Manchester Institute of Innovation Research

A socio-technical transitions perspective on tipping points and acceleration:

Some cautionary reflections on negative feedbacks, transition phases, and potential slowdowns



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Two phases in academic literature on acceleration (and tipping points)

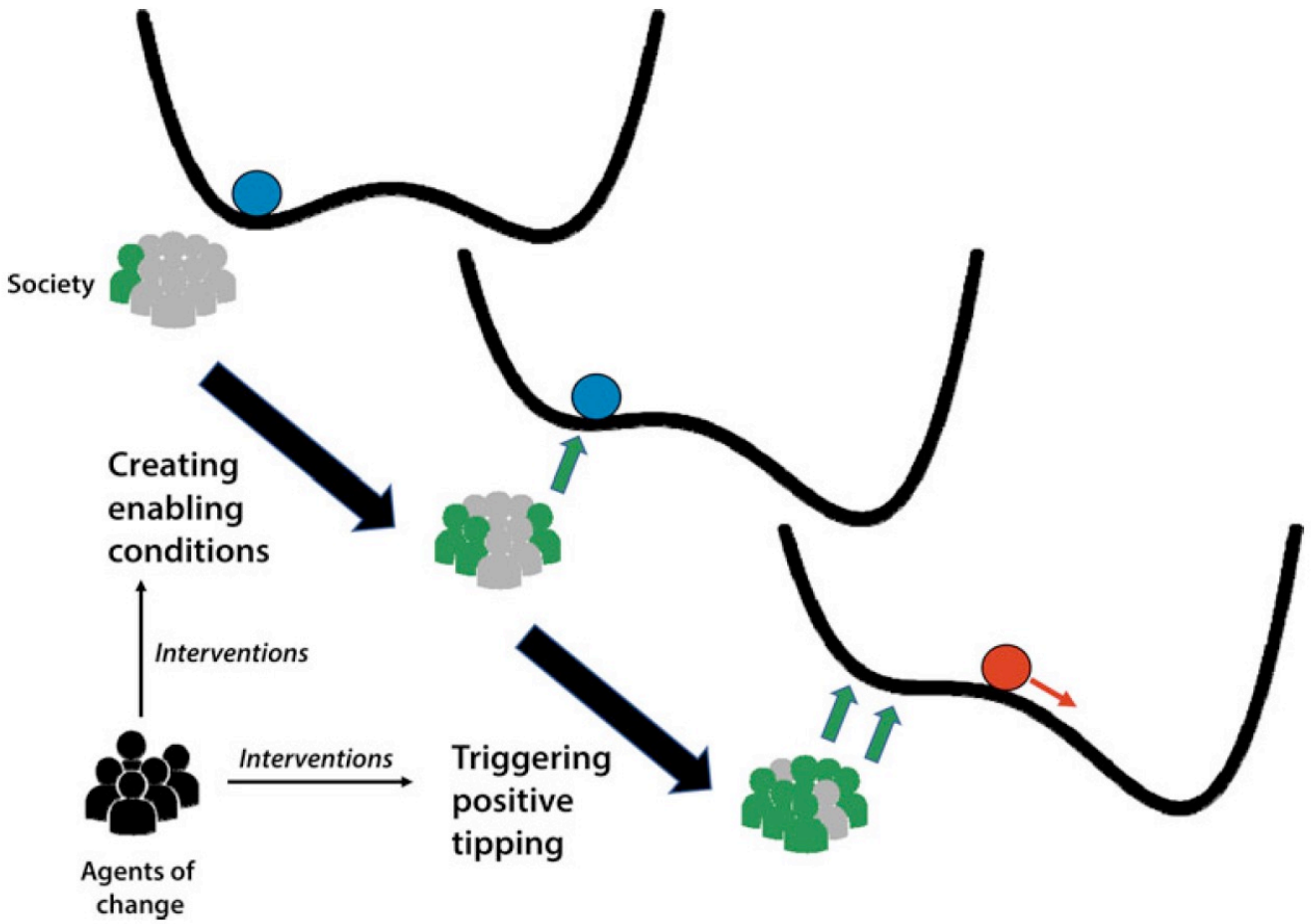
1) Optimistic phase (2015-2022):

- **Real-world context**: 2015 Paris Agreement, 2015 SDGs, Greta Thunberg (2018), cost decreases and diffusion in solar, wind, batteries, EVs
- **Academic literature:** positive tipping points and positive feedback mechanism (scale economies, learning-by-doing, contagion), focus on 'enabling conditions' of tipping points, smooth sailing after crossing of tipping point, exponential growth

2) Optimism with more caution (2022-2026)

- **Real-world context:** continued diffusion and cost reductions, but also backlash, right-wing populism, social acceptance problems, bottlenecks (supply chains, infrastructure, institutions), policy weakening
- **Academic literature:** positive *and* negative feedbacks; less deterministic view on tipping points; more attention to what happens after tipping points, including possibility of slow-down

Early tipping literature often based on ball-in-basin metaphor



Interesting but ….

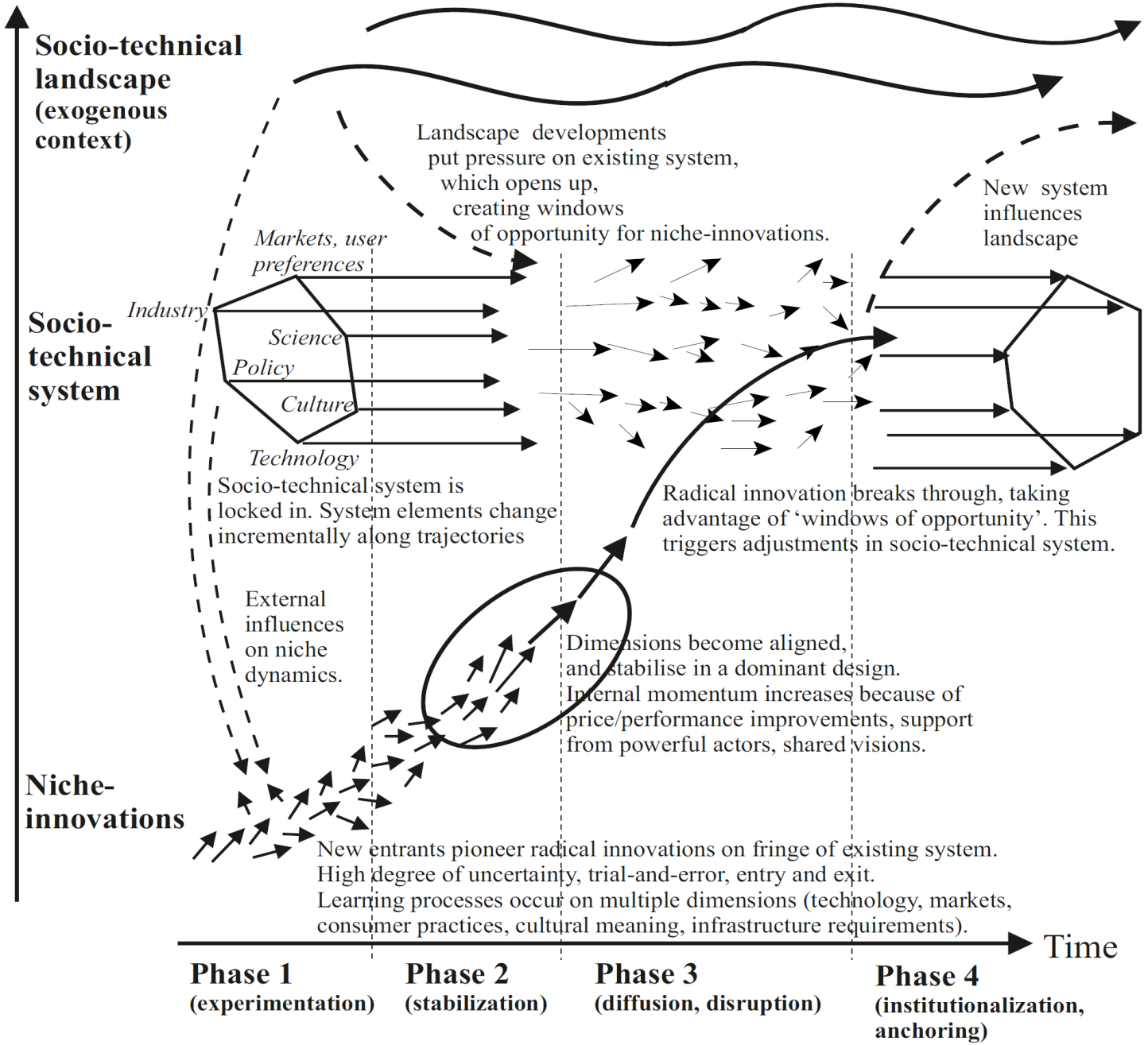
- Limited view of temporality of transitions
- Limited agency (the 'ball' is shaped by external forces)
- Deterministic overtones

→ Limits its usefulness for socio-economic transitions

Lenton et al., 2022, Operationalising positive tipping points towards global sustainability, *Global Sustainability*, Volume 5, e1;

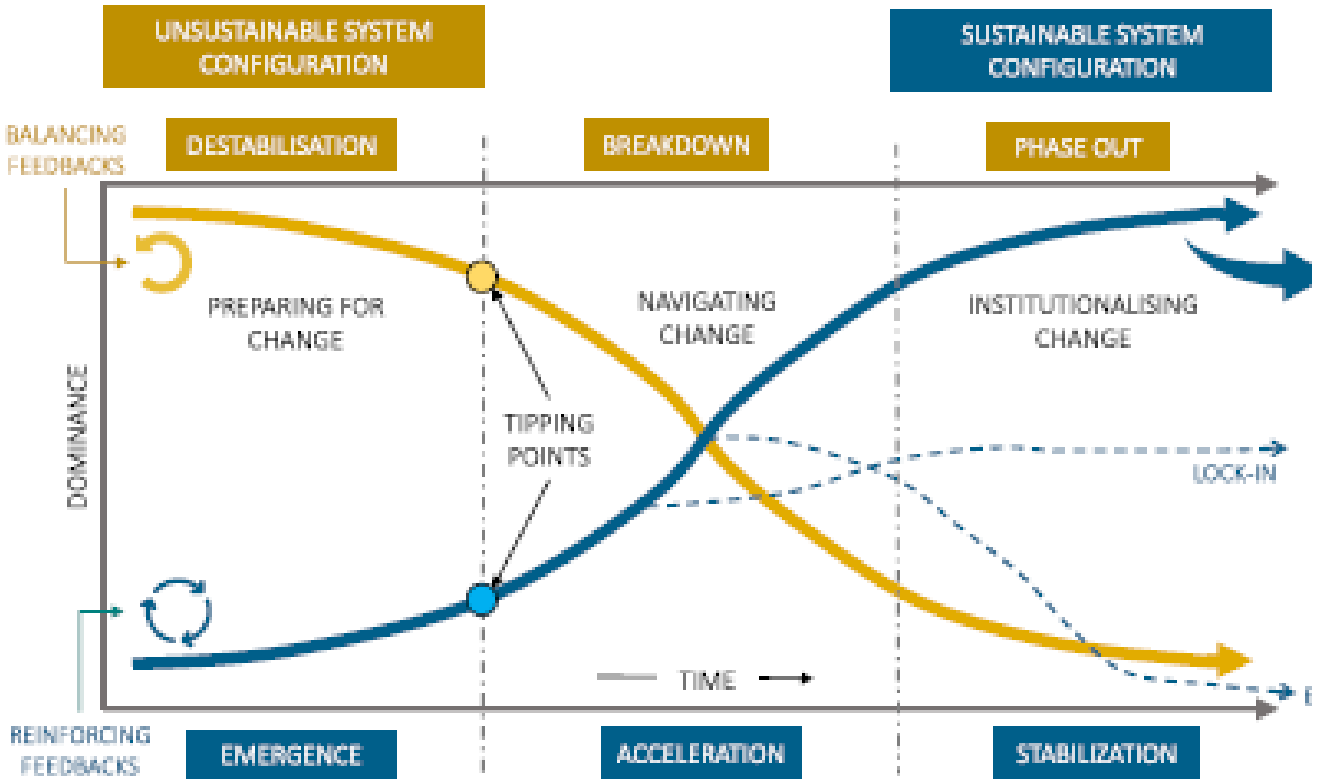
Socio-technical transition perspective on tipping points and acceleration

(Geels and Ayoub, 2023)



Geels, F.W. and Ayoub, M., 2023, A socio-technical transition perspective on positive tipping points in climate change mitigation: Analysing seven interacting feedback loops in offshore wind and electric vehicles acceleration, *Technological Forecasting and Social Change*, 193; 122639

But also tipping points in destabilisation of existing system/regime

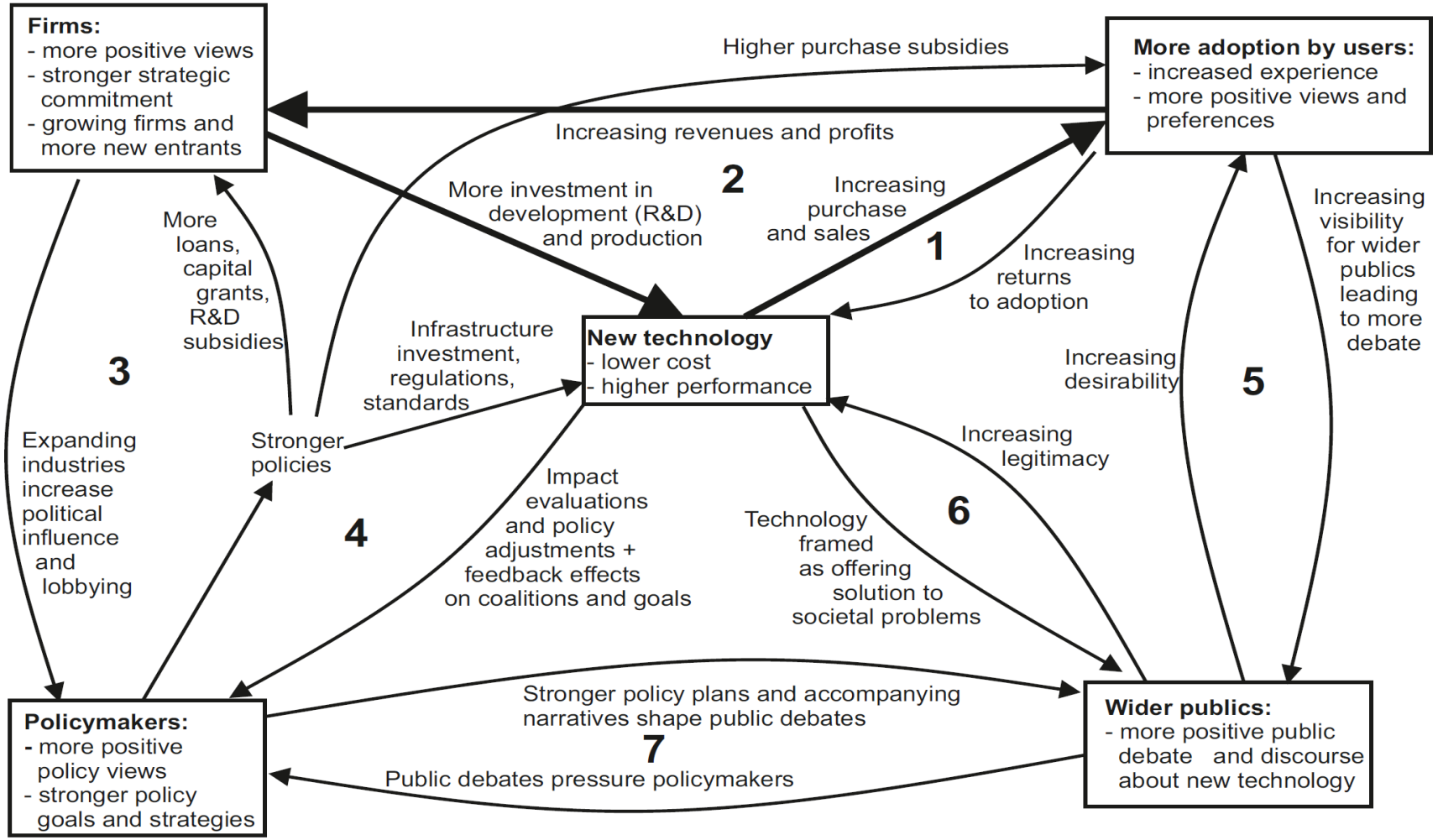


But:

1) may not happen at same time
2) do not conflate high-speed mainstream diffusion with acceleration

Allen, C. and Malekpour, S., 2023, Unlocking and accelerating transformations to the SDGs: a review of existing knowledge, *Sustainability Science*, 18, 1939-1960.

Seven interacting feedback loops in positive tipping points (Geels and Ayoub, 2023)



Hypothesis:

1) Acceleration results from multiple feedbacks

2) but techno-economic feedbacks strongest driver (**in bold**)

Cautionary reflections

1) Acceleration is relatively short phase, followed by long phase of linear growth (high speed but zero acceleration)

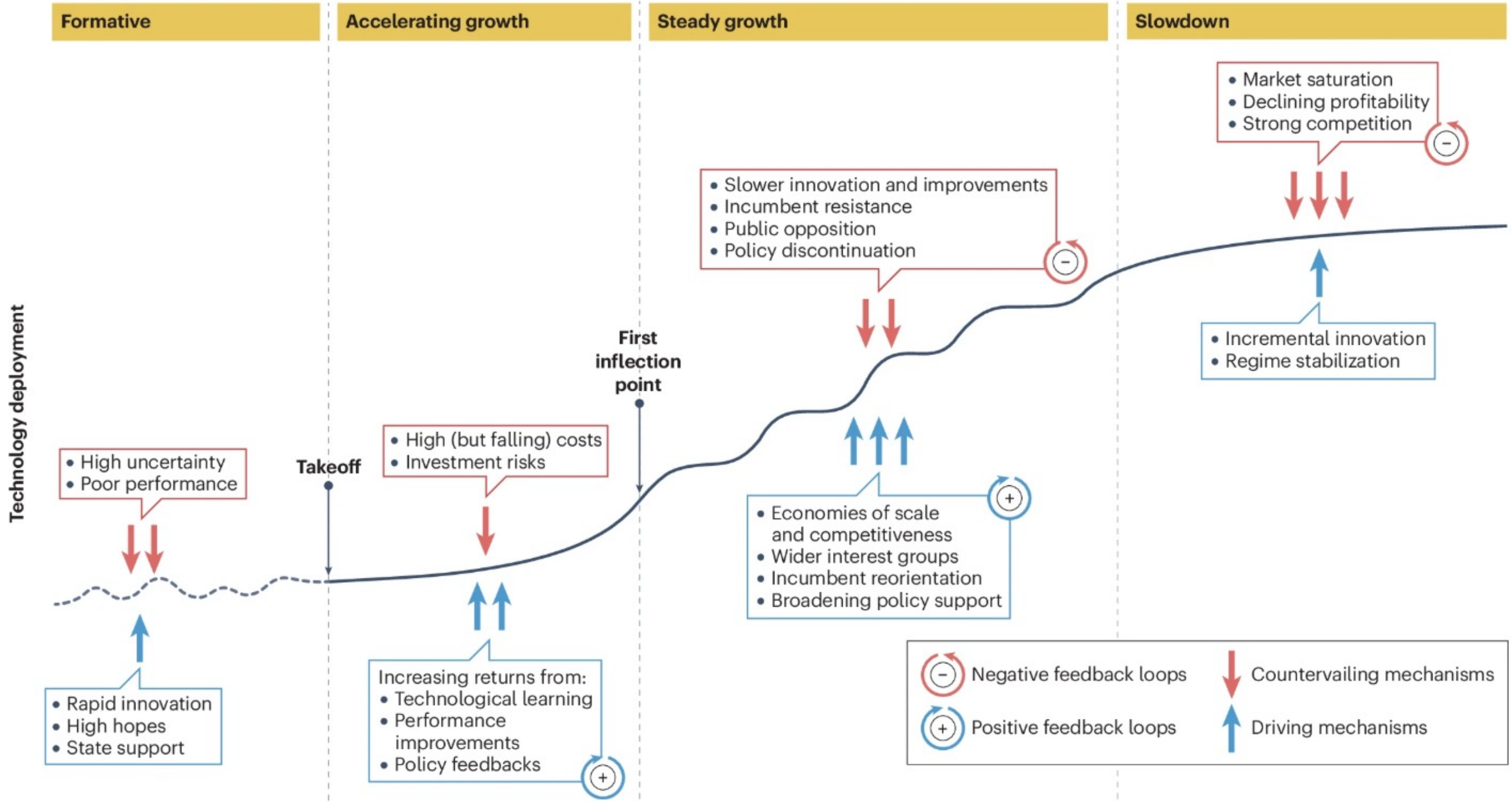
2) All transition phases have **positive and negative** feedbacks, but more positive than negative feedbacks in acceleration phase

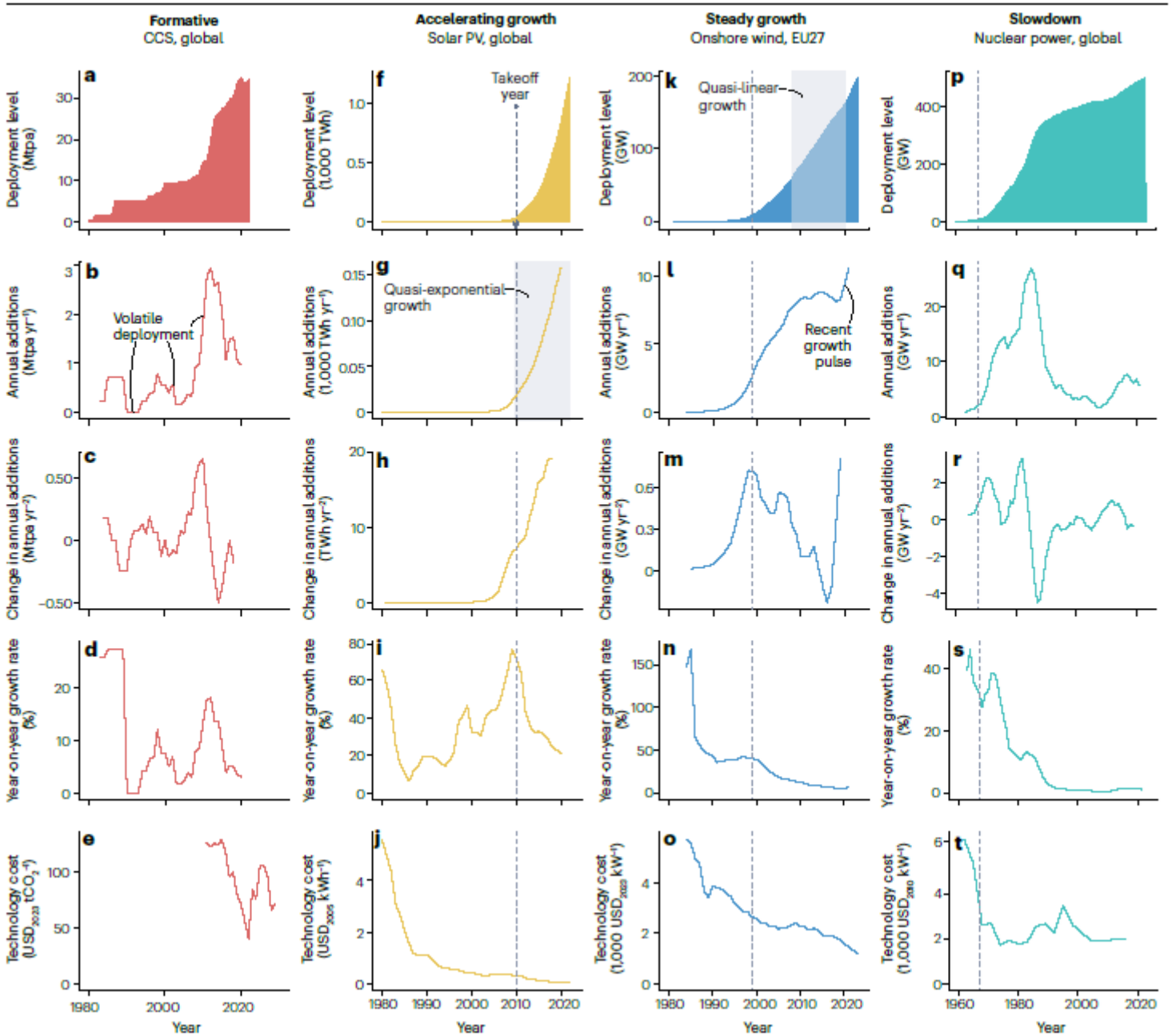
3) Mainstream diffusion (AFTER the tipping point) is not deterministic S-curve but composed of sequence of pulses (fits and starts) due to:

   a) functional bottlenecks (infrastructure, supply chains, institutions)

   b) socio-political problems: social justice, incumbent resistance, social acceptance, populist politization

Jewell, J., Cherp, A., Geels, F.W., Suzuki, M., Nacke, L., Jale Tosun, J., Bhowmik, S., Kazlou, T., Jakhmola, A., Vinichenko, V., 2026, Policy-driven growth of technologies to accelerate climate action, *Nature Reviews Earth & Environment*, 7(4), 235–252


Formative
Accelerating growth
Steady growth
Slowdown
Technology deployment
• High uncertainty
• Poor performance
Takeoff
• High (but falling) costs
• Investment risks
First inflection point
• Slower innovation and improvements
• Incumbent resistance
• Public opposition
• Policy discontinuation
• Market saturation
• Declining profitability
• Strong competition
• Incremental innovation
• Regime stabilization
• Economies of scale and competitiveness
• Wider interest groups
• Incumbent reorientation
• Broadening policy support
• Rapid innovation
• High hopes
• State support
Increasing returns from:
• Technological learning
• Performance improvements
• Policy feedbacks
Negative feedback loops
Positive feedback loops
Countervailing mechanisms
Driving mechanisms

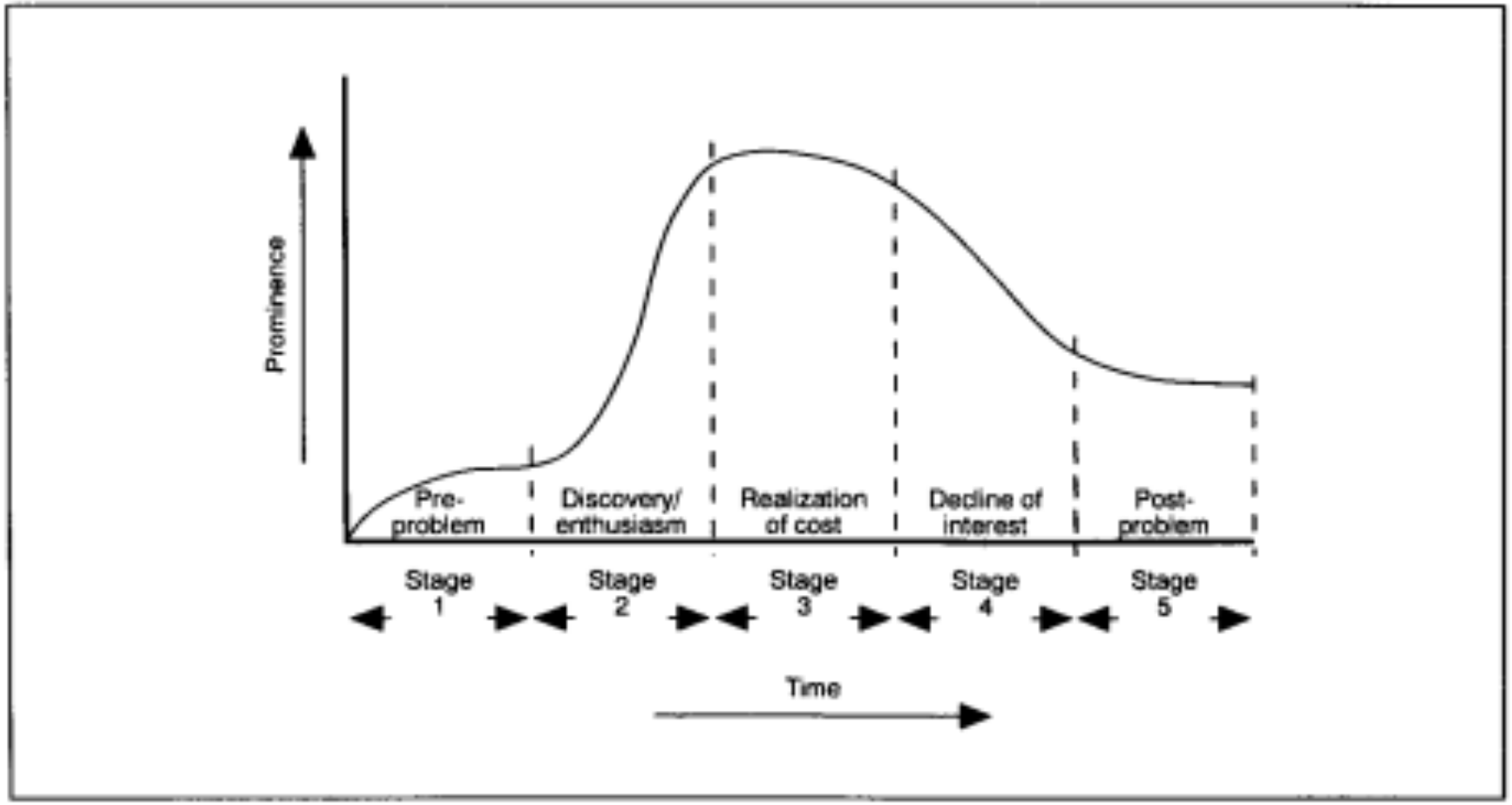


Some empirical evidence: CCS, solar, onshore wind, nuclear

(Jewell et al., 2026)

Some relevant social science literatures in relation to negative feedback and slow-down

1) Issue attention cycles (public debate/discourse)



Downs, A., 1972, Up and down with ecology: the issue attention cycle, *The Public Interest*, 28, 35-50.

2) Issue life cycles

(social problem literature)

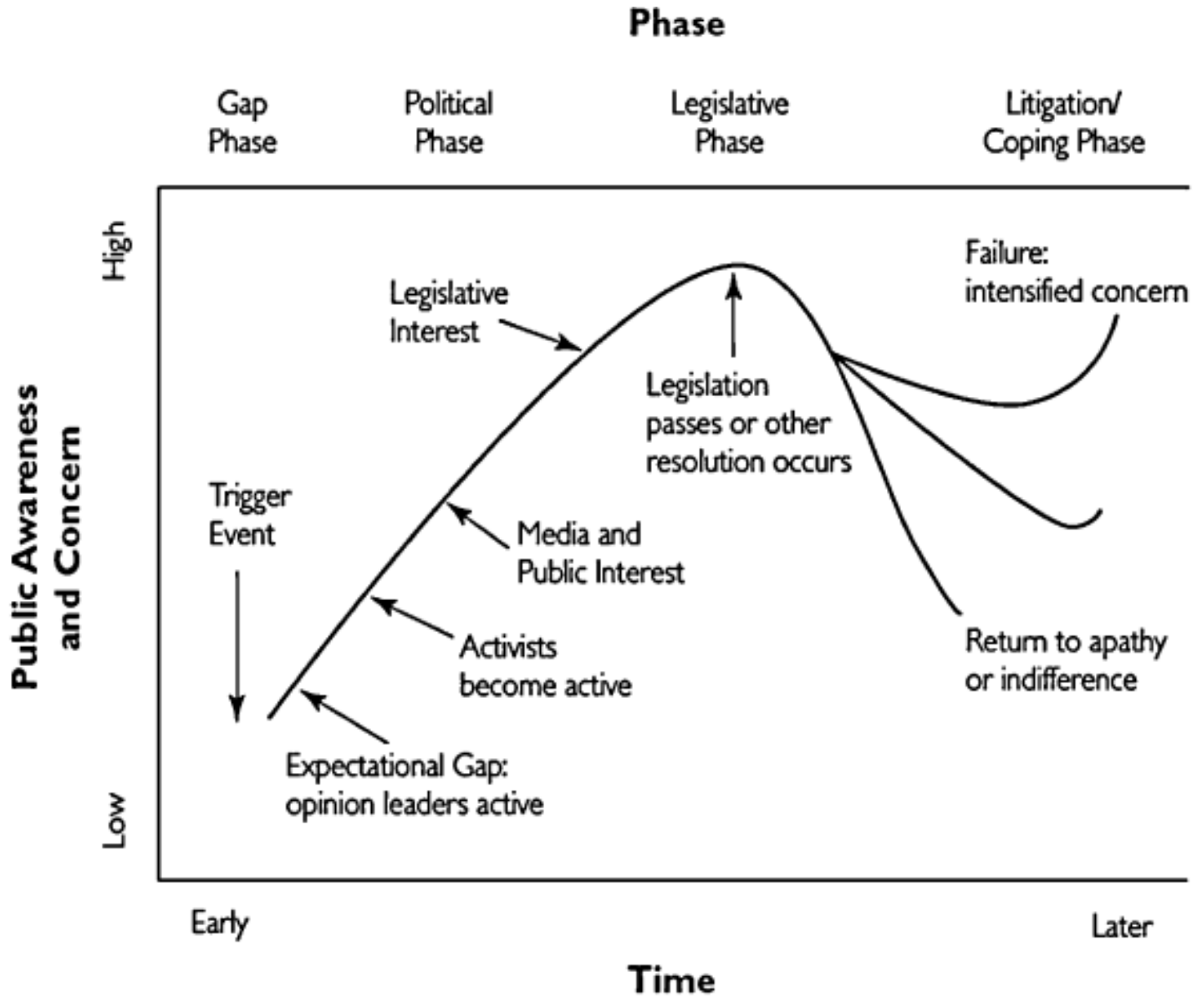


Fig. 1. Temporal dynamics of issue lifecycles (Rivoli and Waddock, 2011: p. 91).

Rivoli, P. and Waddock, S., 2011, 'First they ignore you…': The time-context dynamic and corporate responsibility, *California Management Review*, 53(2), 87-104.

3) Waves of mobilisation and cycles of protest and collective action (social movement theories)

Schneiberg, M. and Lounsbury, M., 2008, Social movements and institutional analysis, in: Greenwood, R., Oliver, C., Andersen, S.K. and Suddaby, R. (eds.), *The Sage Handbook of Organizational Institutionalism*, CA: Sage, 650-672.

Soule, S.A., Roggebrand, C., 2019, Diffusion processes within and across movements. In: Snow, D.A., Soule, S.A., Kriesi, H., McCammon, H.J. (Eds.), *The Blackwell Companion to Social Movements*, Oxford: Blackwell Publishing, p. 236-251.

Tarrow, S., 1993, Cycles of collective action: Between moments of madness and the repertoire of contention, *Social Science History*, 17(2), 281-307.

Tarrow, S., 1994, *Power in Movement: Social Movements, Collective Action, and Politics*, New York: Cambridge University Press.

4) Policy feedback literature (policy studies)

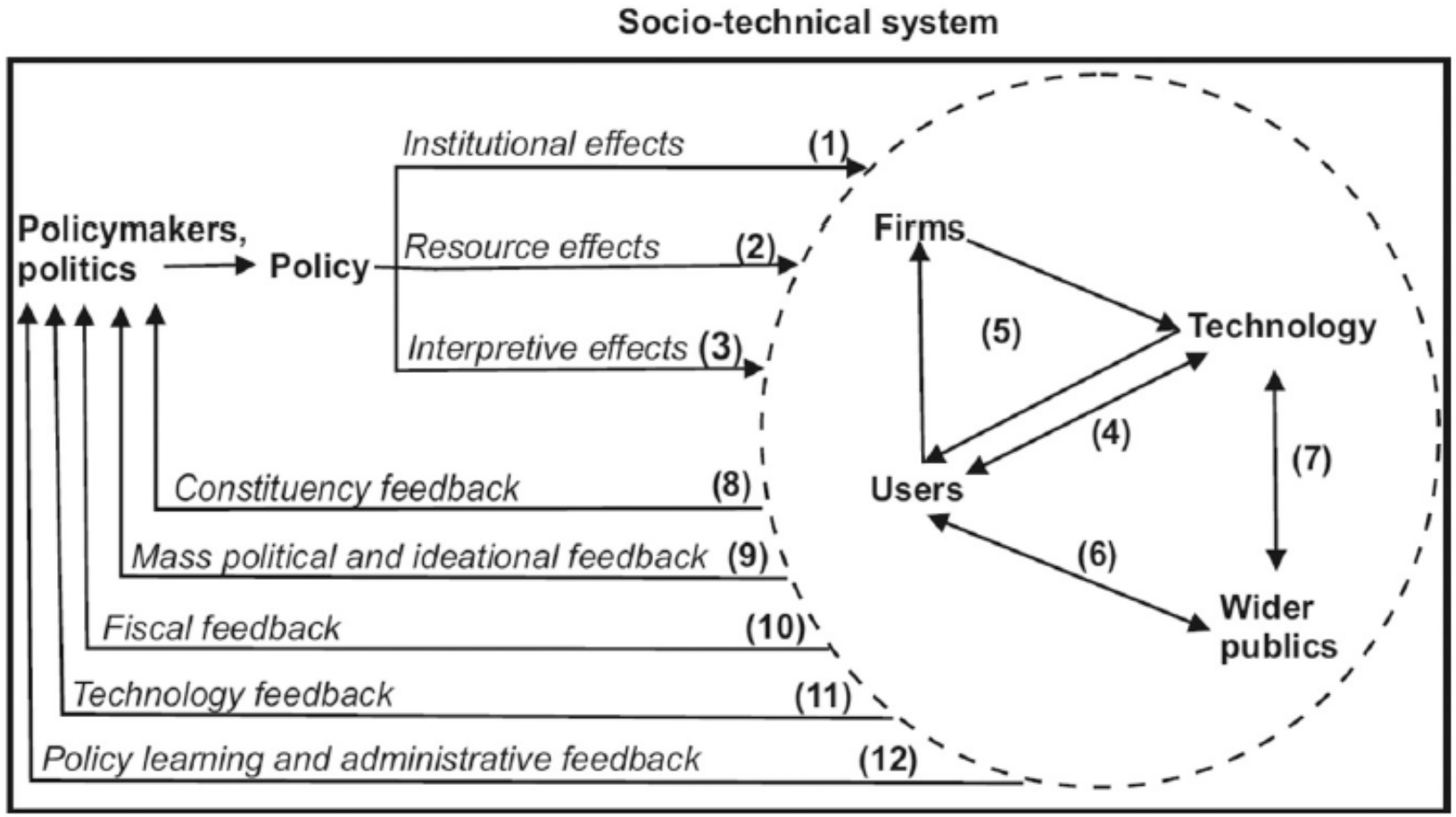


Fig. 4. Schematic representation of policy effects (1–3), socio-technical feedbacks (4–7) and policy feedbacks (8–12).

Geels, F.W. and Ayoub, M., 2025, Policy feedbacks and socio-technical feedbacks in accelerated low-carbon transitions: An integrated conceptual framework illustrated with case studies of lighting and smart meters, *Research Policy*, 54(8), 105294;

Types of negative policy feedback

- Unforeseen losses weaken support of organised interest groups
- Negative
- Failure of policies to achieve stated goals (or generate new problems) leads to nega
- Rising financial cost of policies generate negative fiscal feedbacks and opposition from Finance Ministries

Béland, D., Campbell, AL. Weaver, R.K., 2022. Policy Feedback: How Policies Shape Politics. Cambridge University Press, Cambridge.

Jacobs, A.M., Weaver, R.K., 2015. When policies undo themselves: Self-undermining feedback as a source of policy change. Governance 28(4), 441–457.

Oberlander, J., Weaver, R.K., 2015. Unraveling from within? The affordable care act and self-undermining policy feedbacks. The Forum 13(1), 37–62.

Conclusions

1) Acceleration is possible and driven by reinforcing positive ‘socio-technical’ feedbacks

2) Acceleration is relatively short transition phase (5-10 years), followed by longer linear growth phase (and zero-acceleration)

3) Essential to also consider negative feedbacks, which get bigger in diffusion phase.

→ Plea to use more social science insights beyond (too easy) ideas like contagion.

4) Post-tipping point diffusion is not deterministic, but involves many struggles that require policy attention

5) Tipping points do happen but are relatively rare (see also Abrams et al., 2026)

We identify three essential properties that characterize tipping dynamics: 1) self-reinforcing feedbacks that amplify change, 2) threshold behavior where small parameter changes trigger large responses, and 3) persistence that makes transitions difficult to reverse. (…) Where one or more of the properties are weak or absent, we treat such cases as important transitions, but not as tipping points in the strict sense.

Abrams et al., 2026, Integrating tipping point concepts across diverse systems, *Communications Sustainability,* volume 1, Article number: 68