universität freiburg

Steering acceleration in sustainability transitions

An overview of the strategies to address new emergent lock-ins

IST Conference 2024, track 1: Accelerating sustainability transitions: Unpacking challenges and causal mechanisms

Oslo, June 2024

Chair of Sustainability and Transition Research

Caterina Pacini, PhD

Prof. Dr. Dierk Bauknecht

Sarah Olbrich, PhD

Research objectives and design: systemic and overarching perspective

Acceleration phase – research gap

- Research gap: focus on **emergent lock-ins** and how to cope with them (ideally avoid them) through policy strategies

- Objectives:

(1) conceptualise a challenge for steering of transition, particularly relevant for acceleration phase
(2) Provide solutions to deal with it from a decision-making perspective → decision-making strategies

- Couple governance of transitions with **reflexivity** (Jan-Peter Voß et al., 2013)
- Integrate **uncertainty** (Köhler et al., 2019) as factor exacerbating emergent lock-ins

How we proceeded

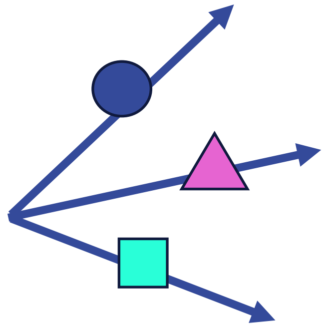
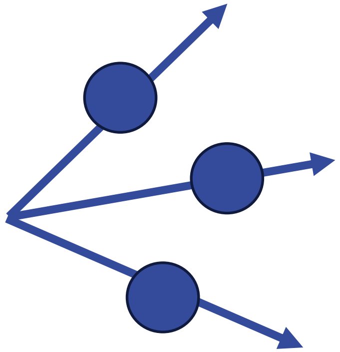
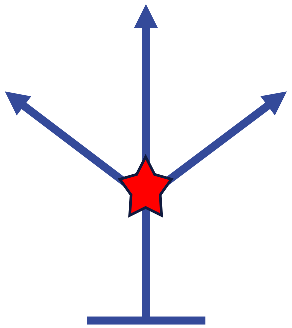
- Defined emergent lock-ins to conduct literature review within transition studies

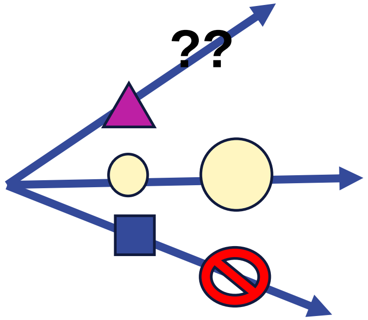
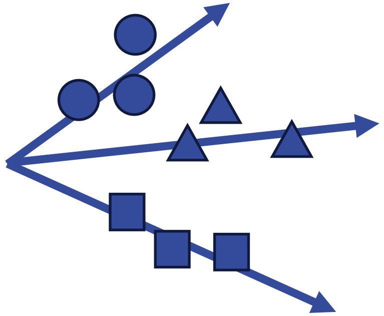
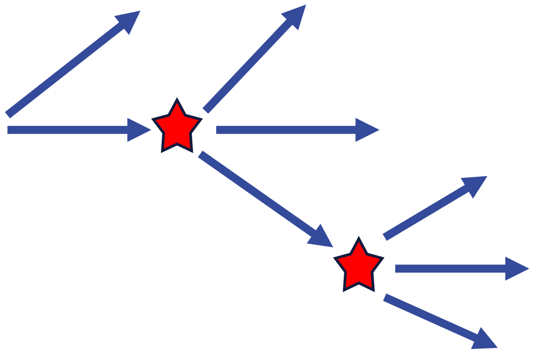
- Broadened literature review to other disciplines and conducted content analysis to fill the gap, looking for strategies in other study fields where:
    - Lock-in and uncertainty are analysed;
    - Ways of dealing with them are outlined.

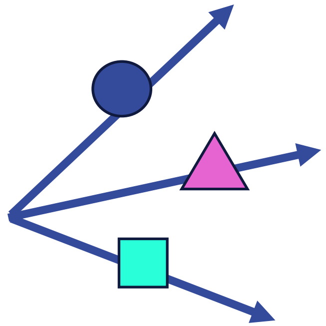
- Provided a common framework to compare the strategies

Incumbent vs. emergent lock-ins in sustainability transition literature

	Analysis	Strategy
Incumbent lock-ins	+++	++
Emergent lock-ins	+	O

Strategy	Visualisation Arrow = transitions pathway; symbols =innovation options	Example	Operationalisation
1) **Keep options open:** developing simultaneously a range of different promising options as long as useful) (Foxon, Pearson, Arapostathis, Carlsson-Hyslop, & Thornton, 2013; Wanitschke & Hoffmann, 2020)		- parallel development of different renewable sources	- incentives and funding to industries e.g. R&D - experimentation with diverse options and creation of early markets - criteria to narrow down the choice later
2) **Low/ no-regret options:** select the options that will perform satisfactorily regardless of the pathway that will emerge (Castrejon-Campos, Aye, & Hui, 2020; Dittrich, Wreford, & Moran, 2016)		- water resource management - heat pumps (Germany)	- exploratory scenarios to analyze which options will reduce vulnerability due to uncertainty across multiple pathways
3) **Bridging options:** choosing the options that can be employed on a short or medium-term to deal with the unavailability and uncertainties related to the optimal option(s) (Brauers, Braunger, & Jewell, 2021; Gürsan & Gooyert, 2021)		- use of blue hydrogen	- roadmap to phase out of bridging options in favour of optimal long-term options

Strategy	Visualisation Arrow = transition pathway; symbols = innovation options	Example	Operationalisation
4) **Real options:** evaluate the available options on the basis of their value to postpone/ expand/ abandon. It regards assessing and choosing the options that will provide the most (managerial) flexibility (Duku-Kaakyire & Nanang, 2004; Regan et al., 2015)		- fresh water supply - Flood risk management	- Assessment of the options based on the attribution of a value and selection of those options with the highest value
5) **Granular options:** select the options that exhibit the following features: (i) modularity; (ii) medium- smaller unit sizes; (iii) lower unit investment costs; (iv) decentralisation (Tazvinga, Thopil, Numbi, & Adefarati, 2017; Wilson et al., 2020)		- heat pumps, - rooftop solar modules - shared-taxi-buses	- Comparison of the options based on the listed features
6) **Branching points:** switch to a better or different pathway due to changing circumstances and to reduced uncertainty around the pathways. Critical decision-points where actors can choose to change the directionality of long-term action (Foxon et al., 2013; Lovell & Foxon, 2021; Malekpour, Walker, Haan, Frantzeskaki, & Marchau, 2020)		- heat decarbonisation (UK)	- Monitoring and evaluation of the chosen pathway to establish whether and in which ways the pathway is followed, and eventually if adaptations are required.

Strategy	**Visualisation** Arrow = transitions pathway; symbols =innovation options	**Example**	**Operationalisation**
1) **Keep options open:** developing simultaneously a range of different promising options as long as useful) (Foxon, Pearson, Arapostathis, Carlsson-Hyslop, & Thornton, 2013; Wanitschke & Hoffmann, 2020)		- parallel development of different renewable sources	- incentives and funding to industries e.g. R&D - experimentation with diverse options and creation of early markets - revision criteria to narrow down the choice later
2) **Low/ no-regret options**			
3) **Bridging options**			

Concluding remarks

- The policy strategies are not meant to eliminate emergent lock-ins, but they are rather an attempt to cope with them by delivering flexibility in the decision-making processes where well-informed choices are not possible due to uncertainty;
- Criticality of tackling this challenge in view of a truly sustainable and working system e.g. net-zero targets;
- Further research objectives: empirical research to customise the strategies into specific policy instruments e.g. case study.

Thank you!

For further discussion: **caterina.pacini@sustainability-transitions.uni-freiburg.de**

References

- Voß J-P., Newig J., Kastens B., Monstadt J., & Nölting B. (2013). Steering for Sustainable Development: a Typology of Problems and Strategies with respect to Ambivalence, Uncertainty and Distributed Power. In GOVERNANCE FOR SUSTAINABLE DEVELOPMENTCOPING WITH AMBIVALENCE, UNCERTAINTY AND DISTRIBUT (pp. 1–20). ABINGDON: Routledge. https://doi.org/10.4324/9781315876702-1
- Köhler, J., Geels, F. W., Kern, F., Markard, J., Onsongo, E., Wieczorek, A., . . . Wells, P. (2019). An agenda for sustainability transitions research: State of the art and future directions. Environmental Innovation and Societal Transitions, 31, 1–32. https://doi.org/10.1016/j.eist.2019.01.004
- Dittrich, R., Wreford, A., & Moran, D. (2016). A survey of decision-making approaches for climate change adaptation: Are robust methods the way forward?. Ecological Economics, 122, 79-89.
- Castrejon-Campos, O., Aye, L., & Hui, F. K. P. (2020). Making policy mixes more robust: An integrative and interdisciplinary approach for clean energy transitions. Energy Research & Social Science, 64, 101425.
- Wanitschke, A., & Hoffmann, S. (2020). Are battery electric vehicles the future? An uncertainty comparison with hydrogen and combustion engines. Environmental Innovation and Societal Transitions, 35, 509-523.
- Foxon, T. J., Pearson, P. J., Arapostathis, S., Carlsson-Hyslop, A., & Thornton, J. (2013). Branching points for transition pathways: assessing responses of actors to challenges on pathways to a low carbon future. *Energy Policy*, *52*, 146-158.

References

- Gürsan, C., & de Gooyert, V. (2021). The systemic impact of a transition fuel: Does natural gas help or hinder the energy transition?. Renewable and Sustainable Energy Reviews, 138, 110552.
- Brauers, H., Braunger, I., & Jewell, J. (2021). Liquefied natural gas expansion plans in Germany: The risk of gas lock-in under energy transitions. Energy Research & Social Science, 76, 102059.
- Malekpour, S., Walker, W. E., de Haan, F. J., Frantzeskaki, N., & Marchau, V. A. (2020). Bridging decision making under deep uncertainty (DMDU) and transition management (TM) to improve strategic planning for sustainable development. Environmental Science & Policy, 107, 158-167.
- Lovell, K., & Foxon, T. J. (2021). Framing branching points for transition: Policy and pathways for UK heat decarbonisation. Environmental Innovation and Societal Transitions, 40, 147-158.
- Wilson, C., Grubler, A., Bento, N., Healey, S., De Stercke, S., & Zimm, C. (2020). Granular technologies to accelerate decarbonization. *Science*, *368*(6486), 36-39.