

Towards harmonised global input-output databases for calculating footprint indicators



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29th Meeting of the London Group on Environmental Accounting

SEPTEMBER 14, 2023



1. About “Global Resource Use”
2. MRIO models: structure, pros and cons
3. Existing MRIO databases and their applications
4. Options and barriers towards harmonised MRIO data system

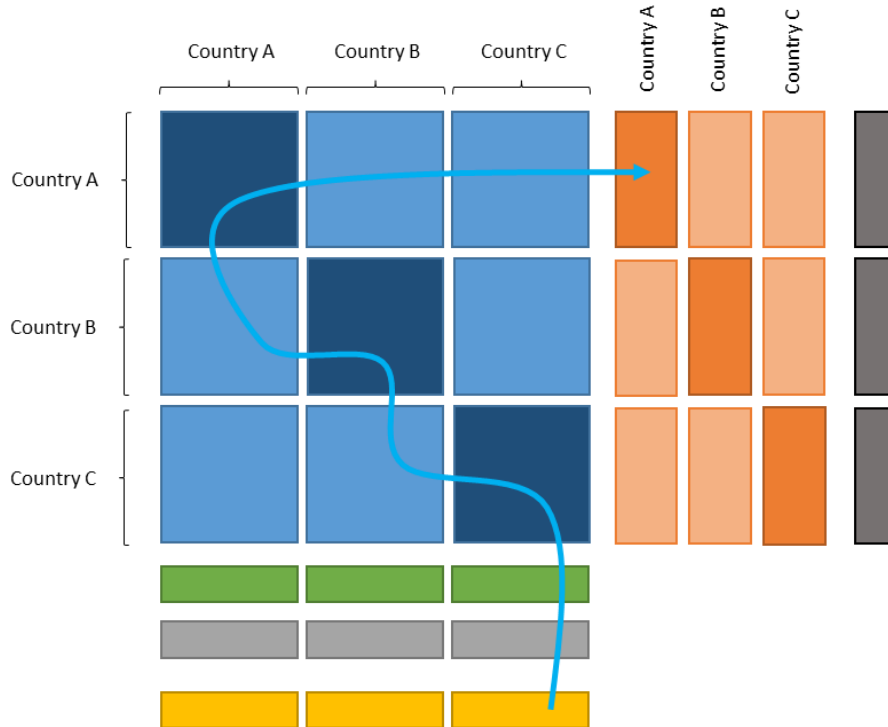
‘Global Resource Use (GRU)’

- Research group of currently 12 researchers
- Projects in European and international context

- Main clients
 - European Commission / European Research Council (ERC)
 - International organisations: UNEP / UNIDO / OECD
 - National environmental agencies
 - NGOs (e.g. Friends of the Earth, WWF)

- **Environmental accounting** (focus on material flows, water, land and energy) → core environmental indicators on the national level
- **Environmental-economic modelling**, multi-regional input-output models → global supply chain and ‘footprint’ analyses
- **Geospatial** and **spatial statistics** methods, incl. use of satellite data → link environmental pressures and local impacts
- **Data visualisation** platforms and **policy-oriented** assessment tools (e.g. materialflows.net; UNEP’s [SCP-HAT](https://www.unep.org/scp-hat))

Basic structure of MRIO databases



- Domestic inter-industry table for one region
- Bilateral trade tables between industries of two regions
- Factor inputs such as value added for one region
- Final demand of domestic produce
- Final demand of imported produce
- Total output of one region
- Total input of one region
- Resource input / pollution output of one region
- ➔ Exemplary supply chain linking extraction in Country C to final demand in Country A

Advantages

- Coverage of all supply chains → no “truncation” errors
- Global consistency → no double counting
- Consistent and comparable procedure across countries and environmental categories

Disadvantages / uncertainties

- Assumption of homogenous product output mix per sector
- Varying data quality and availability (e.g., IO tables, trade data)
- High level of technical knowledge to construct MRIO database

- Past 15 years: MRIO databases widely used for economic, environmental and sustainability assessments
- Several databases exist; different construction principles and structures, different strengths and weaknesses
- No “single-best” option: selection depends on questions addressed (e.g., number of countries, sectors, environmental satellites, etc.)

Global MRIO databases

Item/MRIO	OECD ICIO (version 2022)	FIGARO (version 2022)	EXIOBASE (version 2022)	GLORIA (version 2023)
Countries / regions	76 + 1 RoW	EU27 + 18 main trading partners + 1 RoW	44 + 5 RoW	160 + 4 RoW
Sectors: industries i / products p	45 i	64 i	163 i / 200 p	120 i/p
Time	1995-2020	2010-2020	1995-2022	1990-2021
Main developer	OECD, France	Eurostat & Joint Research Center, EU	University of Science and Technology, Norway	University of Sydney, Australia
References	OECD, 2022	Eurostat, 2021	Stadler et al., 2018; Stadler, 2021	IE Lab, 2021; Lenzen et al., 2021

Selected applications

- **OECD ICIO:** Trade in Value Added (TiVA), carbon footprints
- **FIGARO:** value added and employment studies, e.g., related to EU exports; EU carbon footprints
- **GLORIA:** material footprints for UN International Resource Panel (IRP), MRIO for UNEP's SCP-HAT online tool
- **EXIOBASE:** IRP resources outlook; large number of academic studies (employment, energy, materials, GHG emissions, ...)

Status quo of (non) harmonisation

- Different MRIO databases applied for various questions
- Often results are deviating for the same indicator → difficult for policy-oriented applications, e.g., regarding possible targets for consumption-based indicators
- OECD initiated process with MRIO experts how to move forward towards comparable (material) footprint indicators for science-based policy making on the international level
- WU Vienna led preparation of two documents (available for the London Group): (1) MRIO guidance; (2) Institutional roadmap

Summary MRIO guide

- Overview of available methodologies and advantages of MRIO approaches
- Implementing the MRIO methodology
 - Comparison of available MRIO databases
 - Environmental satellite accounts
 - Step-by-step technical procedure
- Example results from material footprint analyses with ICIO

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Guidance document on measuring demand-based material flows (material footprints)

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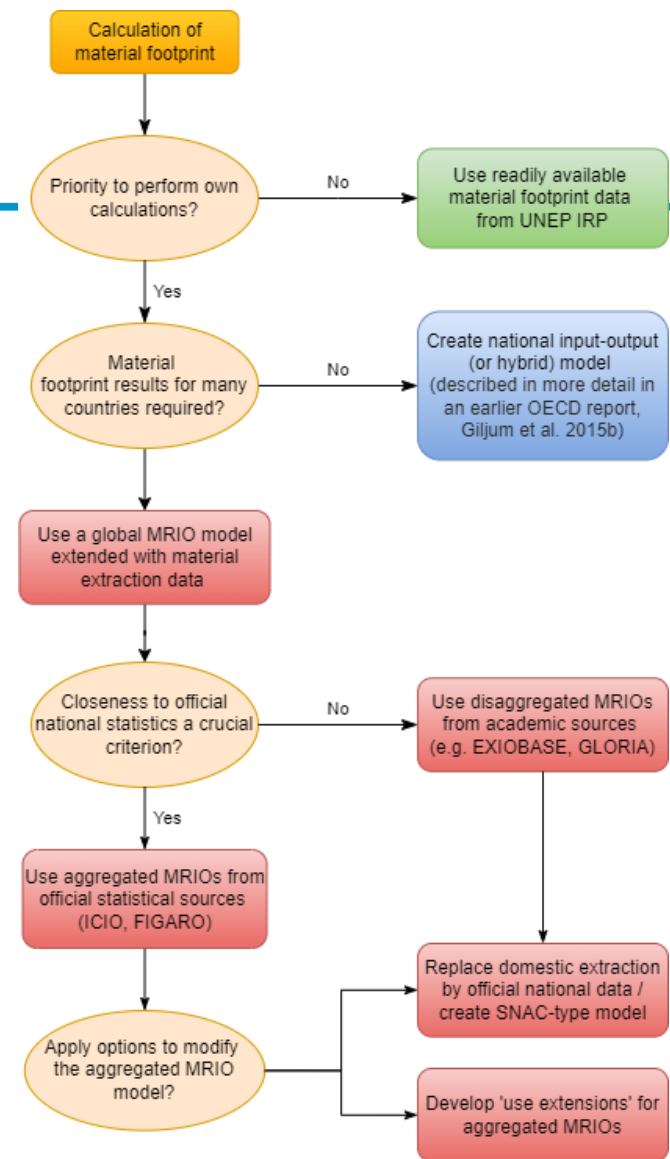
Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

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DRAFT GUIDANCE ON MEASURING DEMAND-BASED MATERIAL FLOWS

Summary MRIO guide

- Choice of approach depends on various criteria
- National IO or hybrid model
- MRIO approaches
 - Official statistics vs. academic sources
 - Sector detail
 - Options to overcome limitations



Summary Roadmap

- Priority topics
 - Improvement of calculation method
 - Alignment of MRIO databases
 - Data provision and capacity building
- Main players within the framework
 - OECD, UNEP & IRP, Eurostat, NSOs, academic institutions, etc.

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**Updated roadmap for
establishing a coordinated global
framework for
measuring demand-based material
flows (material footprints)**

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Three options for MRIO development

- Option 1: Develop ICIO/FIGARO into global reference
- Option 2: Utilise the MRIO data set developed for the UN IRP (GLORIA)
- Option 3: Develop regional MRIO databases

Key results from final expert workshop

- Construction and application of MRIO databases very active and fast developing field in academia and statistics
- Academic experts welcome diversity of models to avoid lock-ins and allow comparative quality assessments and methodological advancements
- ... but agree that a harmonised reference database on the aggregated level published by an official authority would be very helpful as common reference (e.g., for further disaggregation)

Key results from final expert workshop

- Reference database should be maintained by an international organisation, but statements by organisations were inconclusive
- OECD: ICIO database should have a clear place in a global MRIO framework; leadership not clearly addressed
- Eurostat: reference database should be governed by a consortium of international organisations; no resources to lead such a process, but provide EU data to global reference

- MRIO models will play a key role in the future to inform environmental-economic policy making (climate, resources, socio-economic topics) → higher sector detail, more recent data, etc.
- “Competition” is in the interest of science, but policy-oriented work needs a solid and harmonised data foundation
- Key open question: how to ensure longer-term institutional grounding and stable funding scheme to maintain a global reference MRIO data infrastructure?

Thank you for your attention!



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