PATH DEPENDENCE IN SYSTEMS ANALYSIS

The outcome of a problem solving process depends on the path followed

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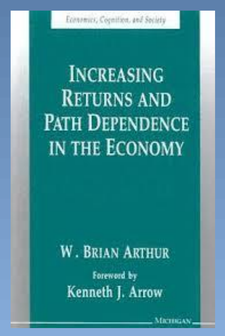
In Economics

Brian Arthur (1989)

Increasing returns in technological development

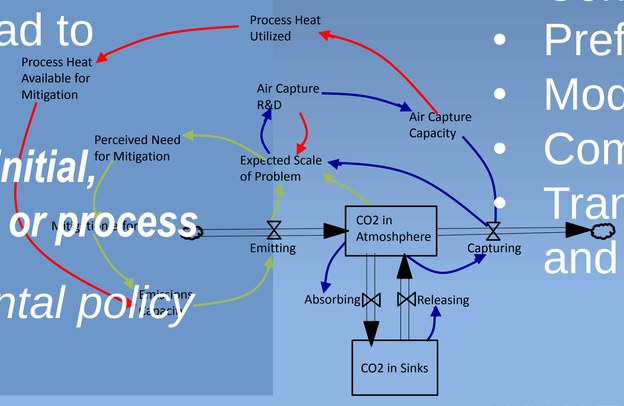


Inferior technology can become dominant

In Model Based Problem Solving

Hämäläinen and Lahtinen (2015)

- Different ”valid” models can produce different results
- Different practices lead to different results
- ***Risk of lock-in into the initial, possibly inferior, model or process***
- *Critical in environmental policy modelling*



Steps in modelling

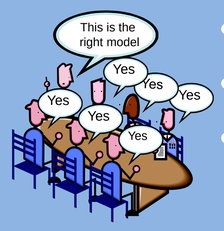
- Forming the team
- Framing and structuring
- Constructing the model
- Preference and data collection
- Model evaluation
- Communicating with the model
- Transfer of results to policy and practice

INTERACTING DRIVERS OF PATH DEPENDENCE IN SYSTEMS ANALYSIS

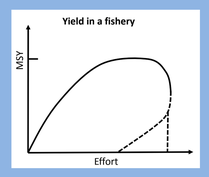
System

Interaction of modeler, decision makers and stakeholders, problem context

- Social: Group dynamics, e.g. groupthink
- Technical: Nonlinearities in the system, e.g. increasing returns



Behaviour



Cognitive biases and behavioural phenomena

- Occur in different steps of the process
- Overall effect depends on the path

Motivational

Hidden goals and motives

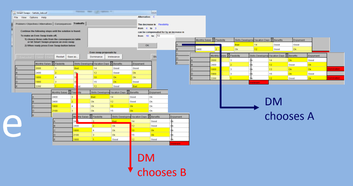
- Confirmation bias in model building
- Strategic behavior in preference elicitation

Procedure

Structure and properties of procedures, models and algorithms

- Procedure can elicit behavioural effects
- Effects of problem decomposition
- We easily pay more attention to aspects considered first

Learning

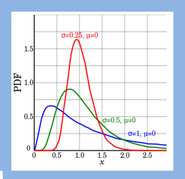


Learning process drives the modeling process

- Methods used influence learning
- Unlearning is difficult

Uncertainty and external environment

Uncertainties in structural assumptions and parameters: high risk of path dependence



Changes in problem environment:

- Process used can become invalid,
- It can lead to different outcome

HOW TO DEAL WITH PATH DEPENDENCE?

➢ Awareness

- Be open to alternative approaches
- Critically evaluate models and assumptions

➢ Multiple independent modeling processes

To detect and understand path dependence

- Builds confidence
- Use Devil’s advocate?

➢ Debiasing methods

To reduce effects of cognitive biases

➢ Problem framing with Value-Focused Thinking

Careful study of our objectives can help choose the right approach

➢ Systems intelligence in facilitation

Modeler needs to:
observe, understand and manage the social system created by the modeling process

related publications

R. P. Hämäläinen and T. J. Lahtinen: Path Dependence in Operational Research – How the Modeling Process Can Influence the Results. *Manuscript*, 2015.
T. J. Lahtinen and R. P. Hämäläinen: Path Dependence and Biases in the Even Swaps Decision Analysis Method. *Manuscript*, 2015.
R.P. Hämäläinen: Behavioural issues in environmental modelling - the missing perspective. *To appear in Environmental Modeling and Software, 2015.*
R. P. Hämäläinen, J. Luoma and E. Saarinen: On the importance of behavioral operations research: The case of understanding and communicating about dynamic systems. *EJOR*, 2013.
R. P. Hämäläinen and E. Saarinen: Systems Intelligence: A Key Competence for Organizational Life. Reflections: *The SoL Journal*, 2006.
W. B. Arthur Competing technologies, increasing returns, and lock-in by historical events. The Economic Journal, 1989