8.4.1/12.2.1 - Material Footprint

Rosstat/UNECE/UNEP/OECD workshop on environment-related SDG indicators

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SD objective and target

- **Objective**
  - Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
  - Goal 12: Ensure sustainable consumption and production patterns

- **Target**
  - Target 8.4: Improve … global resource efficiency in C&P, and … decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on SCP, with developed countries taking the lead
  - Target 12.2: By 2020, achieve the sustainable management and efficient use of natural resources

- **Indicator**
  - Indicators 8.4.1/12.2.1: Material Footprint, material footprint per capita, and material footprint per GDP ←→ 8.4.2/12.2.2: Domestic material consumption

- **Custodian agency**
 - UN Environment

Definition

The "apparent consumption" of raw materials, i.e. the raw material equivalent of imports (RME_{IM}) plus domestic extraction (DE) minus raw material equivalents of exports (RME_{EX})

- Also called "raw material consumption" or "demand-based material consumption"
- Raw material equivalent of imports or exports: raw materials embodied in international trade

- **Expressed as:**
  - Total material footprint
  - The material footprint per capita
  - The material footprint per GDP
  - Underlying data are disaggregated by material groups (biomass, fossil fuels, metal ores and non-metal ores), by domestic final demand sectors and foreign demand (exports)

## Policy relevance and interpretation (1)
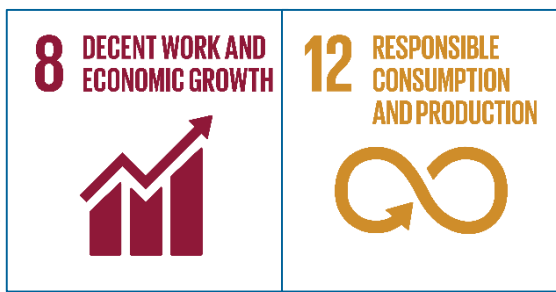
- **Rationale and policy relevance**

  – Reflects the amount of raw materials (extracted globally) that are needed to satisfy final demand in a country, considering global supply chains.

  – Per capita MF describes the average amount of raw materials needed in an economy to satisfy final demand

  – Per GDP MF describes the amount or raw materials needed in an economy to generate a given economic value in terms of GDP

  – When used in combination with DMC, addresses the question of whether a country has become more efficient in using material resources, and how much of the improvement is due to domestic policies and how much to displacement or substitution effects.

Policy relevance and interpretation (2)
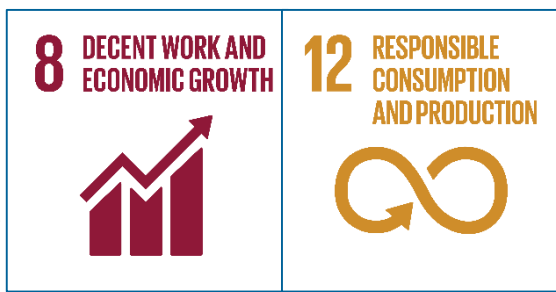
- **Concepts**
  - Based on concepts from material flow analysis and accounting

- **Interpretation**
  - Complements and helps interpret DMC
    - DMC can be high when a country has a large primary production sector for export
    - DMC can be low when a country has outsourced material intensive processes to other countries and imports related goods.
  - Affected by national circumstances
  - Interpretation needs to account for:
    - Properties and composition of material groups
    - Countries' endowment in natural resources
    - Countries' economic structure

- **Presentation**
  - Jointly with DMC, accompanied with materials mix
  - Changes over time rather than levels for one year

Data sources and reporting mechanisms
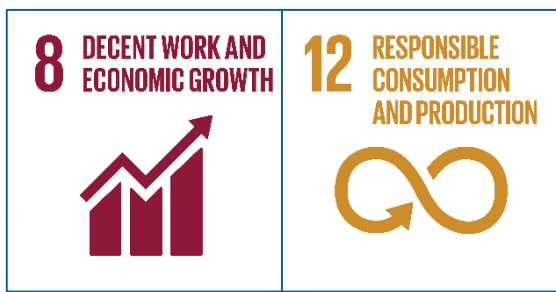
- **Data sources and reporting**
  - UN Environment global material flows database (> 170 countries; 1970-2017), under the IRP Global Material Flows and Resource Productivity working group
    - Based on national (economy-wide) material flow accounts from the European Union and Japan, complemented with estimates for the rest of the world
  - Material footprints estimated for most countries
    - Only some countries produce data on material footprints
    - EU countries: mandatory reporting on MF to Eurostat under EU regulation does not cover footprints
  - OECD pilot database on demand-based material flows (developmental work)

- **Data providers**
 - National Statistical Offices
  - Research institutes

Estimation method
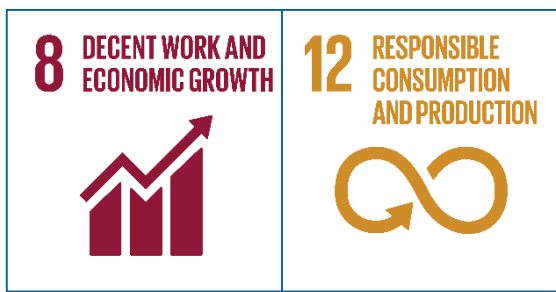
- **Input-output based approach**
  - Based on an economic multi-regional input-output (MRIO) model, which integrates physical data on material extraction (extension)
    - Identifies the final consumer of a specific amount of materials extracted domestically or anywhere in the world
    - Estimates the distribution across countries of raw materials embodied in final demand.
    - UNEP uses the EORA MRIO framework developed by the University of Sydney, Australia; method based on I-O analysis (Wiedmann et al. 2015)
  - Estimations use data on material extraction obtained from national or international datasets (agriculture, forestry, fisheries, mining and energy statistics).
  - International statistical sources for DMC and MF include the IEA, USGS, FAO and COMTRADE databases.

- **International consensus and harmonisation of method**
  - OECD initiative with UN Environment and Eurostat to achieve consensus
    - Other calculation methods exist: coefficient based; hybrid (e.g. Eurostat)
    - **Consensus on input-output approach for international work**
    - Harmonised methodology and guidance being developed (OECD)

Measurement challenges
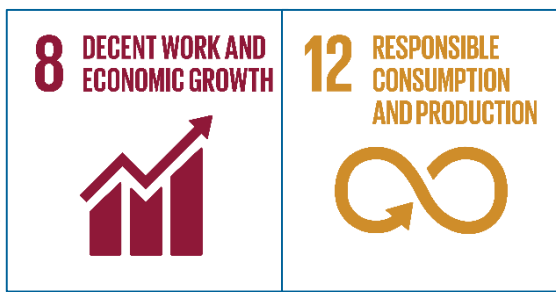
- **Measurability and reliability less good than for DMC**
  - IO estimations based on research work and many assumptions
  - Continued progress

- **Input-output based approach**
  - Application at international level requires the agreement on an institutionalised reference MRIO input-output database (e.g. OECD ICIO/EU FIGARO)
  - Footprint calculations not available/feasible for all countries → use international estimates to fill gap

- **Discrepancies between national and international estimates**
  - Results obtained from other methods used by countries may differ (e.g. EU countries)
  - Investigation of differences needed: → benchmarking case studies by OECD

- **Other issues**
  - Results for MF and DMC stem from different calculation methods & databases
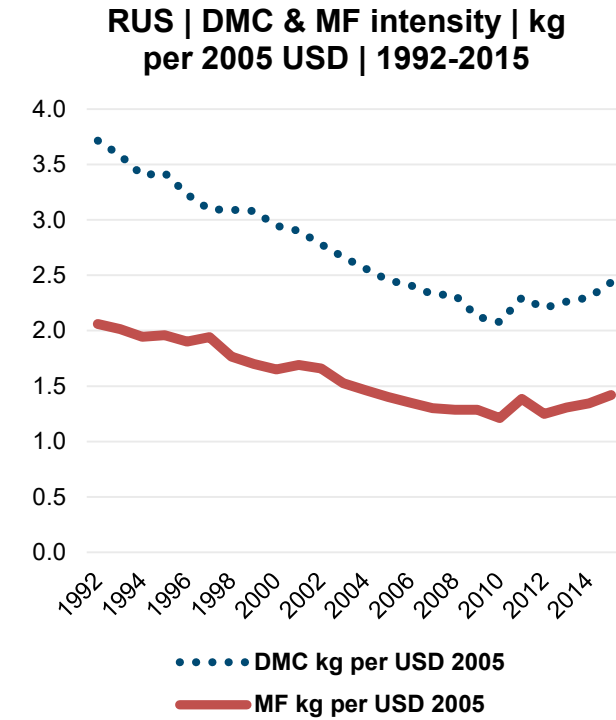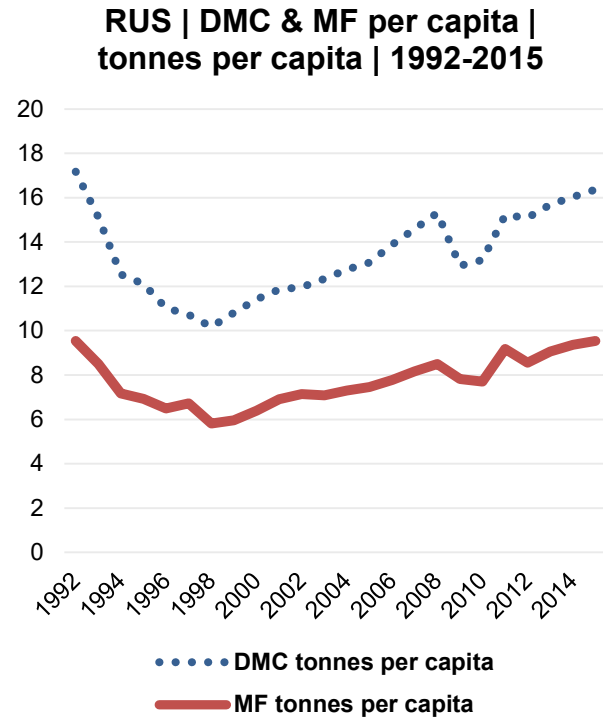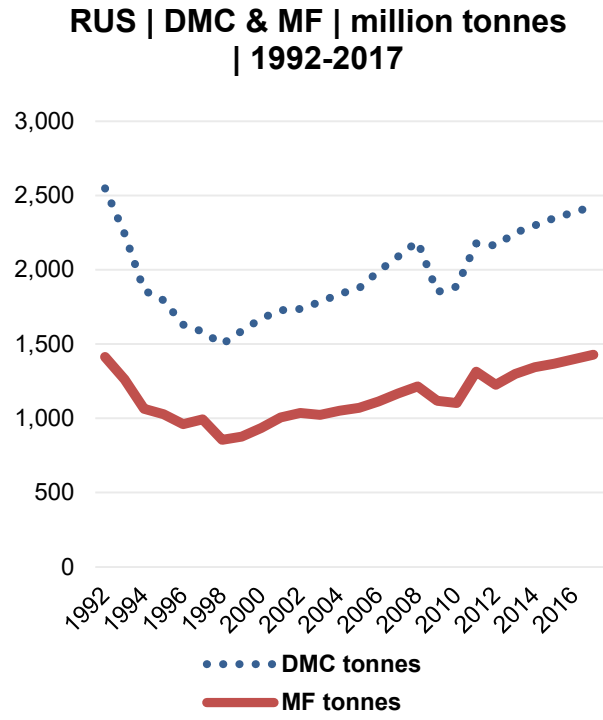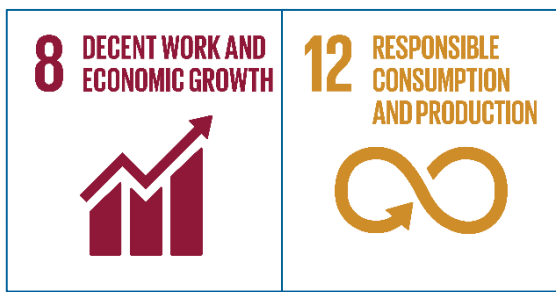 - May affect interpretation

Indicator examples

RUS | DMC & MF | million tonnes | 1992-2017

RUS | DMC & MF per capita | tonnes per capita | 1992-2015

RUS | DMC & MF intensity | kg per 2005 USD | 1992-2015

Links and references

- **Regional aggregates:**
  - http://uneplive.unep.org/media/docs/graphs/aggregation_methods.pdf

- **References**
  - Eurostat Economy-wide Material Flow Accounts Handbook – 2018 Edition https://ec.europa.eu/eurostat/web/environment/material-flows-and-resource-productivity
  - Forthcoming UN Environment MF Manual (with Eurostat and OECD)
  - Forthcoming OECD guide on the measurement of demand-based material flows http://www.oecd.org/environment/resourceefficiency.htm

Thank you!