

**Environmental and economic assessment of regional building materials industries combining material-flow-analysis, input-output-analyses and life-cycle-assessment**

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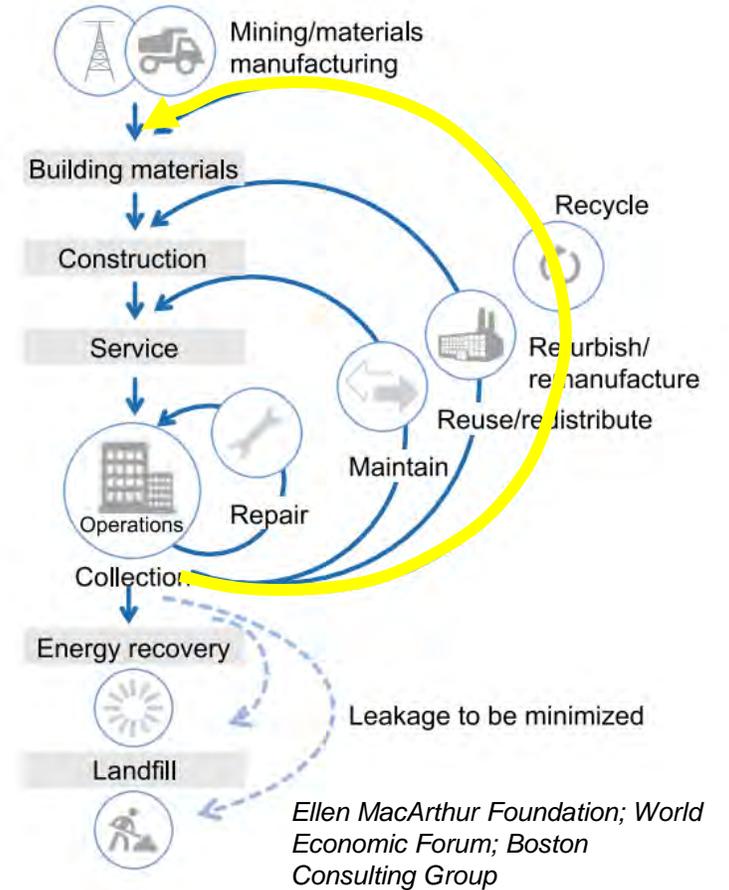


**Sustainable Economy**  
National Research Programme

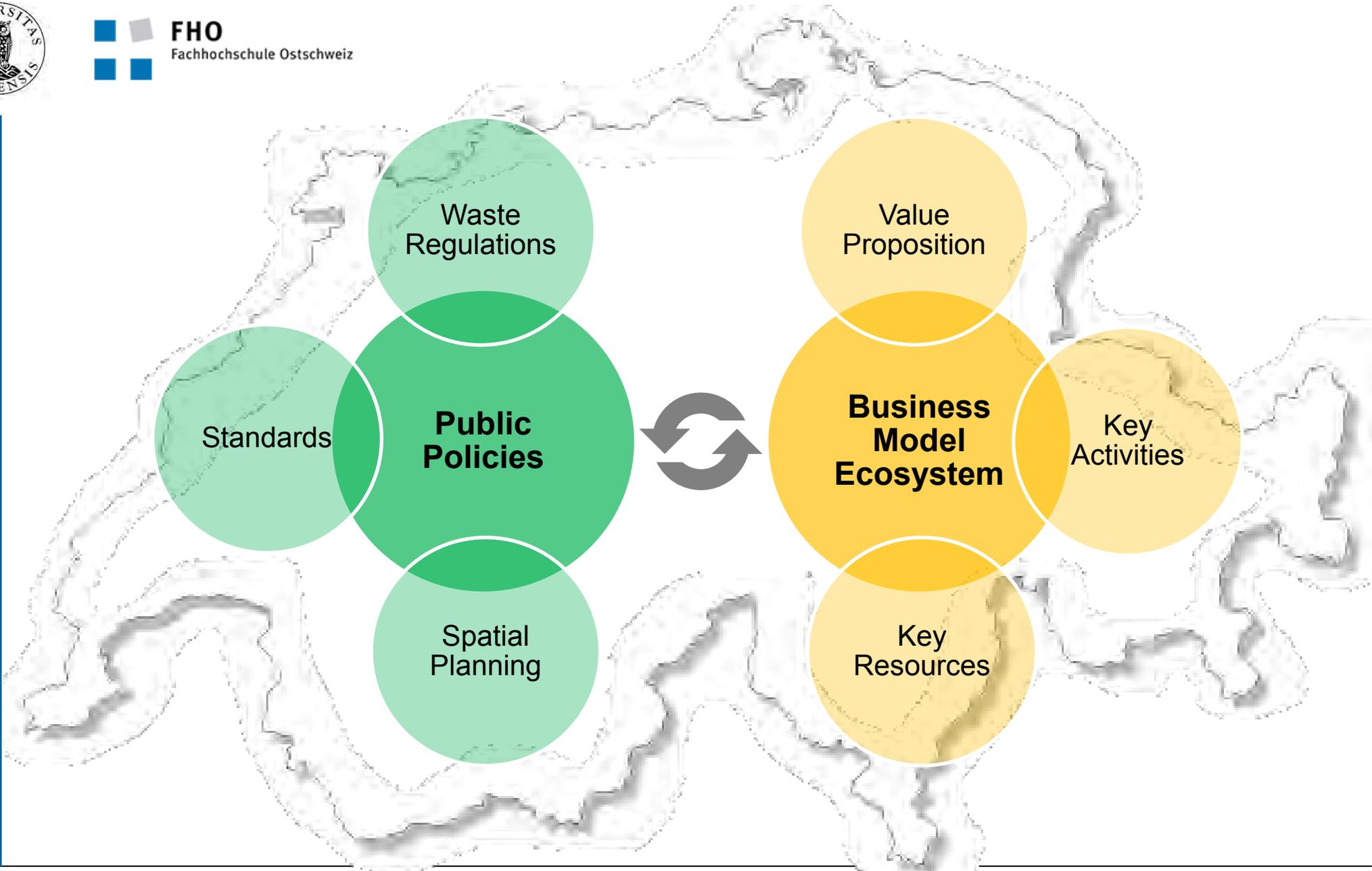


SWISS NATIONAL SCIENCE FOUNDATION

# High construction activity and limited resources call for circular economy!



**“Co-  
Evolution  
of Business  
Strategies in  
Material and  
Construction  
Industries  
and Public  
Policies”**



# Research Questions

## “Co-Evolution of Business Strategies in Material and Construction Industries and Public Policies” – “CUBIC”

Research project funded by the Swiss National Science Foundations (2017-2021).

### Guiding research questions:

- What are the central co-evolution mechanisms driving alternative business models and regulation in the Swiss construction industry?
- How can this co-evolution process be directed towards sustainability?

# The Challenge

- We need to understand the consequences of public policies or alternative business models regarding a sustainable industry, especially in a regional context
- We need **instruments** that evaluate the environmental and economic effects of public policies on a region or a industry in terms of sustainable development and circular economy

**How to assess an industry?**

# Which Methods to use?

| Issue of concern         | Specific concerns related to environmental impacts, supply security, technology development |  |   | General environmental and economic concerns related to the throughput |  |  |
|--------------------------|---|--|---|---|--|--|
|                          | within certain businesses, economic activities, countries, regions                          |  |   | of substances, materials, manufactured goods                          |  |  |
|                          | <i>associated with</i>  |  |   | <i>at the level of</i>  |  |  |
| Object of interest       | <b>Substances</b><br>chemical elements or compounds   | <b>Materials</b><br>raw materials, semi-finished goods | <b>Products</b><br>(manufactured goods)<br>batteries, cars, computers, textiles | <b>Businesses</b><br>establishments, enterprises                      | <b>Economic activities</b><br>mining, construction, chemical industry, iron & steel industry | <b>Countries, regions</b><br>total materials groups of materials, particular materials |
| Type of analysis         | <b>Substance Flow Analysis</b><br>↕   | <b>Material System Analysis</b><br>↕                   | <b>Life Cycle Assessment</b><br>↕   | <b>Business level MF Analysis</b><br>↕                                | <b>Input-Output Analysis</b><br>↕  | <b>Economy-wide MF Analysis</b><br>↕   |
| Type of measurement tool | <b>Substance Flow Accounts</b>  | <b>Individual Material Flow Accounts</b>               | <b>Life Cycle Inventories</b>   | <b>Business Material flow accounts</b>                                | <b>Physical Input-Output Tables, NAMEA-type approaches</b>                                   | <b>Economy-wide Material Flow Accounts</b>   |

Source: OECD, based on Bringezu and Moriguchi (2002).

# Which Methods to use?

|                          | MFA  | IOA   | LCA   |
|--------------------------|--|---|---|
| <b>Purpose</b>           | <ul style="list-style-type: none"> <li>investigate <b>technical processes</b></li> <li>systematic evaluation of flows and stocks</li> </ul>  | <ul style="list-style-type: none"> <li><b>economic</b> tool for analysing interindustrial interdependences</li> </ul>   | <ul style="list-style-type: none"> <li><b>decision-support</b> tool</li> <li>bottom-up methodological framework encompassing all the <b>impacts</b> of a product</li> </ul> |
| <b>System definition</b> | <ul style="list-style-type: none"> <li>Functional or geographical</li> </ul>   | <ul style="list-style-type: none"> <li>Geographical</li> </ul>  | <ul style="list-style-type: none"> <li>Functional</li> </ul>  |
| <b>Allocation</b>        | <ul style="list-style-type: none"> <li>Mass proportional</li> </ul>  | <ul style="list-style-type: none"> <li>Value proportional</li> </ul>  | <ul style="list-style-type: none"> <li>various choices (Mass or value proportional, System expansion, ...)</li> </ul>   |
| <b>Advantage</b>         | <ul style="list-style-type: none"> <li>Flexibility with regard to model assumptions</li> <li><b>Mass balancing</b> (filling data gaps)</li> <li>Basis for impact assessment methods</li> </ul> | <ul style="list-style-type: none"> <li>Represents the <b>whole economy/industry</b></li> <li>Public data available (on nationwide level)</li> <li>Possibility to extend (MRIO, EEIO)</li> </ul> | <ul style="list-style-type: none"> <li><b>Detailed</b> evaluation of a product</li> <li>Product comparisons</li> <li>Multi-dimensional</li> </ul>                           |
| <b>Disadvantage</b>      | <ul style="list-style-type: none"> <li>Availability of data</li> <li>One-dimensional</li> <li>Services are not represented</li> </ul>  | <ul style="list-style-type: none"> <li>Low resolution due to <b>high aggregation</b></li> <li>partial simplifications and assumptions</li> <li>Spatial boundaries</li> </ul>                    | <ul style="list-style-type: none"> <li>subjective <b>definition of the system boundary</b> (e.g. EoL-Phase)</li> <li>How to represent services?</li> </ul>                  |

**Single methods can't provide a comprehensive economic and environmental assessment of a complex system in the context of a circular economy**

# Proposal: Combination of Methods

Increase the resolution:  
Industry-wide MFA

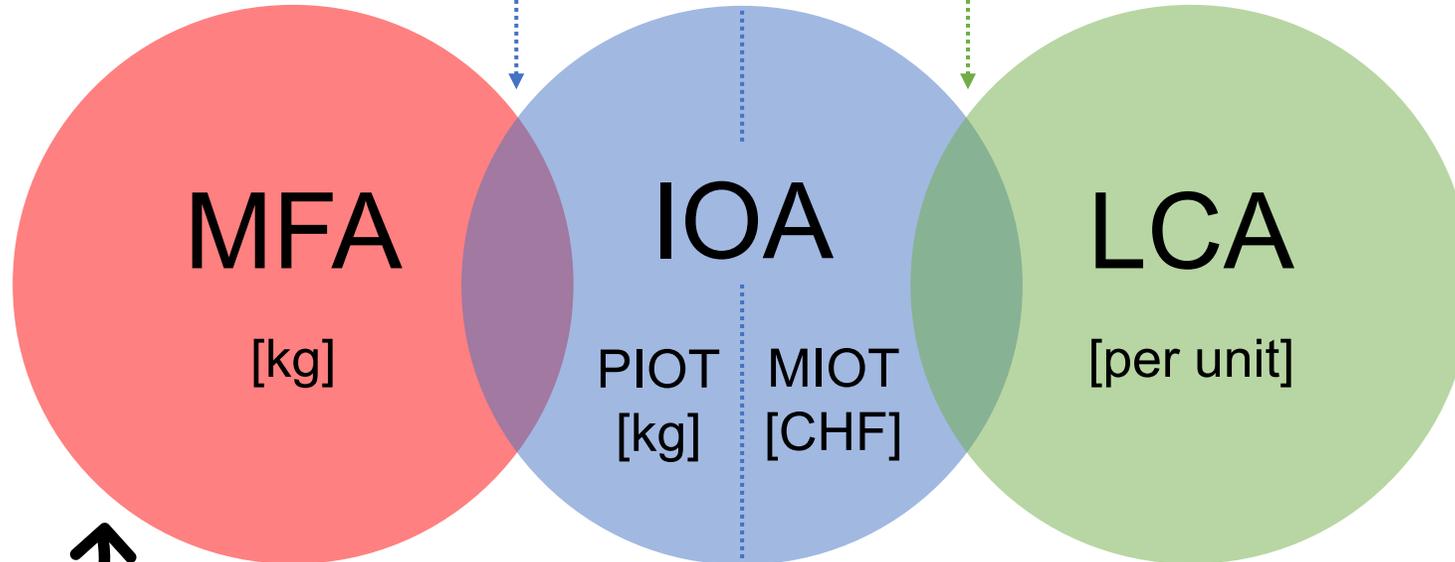


Economy-wide MFA  
[kg]

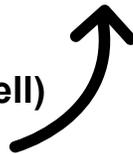
Hybrid-LCA / EEIOA  
[per CHF]



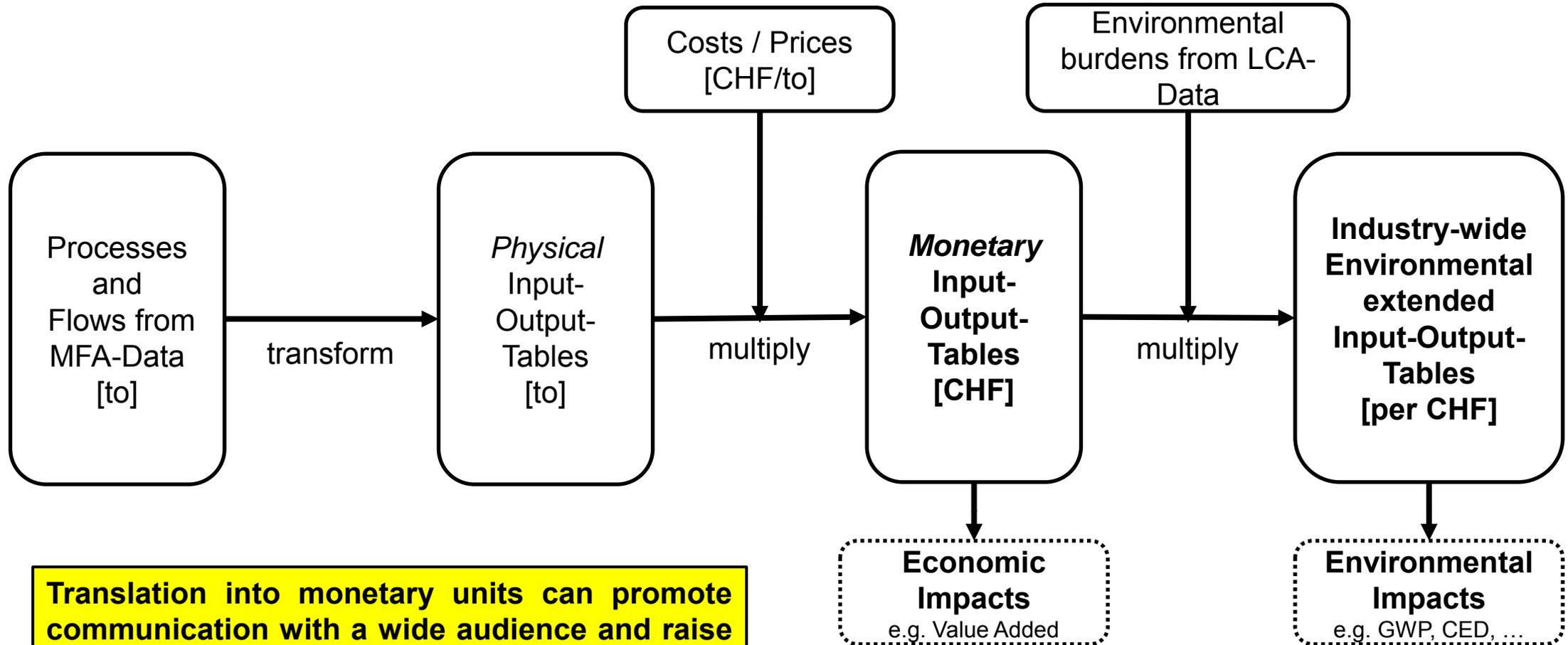
Combination enables us  
to assess the impacts  
of all processes in the  
regional industry



Availability of Data:  
MFA-Database (KAR-Modell)  
Case-Studies

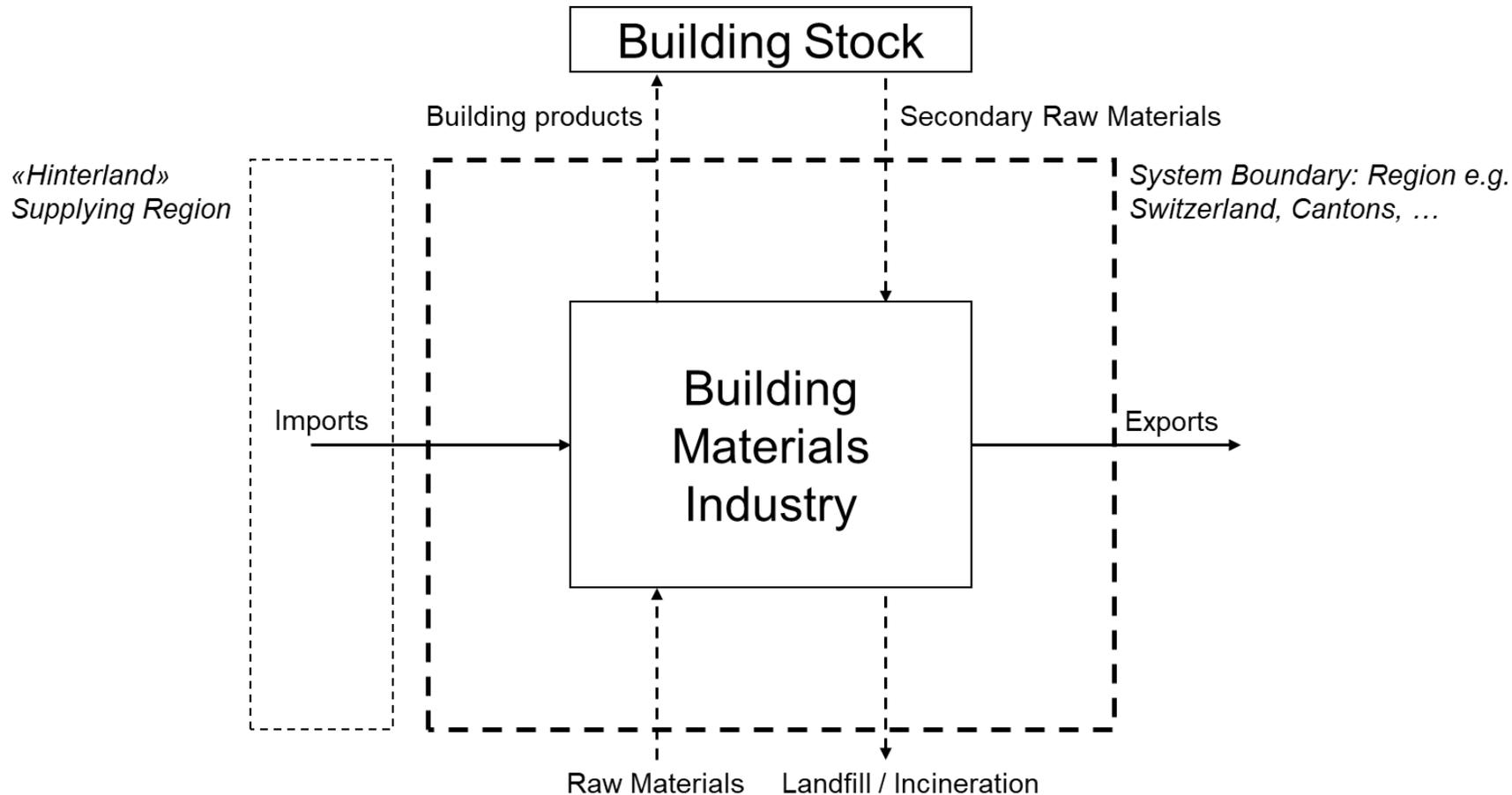


# Assessment-Model



**Translation into monetary units can promote communication with a wide audience and raise social awareness of environmental issues**

# Assessment-Model – System Boundary



## System Boundary:

**Output of the Buildings-Materials-Industry in the defined Region over a specified period**

## Focus:

- Regional comparison
- Boundary analysis in the context of a change in regional demand

## With this Assessment-Model, we can ...

- indicate the **impacts of changing material flows** or innovations on the life cycle most relevant for generating value added, causing emissions and consuming natural resources on a regional level
- highlight the **impact of a specific business-model** and show how this effects environmental and economic performance of a regional building materials industry
- derive **policy recommendations** which promote the development of a circular economy in the building materials industry in a regional context

# THANK YOU FOR YOUR ATTENTION

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