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Sustainable Consumption Institute

Socio-technical transitions and system innovation:
Insights from sociology of innovation and evolutionary economics

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Motivations

Background document: "Is there only one way or are there multiple ways to envisage transformation" (p. 6)

Phrased differently: Can we complement economics and IAMs with other social science insights?

Answer: Open up the black box of 'system innovation'

Context
(price incentives, regulations)

Inputs
(investments)

(green) system innovation
and socio-technical transitions
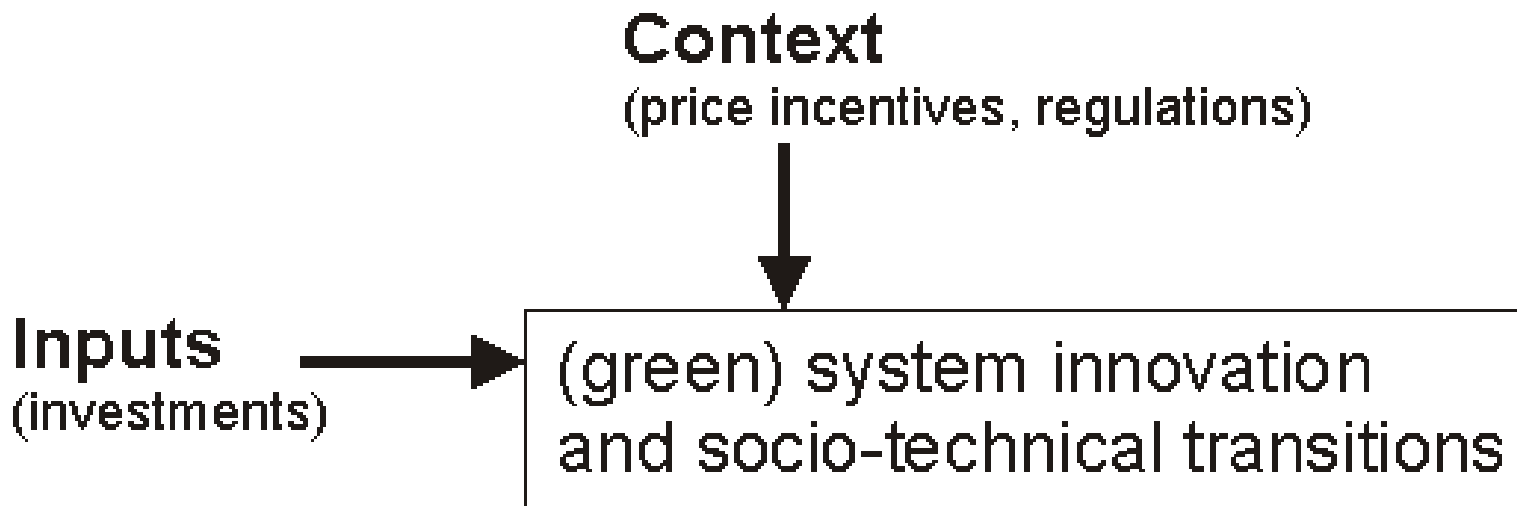
Papers from Nature (and WIRES) in 2016

Current climate models are grossly misleading

Nicholas Stern calls on scientists, engineers and economists to help policymakers by better modelling the immense risks to future generations, and the potential for action.

Embed the social sciences in climate policy

David G. Victor calls for the IPCC process to be extended to include insights into controversial social and behavioural issues.

Make climate–change assessments more relevant

Stéphane Hallegatte, **Katharine J. Mach** and colleagues urge researchers to gear their studies, and the way they present their results, to the needs of policymakers.

A critical review of global decarbonization scenarios: what do they tell us about feasibility?

Peter J. Loftus,[1] Armond M. Cohen,[2*] Jane C. S. Long[3] and Jesse D. Jenkins[4]
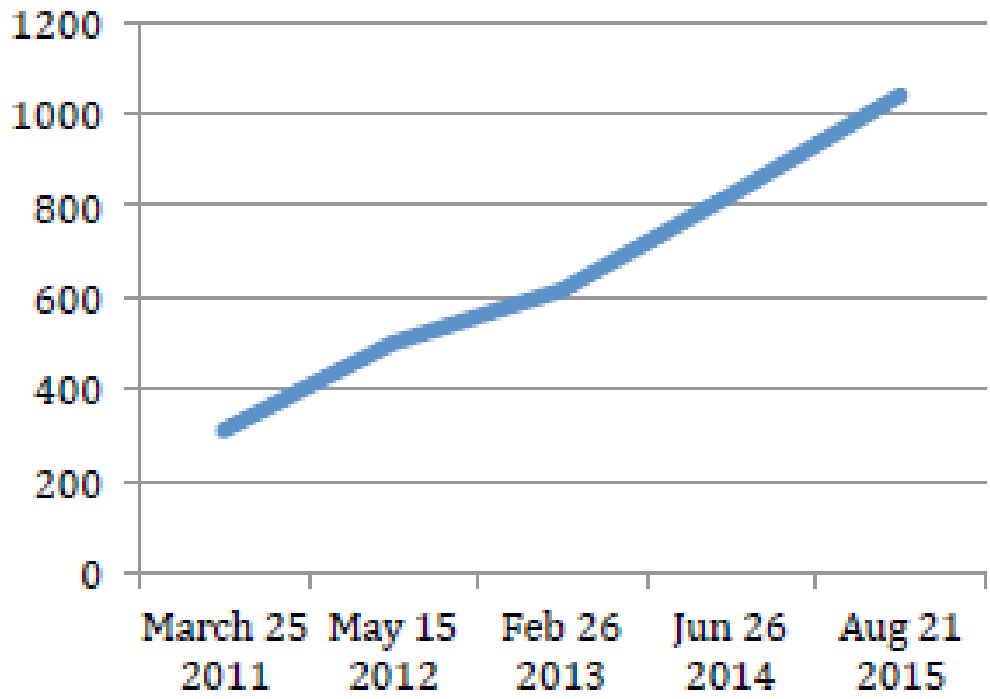
Structure

1. STRN

2. System innovation and socio-technical transition

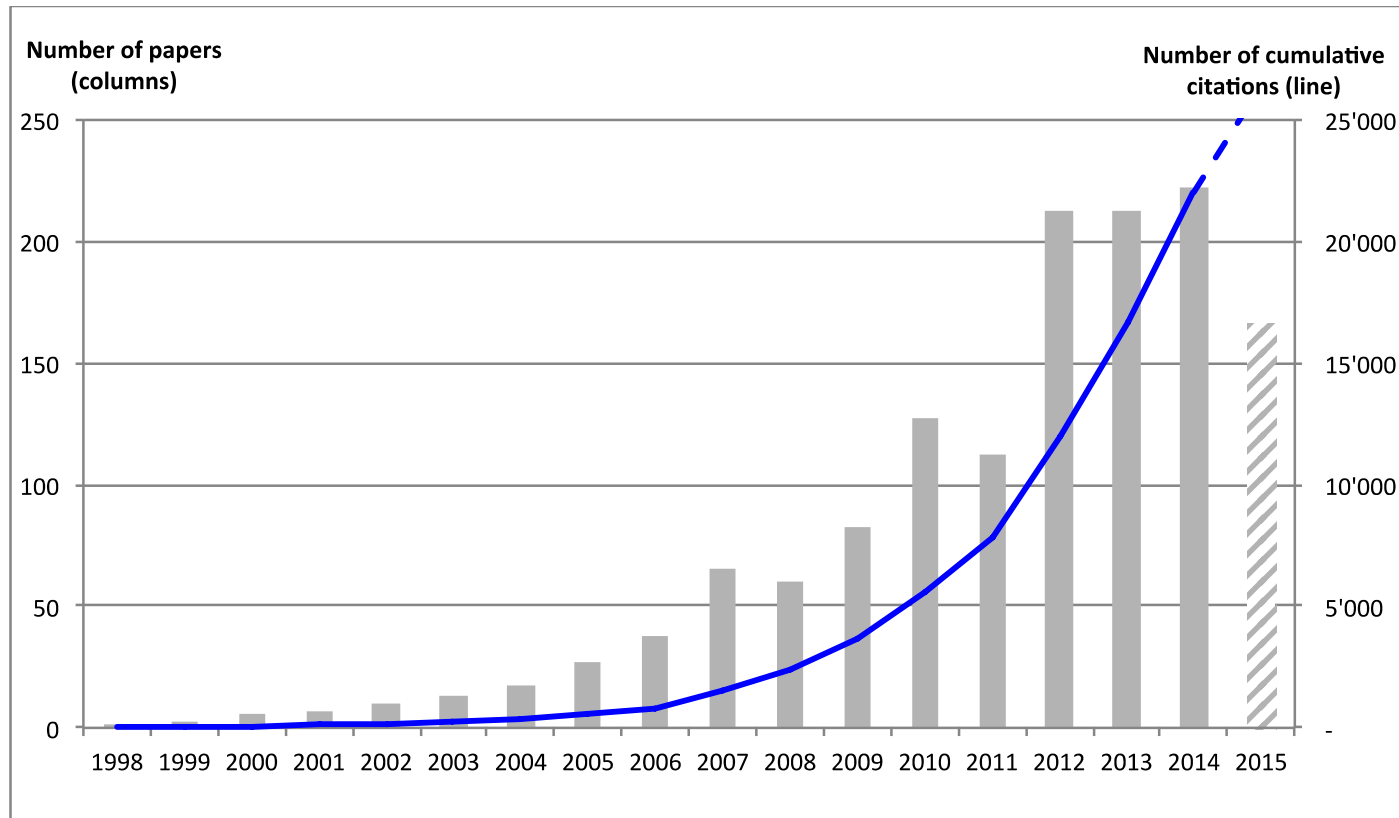3. Multi-level perspective

4. Conclusions for 1.5 degrees

1. Sustainability Transitions Research Network (STRN)

Total members

<u>Multi-disciplinary</u>
Innovation studies
Evolutionary economics
Political science
Social movement theory
History

Sustainability transitions: Increasing number of articles and (cumulative) citations

Empirical focus:

Much on electricity and transport

Some on agro-food, heat/buildings water

Mostly **(developed) country focus** and/or **change initiatives** (city, community)

Types of journals: Innovation studies, energy, sustainability
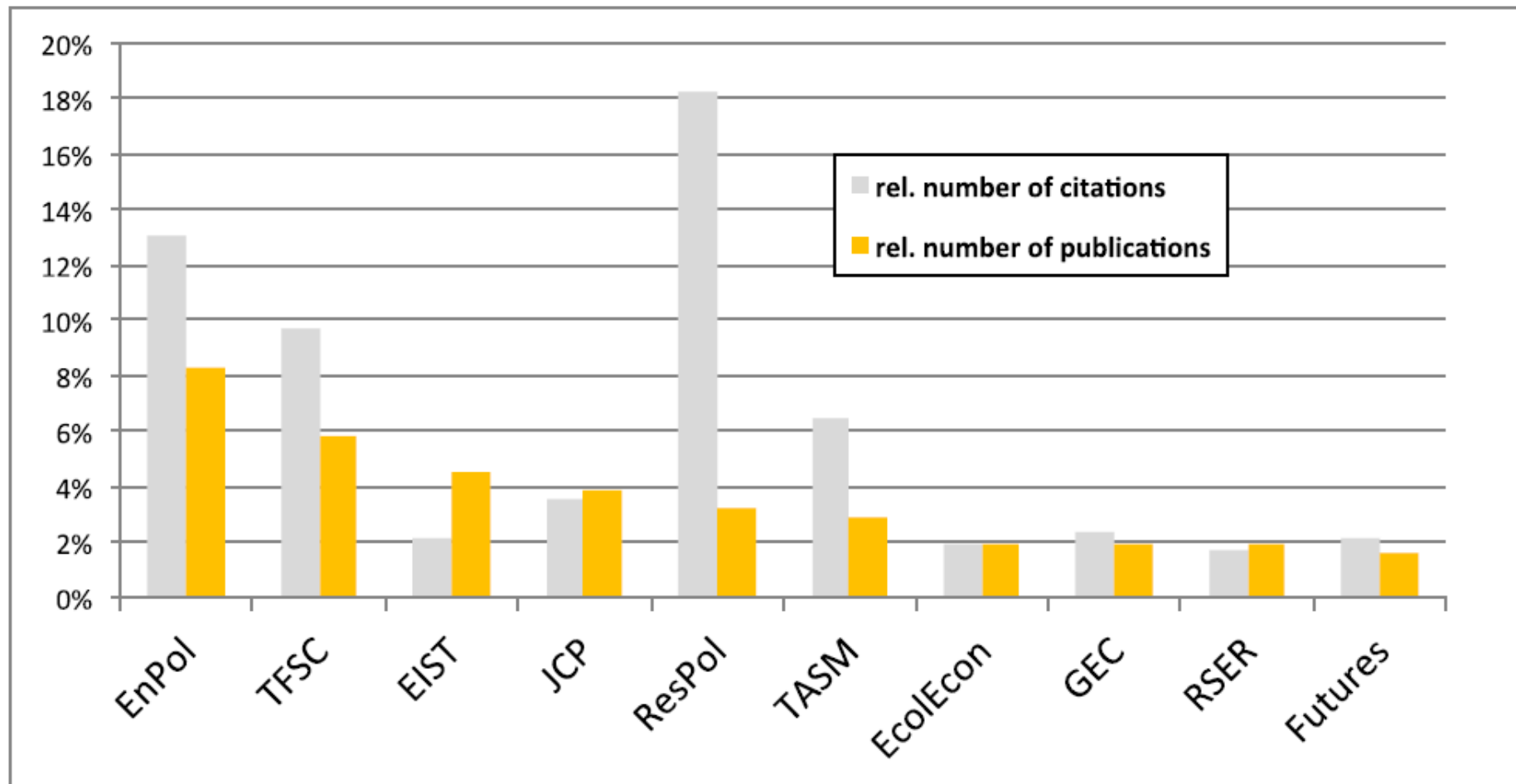
Figure 2: Key journals in the field – relative number of citations and publications

2. System transition

Addressing climate change requires **transitions** to new systems (in energy, transport, agro-food, housing)

Improvement in
environmental efficiency

Factor 10 —

Function innovation
= new system

Factor 5 —

Partial system redesign

Factor 2 —

System optimimisation

5   10   20   Time horizon (years)
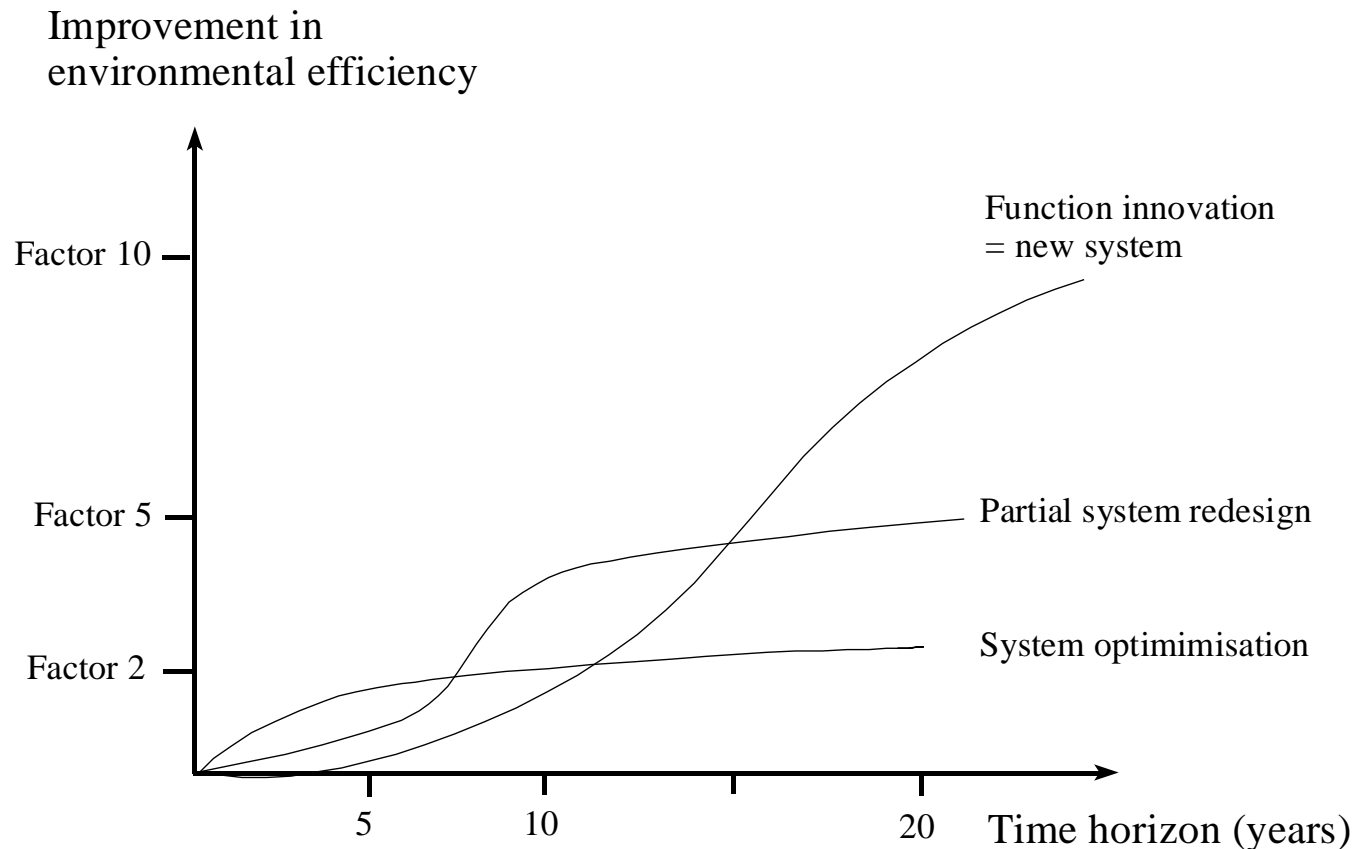
System transitions are multi-dimensional and co-evolutionary

Regulations and policies (e.g. traffic rules, parking fees, emission standards, car tax)

Maintenance and distribution network (e.g. repair shops, dealers)

Industry structure (e.g. car manufacturers, suppliers)

Road infrastructure and traffic system (e.g. lights, signs)

Socio-technical system for transportation

Markets and user practices (mobility patterns, driver preferences)

Culture and symbolic meaning (e.g. Freedom, individuality)

Vehicle (artefact)

Fuel infrastructure (oil companies,

Three examples for 1.5 degrees

- Electricity

- Transport

- Buildings

Innovations to reconfigure <u>electricity</u> systems

- Renewable energy technologies: Solar, wind, bio-power

- New entrants and (decentralized) business models: community energy, citizen producers, farmers

- Improved regime technologies: CCS, shale gas, nuclear

- Electricity storage, back-up capacity, capacity markets

- Grid extensions, super-grid, smart grid (with greater flexibility and bi-directional flows)

- Smart meters, demand-response tariffs, peak-shifting, new energy services

Innovations to reconfigure <u>transport</u> systems

- Cars with alternative power sources: BEV, HEV, FCV

- New fuel or charging infrastructures (maybe also 'vehicle-to-grid')

- New business models: Car sharing, car-pooling, Uber

- Smart ticketing and inter-modal transport systems

- ICT: self-driving cars, dynamic traffic management, intelligent transport systems

- Modal shift ('behaviour change') towards trains, trams, buses and cycling

- Revamping (local) transport systems: bus, tram, bike lanes, bike sharing, car sharing

Innovations to reconfiguring <u>built environment</u>

- Building retrofit: walls, windows, doors, lofts, cellars

- Heating technologies: boilers, heat pumps, passive house, district heating

- Smart homes, smart meters, tele-working, tele-shopping

- Smart cities, community redesign, compact cities, transit-oriented-development (mixed residential/commercial areas)
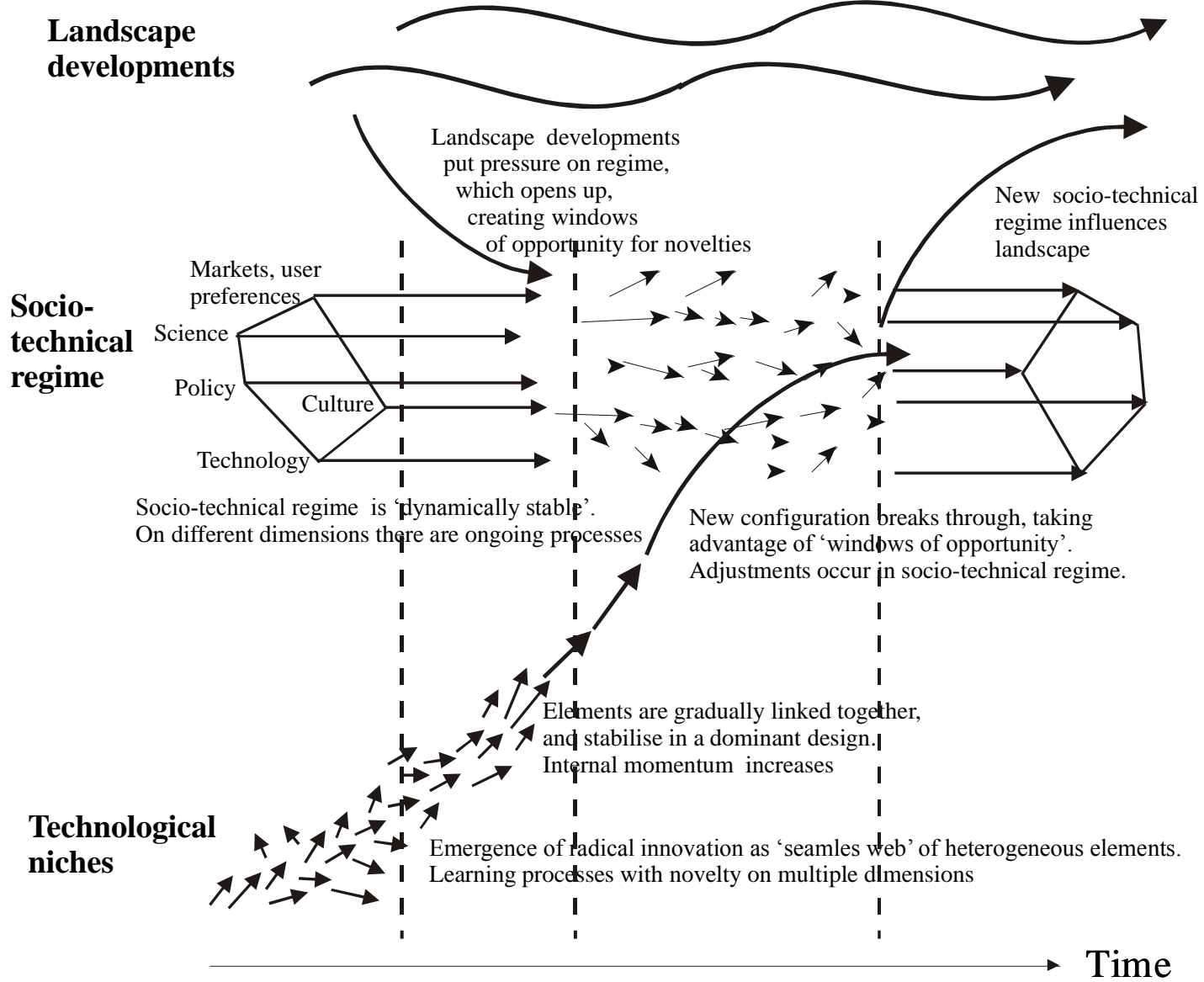
The challenge for 1.5 degrees

- So, green innovations exist in all sectors

- The challenge is **accelerated** diffusion (and the decline of existing fossil-based systems)

3. Multi-level perspective

Landscape developments

Landscape developments put pressure on regime, which opens up, creating windows of opportunity for novelties

New socio-technical regime influences landscape

Socio-technical regime

Markets, user preferences

Science

Policy

Culture

Technology

Socio-technical regime is 'dynamically stable'. On different dimensions there are ongoing processes

New configuration breaks through, taking advantage of 'windows of opportunity'. Adjustments occur in socio-technical regime.

Elements are gradually linked together, and stabilise in a dominant design. Internal momentum increases

Technological niches

Emergence of radical innovation as 'seamles web' of heterogeneous elements. Learning processes with novelty on multiple dimensions

Time

Endogenous momentum of <u>niche-innovations</u>

Economic and business dynamics:

a) Learning-by-doing (learning curves)

b) Increasing returns to adoption (scale, network externalities)

c) Strategic games between firms and innovation races ('jockeying for position')

Socio-cognitive and cultural dynamics:

a) Expanding social networks

b) Building skills, knowledge, capabilities

c) Develop positive discourses/visions to create socio-political legitimacy

Policies, power and politics:

a) Supportive regulations, subsidies, investment

b) Requires advocacy coalitions with political power (business, NGOs, media)

<u>Existing regime</u> is locked-in (path dependent)

<u>Economic</u>:
- Scale advantages, low cost
- Sunk investments (competence, infrastructure)

<u>Social/organizational</u>:
- Incumbent firms have vested interests, mind-sets, routines
- Alignment between social groups ('social capital')
- User practices, values, life styles

<u>Politics and power:</u>
- Uneven playing field (policies favour status quo)
- Opposition to policy change from vested interests

Transitions involve multi-dimensional struggles
between niche-innovations and existing regimes

- Business: New entrants vs. incumbents

- Economic: Competition between 'grey' and 'green' products/technologies (uneven playing field)

- Political: Struggles between incumbent 'elites' (politicians, big firms) and other actors (cities, social movements, green entrepreneurs).

- Cultural: Discursive struggles about problem framing (market failure vs. planetary boundaries) and preferred solutions/pathways

4. Conclusions for 1.5 degrees

- Socio-technical transitions in <u>multiple </u>sectors: not just electricity (which is 'upstream'), but also agro-food, mobility and heat/buildings

- Accelerated diffusion of radical innovations, which includes price/performance, but also social acceptance, positive discourses, new business models, stronger policies, new markets

- Acceleration involves <u>multi-dimensional struggles</u>

Stronger policies and political will

Stronger policies crucial to accelerate change:

- **Innovation policies** to nurture solutions
- **Environmental policies** (regulations, taxes, subsidies) to change markets

Strong policies require **political will**, which is shaped by

- International pressure (agreements, targets and 'deals')
- Pressure from civil society, public discourse ('legitimacy', social acceptance)
- Pressure from business coalitions (new entrants and willing incumbents)
- Working exemplars 'on the ground' (to overcome 'scepticism')
- Positive narrative (co-benefits, green growth, jobs, quality of life)
- 'Bottom-up' pressure (cities, communities, green entrepreneurs)

Need for poly-centric governance (multiple policy styles)

1) Goal-rational: visons, targets, cost-benefit calculation ('policymaking as managerial process')

2) Deliberate: political feasibility, legitimacy, buy-in ('politics as art of the possible')

3) Emergent: learning, experimenting, local projects (policymaking as 'muddling through', modulating ongoing dynamics)
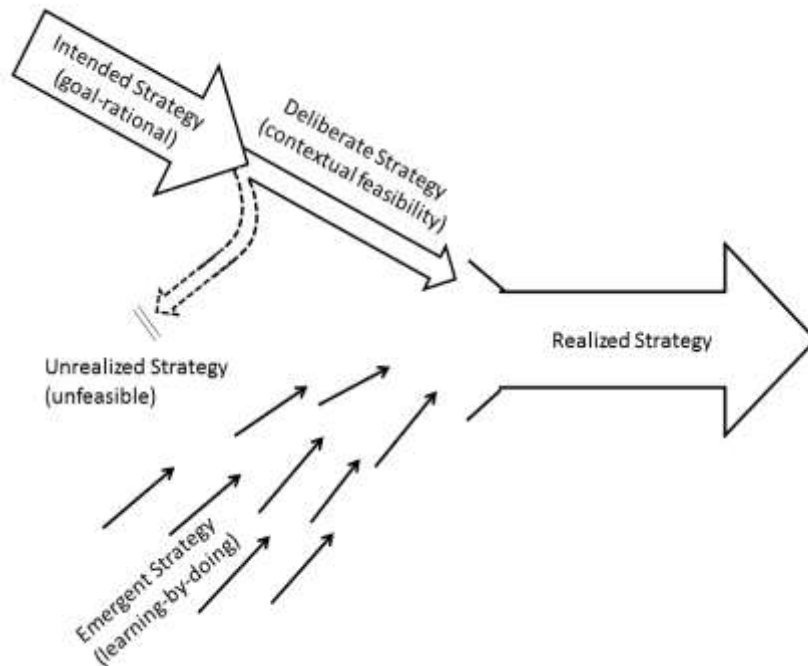
Business strategies emerge from different styles
(Mintzberg et al, 1998)