A globalisation strategy for the ecoinvent LCI database

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For Life Cycle
Inventories

A joint initiative of the ETH domain and Swiss Federal Offices

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The ecoinvent database v.2.0

- More than 4000 generic LCI datasets on energy supply, resource extraction, material supply, chemicals, metals, agriculture, waste management services, and transport services
- Used by more than 1200 members in more than 40 countries
- Included in the leading LCA software and eco-design tools
- Online access to LCI and LCIA results for all datasets
- Based on industry data, compiled by independent experts
- Consistent, validated and transparent
- Continuously maintained
- International in scope, including e.g. data on US agriculture, worldwide sourcing of raw materials and production of electronics in Asia

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A globalisation strategy for the ecoinvent database v.3.0

- Cooperation with national database initiatives
- More detail, more technologies, more completeness:
  - International editorial board and broader supplier base
  - Parameterization (geography, time, technologies, markets)
  - New data structure based on supply-use framework, allowing easier production of national versions

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International editorial board and broader supplier base

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- International editorial board
  - Activity editors, for each industry activity and for household activities
  - Cross-cutting editors, to ensure consistency and monitor developments across the entire database, both for specific (groups of) emissions, for geographical areas, scenarios, etc., and for the meta-data fields, e.g. uncertainty
- Broader supplier base
  - Making it easier for experts and lay users to contribute with new data or corrections to existing data
  - All such contributions will still be subject to our strict quality control, review, and validation procedures before entering into the database

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Geographical parameterisation

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Core international datasets + national differences

Advantages:

- Simple and consistent way to make national databases
- Allows site-dependent impact assessment (when LCIA methods have the same geographical parameterisation)

Nature of the parameter:

- Most basic: GIS coordinates
- All other area parameters can be expressed as ranges of GIS coordinates:
  - Country codes (as currently implemented)
  - Areas with different population densities
  - Habitat areas
  - Watershed areas, etc.

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Temporal and scenario parameterisation

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Advantages:

- Data from several years can serve as input
- Trends can be analysed and used to improve data relevance
- Forecasting can be made more consistent across all datasets

Nature of the parameters:

- Most basic: Periods of time, typically years
- Also allowing to distingush temporal markets (e.g. variations over seasons, time of day)
- Scenario parameters: Possibility to choose between e.g. Business as usual/pessimistic/optimistic
- Lifetime information for stocks and waste

Technology parameterisation and market modelling

- For a given geography, time and scenario, each proces (representing specific technologies or technology mixes) may be classified as e.g. BAT, modern, current, or old. This would allow the user to specify the desired technology level for all - or specific – processes in a product system.
- In market processes, parameters reflecting supply elasticities may be used to allocate demands among suppliers (technologies), thus allowing in addition to modelling of average markets with full supply elasticities for all suppliers, to model markets where some or all suppliers/technologies have less than full supply elasticity.

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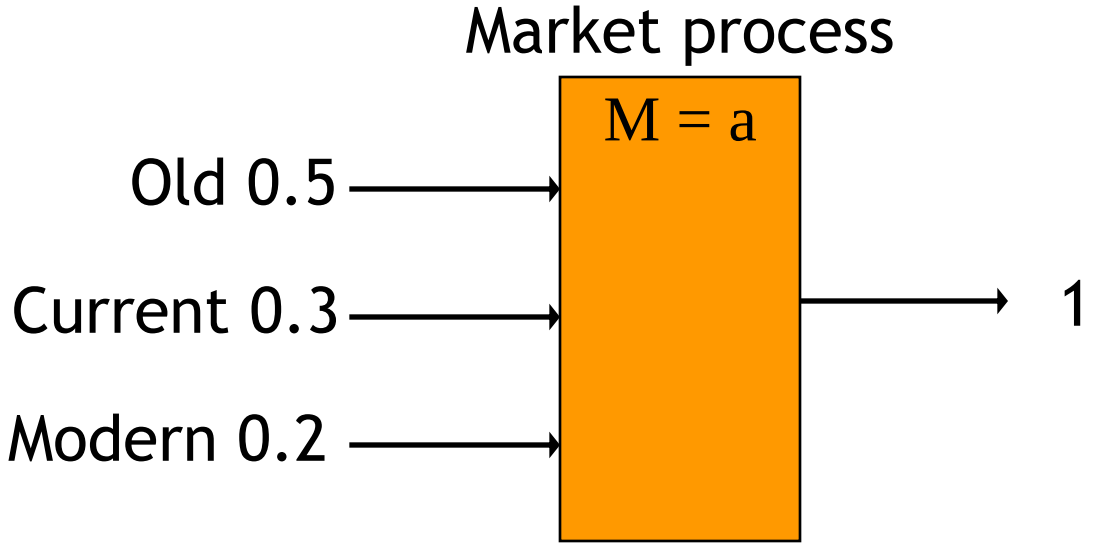
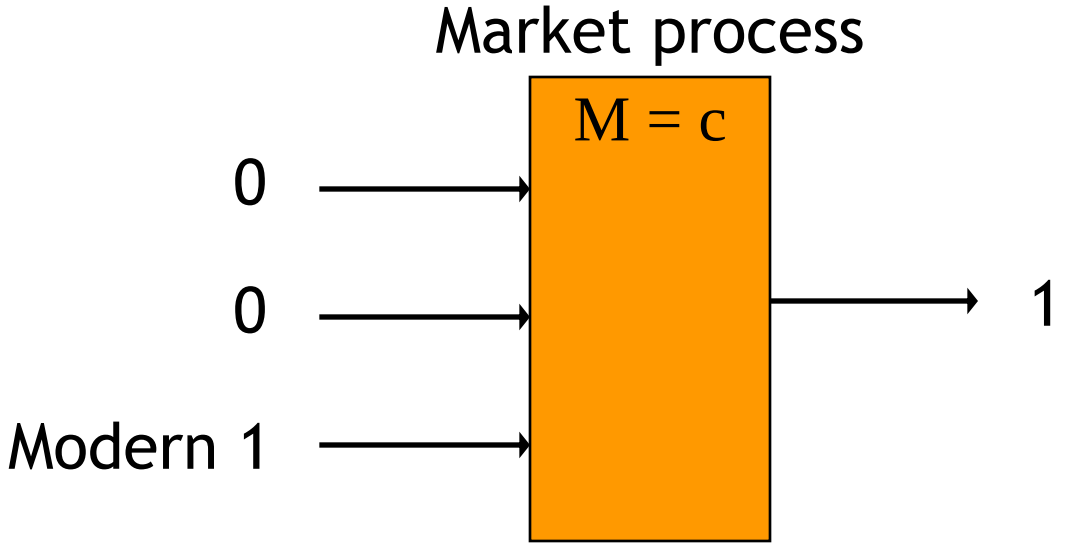
Attributional and consequential market models



- *Principles* of market modelling (as in attributional and consequential modelling) can be specified as database-wide parameter choices, shifting between settings of the elasticity parameters in market processes.

Attributional and consequential market models



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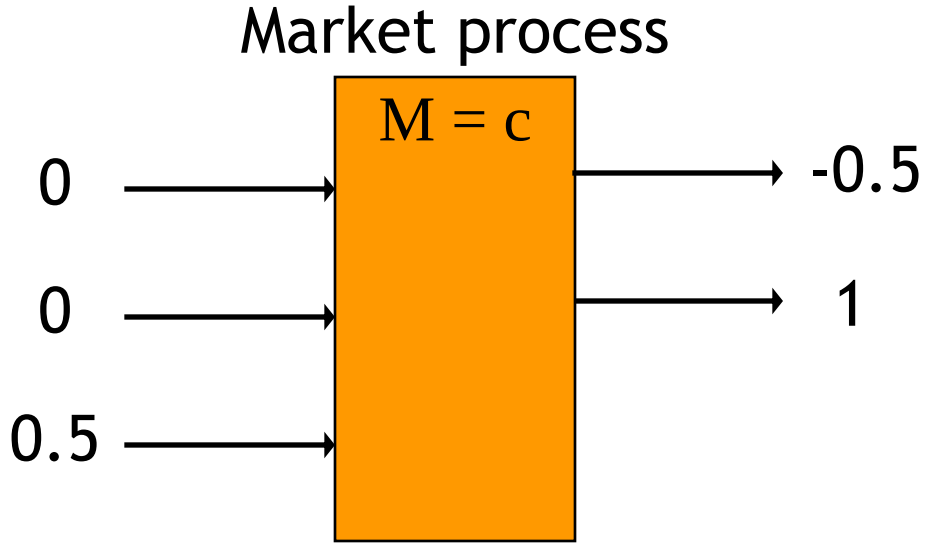
Attributional and consequential market models



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New data structure based on supply-use framework

- Interlinked monetary and physical supply-use tables
  - Ensures completeness of process database
  - Allows easier production of national versions
  - Gives support for both system expansion and allocation
  - Opens up for new applications: LCC, Material Flow Analysis

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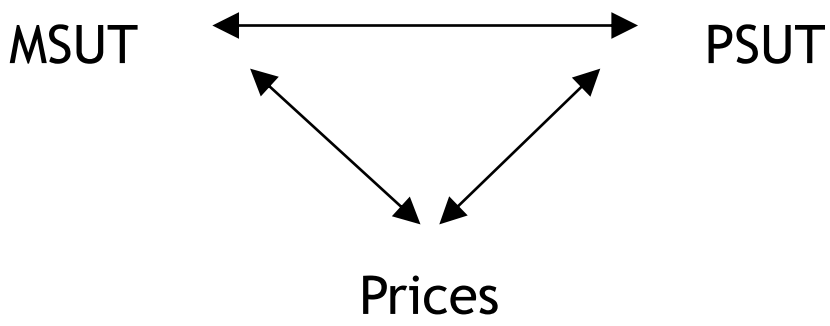
Monetary and physical supply-use tables

Balanced MSUT	Activities (a_U)	Products (c_U)	Export	Total
Activities (a_S)		**V**		**g'**
Products (c_S)	**U**		**E**	**q**
Import		N_V'		
Primary inputs	Labour and profit			
Total	**g**	**q'**		



Balanced PSUT	Activities (a)	Products (c)	Final demand			Total
Activities (a)		**V**				**g**
Products (c)	**U**		**y**	E_c	E_w	**q**
Import		N'_c				
		N'_w				
Stock changes	$-\Delta S$					
Supply of residuals	$-W_V$					
Use of residuals	W_U					
Resources	**R**					
Emissions	**-B**					
Water balancing	Q_{H2O}					
Total	**g'**	**q'**				

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Supply-use framework ensures completeness

- All economic activities in society are covered, i.e. the sum of all activities = national output
- Per process/industry, all monetary inflows are traced to monetary outflows (intermediate inputs or value added), i.e. no upstream cut-offs
- Per product/commodity, what is produced must be used, i.e. ensuring complete product balances across the economy

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Easier production of national process databases

- Most countries produce monetary supply-use tables annually, which can serve as a basis for consistent national versions of the core ecoinvent database
- Often, national reporting of emissions follow the same framework
- This may then be supplemented by specific national process data

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Gives support for both system expansion and allocation

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- Advantages of using the supply-use framework:
  - Data can be stored unallocated
  - From the same basic data, several LCI databases can be constructed, using different technology models when combining the use and supply matrices, demonstrating the consequences of different allocation methods, e.g.:
    - Industry-technology model = Economic allocation in LCA
    - Commodity-technology model = System expansion in LCA
    - Combinations (mixed technology models) possible
  - Supports any combination of allocation parameters

Supply-use framework opens up for new applications of the database

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- Life Cycle Costing (LCC):
  - Consumer spending always ends up as value added → Life cycle cost = price of products = value added over the life cycle
  - Because labour costs, taxes & subsidies, rents & profits (together = value added) are standard elements of the supply-use framework, LCC are calculated automatically along with all the other inventory results
  - Price rebound effects can be calculated from data on average or marginal consumption
- Material Flow Analysis (MFA):
  - Completeness of material balances across the economy gives insights into material flows