



# Sustainable transitions in socio-technical systems; and agent-based modelling approach

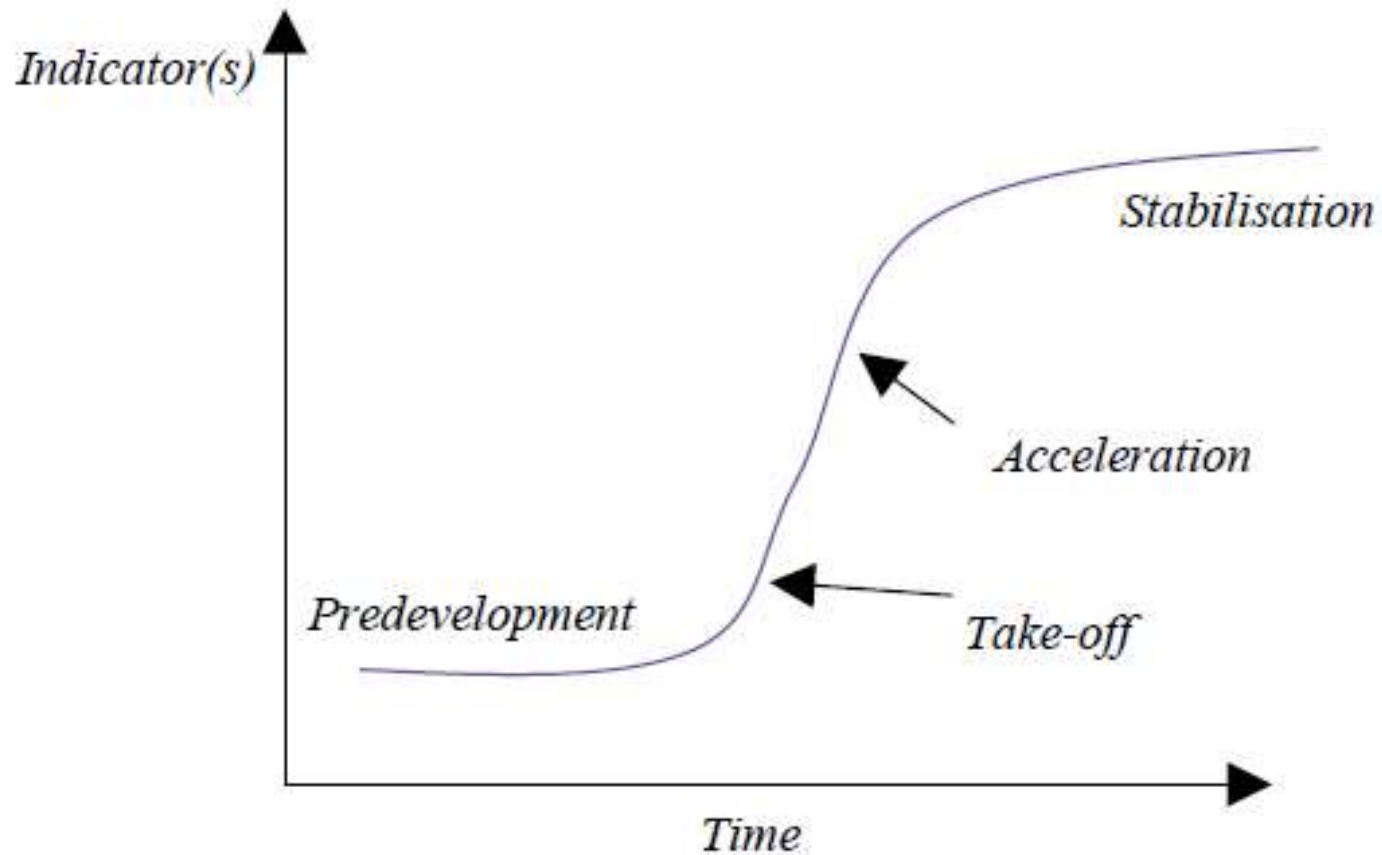
MASS Pecha Kucha 19<sup>th</sup> April 2013

Christof Knoeri

# Systemic transitions



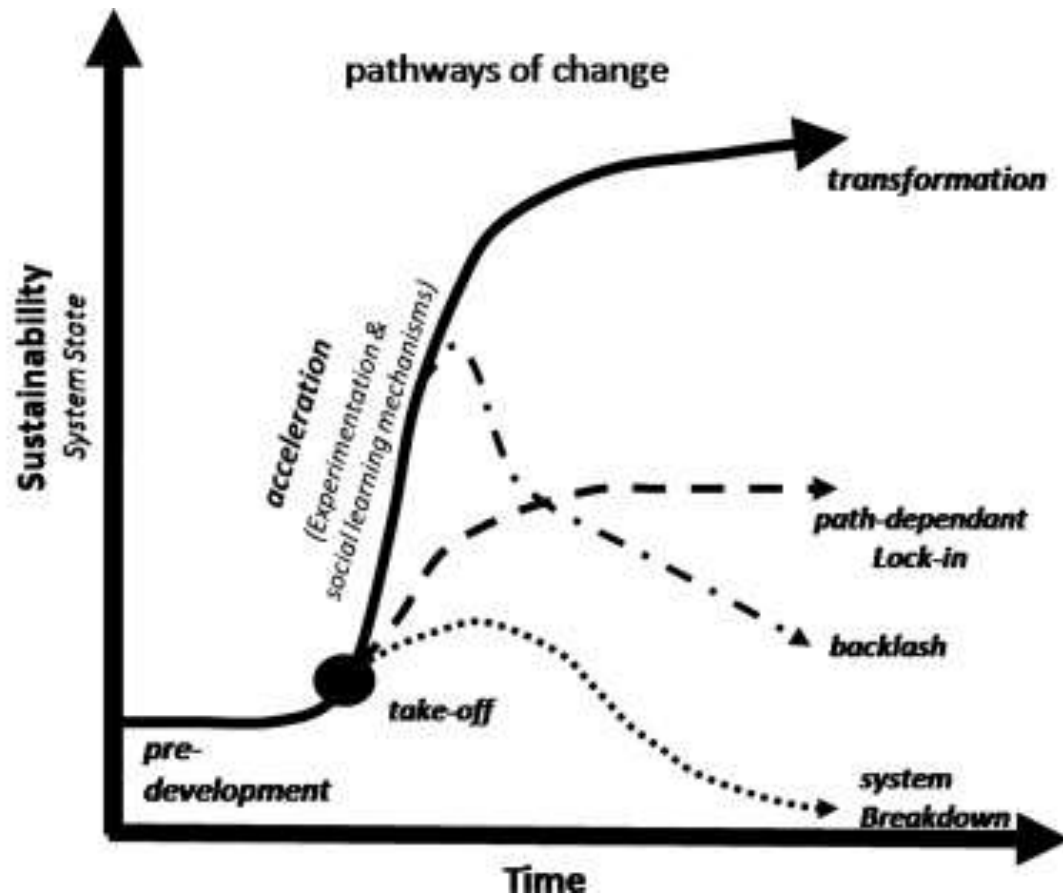
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# Sustainable transition pathways



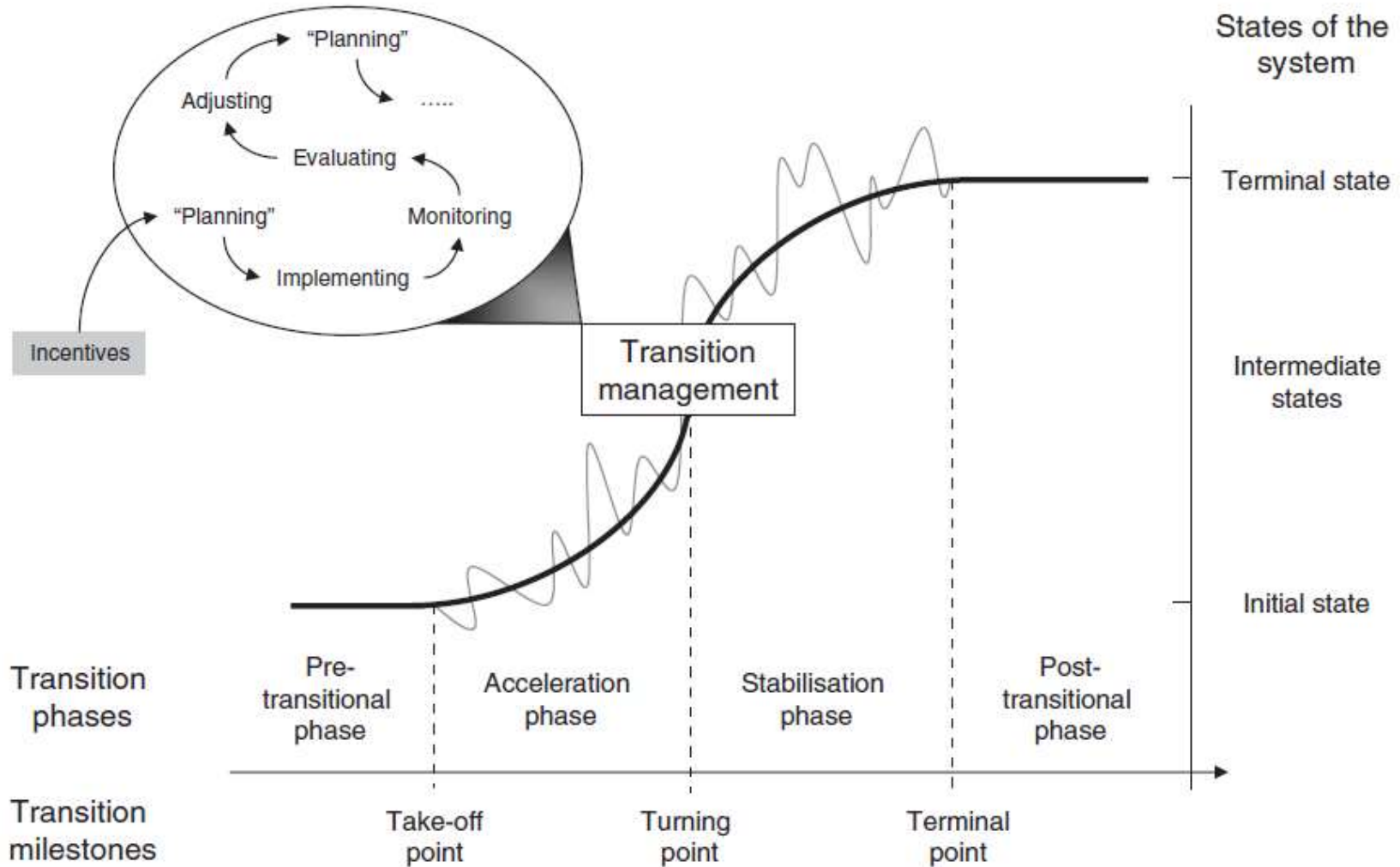
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# Transition management



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# Transitions in socio-technical regimes



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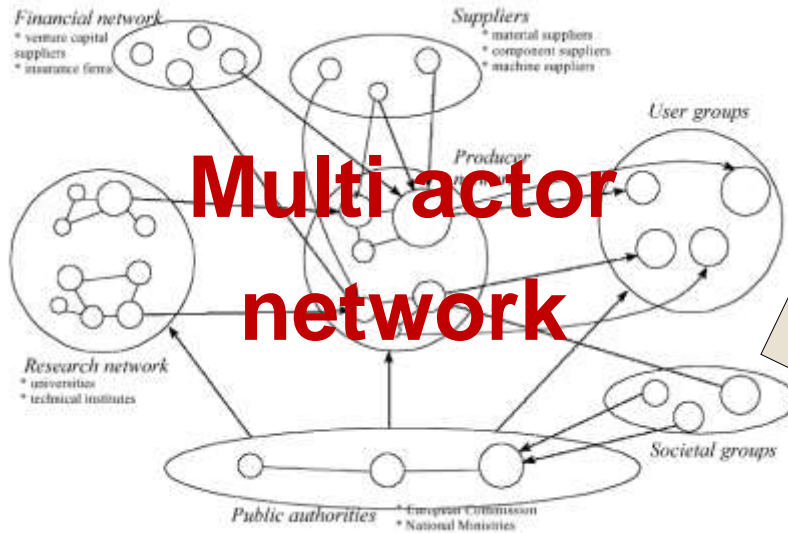


Fig. 2. The multi-actor network involved in sociotechnical regimes



Fig. 3. Multiple levels as a nested hierarchy.

Increasing structuration of activities in local practices

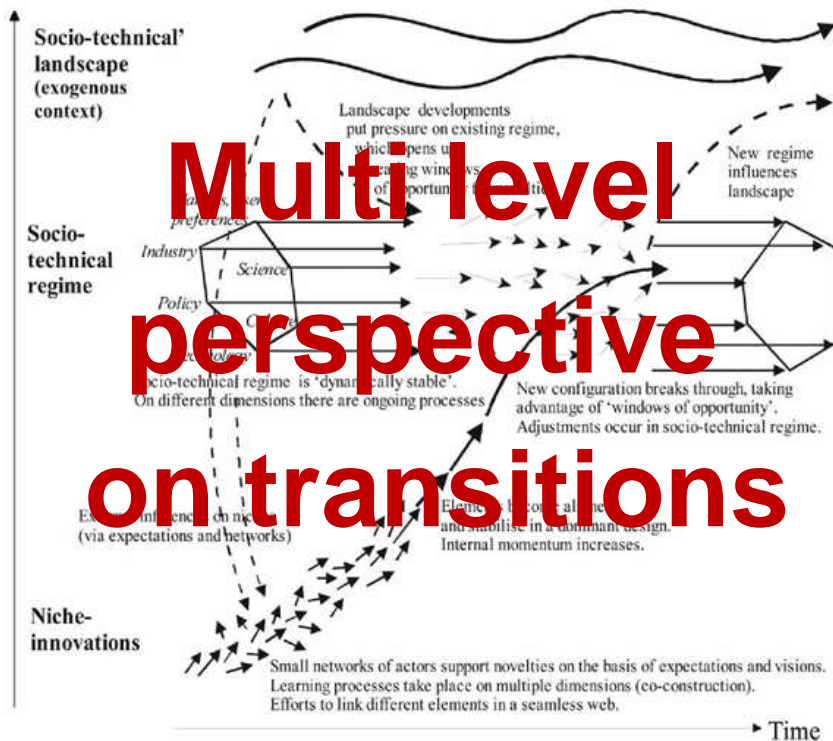


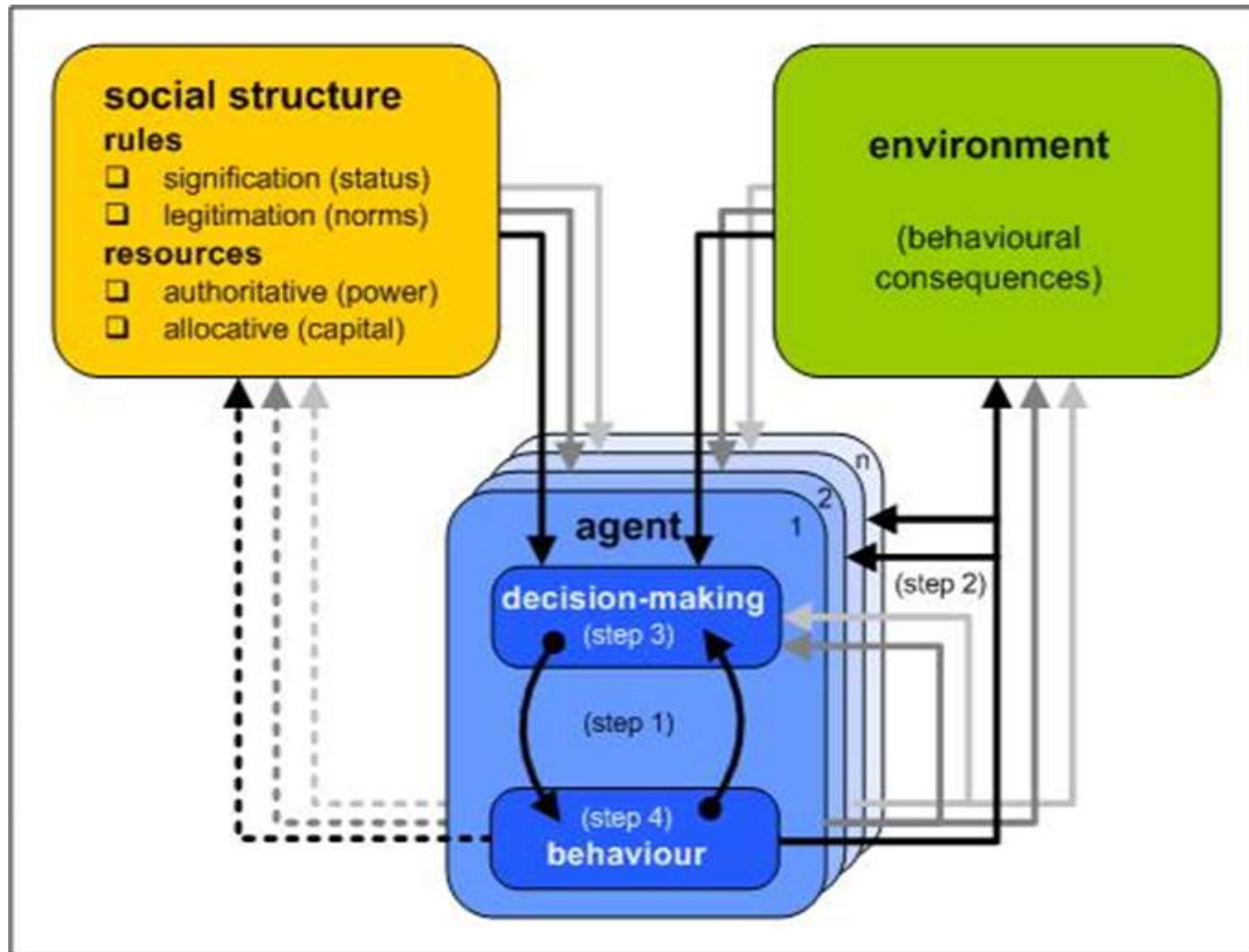
Figure 5. Multi-level perspective on transitions (adapted from Geels 2002, 1263).

Source: Geels et al., 2002, 2005, 2007

# Agent-based modelling for transition management



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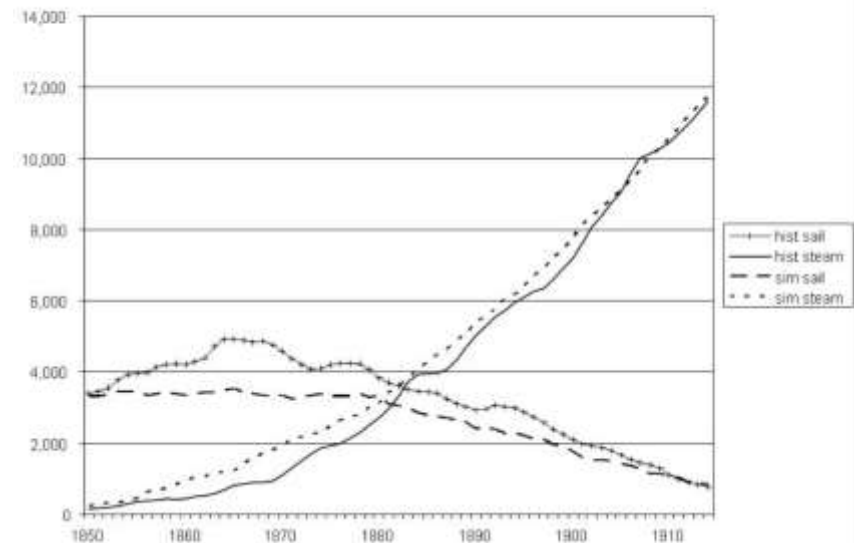
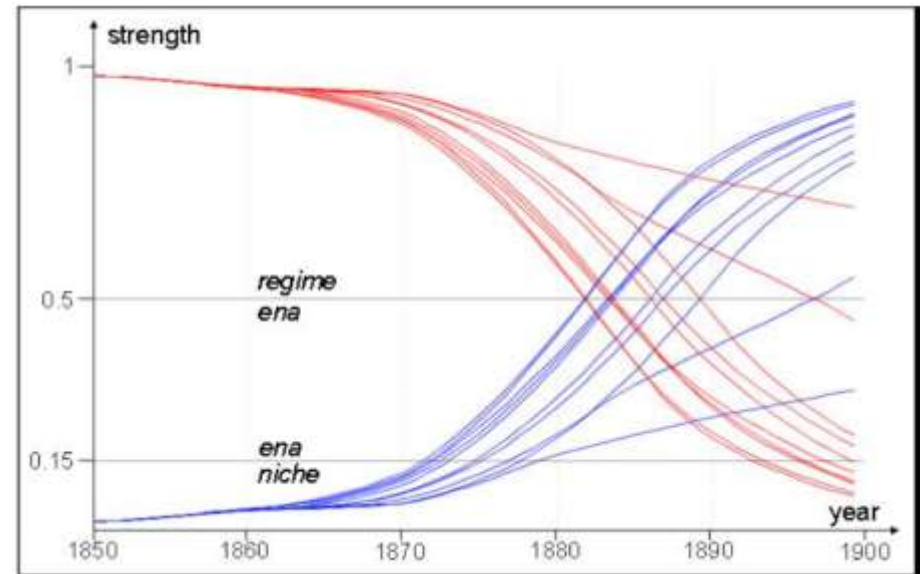
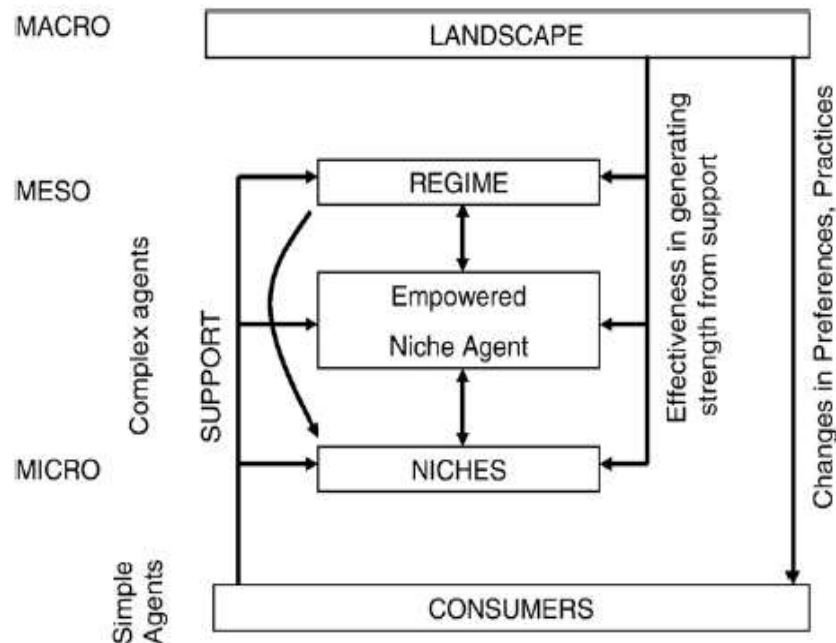


Source: Knoeri et al., 2011

# Agent-based modelling for transition management



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Sources: Bergmann, Haxeltine et al., 2008, Koehler et al., 2009



**Material recycling  
in the  
construction sector**



**Multi utility service  
companies  
(MUSCOs)**



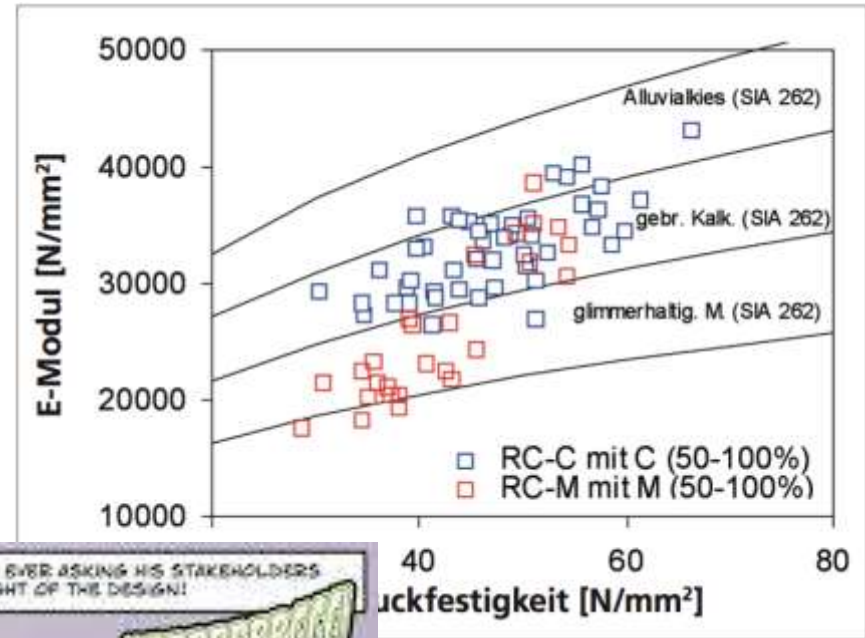
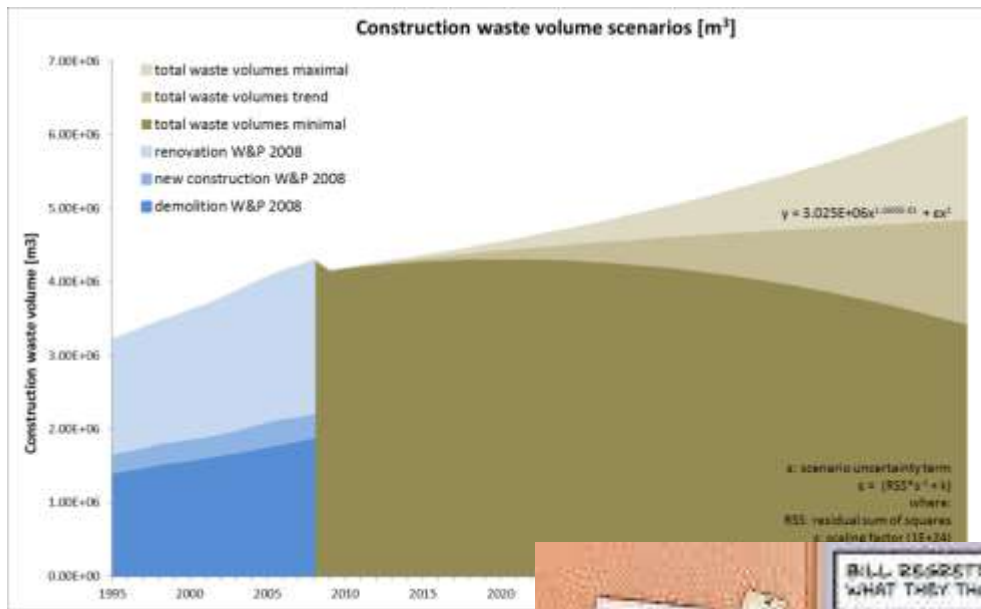
**Supply chain  
decisions and  
critical  
raw materials**



# Increasing waste, tested properties, but reluctant stakeholders



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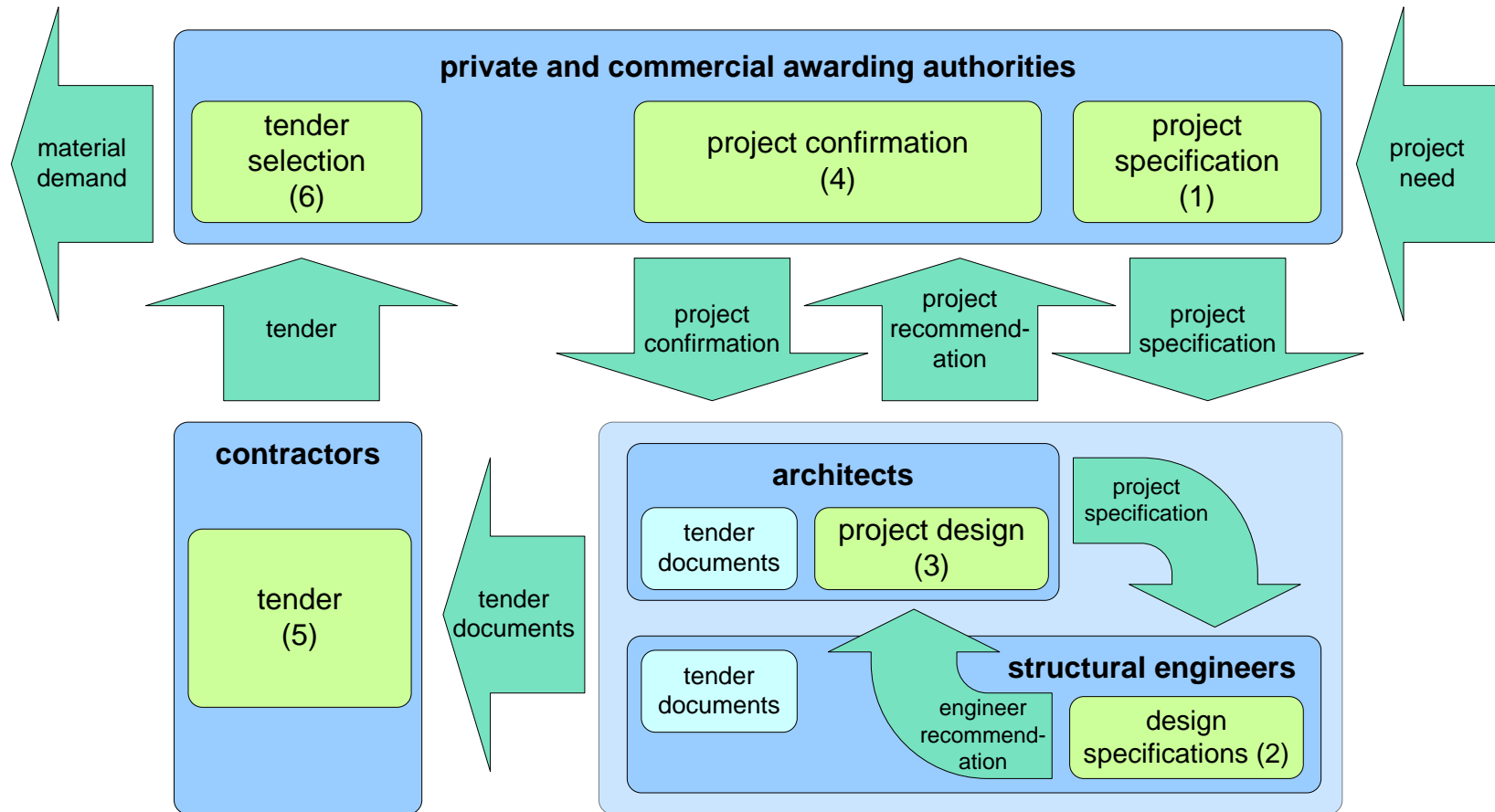


Source: Knoeri et al (submitted)



Source: Hoffmann 2010

## How do stakeholders interact, decide and behave?

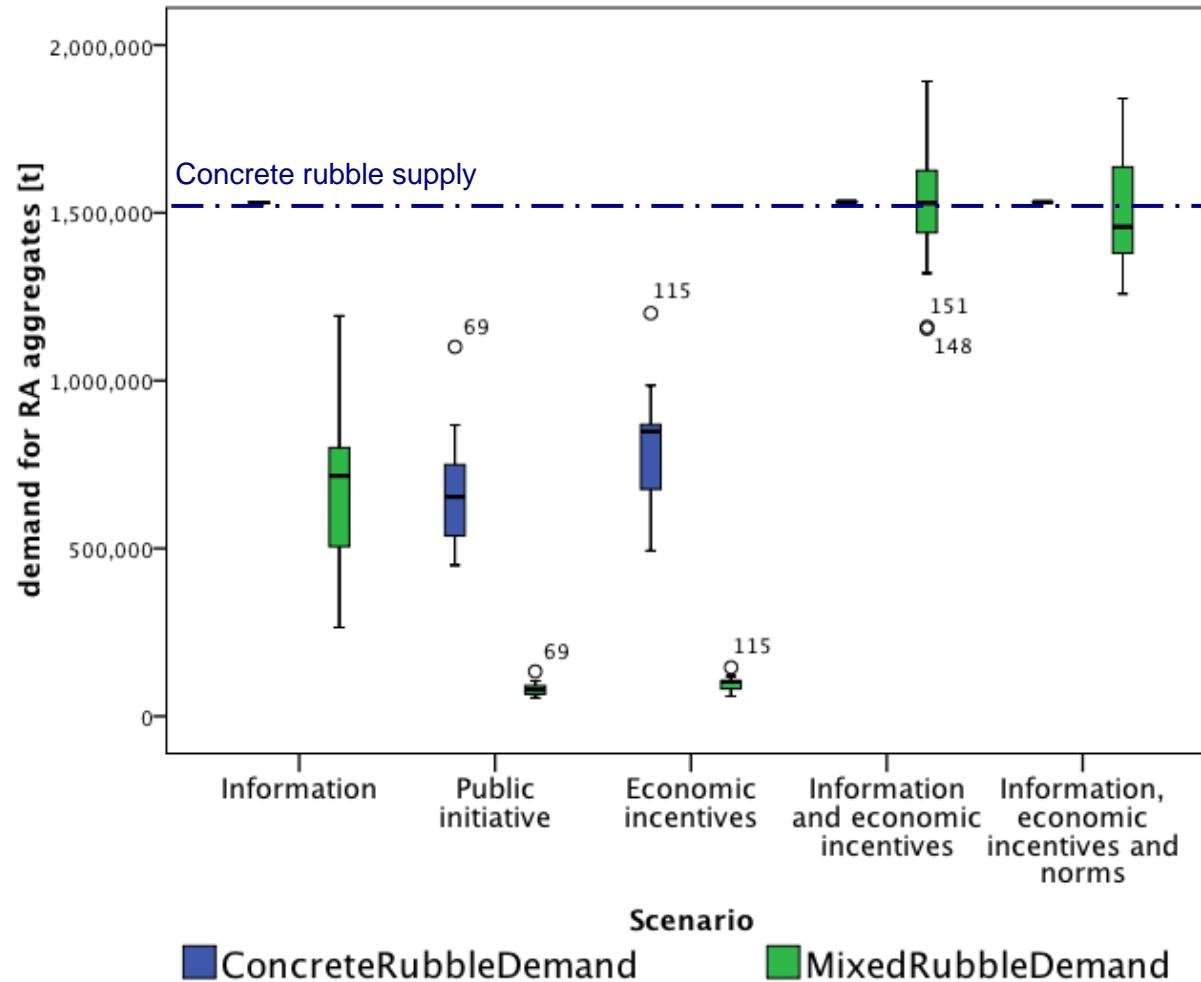


Source: Knoeri et al (2010)

# How to transition to a closed loop recycling?



Demand for RA aggregates [t] with RA substitution fraction= .40





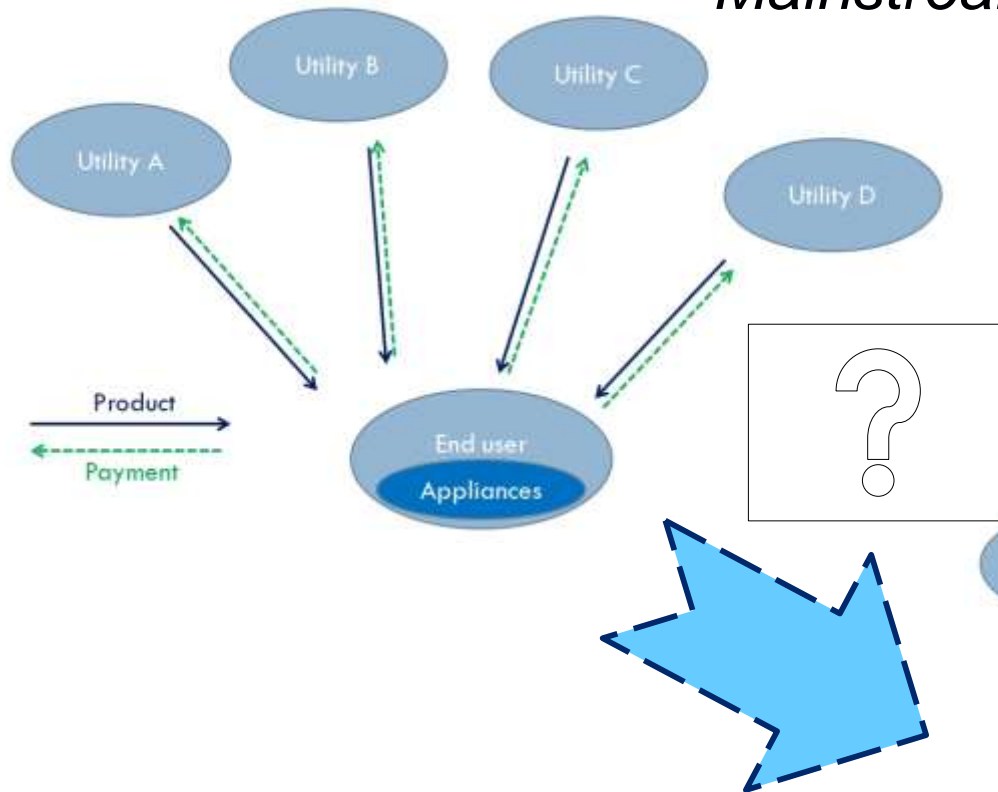
- **Empirical operationalization** of agent does limit degrees of freedom
- **Iterative and incremental model development** is still key
- **Awareness (availability of options)** turned out more/as important as the actual multi-criteria **decision**

# Infrastructure operation; Mainstream and alternative

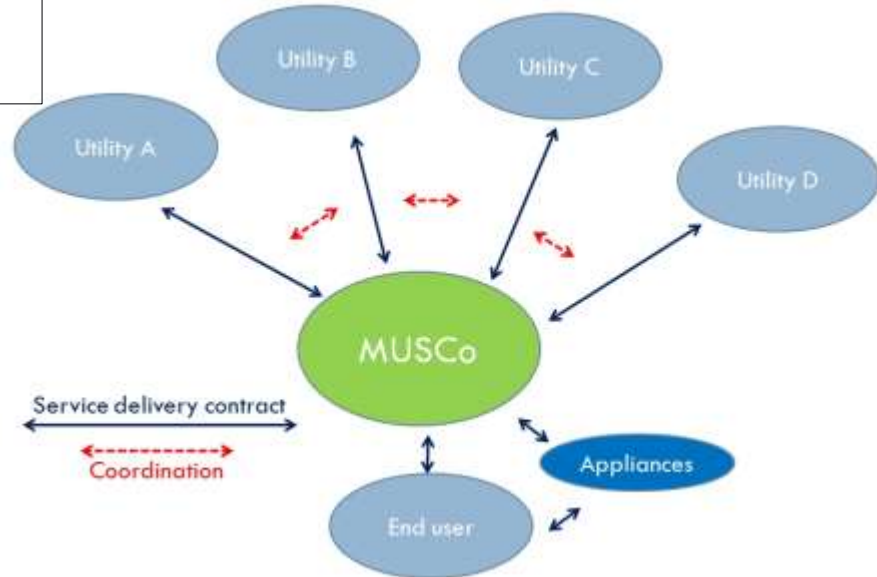


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## Mainstream



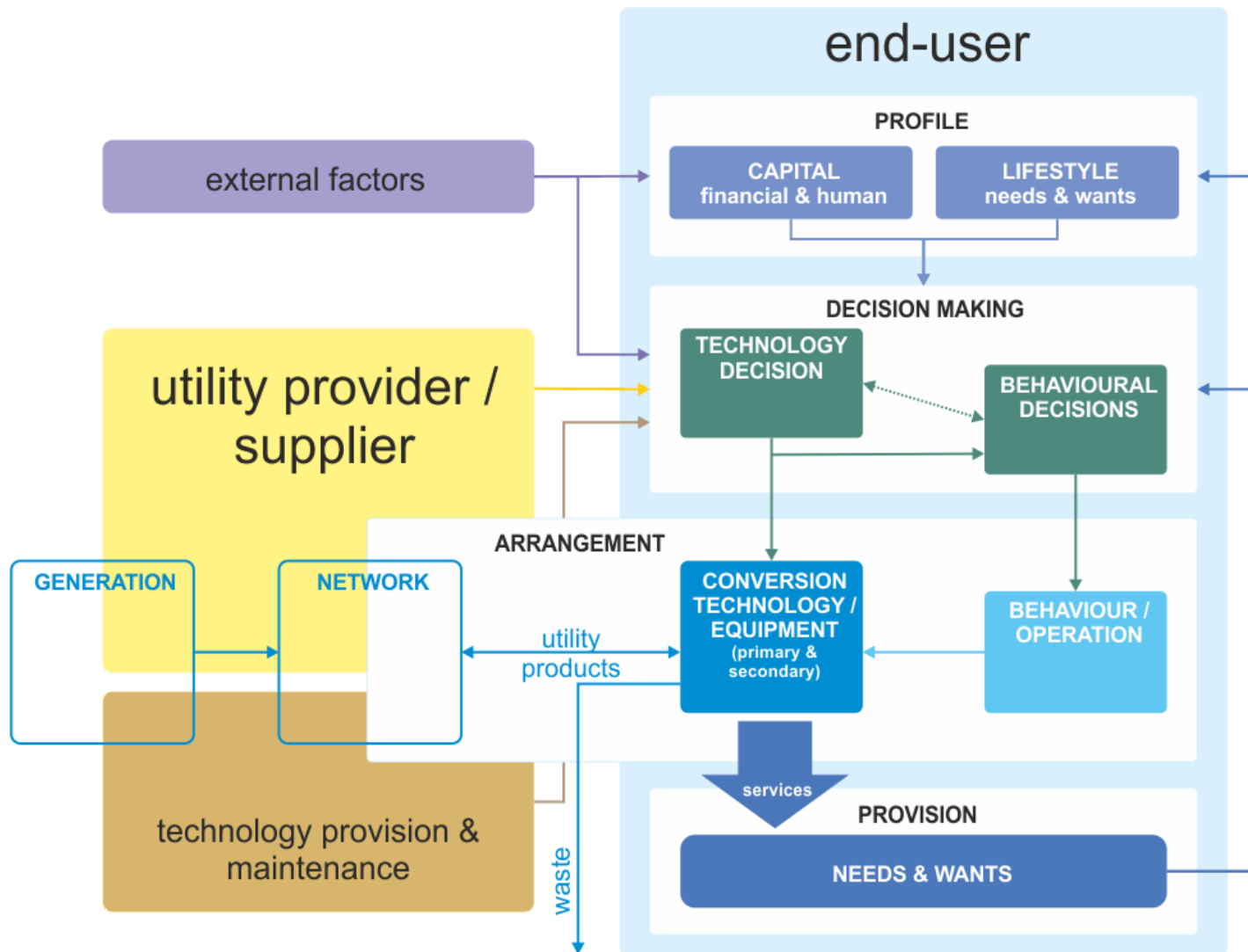
## Alternative



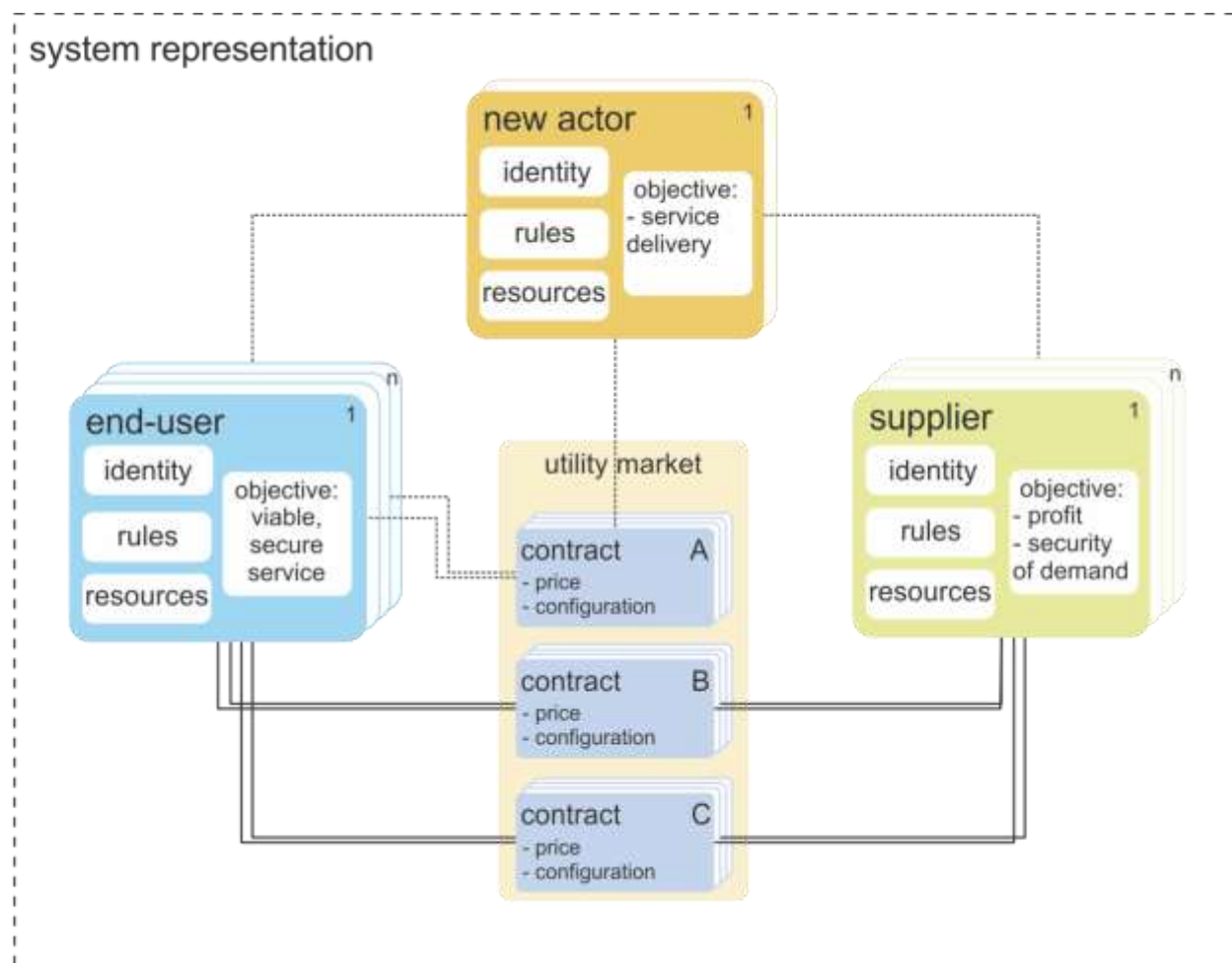
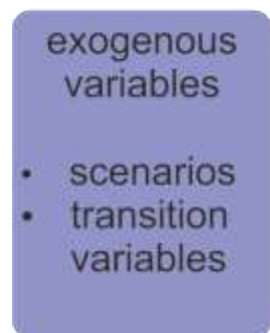
# End-users centred service provision



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# Under which conditions can MUSCo operation occur?



What measures and interventions lead to a transition towards more resource-efficient, service-oriented utility provision?

Phase 1:

- What type of contracts adopt most consistently?
- What policy intervention are most effective?

Phase 2:

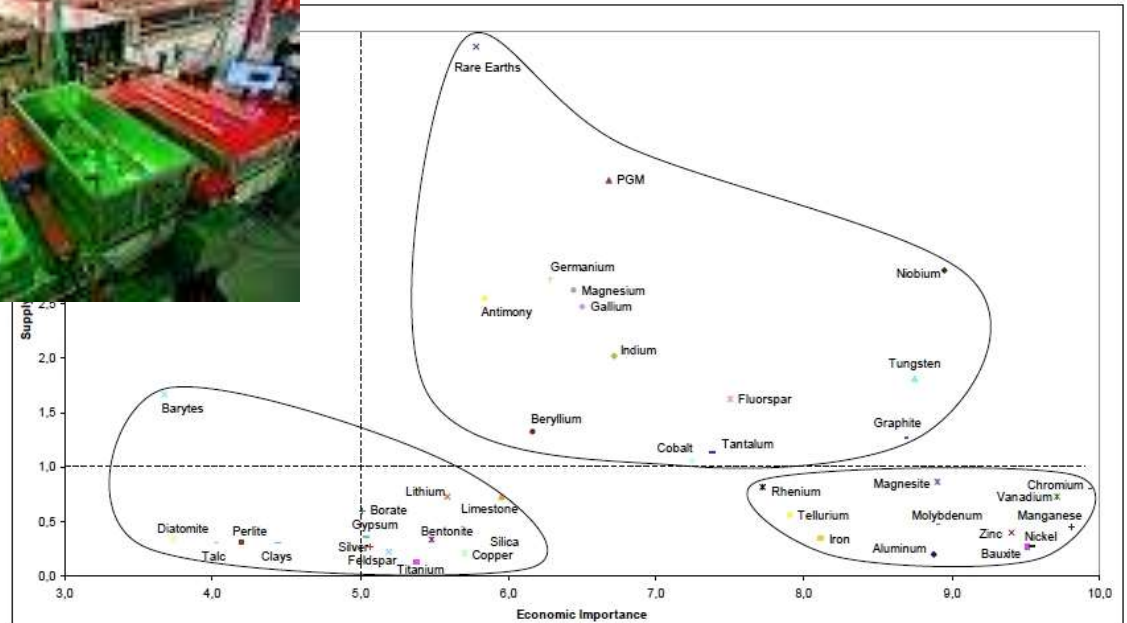
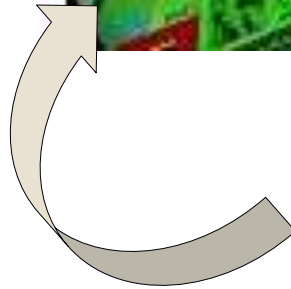
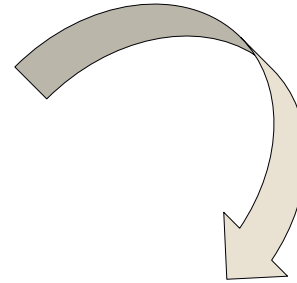
- What is the effect of scale of operation?
- How does learning influence the transition?
- How governance needs to adapt?



# Supply chains and critical materials

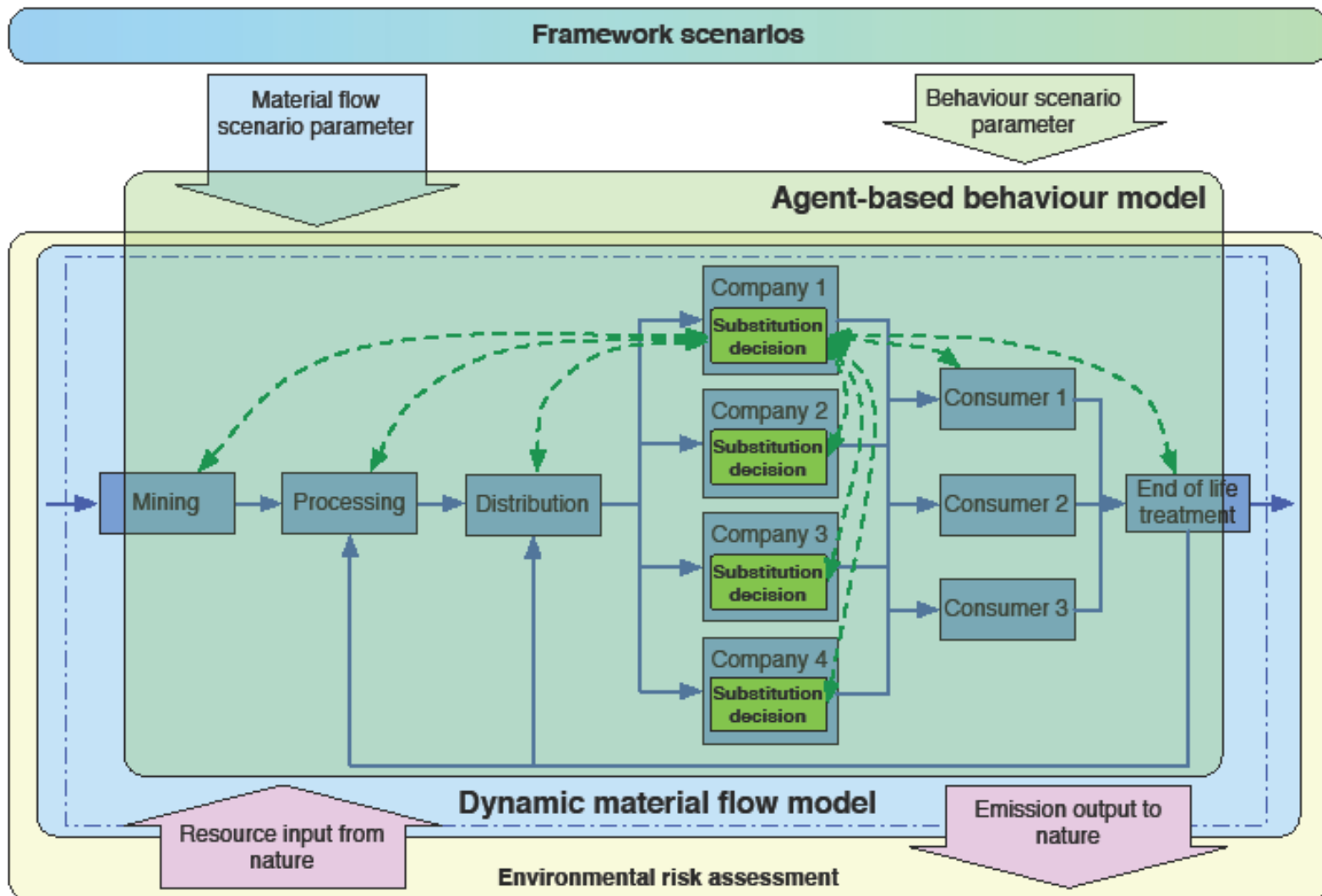


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- Provide a ‘**snapshot**’ of the **criticality** of a certain material at one point in time and do not account for changes in products or activities over time.
- Neglect **feedback between possible demand and supply chain developments**, and their effects on the background systems on which these products and activities depend



# Why agent based modelling?



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