Explicit market modelling in LCI

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The challenge: flexibility, simplicity

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- The challenge (for LCA in general - and databases in particular):
  - How to allow complex modelling while still being simple enough,
  - and how to allow frequent update with a minimum of effort?

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A database design strategy for flexibility and simplicity

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1) Database completeness
   - Data availability for any model
   - Reducing bias
   - A context for embedding new datasets
2) Unlinked and unallocated unit processes
   - Allowing different modelling algorithms on the same data
   - Keeping verifiable data separate from economic and/or normative assumptions
3) Markets as separate unit processes
   - To link the same (non-market) unit processes in many different ways, without changing the flows in each of the processes
   - Document market conditions using same data format as for other processes

(Weidema B P. 2003. Flexibility for application. Market modelling in LCI databases. http://www.lca-net.com/publications/)

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Activity: unlinked and unallocated Unit process

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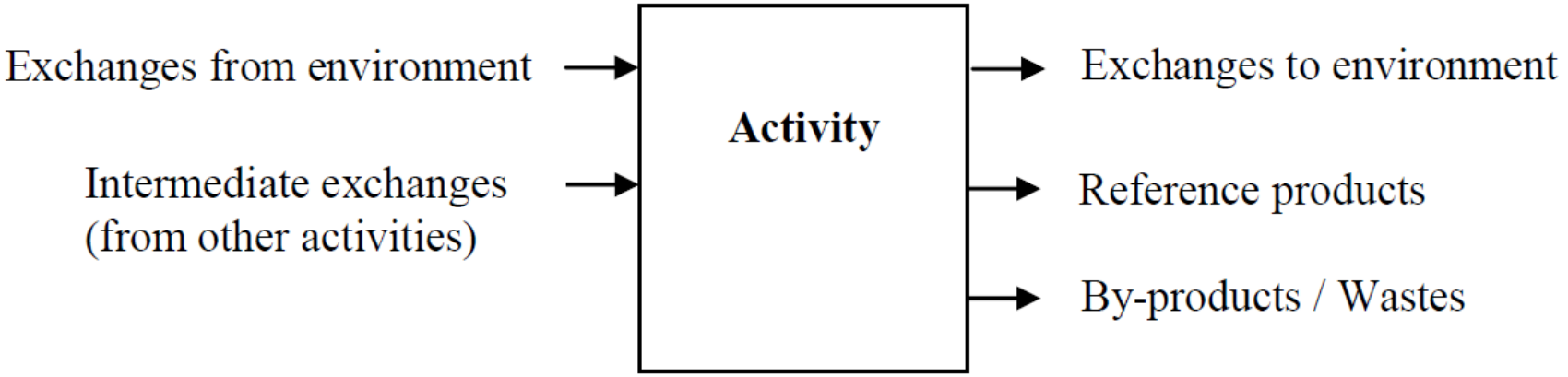
- An ecoinvent activity dataset represents a **unit process of a human activity** and its exchanges with the environment and with other human activities.



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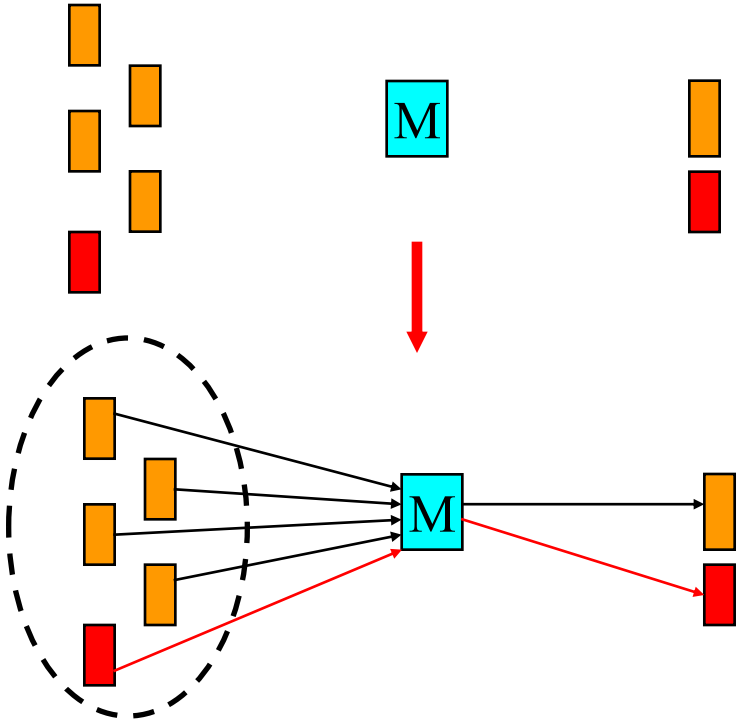
Linking transforming datasets through the markets



Unlinked datasets with product markets

Datasets linked, based on geographical location

- New datasets automatically linked to their suppliers and market
  → more frequent updates of the database possible

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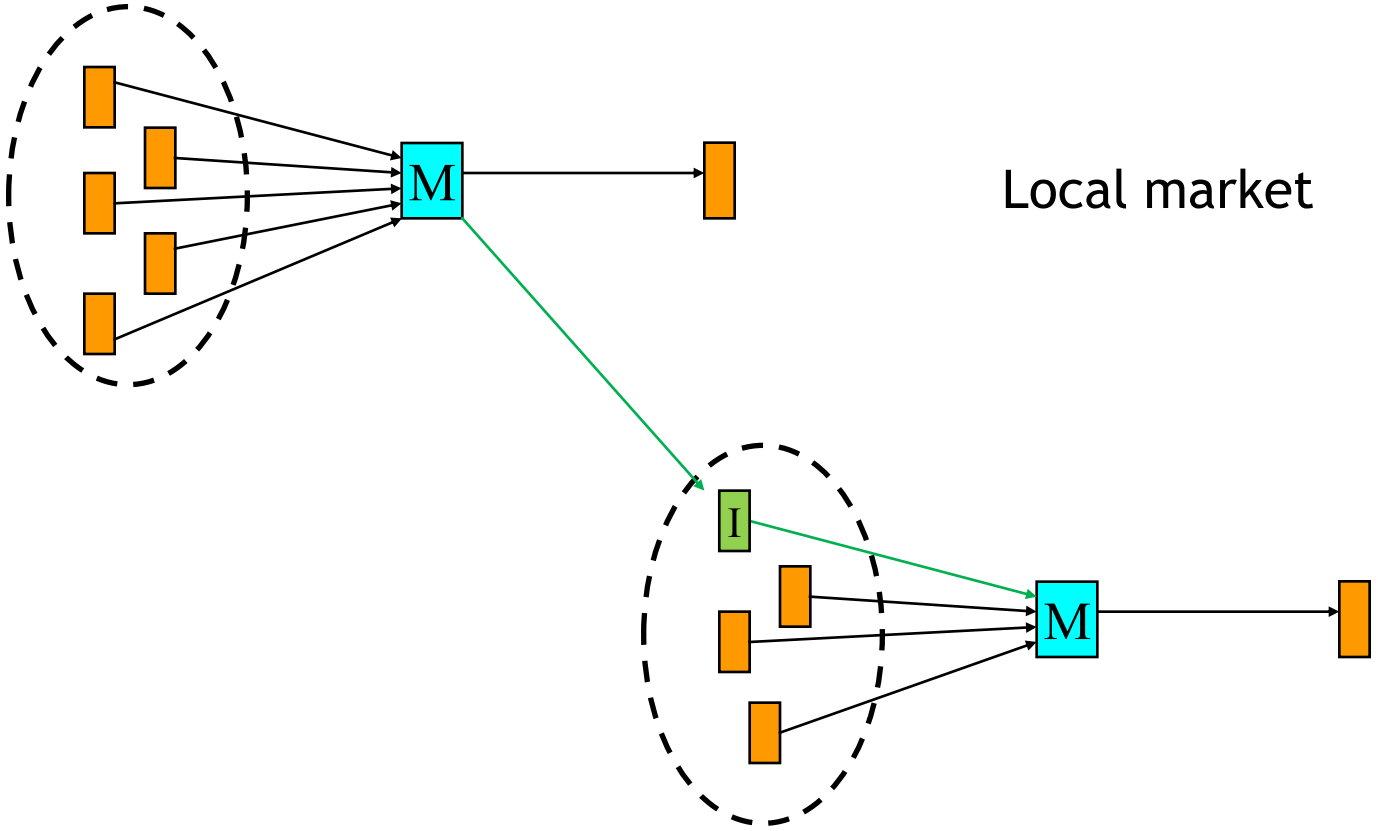
Geographical delimitation: Export



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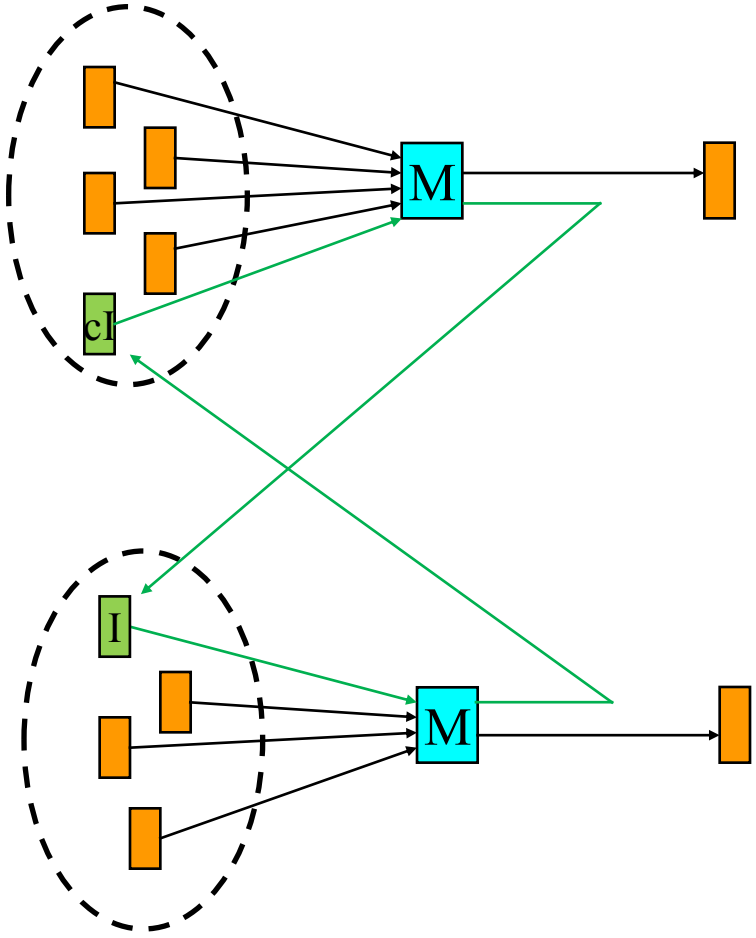
Geographical delimitation: Constrained import



Local market

Rest of the world

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Attributional and consequential system models – the difference

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- Average versus unconstrained (marginal) suppliers
- Allocation versus substitution (system expansion) to handle remaining by-products

- The unallocated (multi-output) activities are the same for both models

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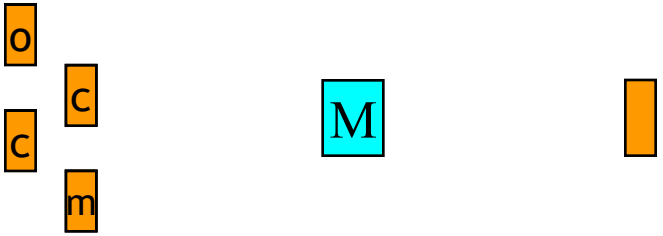
Modelling systems with constraints



Unlinked datasets with product markets

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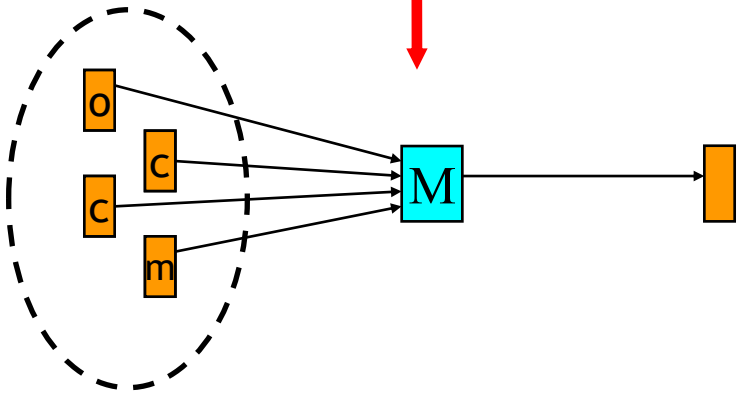
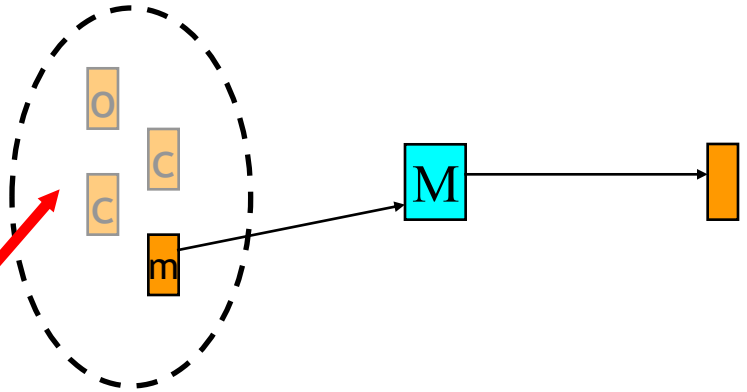
Model without constraints (average suppliers)





Modelling technology constraints using technology level

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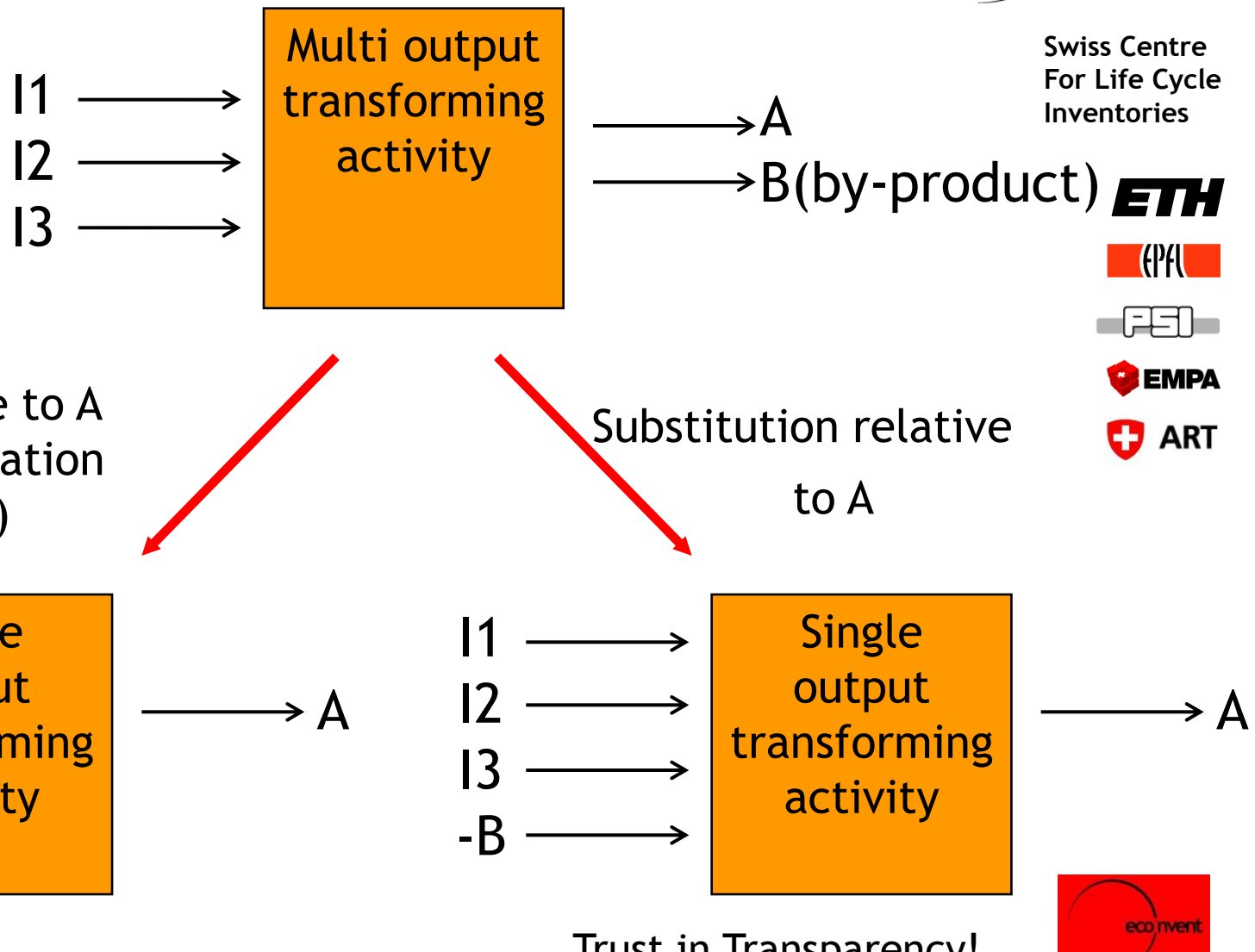
How to deal with by-products



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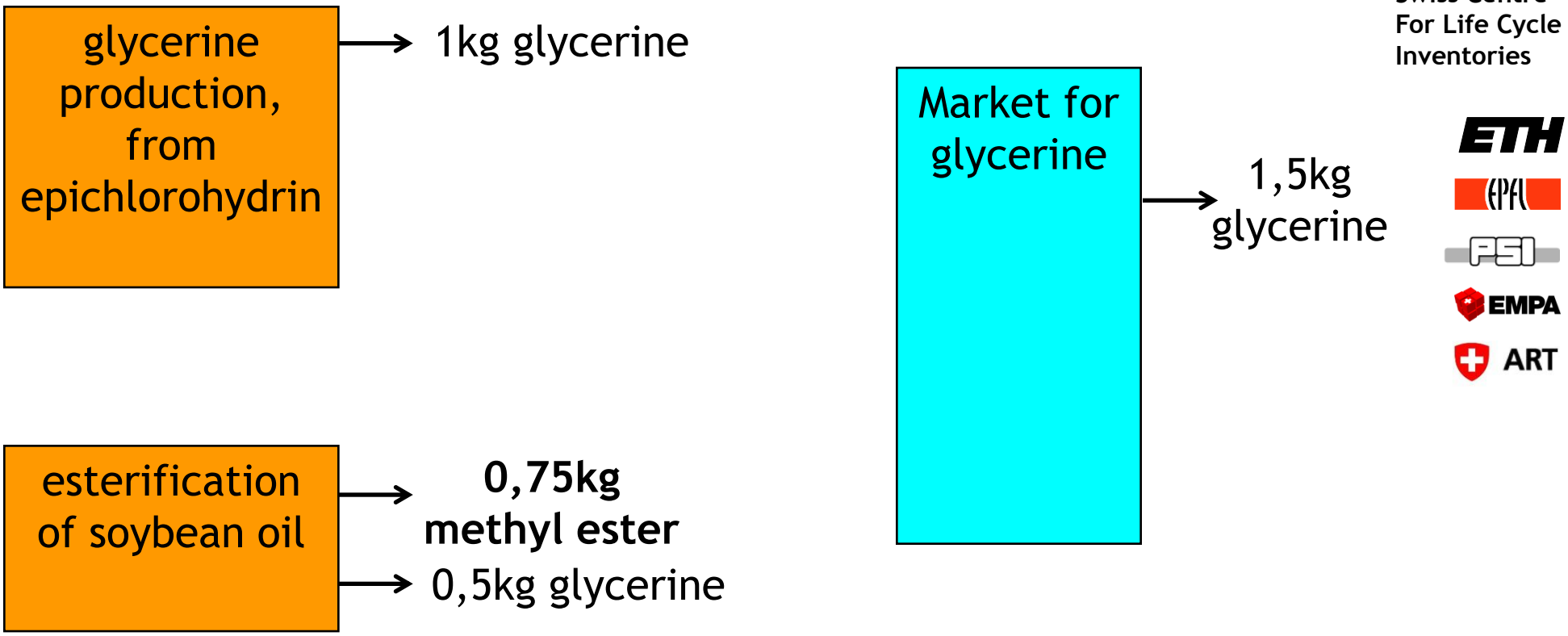
How to deal with by-products: attribution



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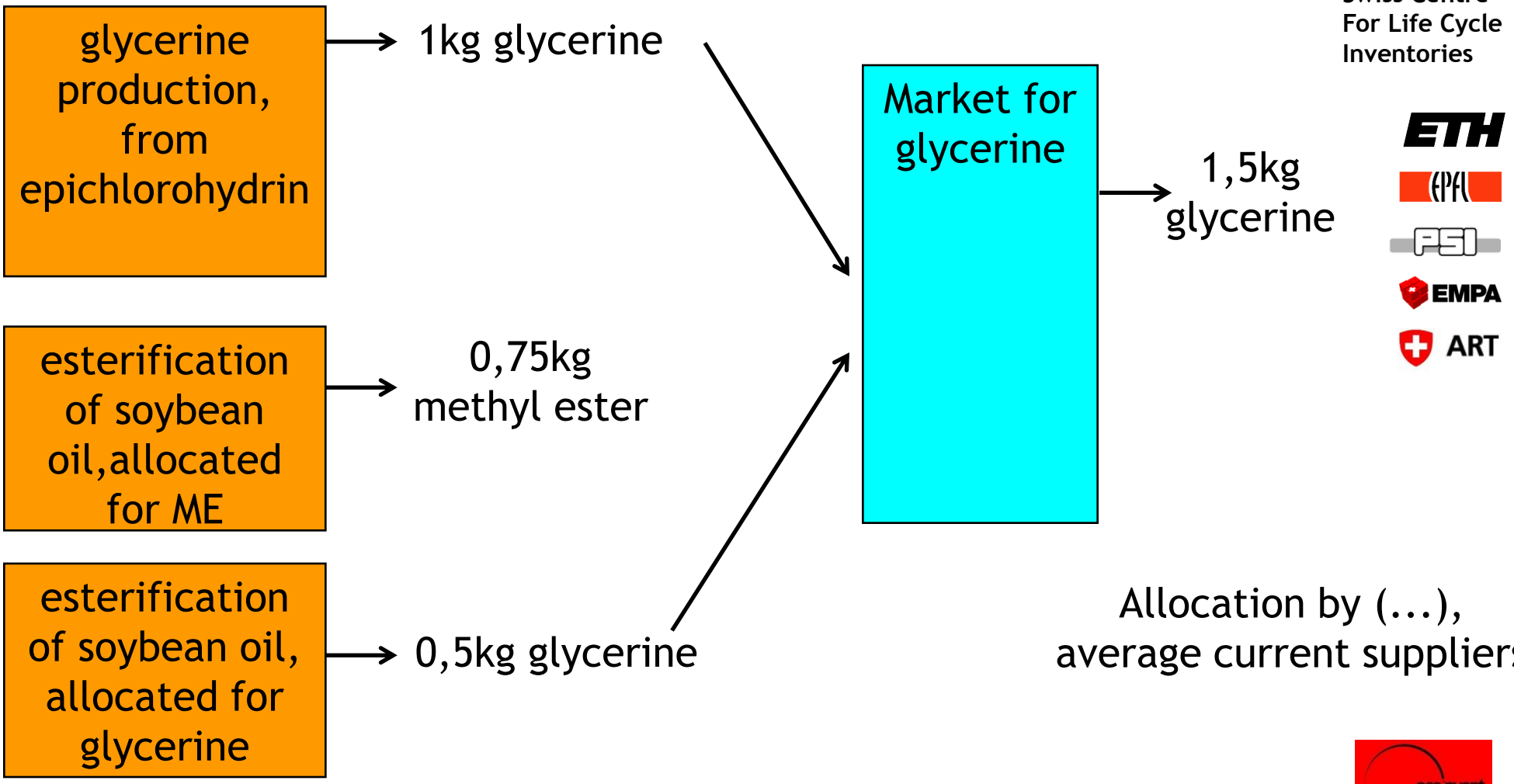
How to deal with by-products: attribution



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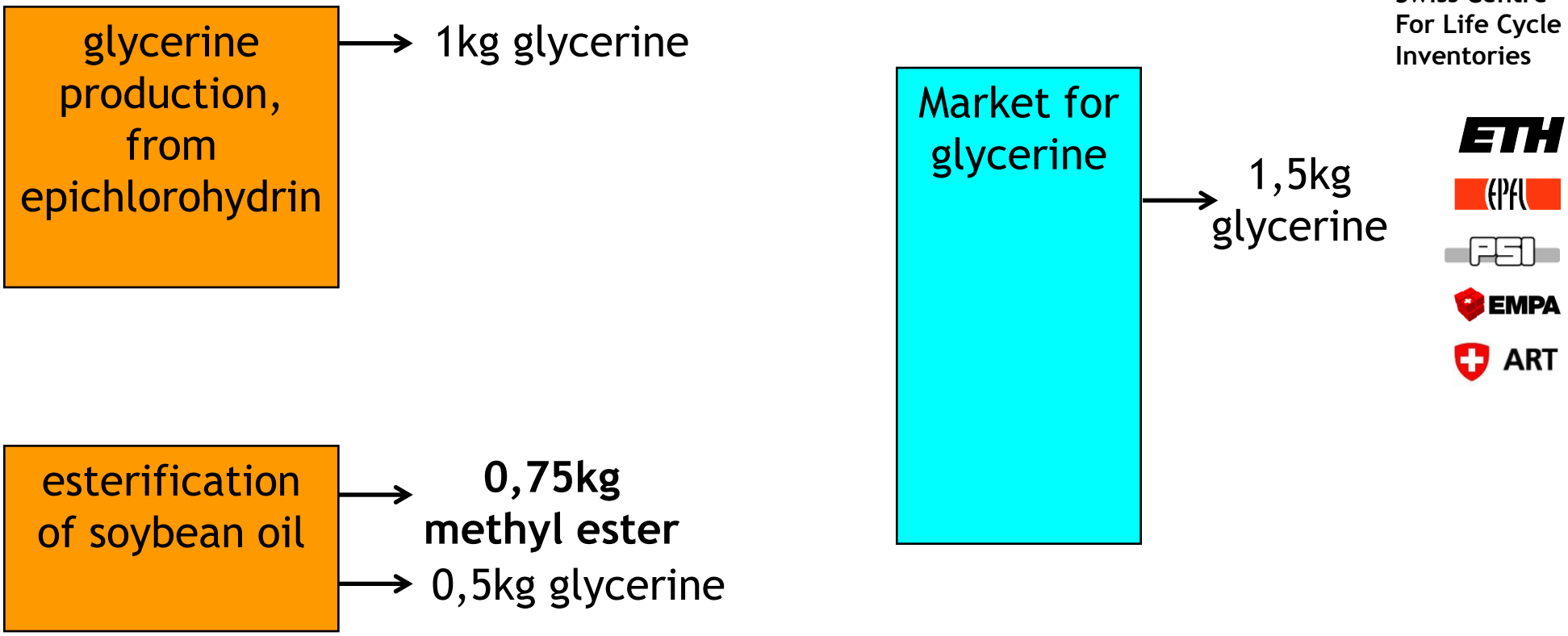
How to deal with by-products: substitution



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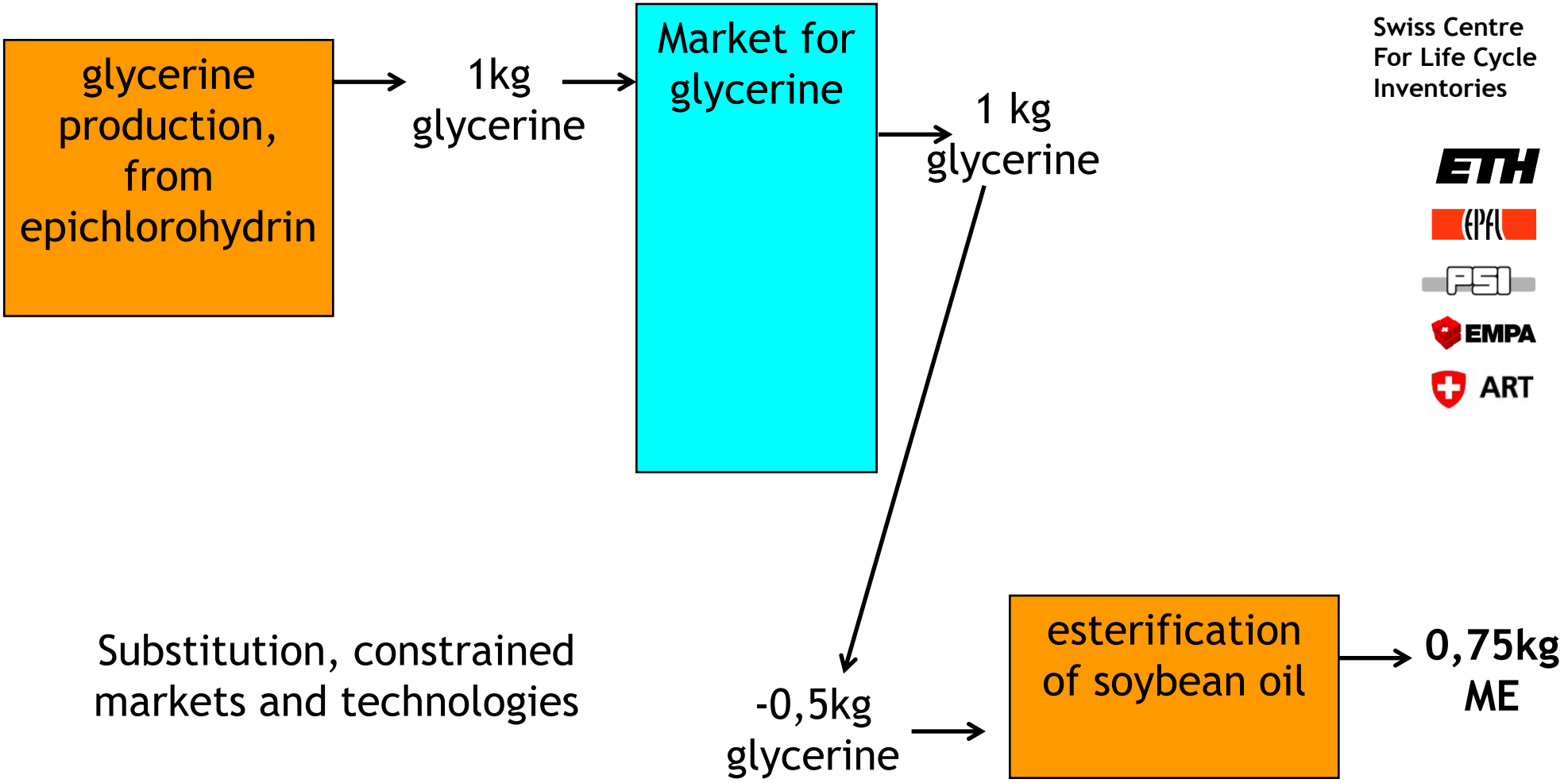
How to deal with by-products: substitution



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Conclusions

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- all datasets – both market and non-market activity datasets – are completely independent of each other
- linking and embedding of datasets ensured by the database linking algorithms (attributional or consequential) system models based on the same unit process data
- consequential system models: availability of market datasets for all products provides a consistent and unambiguous modelling of what the by-product substitutes (changes in demand result in changes in supply from the marginal supplier to the market)

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