Current use of input output analysis in SEEA – a survey

Report to the 25th London group, Melbourne Australia 2019

SCB OECD BETTER POLICIES FOR BETTER LIVES

Summary

The survey results presented in this report speak in general to the wide variety of experience with environmentally extended input-output (EEIO) analysis amongst the respondents and the EEIO community at large. The respondents were supportive of creating a platform for sharing experiences and discuss methodology.

The respondents were also in agreement that the statistical community and organisations working with the use of the data should step up efforts in communicating the results and how the data can be used.

Examples arising from the survey where knowledge and experience sharing could give mutual benefit to all partners include (but are not limited to):

- Coverage of domestic final consumption and international trade
- Compilation of regional analyses
- Inclusion of new different environmental and social variables
- Inclusion of EEIO results in official statistics
- Initiatives for wider communication and uptake of EEIO analysis

Discussion items for the London group:

A pool of experts

There is a well-established community of input-output experts in the International Input-Output Association[1]. To tap into their knowledge would be beneficial, especially since many of the statistical offices are institutional members there. To create a pool of experts – not only on IO matters but the extension to environmental issues – could open up opportunities for global cooperation. A smaller pool of experts could be to organise the London group members into a virtual group where questions and answers can be sent.

Identifying technical issues to work with

The survey has visualised that the environmental impacts analysed through input-output technique varies, from air emissions, to land, to tourism. The underlying input-output technique may also differ – in terms of level of details of products/industries, level of output aggregates (final demand from households, public sector, investments etc). Another issue of discussion is the connection to the environmental impact.

Identifying communication aspects and impacts of policy demands on data

The survey was very clear that the results published and data produced were in need of further enhancements and improvements.

As the respondents of the survey was a good mix of both producers of the data and users of the data several aspects were identified. This could e.g. be to finding out more on how others talk and discuss outcomes of the data, to look into the impacts of policy demands on more data and find common pathways to spread the word of the data.

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[1] https://www.iioa.org/

Introduction

Environmentally extended input output (EEIO) analysis has been used for at least 50 years at national statistical offices and in research as a way to understand the environmental pressures caused by economic activities[2]. The relevance of the approach in the context of the System of Environmental and Economic Accounts (SEEA) has previously been presented in the SEEA 2012 – Applications and Extensions companion document to the SEEA Central Framework[3].

This document offers a summary of the most common applications and extensions, including a brief chapter on EEIO tables and techniques for IO analysis. The description of the EEIO tables is minimal with a list of remaining measurement issues. The description of the method is largely technical in nature and provides little inspiration. There is room for improvement. Further investigation into the value of EEIO analysis for the statistical community is needed. In addition, through the statistical community's activities related to EEIO so far, compilation and communication challenges have been identified. An initial step towards addressing these concerns is to survey the current use of EEIO amongst statistical offices and research groups worldwide, collecting the experience of these stakeholders with communicating EEIO results as well as dealing with methodological issues.

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Aim

The aim of this current survey is to take stock of the work done on EEIO analysis in the framework of the SEEA globally, to identify common problems and areas of improvement. The results of the survey will be presented as part of the London Group meeting in Melbourne, Australia in the autumn of 2019, to find common grounds and discuss methodological and communication needs. The ultimate aim is to enhance the use of EEIO analysis by the statistical community.

The London Group will also discuss the next steps of this initiative. One idea is to create a discussion forum on EEIO for the statistical community to exchange experience and ideas. In the long run the plan is to produce a joint report with those participants working in the area to raise the awareness the data, visualisation of it and enhance the understanding of it.

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[2] http://www.rutgerhoekstra.com/eio/

[3] https://seea.un.org/sites/seea.un.org/files/ae_final_en.pdf

Method

An online survey was developed by Statistics Sweden, Eurostat and the OECD considering such issues as current use of IO-analyses, coverage (in terms of environmental and other such indicators), sub-national regionalization of analyses, type of data used, communication of results and areas of improvement for communication. The questions in the survey are presented in Appendix 1 and the answers in a separate excel sheet to this report. As shown in appendix 1, the questions themselves were intentionally open-ended, offering respondents the chance to enter answers as free text.

The target group for the survey was statistical offices, researchers and international organizations working with environmental economic accounts through the London Group.

The survey was sent by email to the target group on 3rd July 2019. A reminder about the survey was sent on 20th August 2019.

In general, analyses of responses were performed to identify areas of common experience amongst respondents as well as to record areas where experiences and practices differ in order to facilitate knowledge sharing. Results of the analyses are presented in the section below in this report. Respondents' unedited answers (referred to in continuation as microdata) are presented in a companion excel file to this report.

Results

Response rate

A total of fourteen responses were received. The names of responding organizations are given in Table 1 below.

Table 1: List of stakeholders responding to survey.

Statistics Sweden
World Bank
Statistics Netherlands
Statistics Finland
Istat (Instituto Nazionale di Statistica, Italy)
Stats NZ (New Zealand)
UNSW Sydney (The University of New South Wales, Sydney, Australia)
European Environment Agency (EEA)
Inter-American Development Bank (IADB)
National Bureau of Statistics, P.R.China
Statistics Canada
Ministry for an ecological and solidary transition, Office of the Commissioner-General for Sustainable Development, Data and Statistical Studies Department, France (termed further in this report as "Sustainable Development France")
Central Bank of Costa Rica (CB Costa Rica)
Eurostat

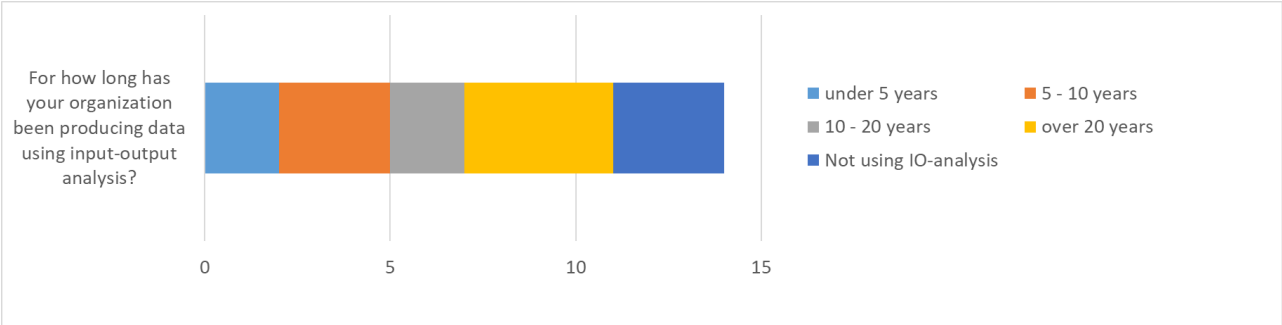## Producing IO-analysis by respondents (Question 1)

Figure 1: Number of responding agencies using IO analysis to produce data and the length of time they have been doing it.

Amongst respondents, only three answered that they were not currently producing IO-analysis. For Statistics Finland and Istat (Italy) this is due to the fact that no resources are allocated for IO analysis and for National Bureau of Statistics (P.R. China) this is because it is not the bureau's responsibility. According to the survey response, a condition for beginning to produce IO analysis at Statistics Finland is to obtain external financing for the work. Meanwhile for Istat whilst the respondent indicated enthusiasm in the organisation for IO analysis, this was not matched by any formal plans to start using it. The respondent for

National Bureau of Statistics (P.R. China) said that it was not a matter s/he could make a decision on.

Areas covered (Question 1)

Table 2: Responses to question " If yes - what areas do you cover (e.g. air emissions, land, social, etc?). Are you planning to extend your portfolio with other areas in the coming three years?"

	Total respondents	...of which planned/pilot	Respondent (if only one)
GHG emissions	5	1	
Air emissions	3		
Land use, land cover	4	2	
Water (water footprint, water use etc.)	4	1	
Material	4		
Energy	2	1	
Forest	2		
Tourism	2	1	
Agriculture	1		IADB
Environmental pressures and impacts	1		EEA
Marine economy	1		Stats NZ
Indirect contribution to GDP	1		Stats NZ
Social accounting matrix	1		CB of Costa Rica

Table 2 shows the range of areas covered by the IO analyses carried out by respondents. Greenhouse gas emissions is most prevalent, with a total of 5 respondents specifically mentioning it (and others mentioning air emissions in general, presumably also covering GHG emissions). Meanwhile land-, water-, material- and forest-related parameters are also considered by multiple respondents. The breadth of areas considered amongst respondents is demonstrated by areas covered by only one respondent (please see Table 2).

An observation about responses to the question about areas considered is that only 3 of the eleven respondents explicitly identified areas that are not included in current work, but rather planned (as also borne out in the data shown in Table 2).

Of respondents that enumerated more specific areas where IO analysis was used, they indicated between 3 and 5 areas. Other respondents noted broad areas such as "air emissions" or " simply "environmental pressures and impacts". See Table 2 and response microdata for more information about the specific coverage of specific partners.
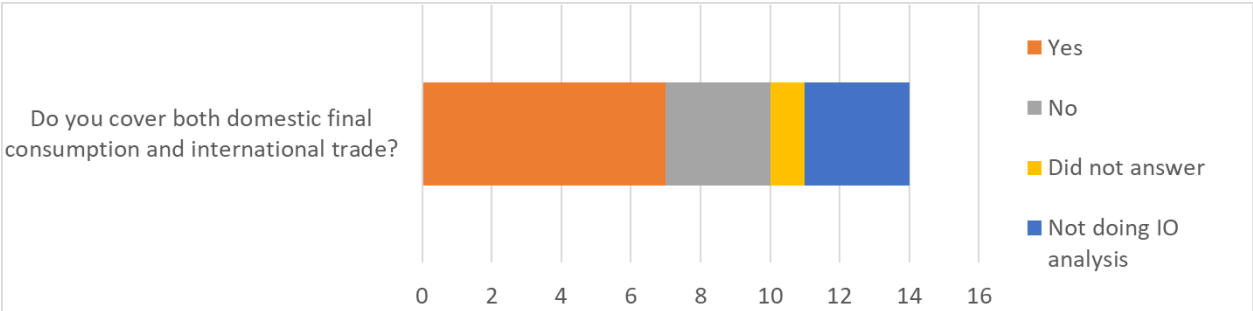
Coverage of approach (Question 2)

Figure 2: Responses to question "do you cover both domestic final consumption and international trade?"

Amongst those covering both domestic final consumption and international trade (see also Figure 2), the following methods are used: MRIO approaches (UNSW Sydney, EEA and Statistics Netherlands), hybrid approaches (World Bank, Statistics Sweden and Eurostat), SRIO (Statistics Netherlands and Eurostat). IADB note that they integrate SEEA accounts into a CGE. In France, a model called Avionic has been developed to estimate imports and conduct further analysis on the data. Meanwhile, amongst those answering no to the same question, Statistics NZ note that they aim to cover "indirect industry contributions" and Statistics Canada note that they cover "domestic consumption".

Data sources (Question 3)

Major data sources used according to respondents include:

- **National statistics** (IO tables and environmental accounts broadly)
- **Eurostat** (noted by EEA and Sustainable Development France)
- **Exiobase** (noted by EEA and Statistics Sweden)
- **Other data sources:** such as IEA (Sustainable Development France)

More information is given in the table below:

Table 3: Edited responses to question "what are your data sources? (E.g. do you use existing statistics or existing tools?)"

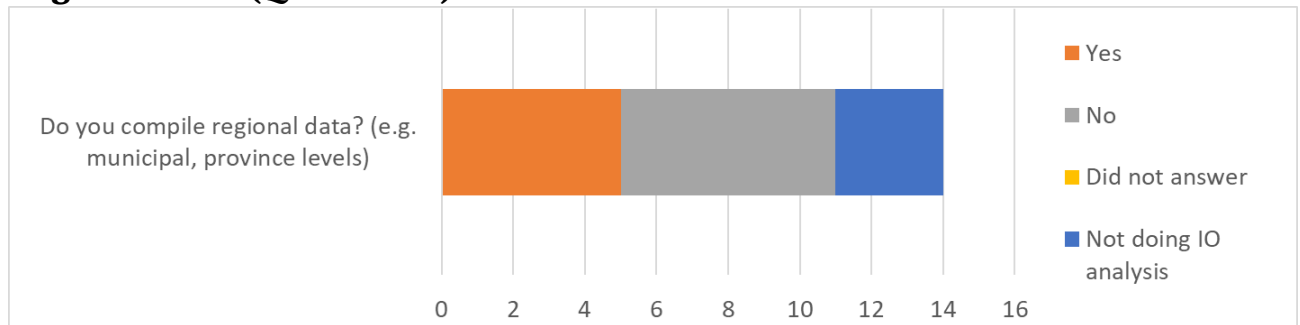| What are your data sources? (E.g. do you use existing Statistics or existing Tools?)	
Statistics Sweden	Exiobase and national IO tables, national air emissions data, national balance of payments
World Bank	SEEA like data
Statistics Netherlands	environmental accounts, IO tables
Statistics NZ	National accounts input output tables; SAS processing
UNSW Sydney, Austraila	Mostly national statistics from the Australian Bureau of Statistics.
European Environment Agency	We use Exiobase v3 and Eurostat and national statistics
Inter-American Development Bank	National statistics
Statistics Canada	Existing statistics (physical flow accounts for energy use, GHG emissions, and water use), which are integrated with the supply and use tables using an in-house IO model.
Sustainable Development France	National statistical office, Eurostat, IEA, custom statistics.
Central Bank of Costa Rica	National accounts, Balance of Payments, International Trade registries, Household Expenditure And Income Survey
Eurostat	EU-wide data on air emissions, material flows, EU-wide data from input-output tables,

Regional data (Question 4)

Figure 3: Responses to question "Do you compile regional data? (e.g. municipal, province levels)"

Figure 3 shows responses to the question about regional data. Comments were not sought on this question. Statistics Canada (who answered yes to this question) noted however that they were in the initial stages of gathering regional data. Also in Sweden, a first attempt at regional environmentally extended input-output analysis has been made in cooperation with Sydney University[4].

Publishing methods (Question 5)

The national statistical offices and international organisations responding in the survey identified:

- Public reports
- Databases
- Tables

as the main forms of publishing for them.

In addition, UNSW Sydney and the IADB noted publications in peer-reviewed scientific journals as has Statistics Sweden. The World Bank noted that results were published first in internal reports and databases, to feed into policy documents. Eurostat uses online articles to present its statistical products, including input-output results. Further examples of publishing methods, including links, are given in the microdata.

Terminology used in publication (Question 6)

The following terminology use was noted by respondents:

- **National accounts terminology** (seven out of eleven actively using IO analysis), with some of these also referring to industrial and commodity classification systems used
- **The term "footprint"** was mentioned by two respondents, where the EEA noted that "footprint" was used to describe calculated indicators and for communication. Sustainable Development France noted that at first they had avoided the use of the term "footprint" in order to avoid possible confusion, but finally adopted it (for all impact areas considered, e.g. carbon, material flows, water) in light of the fact that it was becoming a more widely used term.

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[4] The results were presented at the 27th International Input-Output Association Conference.

- **Scientific/academic terminology:** noted by UNSW Sydney, Inter-American Development Bank and Eurostat.

Finally, as shown in greater detail in microdata, respondents also referred to a variety of other terminological backgrounds, e.g. **tourism satellite account** (Statistics NZ), **CGE, IEEM, SEEA, natural capital accounting, ecosystem services analysis** (Inter-American Development Bank). World Bank noted the need to adapt terminology dependent on the policy application in question and conventions used in different countries. Eurostat mentioned the use of terminology developed in-house.

Description of limitations and uncertainty arising in IO analysis (Question 7)

According to survey responses, limitations and uncertainty are considered in:

- **Statistical documentation**, noted by Statistics NZ, Statistics Canada and EEA, e.g. sections on quality evaluation and data accuracy (Statistics Canada) or rationale for choice of model, statistical metadata and quality profile documents (EEA). EEA goes further to note that an important limitation for them to stress is that their analyses *not* be applied as follow up on policy progress on climate, rather as a way to analyse structure, drivers and policy implications to enable a more complete understanding.
- **Standard deviations -** UNSW Sydney note that each point in the IELab is given a standard deviation,

Sustainable Development France noted that a methodological investigation is planned for the future, but that the degree of uncertainty is not currently assessed. Eurostat mentioned that the uncertainty is only described qualitatively. World Bank pointed out that the method is limited in terms of potential for long-term forecasting. At Statistics Sweden the data will become official statistics by autumn 2019 which will mean that regular quality documentation and metadata has to be provided in a way that has not been done previously.

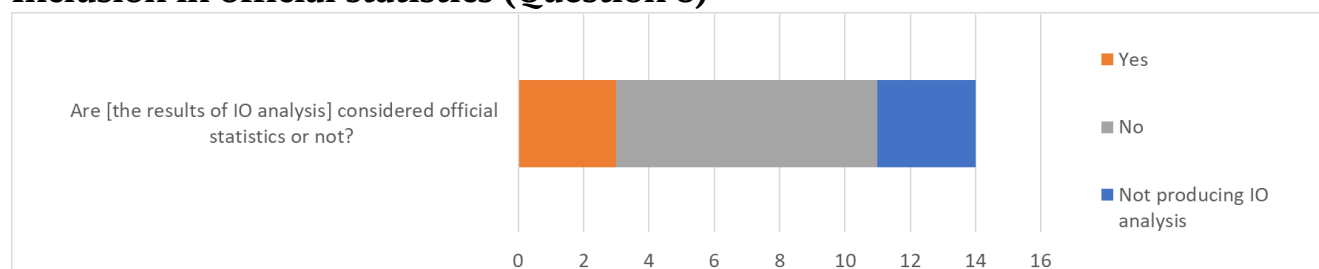## Inclusion in official statistics (Question 8)

Figure 4: Responses to question "are [the results of IO analysis] considered official statistics or not?"

Figure 4 shows responses to the question about inclusion in official statistics. Three respondents say that the data published are considered official statistics. As noted Statistics Sweden will include the published data in the family of official statistics by autumn 2019.

The majority does not consider the data to be official statistics. The international organisations use the data to undertake scenario analysis and to discuss the issues of broader development. Eurostat – as one of the producers of the data describe the data as results from modelling.

Does the analytical nature of the results affect how you present them? (Question 8)

World Bank noted that results are presented as a part of broader development questions, and Statistics Canada notes that whilst IO analysis results are presented in the same way as the main physical flow accounts, specific explanations are included in publications in order to explain to users how to interpret the results. Meanwhile, Sustainable Development France describe an evolution of the way that results are presented: Initially, carbon footprint (interpreted as IO results) was presented together with (and complementary to) the national GHG inventory. More recently, the IO-derived carbon footprint is included amongst the 10 indicators complementary to GDP that are reported annually to the Prime Minister. The IO-derived carbon footprint is also included in the 100 indicators charting progress on the French sustainable development goals.

Adjusting communication to the target audience (Question 9)

Two respondents (Statistics NZ and Central Bank of Costa Rica) noted that they did not make specific considerations in communicating with a target audience. For Statistics NZ the communication was a matter of producing and publishing the numbers but "they are not headline numbers".

Many other respondents noted specific ways of adjusting communication. Statistics Sweden noted adjustments in oral presentations. World Bank pointed out that for policy makers, results are presented and contextualized for the policy application at hand. EEA mentioned a varying level of methodological detail in different channels, e.g. website, briefings and assessment reports. Statistics Canada meanwhile presented good examples of methodological explanations targeted to a general audience (see also microdata). Sustainable Development France pointed out a conscious goal of using the simplest terminology possible, avoiding technical lingo, and clarifying where necessary. Finally, UNSW Sydney and IADB aim to communicate mainly with an academic audience.

Research, policy and other applications of IO-based results (Question 10)

French economic observatory (OFCE) uses carbon footprint to study the impact of a carbon fiscal policy, and the IADB uses data for economic analyses of multilateral development loans (though the extent to which environmental data are used is not stated explicitly), And CB Costa Rica uses IO-based results in a CGE model and the integrated environmental economic model.

Other respondents note the further use of IO-based results in other contexts – Statistics NZ mentions using data to provide context in blue economy reports and EEA notes the further use of data in their reports.

Statistics Canada also note applications judged in this analysis to be proposals for potential future uses, such as the analysis of international trade deals, using GHG intensity by industry data to provide policy insights (existing vs. proposed). Sustainable Development France note interest from the French Agency of energy management and environment and the French geological survey in EEIOA.

Statistics Sweden and UNSW point to the use of IO-based results in research, such as for LCA and scenario analyses (Statistics Sweden). In Sweden, the results are also used to monitor the

environmental quality objectives – specifically the generation goal that states that "*A society in which the major environmental problems in Sweden have been solved ... without increasing environmental and health problems outside Sweden's borders*"

World Bank on the other hand notes in general that there is less experience with policy applications of IO-based results compared to research experience.

Methodological challenges (Question 11)

Statistics Sweden mentioned need for common terminology and the question of how investments are considered in national accounts. Statistics NZ raised the issue of residence adjustment – specifically if tourists' use of vehicles is already adjusted for in SEEA CF then will the IO model estimate a double adjustment? UNSW pointed out that optimizing global MRIO required significant computing time and power. EEA noted that they would prefer to use official data from the "statistical system" (interpreted in analysis to mean Eurostat), pointing out that Exiobase has an advantage in terms of available extensions and level of disaggregation. Eurostat finds that the granularity of the data, i.e. the level of detail available, causes several challenges; the input data does not always contain enough detail for meaningful analysis and it affects directly the results. More detailed tables give different results than more aggregated tables, giving rise to several questions: What is the right level of detail to be used? At was level of detail should results be published? Should the variation of using different aggregation level be published? Finally Statistics Canada raised the issue of the timeliness of data required for IO-based calculations, noting that SUTs are only available 35 months after the reference period.

In addition, World Bank, Statistics Netherlands and IADB note in general the issue of data compilation for input data for IO-analyses, variously referring to country coefficients in MRIO (Stats Netherlands), SUTs and SEEA CF accounts (World Bank) and basic national accounts (IADB). Eurostat indicated that data limitations largely determine the model method used and the assumptions that need to be made. Annual production of footprints requires regular updates of the input data, and this is not ensured for the MRIOs compiled in research projects. Hence, Eurostat uses SRIO and hybrid modelling, because the updating of the input data is guaranteed. At the same time, researchers publish results from MRIO modelling, which then deviate from the results based on other methods. This makes communication of the results more difficult and undermines the user's trust in the modelling estimates published.

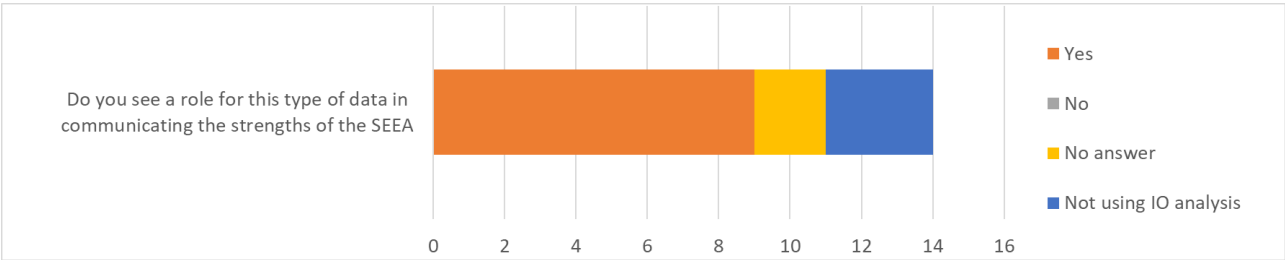## The role of IO-based results in communicating strengths of the SEEA (Question 12)

Figure 5: Responses to question "do you see a role for this type of data in communicating the strengths of the SEEA?"

Figure 5 demonstrates that respondents are in general very positive about IO-based results communicating strengths of the SEEA. Whilst two respondents currently carrying out IO-analyses did not answer the question, all others responded positively.

World Bank notes that the approach is important for developing countries to demonstrate how natural capital is affected (judged in this analysis to refer to being affected by environmental degradation) and how the economy depends on this type of assets, thereby providing important support in the policy advocacy process and raising the credibility of SEEA.

EEA further commented that IO-analyses demonstrate environmental and economic interlinkages and understanding of the structure and drivers of environmental pressures. Eurostat referred to the compatibility of SEEA with SNA and that environmentally extended IO modelling takes advantage of this link and thereby highlights it. Statistics Canada meanwhile noted that IO-analyses are a core strength of the SEEA approach and a way of achieving harmonization in international comparisons.

Areas for improving communication of IO-analyses in SEEA (Question 13)

Four respondents identify better communication of policy relevance. World Bank notes that IO-analyses in SEEA need to be policy relevant and country specific. World Bank further argue that national and subnational models are necessary to support policy uptake. Statistics Canada points to the need to distill a "story" from the data comprising the key implications and take-away messages. UNSW also underlines the need to distill results to policy relevant messages. IADB mention that SEEA are sometimes not linked application and end users. In this analysis such observation can be judged to imply that improved communication could be achieved through developing SEEA IO-analyses in close collaboration with end users.

Sustainable Development France suggest that improved communication could be achieved through more widespread teaching about EEA in general and EEIO in universities, particularly in economics. Statistics Netherlands suggest that better explanation of how SEEA IO-analysis results relate to IPCC-based metrics of environmental pressures could be useful. Eurostat mentioned using less technical language when publishing results, especially where it concerns the general public.

Issues to deal with together (Question 14)

Six respondents shared opinions on this question. Eurostat, UNSW Sydney, Statistics NZ and EEA all noted in general the value of sharing experience, knowledge or best practices and the latter three called for a platform for SEEA research. More specifically, the World Bank pointed to the need to expand the literature review on EEIO to include grey literature, with a focus on reports that have reached policy makers. Eurostat would like to exchange experience on: terminology, communication and visualisation. Besides general comments above, Statistics NZ also identifies the need to use standard models for trade flows and for guidance when IO tables are not produced annually. Eurostat would like to exchange views on how the governance of MRIO models should be organised and how harmonised results can be produced. UNSW highlights the need for policy relevant examples and Sustainable Development France notes the need for consistency checks between different MRIO models.

Other matters (Question 15)

Some respondents added comments on this question:

- EEA: In order to provide added value from IO-analyses EEA works closely with research community and shares perspective on policy relevant questions and how IO-analysis can inform policy
- UNSW Sydney: Funding is a key issue. Currently the work is supported by individual research grants, but there is no general institutional support
- IStat: Expertise exists in Italy for EEIO analyses and are actively interested in developments (in this analysis it is noted that IStat do not currently carry out SEEA IO-analyses)
- Stats NZ: Indicated they are positive about the initiative
- Eurostat: Would like to hear from others if the inclusion of RMC / material footprint in the SDG indicator list has had an effect on the statistical community, in terms of plans to start producing this indicator or plans to re-publish from an international organisation (e.g. UN Environment publishes estimates).

Discussion at the London Group meeting and way forward

Overall, the respondents express an interest in using and improving EEIO. Although 80% of the respondents use EEIO analysis, they also list various challenges and concerns, which would benefit from further investment in EEIO analysis. To support this work, one idea is to become more organised in exchanging experience, knowledge and best practices.

A pool of experts

There is a well-established community of input-output experts in the International Input-Output Association[5]. To tap into their knowledge would be beneficial, especially since many of the statistical offices are institutional members there. To create a pool of experts – not only on IO matters but the extension to environmental issues – could open up opportunities for global cooperation. A slimmer pool of experts could be to organise the London group members into a virtual group where questions and answers can be sent.

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The survey has visualised that the environmental impacts analysed through input-output technique varies, from air emissions, to land, to tourism. The underlying input-output technique may also differ – in terms of level of details of products/industries, level of output aggregates (final demand from households, public sector, investments etc). Another issue of discussion is the connection to the environmental impact.

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Identifying communication aspects and impacts of policy demands on data

 The survey was very clear that the results published and data produced were in need of further enhancements and improvements.

As the respondents of the survey was a good mix of both producers of the data and users of the data several aspects were identified. This could e.g. be to finding out more on how others talk and discuss outcomes of the data, to look into the impacts of policy demands on more data and find common pathways to spread the word of the data.

Thus, the aim of the discussion at the London Group meeting is to discuss the findings reported via the questionnaire, complement the set of views, and discuss a way forward.

Appendix – survey questions

1. Does your organisation produce data using input-output analysis?

    If yes - for how long?

    If yes - what areas do you cover (e.g. air emissions, land, social, etc?). Are you planning to extend your portfolio with other areas in the coming Three years?

    In case of no - why do you not produce this data?

    In case no - do you have plans to start working in this field?

2. Do you cover both domestic final consumption and international trade?

    If yes - can you please describe - briefly your applied method? (eg. use of SRIO, MRIO or hybrid approach?)

    If no - please explain what you cover

3. What are your data sources? (E.g. do you use existing Statistics or existing Tools?)

4. Do you compile regional data? (e.g. municipal, province levels)

5. Please describe your method of publishing? (e.g. databaswe, reports etc). Please provide a link if possible to a web-site

6. What terminology do you use when publishing the results? (e.g. that of the National Accounts or other?)

7. How do you describe the limitations and uncertainty arising from input-output modelling and your choice of model in particular?

8. Does the analytical nature of the data affect how you present them? Are they considered official statistics or not?

9. Do you adjust the communication to the target audience? Please provide some examples of how?

10. Do you have examples of how the data are used in research, policy or other ways?

11. Do you see any specific methodological challenges that you would like to raise with this type of data compilation?

12. Do you see a role for this type of data in communicating the strengths of the SEEA

13. What is in your view the main issue to be improved in the communication of this type of data?

14. Are there issues that you would want us to deal with together? E.g. terminology, use of models for imports, experience sharing

15. Is there anything else you would want to add?