A multi-regional environmental input-output model to quantify embodied material flows

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Content

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1 Background: trade and resource consumption

◈ **growing public interest to reduce use of environment**

◈ **increasing international trade**

◈ **separation between place of production and place of consumption**

◈ **outsourcing of material intensive production processes**

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2 Indirect material flows: concepts

material requirements along the production chain to produce imports and exports

two main approaches:

◈ **LCA-based approach:**
  - **+** disaggregation into single product
  - **−** large data requirements
    - **−** limited availablity for higher manufactured products
    - **−** inclusion of second and third round effects

◈ **Input-output analysis:**
  - **+** coverage of whole production system (national + international)
  - **+** reduced data requirements
  - **−** higher level of aggregation

  - **−** so far: assumptions for production technology of imports

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◈ **multi-regional environmental input-output model**

  ⇨ focussing on material flows (biotic and abiotic)

  ⇨ for year 2000

◈ **economic core model:**

  ⇨ IO tables linked by bilateral trade data

◈ **coverage: 50 countries + 2 regions (OPEC, RoW)**

◈ **extended by material extraction vectors in physical units**

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3 Multi-regional IO-MFA model: data sources

◈ **IO tables:**

⇨ OECD's 3rd edition (2006): 37 countries in 48 harmonised sectors

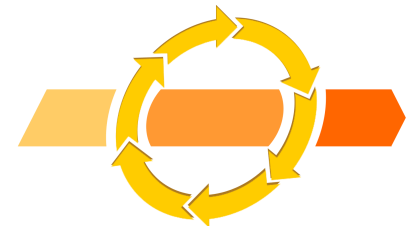⇨ assumptions for economic structure of the remaining 15 countries and 2 regions

◈ **trade data:**

⇨ OECD's bilateral trade database (2006 edition): 25 product groups, 61 trading partners

⇨ same industry classification as IOT

⇨ UN COMTRADE data for trade between non-OECD countries

◈ **material input data**

www.materialflows.net
The online portal for material flow data

⇨ global MFA dataset (MOSUS project): 180 countries, >200 material categories)

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◈ **based on an approach introduced by Ahmad and Wyckoff (2003) for identifying CO_2-emissions embodied in international trade of OECD-countries**
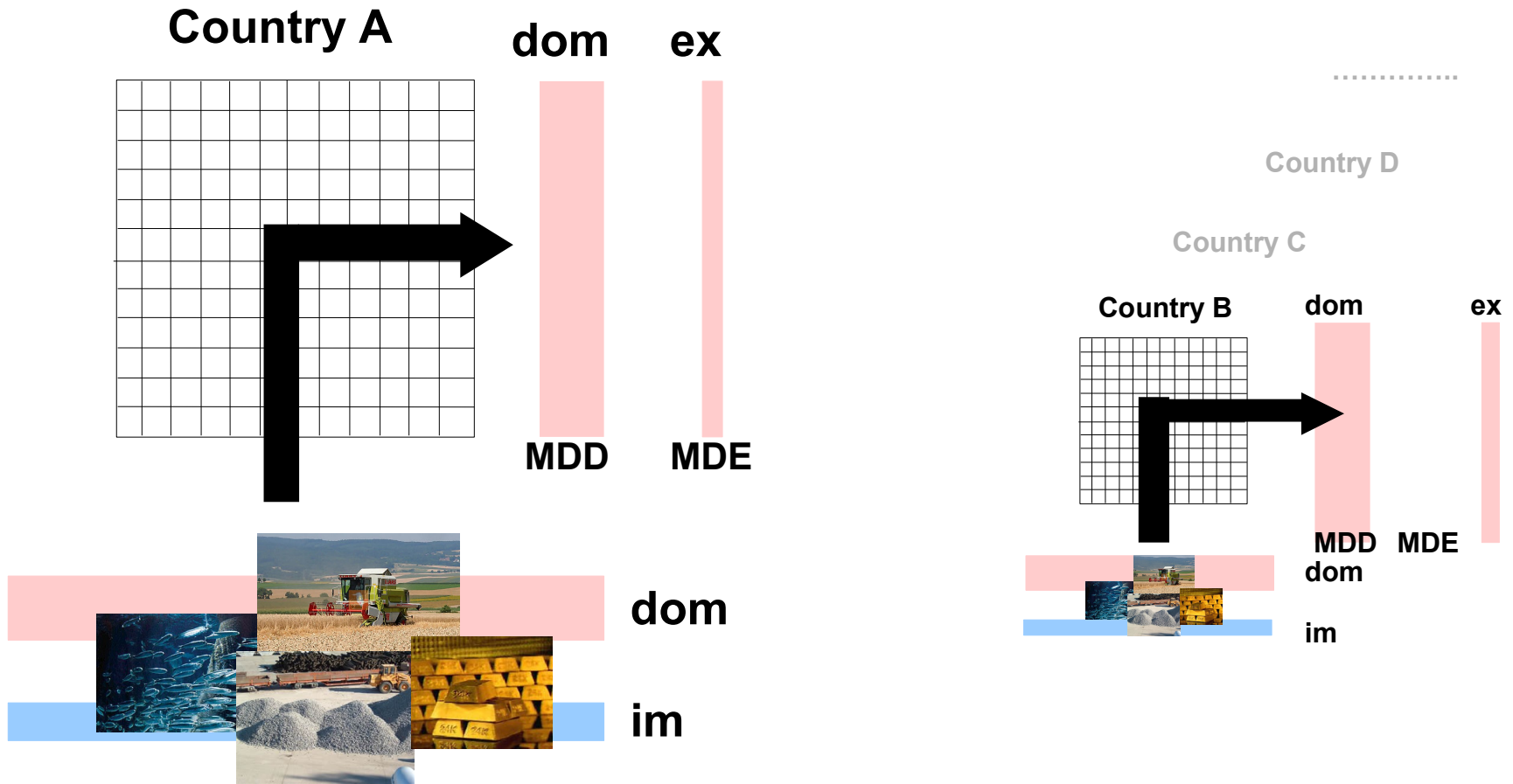
four categories of material use:

4) **MDD: extracted domestically – consumed domestically**
5) **MDE: extracted domestically – exported**
6) **MID: imported – consumed domestically**
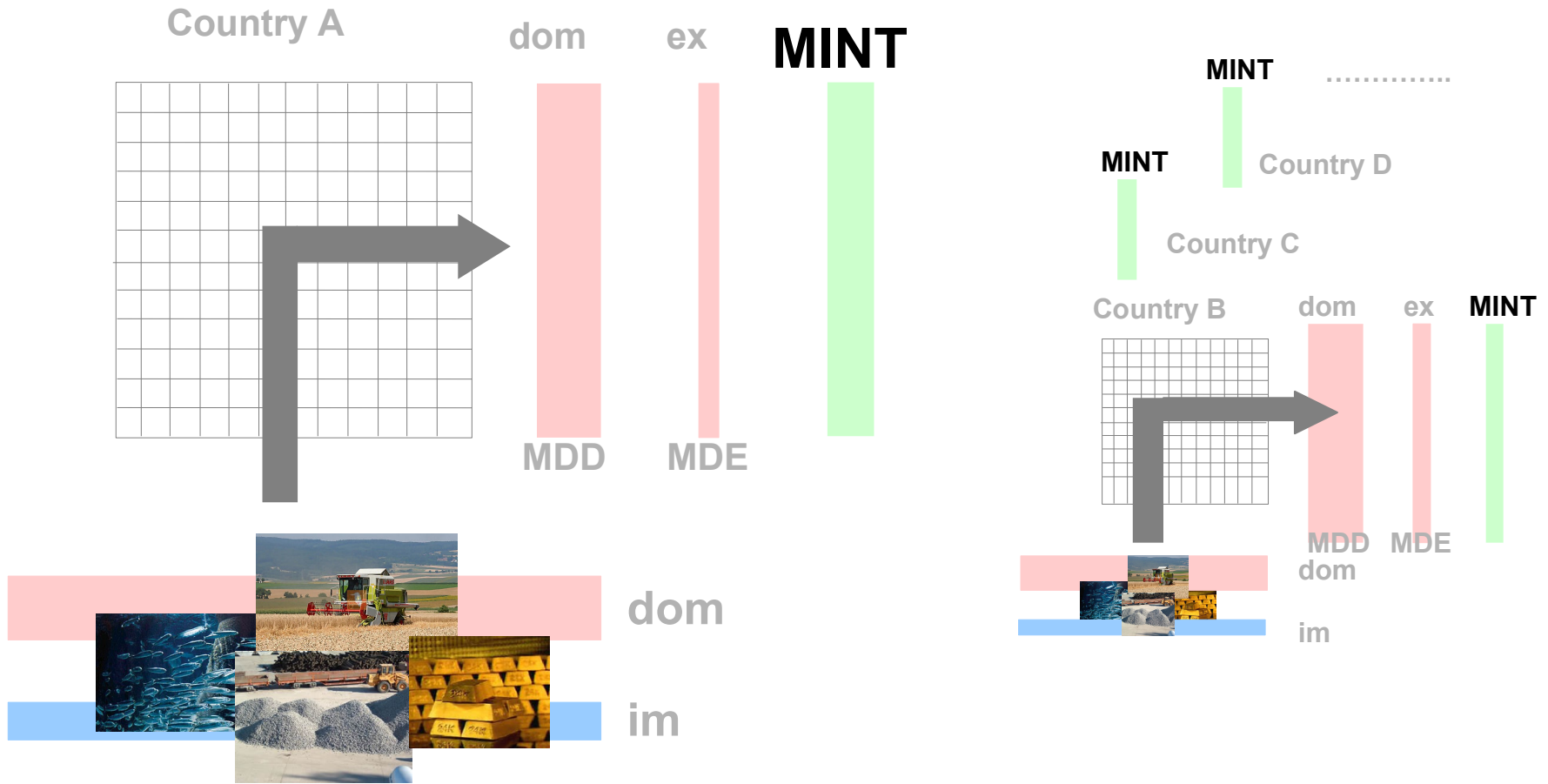7) **MIE: imported – re-exported**

material flow based indicators:
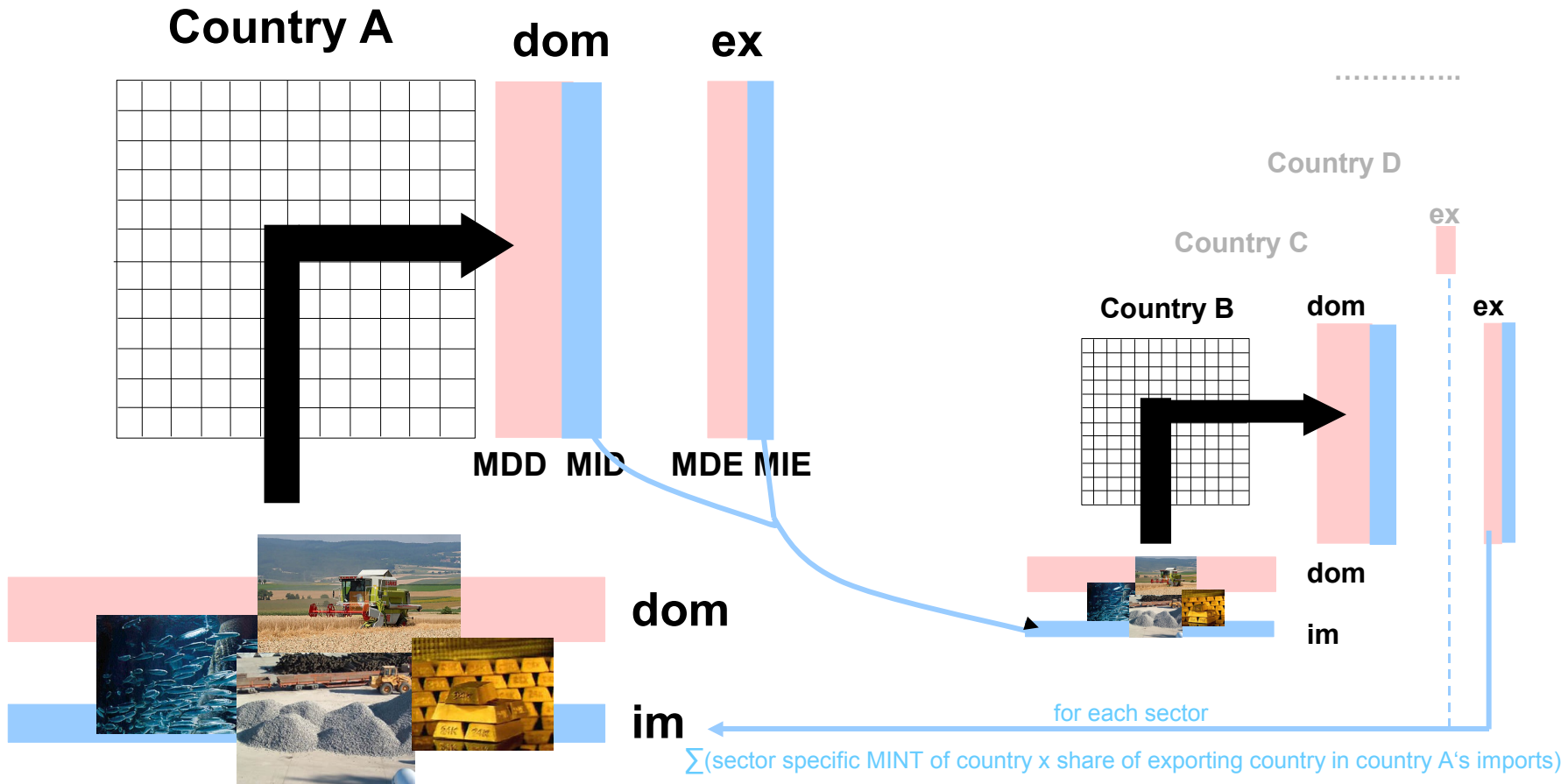
⇨ **TMR= MDD+MDE+MID+MIE**
⇨ **TMC= (MDD+MID)-(MDE+MIE)**

Country A

dom   ex

MDD   MDE

dom

im

Country D

Country C

Country B   dom   ex

MDD   MDE
dom

im

Country A

dom   **ex**

MDD MID   MDE MIE

dom

im

Country D

Country C

ex

Country B   **dom**   **ex**

dom

im

for each sector

$\sum$(sector specific MINT of country x share of exporting country in country A's imports)

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4 Shortcomings and improvements

◈ **Hybrid MFA-model**

 ⇨ economic causalities vs. physical causalities

 ⇨ replacement of monetary flows in first stages of interindustry deliveries

◈ **IO tables**

 ⇨ deeper sectoral disaggregation

 ⇨ replacement of assumed IO tables

 ⇨ separating countries from RoW

◈ **bilateral trade data:**

 ⇨ consideration of more products

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5 Areas of application

◈ **calculation and analysis of indirect material flows**

- ▪ by industries
- ▪ different material categories
- ▪ origin and destination of imports and exports

for all considered countries

◈ **calculation of indicators**

- ▪ **MFA-based**
- ▪ **indicators of resource productivity**

◈ **analyses of international production chains and structural paths**

◈ **historical analyses: links between growth, structural change, international trade and distribution of environmental pressures**

◈ **analysing futures scenarios generated by forecasting or simulation models**

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Thank you for your attention!!!

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