A socio-technical transitions perspective on sustainability transformations

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Sustainability Transitions Research Network (STRN)
2000+ members, annual conference, Elsevier journal (EIST)

Fig. 1. Number of papers on sustainability transitions in peer reviewed journals and citations.
(Source: Scopus, January 12, 2019)
Reframing: Socio-technical systems as core driver of environmental problems
Elements + actors in socio-technical systems

Fig. 1. The basic elements and resources of socio-technical systems.
Existing system is locked-in (resilient, resistant to major change)

**Economic**
- Scale advantages, low cost
- Sunk investments (skills, factories, infrastructure)

**Social/organisational**
- Incumbent firms have vested interests + core capabilities
- Alignment between social groups (‘social capital’)
- User practices, lifestyles

**Politics and power**
- Uneven playing field
- Vested interests oppose policy change (power struggles)
There are many green innovations (seeds for transitional change)
But these struggle to break through

<table>
<thead>
<tr>
<th>Mobility</th>
<th>Agro-food</th>
<th>Energy (electricity, heat)</th>
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</thead>
<tbody>
<tr>
<td>Radical technical innovation</td>
<td>Permaculture, agro-ecology, artificial meat, plant-based milk, manure digestion</td>
<td>Renewable electricity (wind, solar, biomass, hydro), heat pumps, passive house, biomass stoves, smart meters</td>
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<tr>
<td>Mobility services, car sharing, bike sharing</td>
<td>Alternative food networks, organic food, less-meat initiatives, urban farming</td>
<td>Decentralized energy production (‘prosumers’), community energy, energy cafés</td>
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<tr>
<td>Intermodal transport systems, compact cities, revamped urban transport systems (tram, light-rail, metro)</td>
<td>Efficient irrigation systems, agro-forestry, rewilding, multi-functional land-use</td>
<td>District heating system, smart grids, bio-methane in reconfigured gas grid</td>
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So, how do transitions happen?

• Co-evolutionary multi-actor processes: technical, economic, social, political, cultural

• Multiple phases with different mechanisms

• Struggles between forces of stability and change

• Regime shifts + punctuated equilibria: Schumpeterian ‘waves of destruction’ + political struggles/coalitions
Multi-Level Perspective on socio-technical transitions

- No single cause, but alignments between multiple processes with different temporalities
- Bottom-up innovation; external pressures; system destabilisation; reconfiguration

Socio-technical landscape (exogenous context)

Socio-technical regime

Niche-innovations

Phase 1

Phase 2

Phase 3

Phase 4

Time

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

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

Elements become aligned, and stabilise in a dominant design. Internal momentum increases.

External influences on niches (via expectations and networks)

Small networks of actors support novelties on the basis of expectations and visions. Learning processes take place on multiple dimensions (co-construction). Efforts to link different elements in a seamless web.
Phase 1. Emergence

• Radical innovations emerge in peripheral ‘niches’ (R&D, experiments, demonstration projects)

• Entrepreneurs, start-ups, local communities, NGOs

Core processes (Schot and Geels, 2008):

a) learning-by-doing

b) building new social (shadow) networks (Folke)

c) articulating new visions

Schot, J.W. and Geels, F.W., 2008, Strategic niche management and sustainable innovation journeys: Theory, findings, research agenda and policy, Technology Analysis & Strategic Management, 20(5), 537-554
Phase 2: Stabilisation + upscaling

Niche-innovations develop through **sequences of projects** (Geels/Raven, 2006)

a) **up-scaling**: more and larger projects
b) **broadening**: include more actors, expand application domains
c) **stabilisation**: aggregate lessons and articulate rules/best practices
Phase 3: Diffusion into mainstream markets

• Price/performance improvements (scale economies, learning-by-doing)

• Growing markets + positive cultural discourses

• Increasing business interest and ‘innovation races’

• Growing support coalitions + political lobbies

• Favourable policy adjustments

• But also: Resistance + fight-back from incumbents
Phase 4: Reconfiguration

- Wider system change in institutions, infrastructure, views of normality, professional standards

- Decline of existing systems and exit or reorientation of incumbent actors/industries
Low-carbon transitions are in different phases (in different countries)

**EMERGENCE**
- Coordinated development and testing of new technologies – to accelerate learning

**DIFFUSION**
- Coordinated policies to expand deployment – to increase economies of scale and improve performance

**RECONFIGURATION**
- Coordinated standards and incentives – to ensure change throughout the whole sector
Future/ongoing research

• Different transition pathways, based on different sequences and kinds of MLP-interactions

• Incumbents: resistance or reorientation?

• Decline: ‘just transition’, compensation

• Conditions for (political) acceleration

• Whole system change, innovation cascades, spillovers, knock-on effects