Flexibility for application - Market modelling in LCI databases

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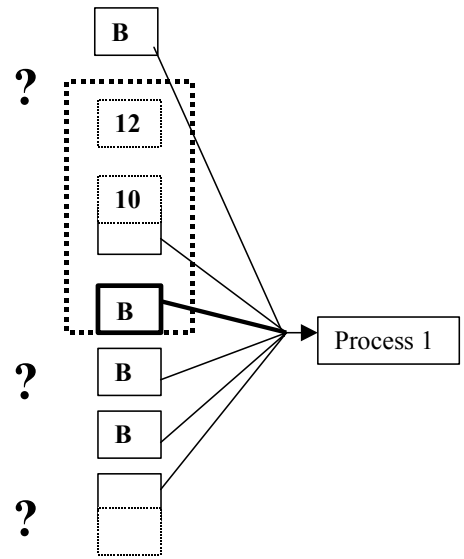
- Specific aspect: Linking of unit processes
- Prerequisites for flexibility in process linking
- Modelling markets as processes
- Two examples of how market modelling can work flexibly in practice

Which processes to link?

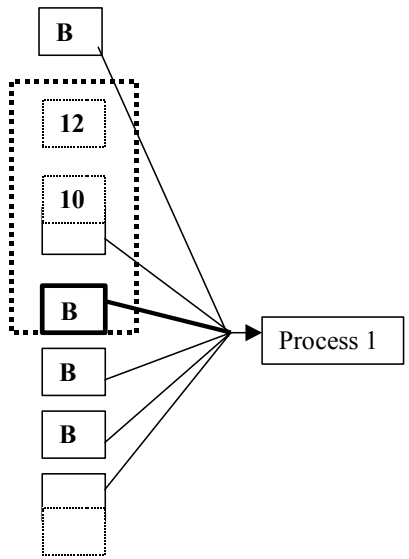
- Current suppliers?
- Potential suppliers?
- Marginal suppliers?
- Average of all?
- On what market?



The choice often determines the result

The standard assumption

Fully elastic supply –
Current suppliers are affected in proportion to their current market share



Three situations that demand deviations from the standard assumption

1) Constrained processes: Shift to alternative suppliers
2) Constrained markets: Behavioural changes
3) Co-product constraints: System expansion

- each situation implies different processes to link compared to the standard assumption
- different scenarios may imply different market conditions, and thus different processes to be linked

Therefore, flexibility in options for linking is important

Prerequisites for flexibility

- All necessary unit processes must be available: database completeness
- Unaggregated unit processes, so that links can be altered as required; specifically multi-product processes must be left unallocated

One option is to model markets as processes, with inputs from different suppliers or as “negative outputs” to processes affected by price changes

Advantage of modelling markets as processes

- Possible to combine the same unit processes in many different ways, depending on the scenario and market conditions appropriate for the individual LCI study, without changing the flows in each of the processes supplying and being supplied by the affected market
- Different market conditions can be documented in the same data documentation format as used for other processes (ISO 14048)

Allowing for market modelling in LCA-databases: Two examples

- The Danish LCA Food Data Base
- The Danish input-output based LCA-database

Both fulfil the prerequisites of completeness and unaggregated processes

Allowing for market modelling in the Danish LCA Food Data Base

- Data on what farm types are affected by a small (marginal) change in demand are available as part of the database
- For crops, these data are based on simulations with an econometric model, i.e. an empirical model of Danish farmers actual market behaviour
- For fish, sugar and milk, data are provided for both the situations with and without production constraints (quotas etc.)
- For the dairy, supply from agriculture is only included in the situation without quotas, else the supply is from decrease in butter and milk powder production

Allowing for market modelling in the Danish input-output based LCA-database

Traditional environmental IOA implies the standard assumption of full elasticity

To diminish the consequent errors in LCI modelling, we have analysed the Danish economy systematically for industries with long-term production constraints

Main areas where constraints play a role

- Agriculture, fishery, and the food industry
- The vegetable oil and animal fats industry
- Extraction of crude oil and gas
- Electricity generation
- The recycling industry
- Industries in decline, such as the European ammonia and chlorine industry

Allowing for market modelling in the Danish input-output based LCA-database

Technical implementation:

- Each industry with internal constraints are divided into a constrained and a non-constrained part
- the constrained supplies are transferred to the alternative non-constrained industry
- The constrained industries are not removed, thus allowing simulations of different market situations

Furthermore, it is recommended to supplement the database with specific modern processes in the cases where there is a significant difference in technology and emissions between the average and the modern plants

Conclusions

- Market modelling can be implemented consistently in large databases
- Flexible implementation allows many alternative market assumptions to be applied to the same data
- Widens the application fields for these databases
- Increases validity and policy relevance of resulting LCIs