No effect
Manufacturing products	-(F/X)*T	+(F/X)*T	No effect	No effect	-T	+T	No effect
Wages and salaries	-(J/X)*T	+(J/X)*T	No effect	No effect			
Operating surplus	-(N/X)*T	+(N/X)*T	No effect	No effect			
Total	Sum will equal -T	Sum will equal +T	No effect		-T	+T	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 11 below shows the SU-table (from Table 9) being transformed by extracting and adding the input cost structures of the effected industries. Model A, as mentioned previously, does not affect final demand.

Table 11: The simplified supply and use table transformed using Model A coefficients

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	A-((B/X)*T)	B+((B/X)*T)	C	D	Q	R	S
Manufacturing products	E-((F/X)*T)	F+((F/X)*T)	G	H	T-T	U+T	V
Wages and salaries	I-((J/X)*T)	J+((J/X)*T)	K	L	ZB	ZC	ZD
Operating surplus	M-(N/X)*T)	N+((N/X)*T)	O	P	ZE	ZF	ZG
Total	W (sum must equal S)	X (sum must equal V)	Y		Z-T (sum must equal S)	ZA+T (sum must equal V)	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

2.2.2 Compilation of a product-by-product input-output table using the industry technology assumption (Model B)

The alternative method of transforming SU-tables into product-by-product I-O tables is to use the industry product technology assumption (Model B). This assumption states that `each industry has its own specific way of production, irrespective of its product mix'. It's important to note that, due to the nature of this method, negative values are unlikely to occur. This is because the maximum transferred amount will always be less than the amount that is being transferred from. This is not the case with Model A (the negative values can be seen in the example above[38]).

To calculate a product-by-product I-O table using Model B, each industry's input structure must remain constant, irrespective of which products are being produced. If the product-output mix changes with respect to an individual industry, the input structure will remain constant. This method assumes that the inputs used will not change. This model is suited for situations where a major amount of production within industries is produced using the same process, for example by products. For demonstration purposes, Table 11 below contains the same SU-table data used in Table 6.

Table 12: Model B – product-by-product input-output table compilation (example)

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	0	70	50	120	120	0	120
Manufacturing products	62	40	140	242	22	220	242
Wages and salaries	50	30		80			
Operating surplus	30	80		110			
Total	142	220	190		142	220	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

The approach is similar to the product technology approach (Model A). The manufacturing output produced by agriculture is removed from agriculture. However, in Model A the input cost structure of the primary producer of that product is used (in the previous example this was manufacturing). Model B implies the industry that produced the original product that is being removed, maintains its input cost structure, and this cost structure is therefore used to create the I-O table coefficients used the remove the product output. In this example that industry is agriculture. This is demonstrated in Table 13 below.

[38] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 13: Model B – product-by-product input-output table compilation (example)

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	0	0	0		0	0	0
Manufacturing products	-9.6	9.6	0		-22	+22	0
Wages and salaries	-7.8	7.8					
Operating surplus	-4.6	4.6					
Total	-22	22	0		-22	22	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 14 below shows the SU-tables after the Model B product-by-product I-O table coefficients have been applied. It should be noted that the industry that receives the products (in this example manufacturing), will now contain a mixture of two input cost structures. While this approach does not result in negative values for industry output, this does not make it more correct or valid than Model A. Eurostat recommends the use of Model A, because it is more practical in real-world scenarios[39].

Table 14: Model B - product-by-product input-output table compilation (example)

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	0	70	50	120	120	0	120
Manufacturing products	52.4	49.6	140	242	0	242	242
Wages and salaries	42.2	37.8		80			
Operating surplus	25.4	84.6		110			
Total	120	242	190		120	242	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

[39] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

The mathematical steps for Model B are represented in the three tables below. The tables below show the algebraic representations of the compilation example for Model B above (Tables 12, 13 and 14). Table 15 is a replica of Table 9. This table was repeated (as with the numerical SU-table examples) to make the process easier to follow for demonstration purposes.

Table 15: A simplified supply and use table

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	A	B	C	D	Q	R	S
Manufacturing products	E	F	G	H	T	U	V
Wages and salaries	I	J	K	L	ZB	ZC	ZD
Operating surplus	M	N	O	P	ZE	ZF	ZG
Total	W	X	Y		Z	ZA	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Transformations of the SU-table above are shown in Table 16 below. The transformation for Model B is similar to Model A, with the major difference being the adjustment of the input cost structure for the respective industries. The amount `T', as in the case of Model A, are `manufacturing products' produced in the `agriculture industry'. This is transferred to the `manufacturing industry'. The major difference between using Model A and Model B is that in Model B, the `manufacturing products' input costs structure is based on the industry that produced it originally; in this example the `agriculture industry', and is not based on the primary producing industry of that product.

Table 16: The transformation matrix for Model B

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	-(A/W)*T	+(A/W)*T	No effect		No effect	No effect	No effect
Manufacturing products	-(E/W)*T	+(E/W)*T	No effect		-T	+T	No effect
Wages and salaries	-(I/W)*T	+(I/W)*T	No effect				
Operating surplus	-(M/W)*T	+(M/W)*T	No effect				
Total	Sum will equal -T	Sum will equal +T	No effect		-T	+T	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 17 below shows the SU-table (from Table 15) being transformed by extracting and adding the input cost structures of the effected industries. Final demand is not affected using Model B, because like Model A, final demand is already reflected in the products.

Table 17: The simplified supply and use table transformed using Model B coefficients

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	A-(A/W)*T	B+(A/W)*T	C	D	Q	R	S
Manufacturing products	E-(E/W)*T	F+(E/W)*T	G	H	T-T	U+T	V
Wages and salaries	I-(I/W)*T	J+(I/W)*T	K	L	ZB	ZC	
Operating surplus	M-(M/W)*T	N+(M/W)*T	O	P	ZE	ZF	
Total	Sum must equal S	Sum must equal V	Y		Z-T (Sum must equal S)	ZA+T (Sum must equal V)	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

In real-world situations however, both models offer benefits and disadvantages, and both models are preferred in different production scenarios. Model A is best suited where the input cost structure for different products produced within the same industry varies, while Model B is suited for situations where the input cost structure for different products produced within the same industry is the same. Thus, for subsidiary production it would be beneficial to use Model A, whereas for production that is joint or by product, Model B is preferable.

According to Eurostat, it is possible to combine the two approaches to create a hybrid assumption used for the compilation of a product-by-product I-O table. In principal, this approach would allow for the best features of both models to be utilised. The basic idea behind a hybrid assumption compilation is to split SU-tables into two separate units. The one unit will feature products produced as primary and subsidiary, while the second unit will contain products produced as joint or by product. Therefore the different assumptions can be applied to the most suited SU-tables. Finally, the two split units of the SU-tables are recombined, and the hybrid assumption based I-O table can be produced. This hybrid approach was originally described in the 1968 SNA[40].

[40] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

2.2.3 Compilation of a industry-by-industry input-output table using the fixed industry output structure assumption (Model C)

An industry-by-industry I-O table is compiled by transferring inputs and outputs across rows. This results in the product classification of the rows (from the SU-tables) falling away, and instead, the rows are converted into the industry classification of the columns. Two different assumption models are used for this approach; either the assumption of fixed industry output structure (Model C), or the assumption of the fixed product output structure (Model D)[41].

The fixed industry output structure (Model C) states that `each industry has its own specific output structure, irrespective of its product mix'[42]. To compile an industry-by-industry I-O table using this assumption, all secondary or off-diagonal production output from an industry must be treated as primary production. Table 19 demonstrates this procedure. To keep the examples consistent, Table 18 below contains the same SU-table data used in Table 6.

Table 18: Model C – industry-by-industry input-output table compilation (example)

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	0	70	50	120	120	0	120
Manufacturing products	62	40	140	242	22	220	242
Wages and salaries	50	30		80			
Operating surplus	30	80		110			
Total	142	220	190		142	220	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

In the above table (Table 18), using agriculture as an example, the 22 units of manufacturing output produced by the agricultural industry need to be redistributed as primary output of the agricultural industry. This is because of the assumption of fixed industrial output structure (the products being produced must be regarded as being sold in the same manner). Table 19 shows the transformation matrix using this approach.

[41] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[42] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 19: Model C - industry-by-industry input-output table compilation (example)

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	0	+12.8	+9.2	22	+22	0	22
Manufacturing products	0	-12.8	-9.2	-22	-22	0	-22
Wages and salaries	0						
Operating surplus	0						
Total	0	0	0		0	0	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Unlike the product-by-product transformations, this transformation is applied to the rows and not the columns. On the use table, the `manufacturing products' is added to `agriculture products'. This is because it is treated with the agricultural output structure from the agricultural industry. The distribution of the `manufacturing products' produced within agriculture is determined by using the same proportions as the primary products (agricultural products in this example). Therefore, mathematically it is row 1, column 1, 2 and 3 divided by the total output of the row multiplied by the transferred product (22 manufacturing products in this example). Table 20 below shows the SU-tables after the Model C industry-by-industry I-O table coefficients have been applied.

Table 20: Model C - industry-by-industry input-output table compilation (example)

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	0	82.8	59.2	142	142	0	142
Manufacturing products	62	27.2	130.8	220	0	220	220
Wages and salaries	50	30		80			
Operating surplus	30	80		110			
Total	142	220	190		142	220	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

The mathematical steps for Model C are represented in the three tables below. The tables below show the algebraic representations of the compilation example for Model C above (Tables 18, 19 and 20). Table 21 is a replica of Table 9. For demonstration purposes, this table was repeated.

Table 21: A simplified supply and use table

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	A	B	C	D	Q	R	S
Manufacturing products	E	F	G	H	T	U	V
Wages and salaries	I	J	K	L	ZB	ZC	ZD
Operating surplus	M	N	O	P	ZE	ZF	ZG
Total	W	X	Y		Z	ZA	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Transformations of the SU-table above are shown in Table 22 below. The transformation using Model C is different from Models A and B, because it focuses on the output structure of the industries. This implies the transformed SU-table would be suitable for industry-by-industry I-O tables and not product-by-product I-O tables, as in Models A and B. The amount `T' are `manufacturing products' produced in the `agriculture industry'. This is transferred within the `agricultural industry' from `manufacturing products' to `agriculture products'. Model C implies each industry maintains a unique output structure, ignoring the product mix. The transfer of `T' from `manufacturing products' to `agriculture products' necessitates the transfer of `manufacturing products' output structure to `agriculture products'. Using Model C implies that the input output structure of `agricultural industry' is used; this is the industry transferred to.

Table 22: The transformation matrix for Model C

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	+(A/D)*T	+(B/D)*T	+(C/D)*T	Sum will be equal to +T	+T	No effect	+T
Manufacturing products	-(A/D)*T	-(B/D)*T	-(C/D)*T	Sum will be equal to -T	-T	No effect	-T
Wages and salaries							
Operating surplus							
Total	0	0	0	0	No effect	No effect	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 23 below shows the SU-table (from Table 21) being transformed by extracting and adding the industry output structure of the effected industries.

Table 23: The simplified supply and use table transformed using Model C coefficients

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	A+(A/D)*T	B+(B/D)*T	C+(C/D)*T	Sum will be equal to S+T	Q+T	R	S+T
Manufacturing products	E-(A/D)*T	F-(B/D)*T	G-(C/D)*T	Sum will be equal to V-T	T-T	U	V-T
Wages and salaries	I	J	K	L	ZB	ZC	ZD
Operating surplus	M	N	O	P	ZE	ZF	ZG
Total	W(equals S+T)	X(equals V-T)	Y		Z	ZA	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Unfortunately, Model C does present concerns in certain scenarios; not all industries will supply their different products at the same proportions to their various consumers. In most cases it can be assumed that each product has a different output structure and will be destined to different consumers. There are examples where Model C would hold true, such as computer software being sold along with computer hardware where computer hardware is the primary product, although in general, this is not the case[43].

2.2.4 Compilation of a industry-by-industry input-output table using the fixed product output structure assumption (Model D)

The alternative assumption for compiling an industry-by-industry I-O table is the fixed product output structure or model D, which states that `each product has its own specific output structure, irrespective of the industry where it is produced'[44]. To keep the examples consistent, Table 24 below contains the same SU-table data as in Table 6.

Table 24: Model D - industry-by-industry input-output table compilation (example)

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	0	70	50	120	120	0	120
Manufacturing products	62	40	140	242	22	220	242
Wages and salaries	50	30		80			
Operating surplus	30	80		110			
Total	142	220	190		142	220	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

To compile the industry-by-industry I-O table transformation matrix using Model D, which is the fixed product output structure assumption, the secondary products produced in industries (off-diagonal production) must be regarded as having the same output structure as the homogeneous products being produced in the primary producing industry for those products. Table 25 shows the transformation matrix using this approach.

[43] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[44] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 25: Model D - industry-by-industry input-output table compilation (example)

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	+5.6	+3.7	+12.7	22	+22	0	+22
Manufacturing products	-5.6	-3.7	-12.7	-22	-22	0	-22
Wages and salaries							
Operating surplus							
Total	0	0	0		0	0	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

This transformation method, like Model C, is applied to the rows and not the columns. On the use table the `manufacturing products' is added to `agriculture products'. The distribution of the products is determined by using the same proportions as the primary product's producing industry (in this case manufacturing). Therefore, mathematically it is row 2 (manufacturing products), column 1, 2 and 3 divided by the total output of the row multiplied by the transferred product (22 manufacturing products in this example). Table 26 below shows the SU-tables after the Model D industry-by-industry I-O table coefficients have been applied.

Table 26: Model D - industry-by-industry input-output table compilation (example)

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	5.6	73.7	62.7	142	142	0	142
Manufacturing products	56.4	36.3	127.3	220	0	220	220
Wages and salaries	50	30		80			
Operating surplus	30	80		110			
Total	142	220	190		142	220	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

The mathematical steps for Model D are represented in the three tables below. The tables below show the algebraic representations of the compilation example for Model D above (Tables 24, 25 and 26). Table 27 is a replica of Table 9. For demonstration purposes, this table was repeated (as with the numerical SU-table examples).

Table 27: A simplified supply and use table

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	A	B	C	D	Q	R	S
Manufacturing products	E	F	G	H	T	U	V
Wages and salaries	I	J	K	L	ZB	ZC	ZD
Operating surplus	M	N	O	P	ZE	ZF	ZG
Total	W	X	Y		Z	ZA	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Transformations of the SU-table above are shown in Table 28 below. The transformation using Model D implies that each product has a specific output structure, regardless of the producing industry. The amount `T' are `manufacturing products' produced in the `agriculture industry'. This is transferred within the `agricultural industry' from `manufacturing products' to `agriculture products'; the same as with Model C. The difference between Models C and D is apparent in the output structure transferred. In Model C, the receiving industry's output structure (agriculture in the example) was used for all products transferred to it. In model D however, the output structure of the specific product transferred is used. The output structure is generated from the `manufacturing products' row, because that was the original production point of the `T', and therefore represents its original output structure.

Table 28: The transformation matrix for Model D

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	+(E/H)*T	+(F/H)*T	+(G/H)*T	Sum will be equal to +T	+T	No effect	+T
Manufacturing products	-(E/H)*T	-(F/H)*T	-(G/H)*T	Sum will be equal to -T	-T	No effect	-T
Wages and salaries							
Operating surplus							
Total	0	0	0	0	No effect	No effect	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Table 29 below shows the SU-table (from Table 27) being transformed by extracting and adding the industry output structure of the effected industries.

Table 29: The simplified supply and use table transformed using Model D coefficients

	Use table				Supply table		
	Agriculture	Manufacturing	Final demand	Total	Agriculture	Manufacturing	Total
Agriculture products	A+(E/H)*T	B+(F/H)*T	C+(G/H)*T	Sum will be equal to S+T	Q+T	R	S+T
Manufacturing products	E-(E/H)*T	F-(F/H)*T	G-(G/H)*T	Sum will be equal to V-T	T-T	U	V-T
Wages and salaries	I	J	K	L	ZB	ZC	ZD
Operating surplus	M	N	O	P	ZE	ZF	ZG
Total	W(equals S+T)	X(equals V-T)	Y		Z	ZA	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

Model D is the preferred assumption for compiling an industry-by-industry I-O table, as it offers a more realistic approach, while Model A is the preferred assumption for product-by-product I-O tables. The four different assumptions each have benefits and disadvantages, and when compiling an I-O output table, these must be considered. An important consideration to take into account when determining which model should be used in the compilation of I-O tables, is what the purpose and function of the I-O table will be. The resulting analysis on an I-O table using the different models will yield different results.

Negative elements that can appear when using Models A and C can impose certain problems when using the I-O tables for analysis. The negative numbers occur because of the theoretical mathematical methods undertaken to transform SU-tables into I-O tables when Models A and C assumptions are used. Models B and D assumptions will generally not cause negative numbers to occur, because the amount transferred can never be greater than the amount of product output produced in the secondary industry. There are other possibilities for negative numbers to occur, such as data errors in the source data. According to Eurostat, it is possible to avoid negative values from occurring when compiling a product-by-product I-O table using Model A; one such solution is to utilise SU-tables that were compiled using homogeneous production units with constant input coefficients[45].

In a real-world scenario, the compilation of an I-O table is made more complex by rectangular SU-tables, where there are more products than industries. This is not the situation with SU-tables used in South Africa. The published SU-tables used in South Africa contain 171 industries and 104 products, while the unpublished SU-tables contain 292 industries and 105 products. The industries are classified according to SIC (5th edition), while the products are classified according to the central production classification version 2 (CPC). When compiling a product-by-product I-O table, the products are assigned a primary industry. This industry forms the basis of the input cost structure, and the technology used to create the products. Therefore, rectangular SU-tables pose a certain problem, because they are asymmetric.

A solution is to assign multiple products to a single primary industry, but the major disadvantage of this is that it then forces the assumption that those multiple products have identical input cost structures, and the technology used to produce those products is the same. Despite this, the aggregation of the products in an SU-table does offer a viable solution, allowing the compilation of I-O tables to commence[46].

South Africa has more industries than products in current SU-tables; therefore the above solution will not work effectively. An alternative approach for South Africa is to assign multiple industries to a single product, or in other words, aggregate the industries until they link to products. This would reduce the number of industries represented and in effect, allow products and industries to link directly. Unfortunately, the disadvantage of this would be mixing industry input output structures and product technologies. Care must be taken when aggregating industries to make sure they are compatible, allowing effective linking toward products.

[45] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[46] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

When compiling an I-O table it is important to consider what the different assumptions offer and what disadvantages they hold. If SU-tables need to be aggregated into a square SU-framework, the grouping of various products and industries must be carefully considered not to invalidate the use of the assumptions used by the four models.

2.3 International experience in the development of input-output tables

The Eurostat manual provided the accepted recommendations for the compilation of I-O tables for member countries of the EU, but it focuses mostly on theoretical knowledge and approaches. This section will examine the country's experiences of Scotland and Turkey. While most countries would use the 1993 SNA (or the ESA 1995) as a guideline, each country experiences unique problems when compiling National Accounts, and this section aims to examine this.

2.3.1 The methodology used by Scotland

The Scottish Government uses a hybrid technology assumption for the compilation of Scottish I-O tables, which are currently for the years 1990 and 1995. They use a hybrid technology assumption that combines the industry technology assumption (Model B) and the product technology assumption (Model A)[47]. This allows either the compilation of a hybrid product-by-product I-O table.

There are a number of benefits to using a hybrid assumption, but the treatment of secondary and off-diagonal output is where the key advantage of a hybrid assumption can be seen. An example of this is given by the Scottish Government and it relates to animal feed which is produced as a by-product to the production of whiskey. In the example the distiller will only purchase the inputs required for whiskey. In other words, the input cost structure of the primary producing industry is whiskey production; however, animal feed is produced as a result. The animal feed's input cost structure in this example would clearly be different to that of animal feed that is produced in the animal feed's primary industry. Therefore, the industry technology assumption (Model B) must be used, as it assumes that each industry has its own specific way of production. The product technology assumption (Model A), which assumes each product is produced in its own specific way, is clearly incorrect in this example[48].

However, another example, which relates to the production of accommodation and restaurants output from the agricultural industry, shows how the product technology assumption (Model A) is better suited. Accommodation and restaurants will always require a different input cost structure when compared to the agricultural industry. For example, accommodation requires linen, detergents, food and specific tourist-related inputs, while the agricultural industry does not require these inputs. Therefore, the product technology assumption (Model A) must be employed. This will alter the cost input structure of the agricultural industry for accommodation and restaurants[49].

[47] The Scottish Government – Input-Output Methodology Guide, May 2011
[48] The Scottish Government – Input-Output Methodology Guide, May 2011
[49] The Scottish Government – Input-Output Methodology Guide, May 2011

The examples above clearly show how each different assumption has advantages under different conditions. The hybrid assumption combines both approaches, and as a result, allows the advantages of both Models A and B to be used. The basic compilation method for a hybrid assumption is to isolate subsidiary, by-products and joint production in two separate SU-tables, to apply the individual models to the respective SU-tables and combing the SU-tables tables back into a single one. From the recombined square use table, it is possible to form the I-O table[50].

2.3.2 The methodology used by Turkey

The Turkish State Planning Organisation first compiled I-O tables for the years 1959, 1963 and 1967. The first I-O table contained 15 producer industries, while the later two contained 37 industries[51]. The Turkish Statistical Institute compiled five subsequent I-O tables for the years 1968, 1973, 1979, 1985 and 1990.

The I-O tables for 1968 contained 50 industries and six final demand categories, while the remaining I-O tables were compiled for 64 industries. The I-O tables published by the Turkish Statistical Institute were published as six separate matrices[52]:

- I-O tables;
- Output-mix tables;
- Table of trade and transportation margins;
- Input-output coefficient matrix;
- Leontief inverse matrix; and
- Imports matrix

Initially Turkey, unlike Scotland, did not use a hybrid assumption. Instead, only the industry technology assumption (Model B) was utilised. This assumption favours situations where by-products or joint production is prevalent. However, the newer I-O table compilation for 1998 was compiled using both the product technology assumption and the industry technology structure for the product-by-product I-O table that was published[53].

[50] Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008
[51] Turkish Statistical Institute – Supply and Use Table and Input-Output Tables for Turkey, 2007
[52] Turkish Statistical Institute – Supply and Use Table and Input-Output Tables for Turkey, 2007
[53] Turkish Statistical Institute – Supply and Use Table and Input-Output Tables for Turkey, 2007

3. Compilation of South African input-output tables

Compilation of the draft I-O tables for South Africa has started in the 2011/2012 financial year. The compilation process is based on the methodology described in the Eurostat guideline, as well as countries' experiences. The process already undertaken, as well as future steps, will be described in this chapter. The compilation will focus on the conversion and transformation of SU-tables into I-O tables. This process is mathematical, and as a result, certain assumptions have to be made. This approach provides the most effective solution to the production of IO-tables for South Africa.

This chapter will explain how the South African draft I-O tables will be compiled, as well as how the I-O framework will function. The examples will not include any real data or figures, but rather provide a graphical representation of how the I-O system will work. The last section in this chapter will provide a brief description of the progress made on the I-O framework and on the compilation of I-O tables.

3.1 Methodology adopted for the compilation of input-output tables for South Africa

There are a number of conceptual requirements for both the SU-table framework and the I-O table framework. In Table 3 and Table 4 the main features of the ESA 1995 SU-table framework and I-O table framework were discussed. While conceptually very similar to the 1993 SNA, South Africa uses slightly different classifications and concepts. These different classifications and concepts are listed in Table 30 for the SU-table framework, while Table 31 shows the proposed main features of the I-O tables.

Table 30: The main features of the South African System of National Accounts 1993 supply and use tables

Supply tables		
	Industry classification	• Standard Industrial Classification of all Economic Activities (SIC) (5th edition)
	Product classification	• Central Product Classification (CPC) version 2
Intermediate use table		
	Industry classification	• Standard Industrial Classification of all Economic Activities (SIC) (5th edition)
	Product classification	• Central Product Classification (CPC) version 2
Final uses		
	Final consumption expenditure	• By households • By governments
	Gross capital formulation	• Gross fixed capital formation and valuables • Changes in inventories
	Exports	
Value added		
	Compensation of employees	
	Taxes less subsidies	
	Taxes on products	
	Subsidies on products	
	Other taxes on production	
	Other subsidies	
	Gross operating surplus	
Valuation		
	Supply table	• Basic prices including a transformation to purchasers' prices
	Use table	• Purchasers' prices
Statistical units		
	Local kind of activity units	

Source: Organisation for Economic Co-operation and Development – System of National Accounts 1993

Table 31: The main features of the proposed South African input and output framework

Kind of table		
	Product-by-product input and output table	
	Industry-by-industry input and output table	
Transformation method		
	Product technology assumption	
	Industry technology assumption	
	Fixed industry output structure assumption	
	Fixed product output structure assumption	
Classifications		
	Products	• Central Product Classification (CPC) version 2
	Industries	• Standard Industrial Classification of all Economic Activities (SIC) (5th edition)
Valuation		
	Basic prices	
Domestic outputs and imports[54]		
	Product-by-product input and output tables for domestic output and for imports	
	Industry-by-industry input and output tables for domestic output and for imports	

Source: Organisation for Economic Co-operation and Development – System of National Accounts 1993

The compilation of I-O tables using transformed SU-tables requires a number of fundamental steps:

- SU-tables need to be converted to square tables (while Model D allows for the transformation of rectangular SU-tables, the other models do not. South African SU-tables are rectangular, containing more industries than products, unlike examples cited in Eurostat);
- The square SU-tables need to be balanced without a discrepancy;
- The square use table must be converted to basic prices;
- Either Model A, B, C or D must then be mathematically applied across the square supply and use (at basic prices) tables; and
- The resulting use table needs to be balanced, resulting in an I-O table.

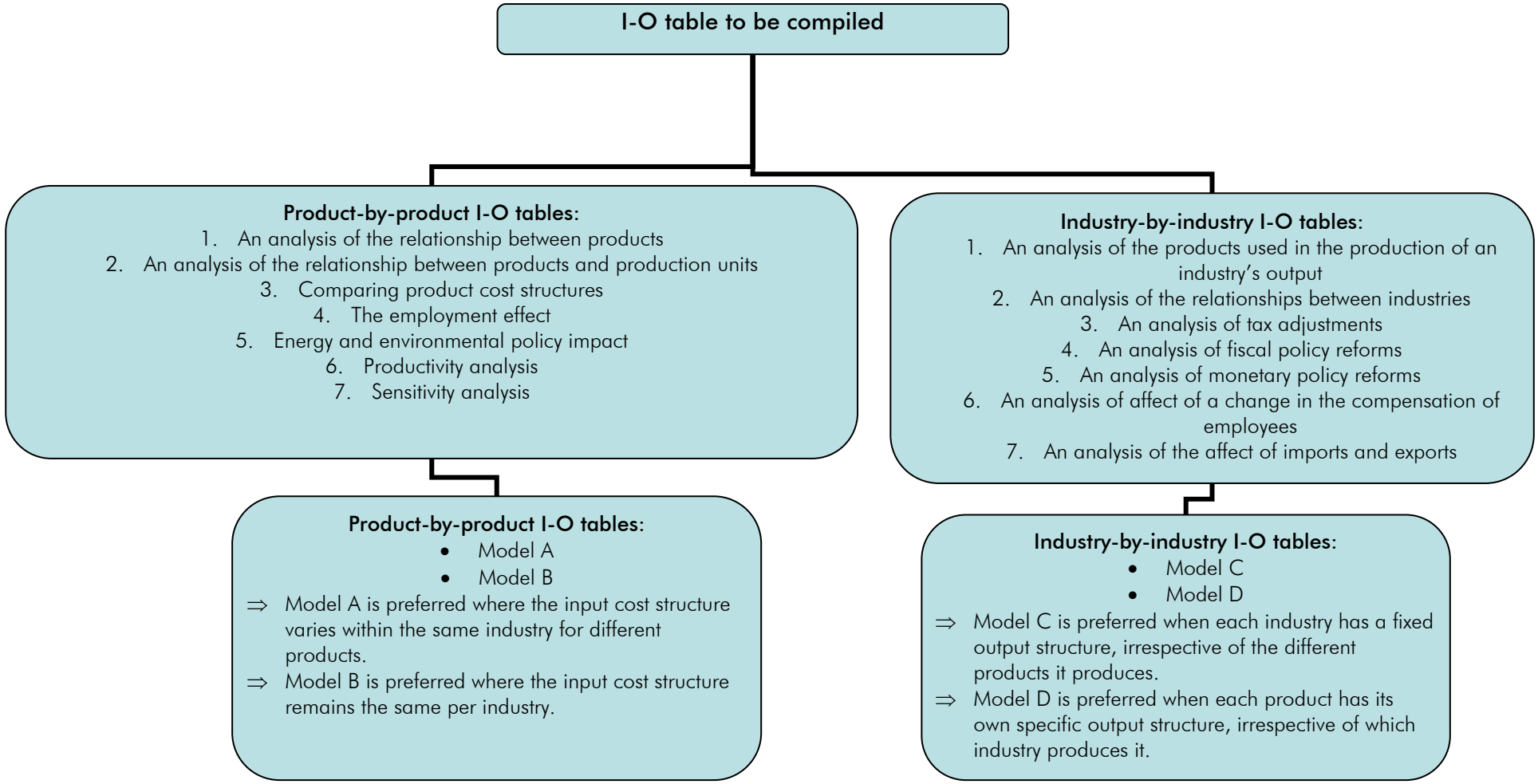
[54] Imports Input Output tables will be investigated in the future

Following the compilation of the I-O tables, both indirect and direct coefficients would need to be generated, as this would allow I-O tables to be fully utilised in an analytical capacity. The resulting analysis would be able to provide data on:

- The effects of fiscal policies (industry-by-industry I-O tables);
- The effects of taxation and subsidies on industries and the economy as a whole (industry-by-industry I-O tables); or
- It can provide details in product makeup (product-by-product I-O tables); and
- The cost structure of products (product-by-product I-O tables)

Figure 2 below is an example of a decision tree that would assist in deciding what type of I-O table should be produced:

Figure 2: A visual representation of the advantages of different input-output tables



According to Eurostat, Model A is preferred for the compilation of product-by-product I-O tables, as it is a more practical assumption of how industry operates. Eurostat prefers Model D for the compilation of industry-by-industry I-O tables, as it offers the most practical solution, considering most products feature their own specific output structures, irrespective of producing industry. This does not imply Models B and C are to be disregarded. There are industries and products that would meet the assumptions made under those models. The decision regarding which model is preferable is based on:

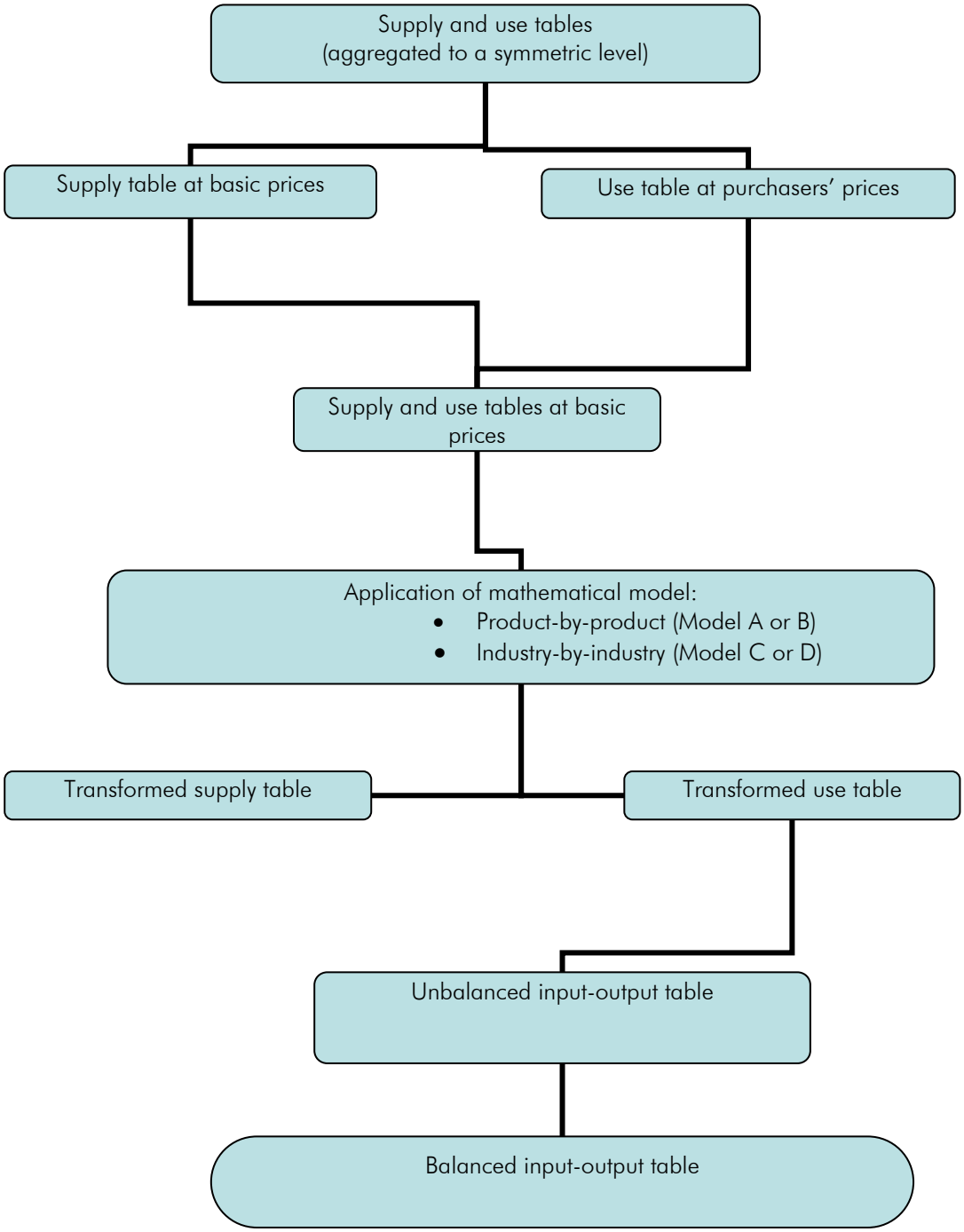
- The type of I-O table; and
- The model which best fits the available data and SU-table data structure.

In a practical context different industries fit the models differently, and in an economy there are different structures of industries and products. This makes choosing an appropriate model difficult, as it is unlikely that a perfect fit will ever exist. Another possibility is producing an I-O table using a mixture of the two models, a hybrid design. Although Eurostat supports this approach, it is, however, the most data-intensive approach compared to a single model.

The compilation of South African I-O tables is an experimental draft compilation, using the theoretical backdrop sanctioned by Eurostat. As a result of it being based on a mathematical model, a number of assumptions need to be made during the process. Assumptions are made where there is a lack of data of the required detail. To produce an accurate portrayal of the economy, the different models will be examined and the model requiring the least assumptions will be further developed.

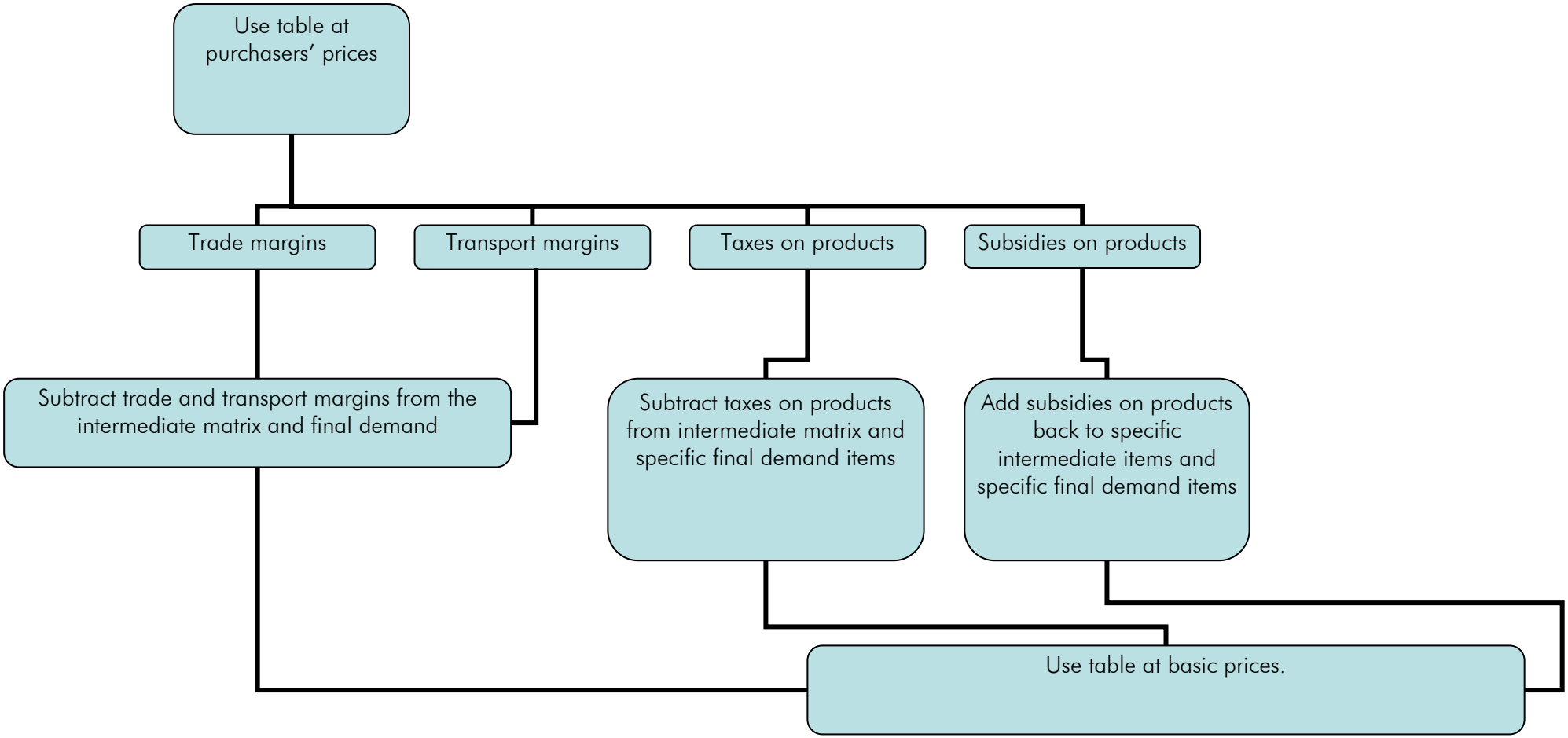
To develop and compile I-O tables for South Africa, development of an I-O framework is required. The I-O framework will ultimately directly link with the SU-tables and allow for the compilation of I-O tables on an annual basis. Figure 3 below is a representative diagram of the compilation process for an I-O table (it will outline the core functions of the I-O framework).

Figure 3: A visual representation of the input-output table compilation process



The use table is published at purchasers' prices, while an I-O table is published at basic prices. To begin the mathematical application of the four I-O models, the use table will need to be converted into basic prices. Figure 4 below details the process of converting the use table into basic prices.

Figure 4: A visual representation of converting the use table to basic prices



The use table at basic prices forms the basis for the transformation model to be applied. The I-O framework being developed has three stages:

- The conversion of the use table into basic prices;
- The application of one of the four models; and
- The balancing of the unbalanced I-O table (the converted use table).

The application of the various models will be undertaken primarily as a computational step. The models are effectively formulas applied in slightly different ways to the supply tables, which shows the transfer of output to or from various industries. This transfer is then distributed into the use table. The distribution's structure is what varies per model. This is a purely application or computational process.

The unbalanced I-O tables will be checked for consistency and correctness. There is a possibility that negative numbers can occur with Models A and C. There are a number of reasons for negative numbers occurring, including data weakness or the incorrect model being applied. It is also possible that negative numbers occur purely because of the physical approach undertaken by the specific models. If this occurs, the negative numbers need to be addressed. One possible solution is to utilise a model better suited to data available, or better suited to the industry or product structures.

Once the unbalanced I-O tables have been completed, and there are no negative numbers present, I-O tables will be balanced using the bi-proportional matrix balancing (RAS) procedure. The use table will now represent a balanced symmetric I-O table (either product-by-product or industry-by-industry). This I-O table will then be used to generate indirect and direct coefficients for use in analytical functions.

3.2 Current progress of the compilation of input-output tables for South Africa

The compilation of the draft I-O tables for South Africa has started[55] with the construction of the I-O framework. The framework has been constructed with the intention of allowing future (and backdated) I-O tables to be produced to allow for a time series to be created.

Currently[56], the draft I-O table for South Africa will be based on the 2009 SU-tables. The SU-tables will be aggregated to 51 industries by 51 products (from the original 171 industries and 104 products). The reason for the aggregation is to allow for the formation of symmetric SU-tables, which is a requirement for the compilation of I-O tables. The aggregation to a 51 by 51 matrix is also the result of the classification systems used in SU-tables. The products are classified according to the CPC (version 2), whereas the industries are classified according to SIC (5th edition). These two classifications do not link completely, unlike the CPC (version 2) and the International Standard Industrial Classification of all Economic Activities (ISIC), 4th revision.

[55] September 2011
[56] February 2012

Another reason I-O tables were chosen to be 51 by 51 units[57] in size was to allow for the experimental nature of the project. The last time I-O tables were published in South Africa was in 1995 for the 1993 reference year. There have been some technological and methodological changes since then; not only within the compilation of I-O tables themselves, but also within the industries and products that are measured. Care was taken to properly research the project and ensure the data quality and integrity of I-O tables as a product.

Currently[58], the production of all four I-O table models will be undertaken (two product-by-product I-O tables and two industry-by-industry I-O tables will be produced). The production of all four I-O table models will test the data strength of the SU-tables. This approach will also allow an examination of whether or not there is sufficient data available for the publication of product-by-product I-O tables. If the compilation of the two product-by-product I-O tables requires too many assumptions to produce the I-O tables, then the product-by-product I-O tables will not be published. When too many assumptions are used, it will breakdown the quality of the I-O table and any resulting analysis using that I-O table would not be reliable.

Therefore, publication of the I-O tables depends entirely on the data quality of the produced I-O tables. The transformation of the use table (at basic prices) into an unbalanced I-O table is fundamentally computational in nature, and because of this there are possibilities the data, once exposed to the various models, will not maintain its strength and integrity.

This implies that only I-O tables where data integrity is maintained will be published. The goal is to use the least amount of assumptions. The non-published I-O tables may serve to demonstrate weaknesses in the data available. They will be used internally as a test to improve data. The goal of this project is to release a useable I-O table through the conversion of SU-tables, and this goal dictates which I-O tables and which models will be published.

If data is available, a long-term goal will be to include the creation of hybrid I-O tables; this would allow a more accurate reflection of the economy by reducing the number of assumptions required. Improvements in data availability might eventually allow the publishing of I-O tables which may be based on bigger matrices. At this stage[59], the focus is ensuring a smaller, but more meaningful and useable product.

The current timeframe suggests that an experimental I-O table will be published in the 2013 financial year. The success of this timeframe depends on a number of factors to ensure the data quality of the product; it is therefore an estimated timeframe. The current focus[60] is to first publish an industry-by-industry I-O table, and then to analyse the quality of the product-by-product I-O tables for publication.

[57] For an industry-by-industry I-O table these would be industries, and for a product-by-product I-O table these would be products
[58] February 2012
[59] February 2012
[60] February 2012

4. Conclusion and way forward

The I-O framework is an important part of the National Accounts setup. It completes the SU-table framework by offering an alternative approach to display information contained within SU-tables. Furthermore, I-O tables offer extensive analytical ability in both the product-by-product and industry-by-industry frameworks.

Industry–by-industry I-O tables allow for analysis that aims to examine:

- Tax structures and reforms;
- The affect of a change in compensation of employees;
- The effects of fiscal policy; and
- The effect of monetary policy.

Product-by-product I-O tables allow for analysis that aims to:

- Compare cost structures;
- Examine employment effect;
- Examine energy policies; and
- Examine the impact of environmental policy.

The I-O tables offer a more complete National Accounts framework. They also test and reveal any weaknesses in SU-tables data; this in itself is a useful tool. Despite their benefits, many countries have not undertaken I-O tables, as they can be costly and data intensive; and in the 1993 SNA, they are not regarded as a requirement to the National Accounts. South Africa published I-O tables in 1995 for the 1993 reference year, but these where discontinued in favour of further developing SU-tables. SU-tables offer substantial flexibility in statistical measurement, as well as analytical function and they are also less data intensive. Therefore, most countries will focus on compiling SU-tables only, which are seen as more essential than I-O tables.

Since I-O tables offer advantages that improve the quality of the National Accounts framework, it is recommended that I-O tables be compiled, provided that the data is available. The most important step is converting the use table back to basic prices from purchasers' prices. This step requires additional data, as well as making certain assumptions. Based on the current data availability in South Africa, it is possible to perform this conversion. Once the use table has been converted back the basic prices, the transformation of SU-tables into I-O tables is mostly mathematical.

Due to data availability, as well as the SIC and CPC classifications (which are used in South Africa) not directly linking products and industries, assumptions affecting the quality and accuracy of I-O tables will need to be made. However, where possible, a minimum set of assumptions will be made. At this stage[61] the focus will first be on the completion of the I-O framework which allows for the compilation of I-O tables. An industry-by-industry I-O table will be compiled first using either Model C or D, depending on which model stays truest to the data sources and uses the least assumptions. Following this, product–by-product I-O tables will be compiled, but publication of such tables is dependent on whether the assumptions required have affected the data quality and integrity.

[61] February 2012

The recommended way forward for Stats SA in the development of the I-O table framework is as follows:

1. Compilation of the I-O framework and linking it to the SU-tables[62]. This will consist of five major steps:
   1.1 Converting the SU-tables into balanced square SU-tables without a discrepancy;
   1.2 Converting the use table back to basic prices;
      1.1.1 Research will be conducted for the treatment of taxes on products and subsidies; and how to distribute them within the use table; and
      1.1.2 Research into import trade margins will also be conducted.
   1.3 Transformation of the SU-tables into an I-O table (this is a mathematical step);
   1.4 Balancing the transformed use table to produce the balance I-O table; and
   1.5 The creation of direct and indirect coefficient tables.
2. Identify data gaps within the I-O framework, and address the data issues to successfully compile the draft I-O tables[63]; and
3. Conduct a data audit to determine which of the required data is available that will further improve the quality of I-O tables. This step would include an audit of internal and external data, such as[64]:
   1. South African Revenue Service (SARS) data for imports and exports of goods;
   2. South African Reserve Bank (SARB) data for the imports and exports of services;
   3. VAT data along with other taxes on product data;
   4. Transport margins per product;
   5. Trade margins data per product; and
   6. Subsidies on product data.

The I-O framework is currently[65] being developed by Stats SA and an experimental I-O table is being created based on a symmetric 51 industry by 51 products SU-table for the 2009 reference year. During the development of the I-O tables, various data gaps were determined and investigated. Where possible, assumptions will be used to compensate for the data shortages.

The development of the I-O framework will fulfil the recommended way forward and will apply the Eurostat guidelines and recommendations to the compilation of I-O tables for South Africa. The framework will be improved as data quality and availability improves. The recommendation for Stats SA is to initially develop industry-by-industry I-O tables, but while Model C is favoured due to data availability, model D will also be investigated, as this is the international preferred approach.

In the long term, a hybrid assumption approach might be undertaken, combining Models C and D. This might only be possible if South Africa adopts a classification system based on ISIC (4th revision) instead of the currently used SIC (5th edition). Under the ISIC, industries link more directly to products using the CPC and this allows for a more efficient symmetrical aggregation. Splitting SU-tables into industries and products that fit the various I-O table models most accurately would also be more effective than is currently the case.

[62] This is currently underway, as of September 2011
[63] This is currently underway, as of September 2011
[64] This is currently underway, as of September 2011
[65] This is currently under development, as of September 2011

Developing I-O tables represents an analytical step forward. SU-tables can provide detailed analysis of the economy, but I-O tables can allow for the use of multipliers. Multipliers, such as the value added multiplier or a tax multiplier, are effective in sensitivity analysis demonstrating the effects of changes in a particular value, such as tax on a particular industry or on the economy as a whole. An industry-by-industry I-O table can therefore provide a more detailed analysis of current and proposed fiscal and monetary policies than a SU-table can, while a product-by-product I-O table can provide a detailed analysis of production units, cost structures, employment and even environmental and energy policy impacts.

Stats SA welcomes any feedback on this discussion document. Any comments and/or suggestions can be sent to Kevin Geddes (KevinG@statssa.gov.za) by 31 July 2012.

5. Glossary

Basic prices

The basic price is the amount receivable by the producer from the purchaser for a unit of a good or service as output minus any tax payable, and plus any subsidy receivable by the producer as a consequence of its production or sale. It excludes any transport charges invoiced separately by the producer.

Gross domestic product

The total value of goods and services produced within the geographic boundaries of a country for a specified period of time.

Gross fixed capital formation

Shows the acquisition less disposal of produced assets for purposes of fixed capital formation, inventories or valuables.

Household final consumption expenditure

Includes all consumption expenditure made by households from their own cash resources (including all income in cash received), as well as all the counterpart of income in kind (except social transfers in kind) that those households might have received, such as remuneration in kind and other transfers in kind. Note: It also includes the value of all consumption of output for own final use, such as those provided by second homes on own account used for tourism purposes or what it has received through barter transactions.

Industry

Groups of establishments engaged in the same or similar kinds of activity. Note: The definition of industries is based on the 1993 SNA and is in line with that contained in the Standard Industrial Classification of all Economic Activities, Fifth Edition, Report No. 09-90-02 of January 1993 (SIC).

Institutional unit

An institutional unit is an economic entity that is capable, in its own right, of owning assets, incurring liabilities and engaging in economic activities and in transactions with other entities

Intermediate consumption

Intermediate consumption consists of the value of the goods and services consumed as inputs by a process of production, excluding fixed assets. Consumption of fixed assets is recorded as consumption of fixed capital.

International Standard Industrial Classification

The United Nation's version of a classification system used to classify businesses according to their economic activity.

Kind of activity unit

An enterprise, or part of an enterprise, that engages in only one kind of productive activity, or in which the principal productive activity accounts for most of the value added.

National accounts

Serves as a framework for statistical systems. It also serves as a point of reference in establishing standards for related statistics. The internationally agreed framework that guides the compilation of national accounts is contained in the 1993 SNA.

Production

A process, carried out under the responsibility, control and management of an institutional unit, in which labour and assets are used to transform inputs of goods and services into outputs of other goods and services. All goods and services produced as outputs must be of such a nature that they can be sold on markets, or at least be capable of being provided by one unit to another, with or without charge.

Purchaser's price

The purchaser's price is the amount paid by the purchaser, excluding any VAT or similar tax deductible by the purchaser, in order to take delivery of a unit of a good or a service at the time and place required by the purchaser. The purchaser's price of a good includes any transport charges paid separately by the purchaser to take delivery at the required time and place.

Standard Industrial Classification

A South African version of a classification coding system used to classify an enterprise according to its economic activity. Note: It is based on the United Nations' ISIC with a number of adaptations for local conditions.

System of national accounts

An internationally-agreed standard system for macro-economic accounts. The latest version is described in the System of National Accounts 1993.

6. References

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Annexure 1

The SU-tables used in the I-O table compilation examples are based on a simplified SU framework used by Eurostat. For illustrative purposes, the Eurostat simplified SU-tables' layout provides a concise and understandable view of the underlying mathematical transformations. South Africa's SU-tables use a different layout than used in this discussion document. I-O tables for South Africa will be based on South African SU-tables; therefore, they will reflect a similar layout. The Eurostat simplified SU-tables are used as examples, due to their ease of use.

Annexure 1 shows the conversion of South Africa SU-tables to the Eurostat simplified SU framework and then subsequently, the conversion to the simplified SU tables used throughout this discussion document. SU-tables used in this annexure are based on the condensed SU-tables released for the 2005 reference year. It must be considered that, due to the simplification process, detail is lost; this will not affect the compilation of I-O tables, but only the examples used in this document. Tables 32 and 33 show the condensed SU-tables.

Table 32: The condensed 2005 supply table

Supply of products	Total supply at purchaser's prices	Taxes less subsidies on products	Trade and transport margins	Total supply at basic prices	Primary industry	Secondary industry	Tertiary industry	Total industry	Imports	cif/fob adjust-ment on imports
Primary products	360 455	8 594	16 955	334 906	265 907	14 435	0	280 342	54 564	
Secondary products	1 789 661	115 837	262 738	1 411 086	1 028	1 094 161	4 422	1 099 611	311 475	
Tertiary products	1 683 512	45 584	(279 693)	1 917 621	7 084	133 492	1 727 622	1 868 198	77 242	(27 819)
cif/fob adjust-ment on imports	0			0					(27 819)	27 819
Direct purchases residents	22 097			22 097					22 097	
Total	3 855 725	170 015	0	3 685 710	274 019	1 242 088	1 732 044	3 248 151	437 559	0

Source: Statistics South Africa – Final Supply and Use tables, 2005

Table 33: The condensed 2005 use table

Supply of products	Total supply at purchaser' prices	Taxes on products	Subsidies on products	Primary industry	Secondary industry	Tertiary industry	Total industry	Total economy	Components of final demand
Primary products	360 455			6 331	181 738	3 261	191 330		169 125
Secondary products	1 789 661			68 784	514 523	244 395	827 702		961 959
Tertiary products	1 683 512			55 510	215 158	557 384	828 052		855 460
Direct purchases residents	22 097								22 097
Direct purchasers non residents	0								0
Total uses at purchasers' prices	3 855 725			130 625	911 419	805 040	1 847 084		2 008 641
Gross value added/GDP		170 015		143 394	330 669	927 004	1 401 067	1 571 082	
Total output at basic prices				274 019	1 242 088	1 732 044	3 248 151		

Source: Statistics South Africa – Final Supply and Use tables, 2005

Table 34 below shows the Eurostat simplified SU framework. This framework represents the supply and use in a single table. In this framework the production matrix is transposed, along with the imports column.

Table 34: The Eurostat supply and use framework table

		Products			Industries			Final demand	Total
		Primary products	Secondary products	Tertiary products	Primary industry	Secondary industry	Tertiary industry	Components of final demand	
Products	Primary products				6 331	181 738	3 261	169 125	360 455
	Secondary products				68 784	514 523	244 395	961 959	1 789 661
	Tertiary products				55 510	215 158	557 384	877 557[66]	1 705 609
Industries	Primary industry	265 907	1 028	7 084					274 019
	Secondary industry	14 435	1 094 161	133 492					1 242 088
	Tertiary industry	0	4 422	1 727 622					1 732 044
Value added					143 394	330 669	927 004		
Imports		54 564	311 475	49 423[67]					
Total		334 906	1 411 086	1 917 621	274 019	1 242 088	1 732 044	2 008 641	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

[66] Contains direct purchases of residents, research from the TSA indicates most expenditure is tertiary in nature
[67] Calculated as imports of 77 242 minus c.i.f. adjustment of -27819

Table 35 below shows the simplified SU-tables used throughout this discussion document; there is detail loss as a result of the simplification progress. This is not a problem, due to the illustrative nature of the tables used for the compilation examples. The simplified SU-tables will not be used within the I-O framework currently being constructed by Stats SA. However, the mathematical approaches to the transformation of SU-tables used by Eurostat will be followed. In Table 35, the calculation of `wages and salaries', along with `operating surplus,' used industry averages of the industries within the aggregated sectors. It is for illustrative purposes for this example.

Table 35: The simplified combined supply and use table

	Use					Supply			
	Primary industry	Secondary industry	Tertiary industry	Components of final demand	Total	Primary industry	Secondary industry	Tertiary industry	Total
Primary products	6 331	181 738	3 261	169 125	360 455	265 907	14 435	0	280 342
Secondary products	68 784	514 523	244 395	961 959	1 789 661	1 028	1 094 161	4 422	1 099 611
Tertiary products	55 510	215 158	557 384	877 557[68]	1 705 609	7 084	133 492	1 727 622	1 868 198
Wages and salaries	52 124	149 926	528 207						
Operating surplus[69]	91 270	180 743	398 797						
Total	274 019	1 242 088	1 732 044			274 019	1 242 088	1 732 044	

Source: Eurostat – Eurostat Manual of Supply, Use and Input-Output Tables, 2008

[68] Contains direct purchases of residents, research from the Tourism Satellite Account indicates most expenditure is tertiary in nature
[69] Net Taxes and Subsidies on production are included within Operating Surplus for the purpose of this example