



Swiss Centre for Life Cycle Inventories

A joint initiative of the
ETH domain and Swiss
Federal Offices

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3rd International ecoinvent meeting



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ecoinvent v3: System models & linking of datasets into systems

The situation in ecoinvent so far



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Single system
model



Multiple system
models

Enforced direct
linking



Direct & indirect
linking possible

System models for an LCI database



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- A **system model** is a collection of modelling choices made for the database
- System models differ in 2 main modelling choices
 - ◆ Resolving multi-output activities by **allocation** or by **system expansion**
 - ◆ The use of **average** or **unconstrained** suppliers
- In LCA, the **attributional** and **consequential** system models are the most well-known
 - ◆ Attributional uses **allocation** and **average** suppliers
 - ◆ Consequential uses **substitution / system expansion** and **unconstrained** suppliers

System models in ecoinvent v3



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- So far, the ecoinvent database applied **one** system model
 - ◆ Allocation (expert identified)
 - ◆ Average suppliers
 - ◆ Carbon corrections
- In version 3, **multiple system models** will be available
 - ◆ **Allocation, Default** (attributional LCA)
 - Uses **allocation** (expert identified, optional – revenue by default)
 - **Average** suppliers, **carbon corrections**
 - **Maintains** system model choices of ecoinvent v2.2
 - ◆ System models based on other allocation properties possible
 - **Revenue allocation**, mass, carbon content, ... ?

System models in ecoinvent v3



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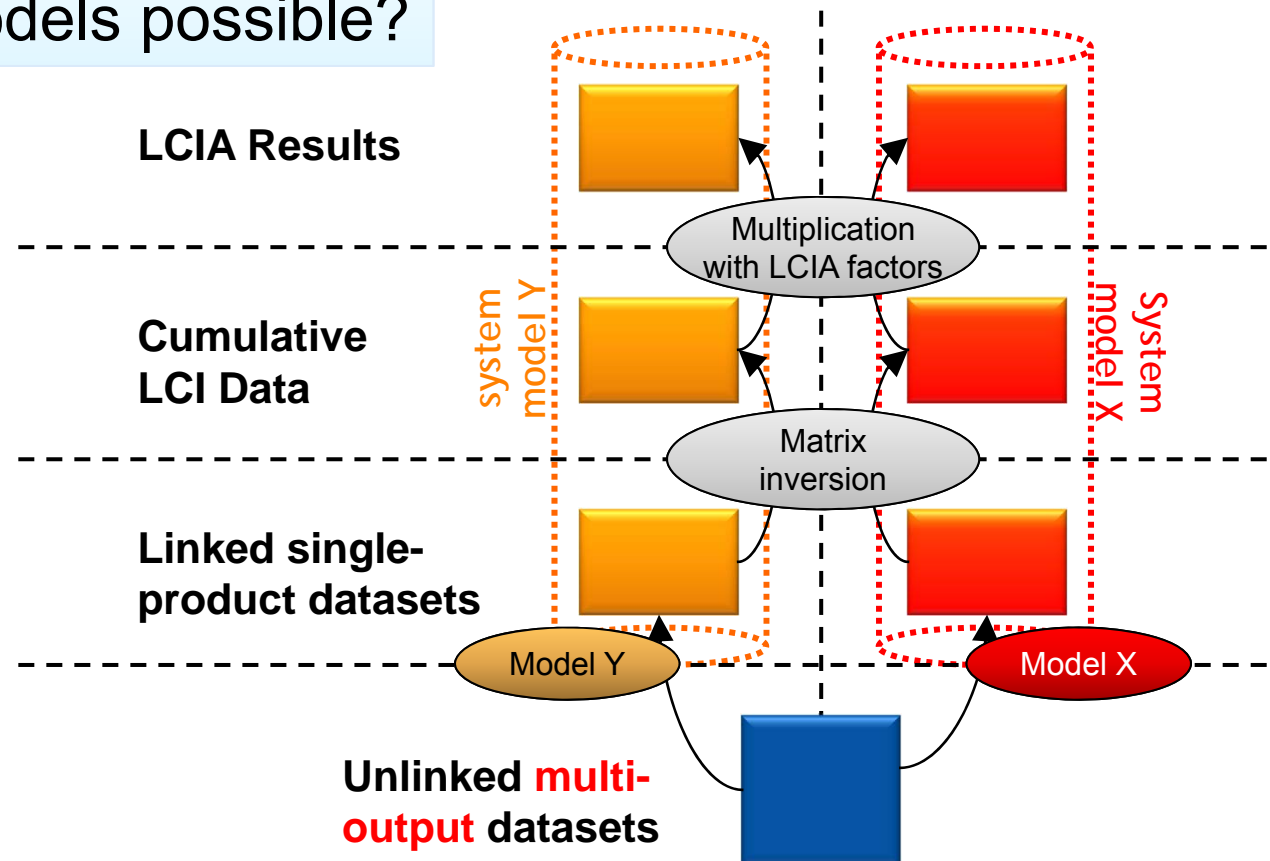
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- In addition to **allocation-based** models, there are now **substitution-based** models available
 - ◆ **Consequential**
 - Uses **substitution** (i.e. **system expansion**), with constrained by-products, markets and technologies
 - ◆ **Substitution, constrained by-products**
 - **Similar** to the consequential model
 - Does **not** use constraints due to markets and technology (i.e. **average**, not **marginal** suppliers)
- Further system models possible as demand develops

System models in ecoinvent v3

How are multiple
system models possible?



Indirect linking in ecoinvent v3



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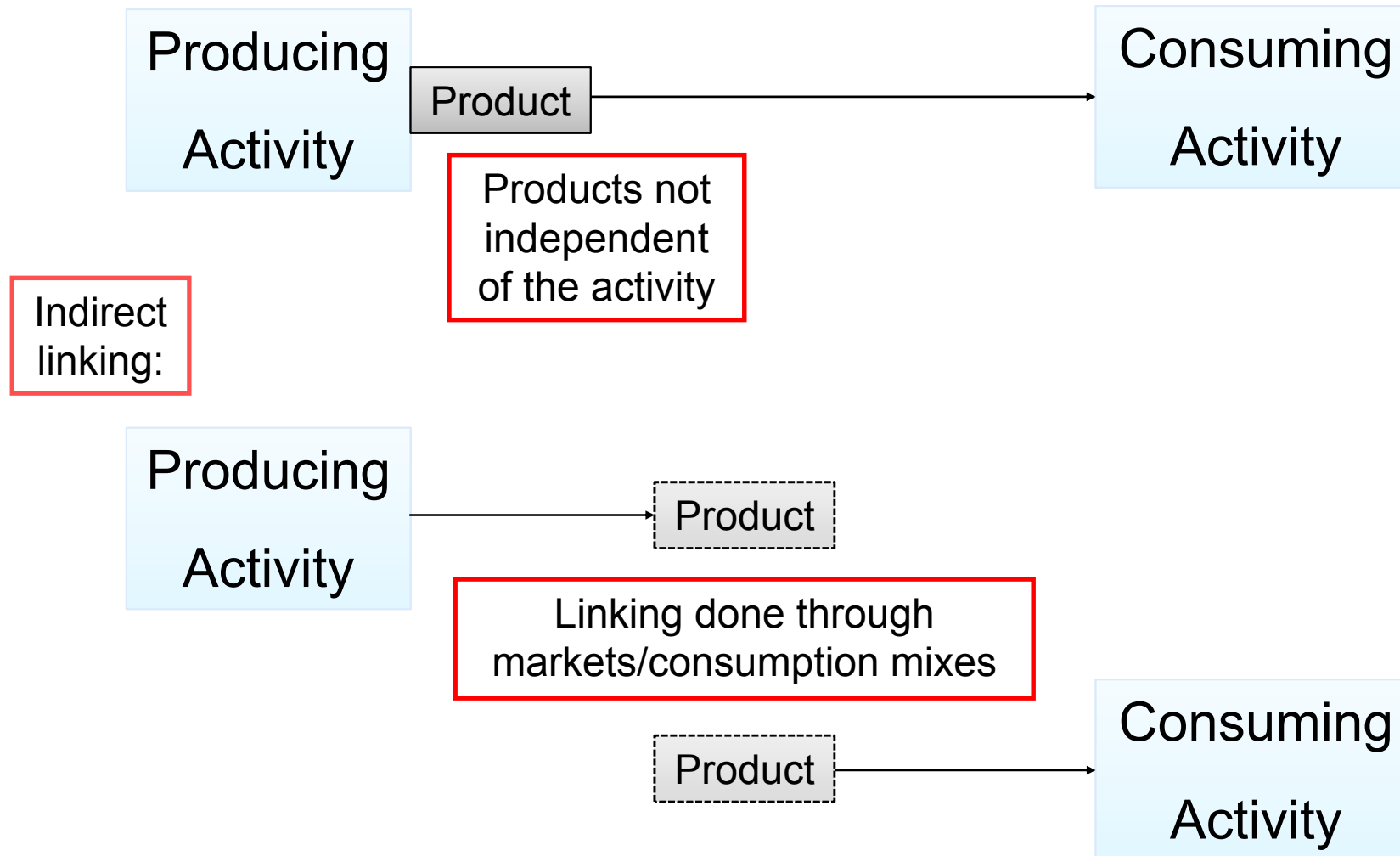
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Benefits of indirect linking



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- **Market datasets** provide all producing activities of a product for a region, they represent the consumption mix
- Linking rules can be **modified** to create **multiple system models**
- **Consistent availability** of consumption mixes is beneficial for data suppliers
- **Flexible updating** of existing supply chains
- **Additional information** can be added
 - ◆ Transportation requirements
 - ◆ Losses & spoilage
 - ◆ ...
- Direct linking **still possible** to specify supplying activities

Flexible supply chain updates



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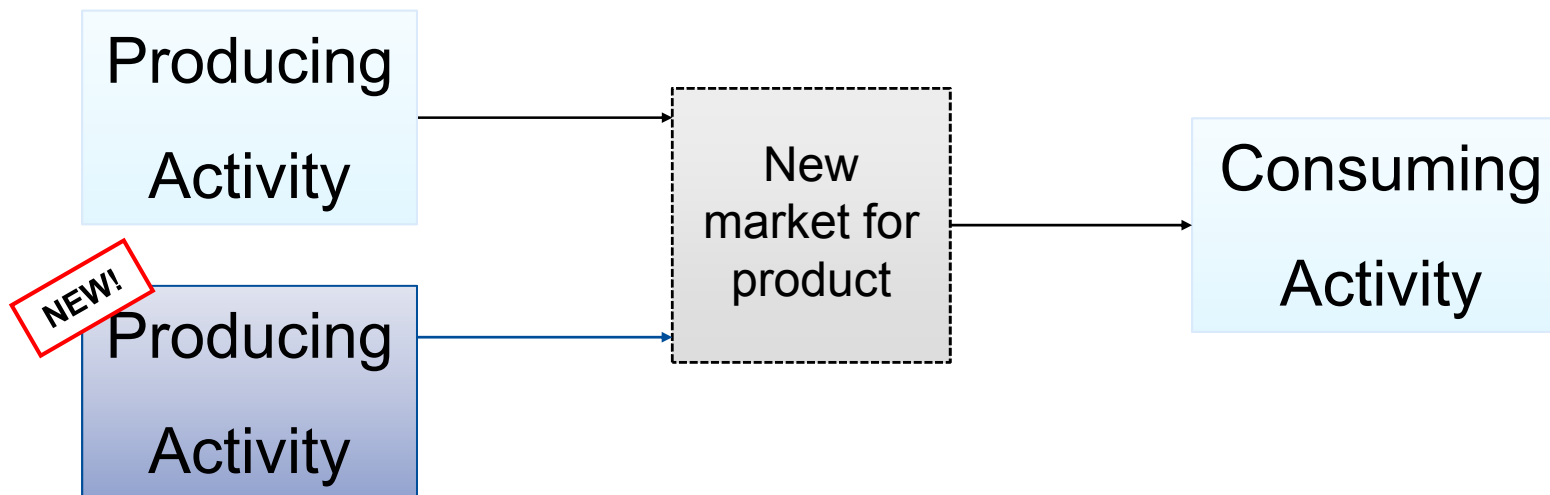
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System model linking



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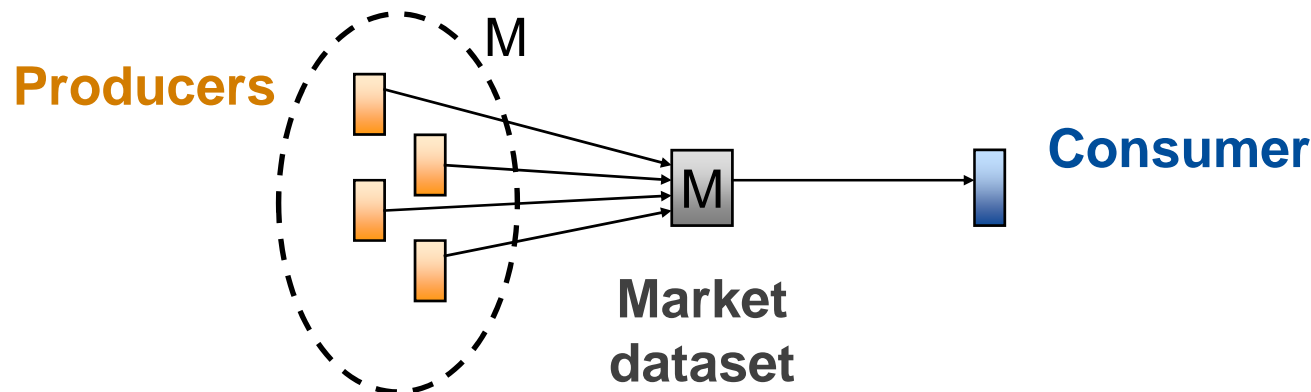
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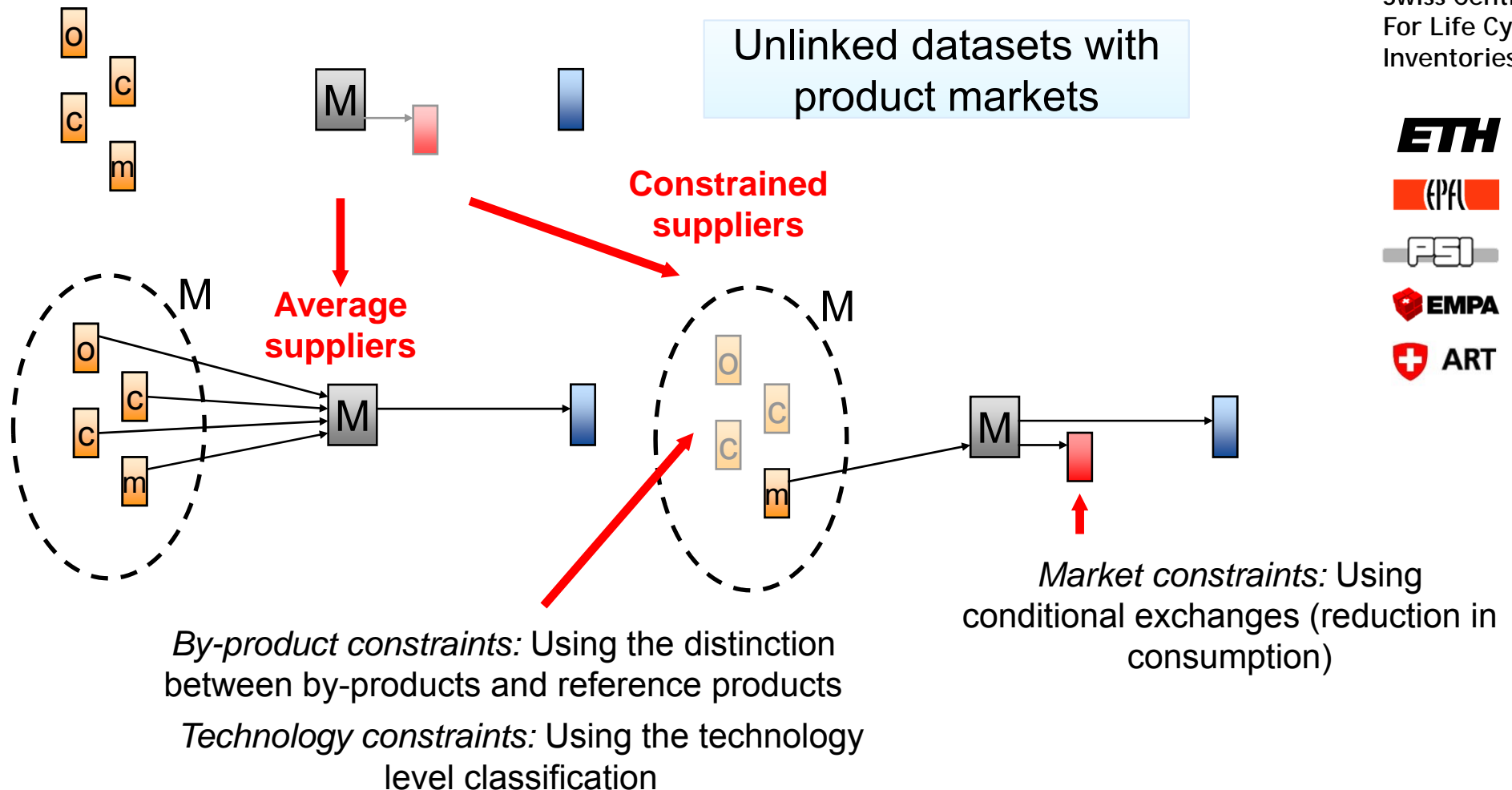
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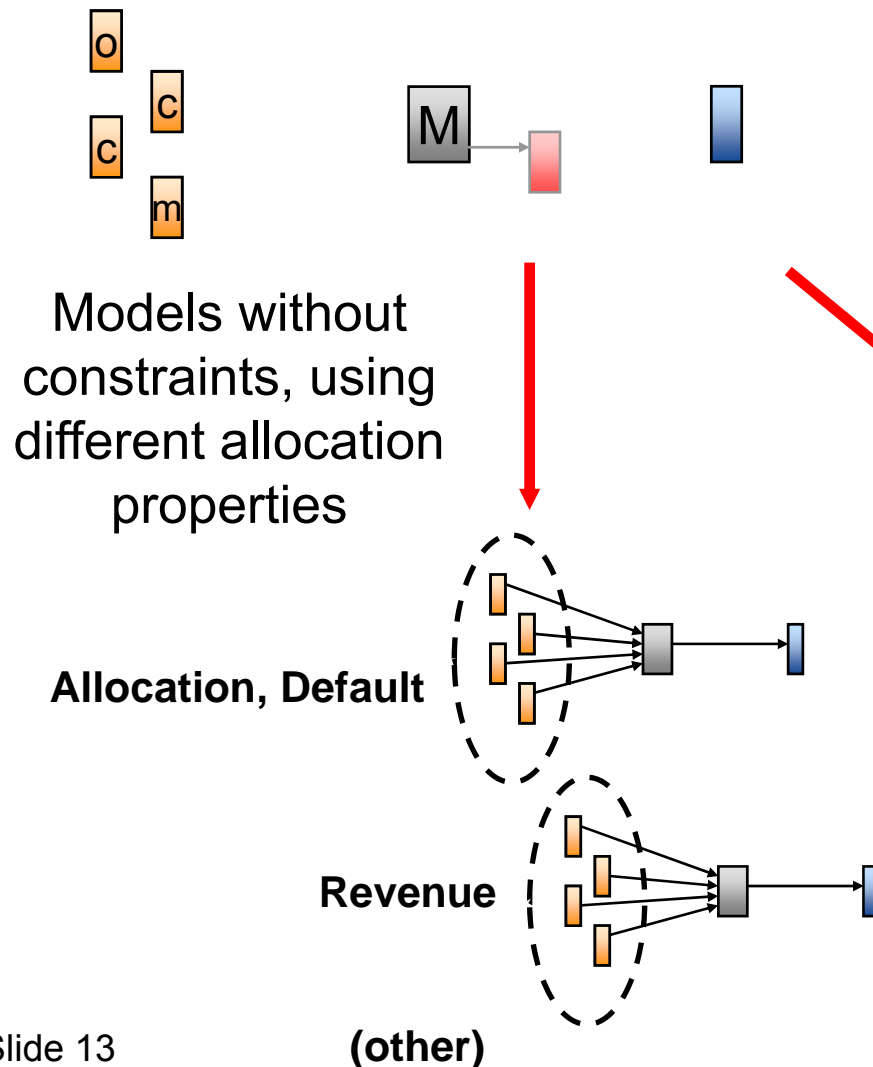
- **Separation** of product and activity names
- **Market datasets** are available for all products
- **Linking step** applies **system model rules** based on product names and geographical location



System model linking

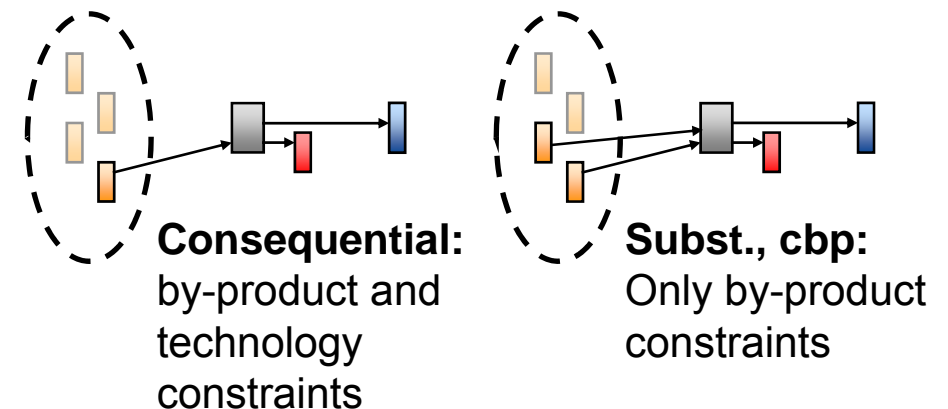


System model linking



One simple, unlinked system of datasets

Models with different constraints, using substitution



Implications for data providers



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- No requirement to **link to specific producing activities**, product inputs available that are linked to **market** inputs
- No requirement to provide **allocation factors** (optional)
- No requirement to **distinguish** between by-products, recyclable materials or wastes
 - ◆ Database automatically identifies **materials for treatment**
- No need to **supply market datasets**
 - ◆ A **global** market is autogenerated for new products
 - ◆ Local markets or other information **can be added**

Implications for data providers



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- Correct **choice** of intermediate **outputs** is important
 - ◆ Choice determines the **market & alternative producers**
- **Reference product** needs to be specified
- **Technology level** should be considered (optional)
 - ◆ Determines marginal suppliers in the consequential system model
- Contribution to existing markets shall be provided
 - ◆ Specified via production volumes of activities
- **New requirements – detailed guidance** is provided

Implications for end users



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- **Multiple system models** are available
 - ◆ Different system models serve **different purposes**, so the **applicability** of the ecoinvent database is broadened
 - ◆ Based on the **same underlying data** → discussion on system model choice is removed from discussion on data quality
 - ◆ Results will be **significantly different** between system models for certain products
 - Areas of significant technological change
- Existing data in ecoinvent is **automatically updated** with improved supply chain data over updates

Implications for end users



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- **Consistency** with the existing approach is maintained in the “**Allocation, Default**” system model
- Data for **new system models** (technology levels, constraints) do not affect the quality of the default model
- **Linked unit processes**, cumulated **system inventories** and **impact assessment** results are all available
 - ◆ Data available on homepage in **ecospold2** and as **excel-sheets**
 - ◆ **Software tools** can **use the data** without implementing the linking algorithms

Thank you for your attention!



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