

Understanding transition processes: With applications to circular economy



Professor Frank Geels

Manchester Institute of Innovation Research
Sustainable Consumption Institute
The University of Manchester

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Structure of talk:

- 1) Introduction: Need for transitions
- 2) Conceptual perspective on system innovation and socio-technical transitions
- 3) Circular economy as niche-innovation
- 4) Management and policy implications

1. Introduction

New socio-environmental challenges

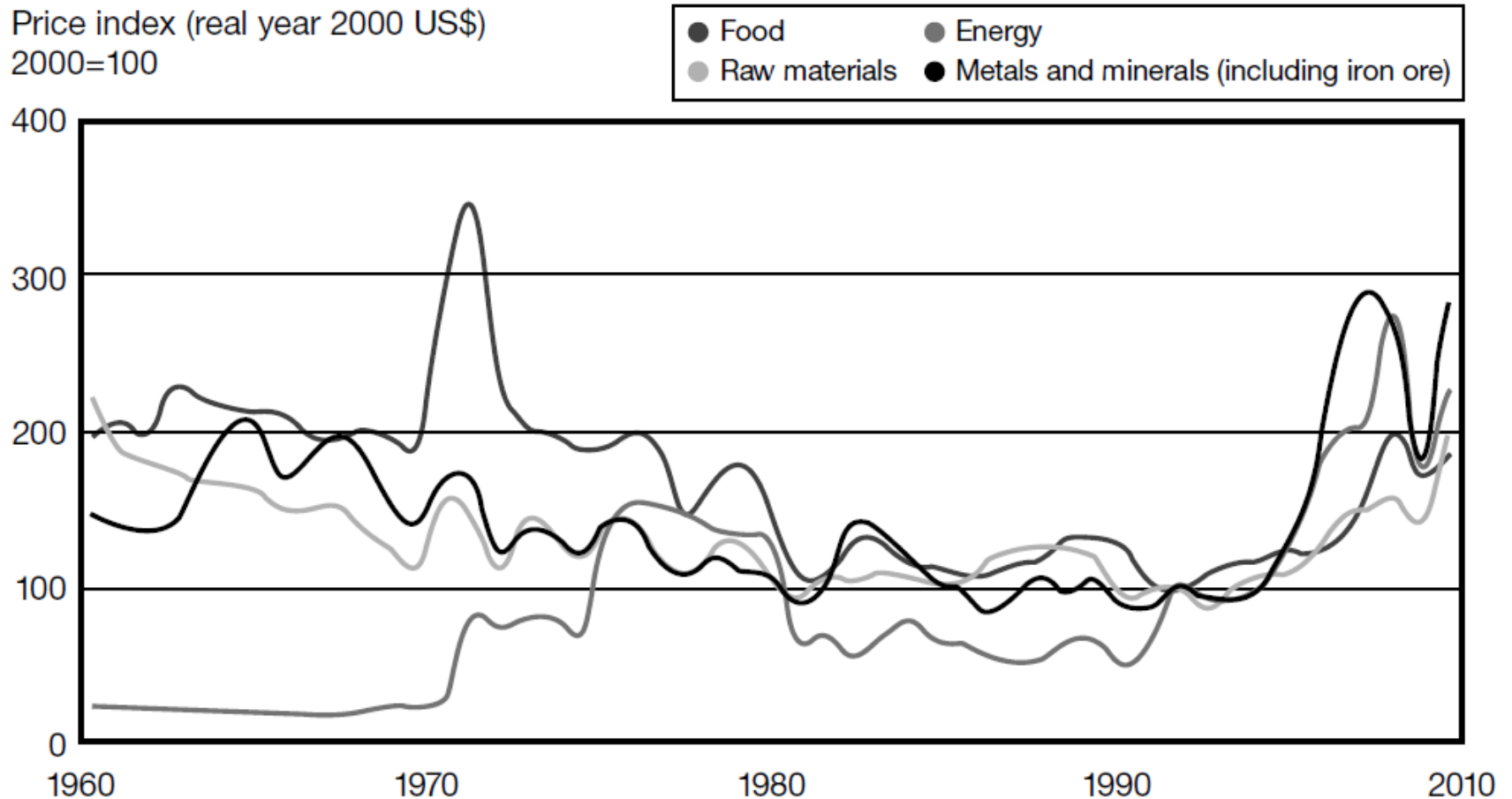
- Global environmental problems: Climate change, biodiversity, resource problems (water, forests, fish, rare metals)
- Grand societal challenges (energy security, obesity, aging)
- Business concerns about resource availability and prices

→ Incremental change and BAU not enough

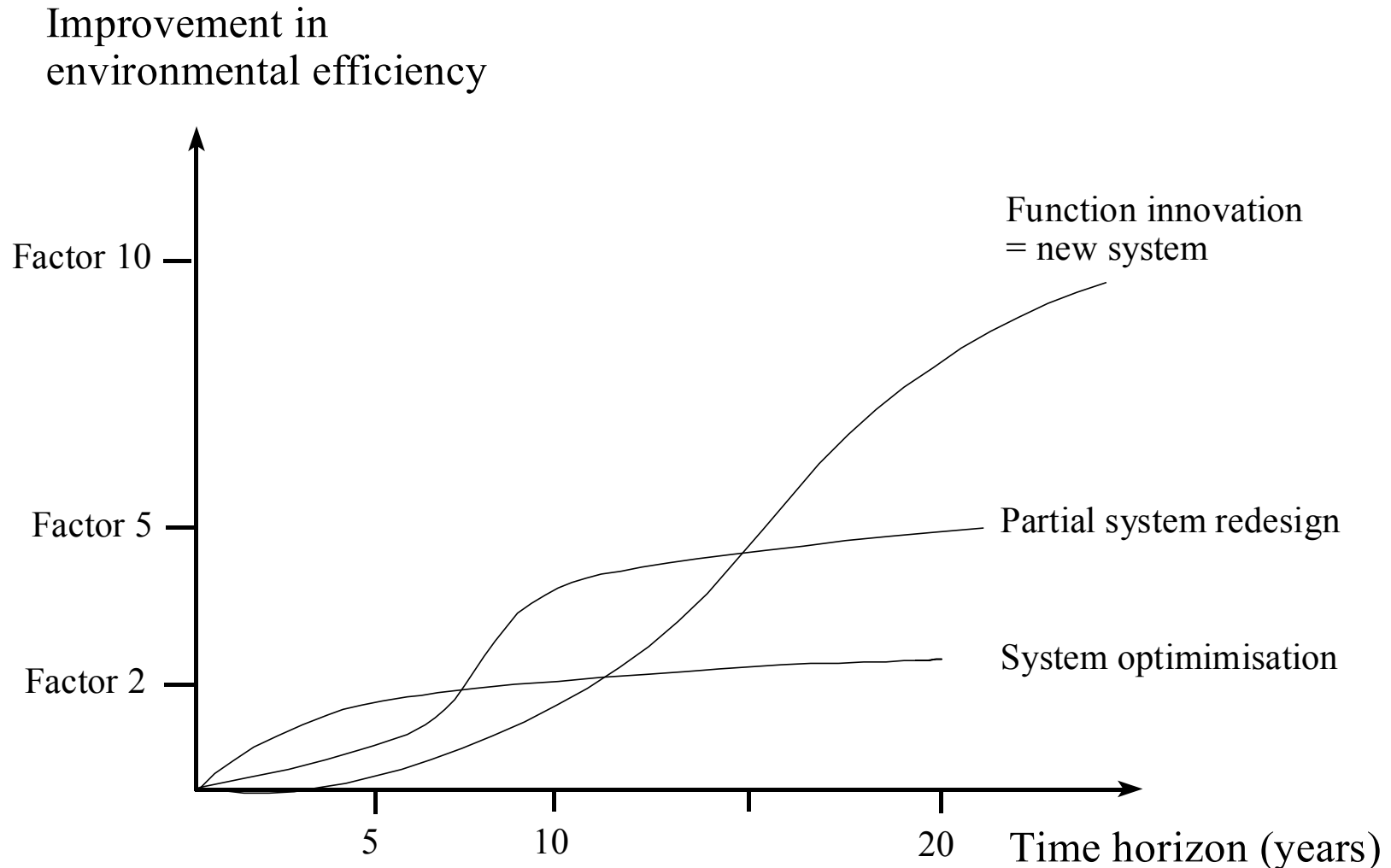
→ Need for transitions and system change

Circular economy interest stimulated by rising resource prices

Commodity price index (Fisher-Kowalski and Swilling, 2011)

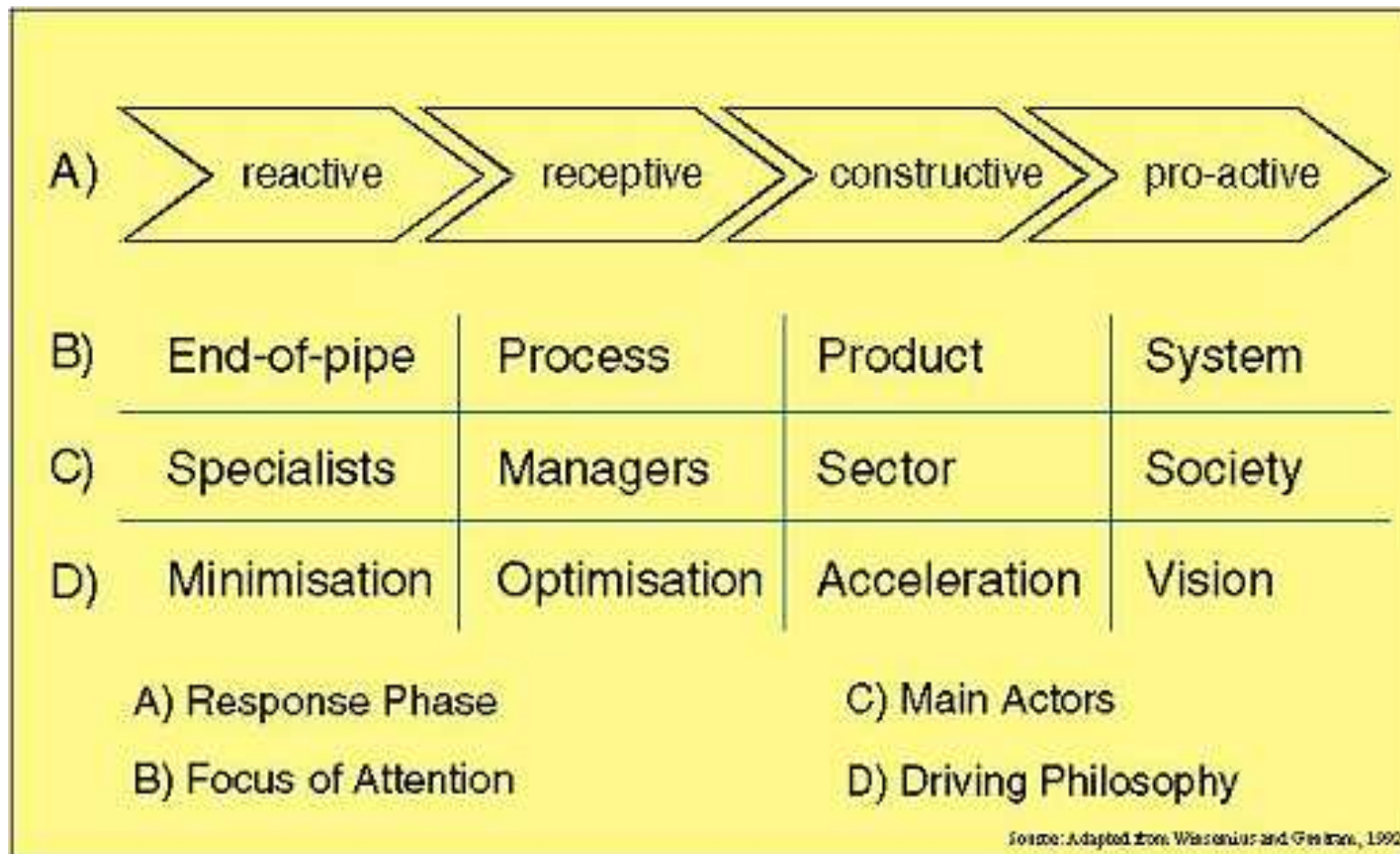


Problems require transitions to new systems (in energy, transport, agro-food, production/consumption)



System change is more than product and process innovation; involving a wider range of actors

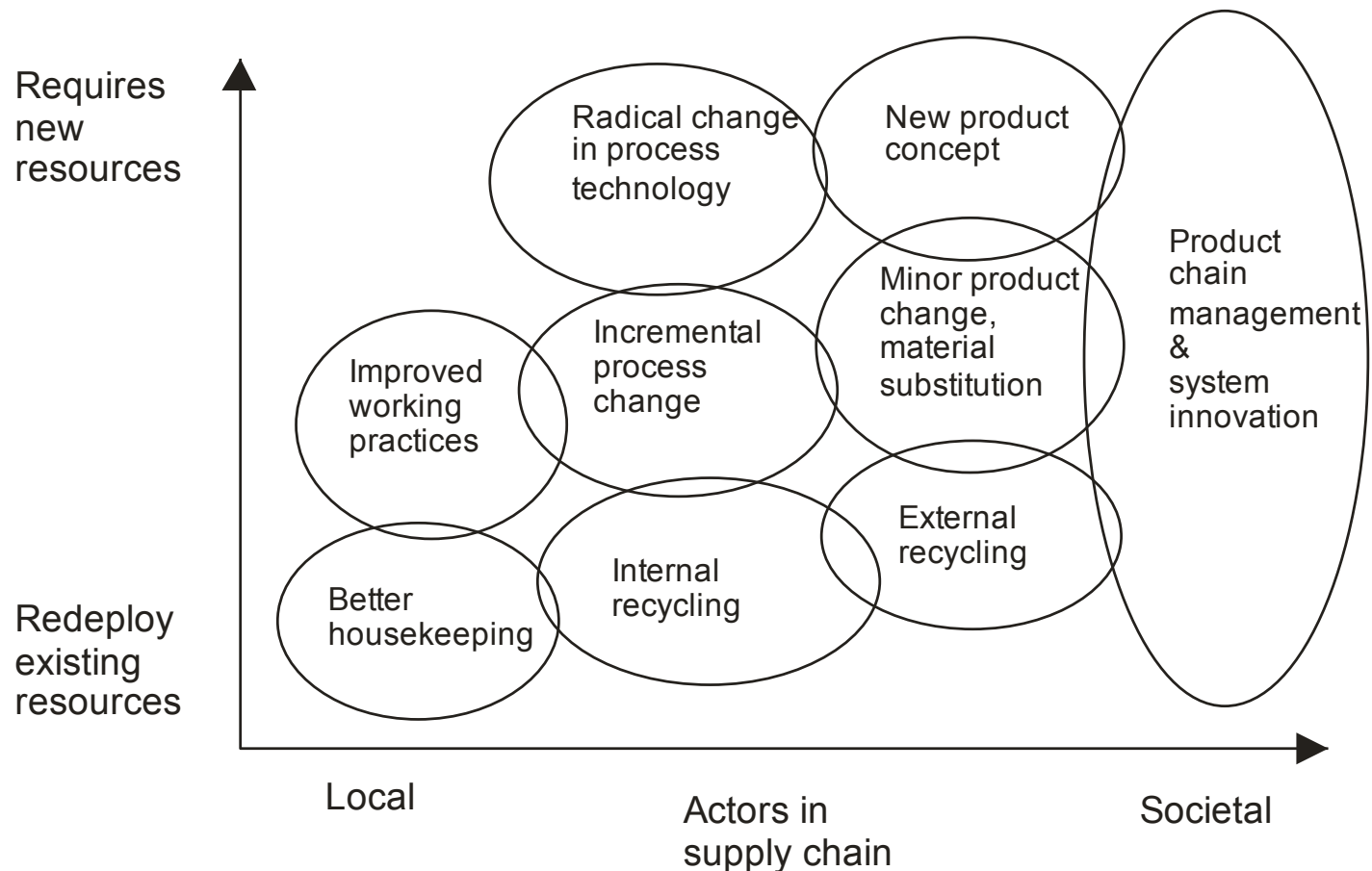
Phases in kinds of environmental policies (United Nations, 1999)



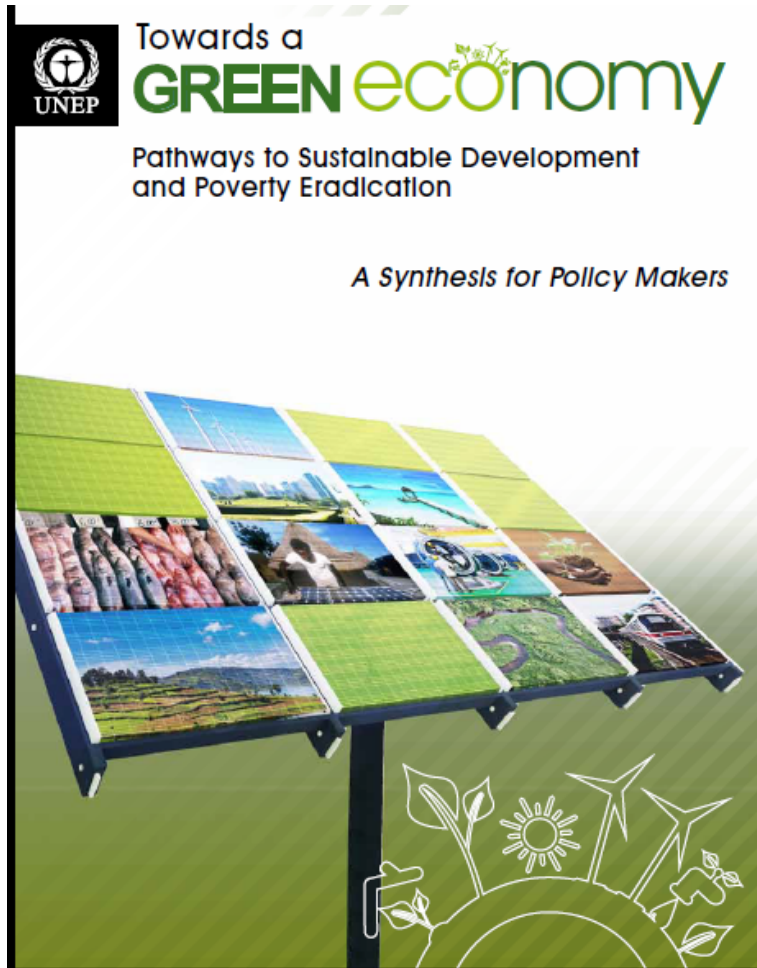
System innovation involves many actors and requires new resources

Types of green innovation (adapted from Clayton et al., 1999)

Resources = equipment, skills, finance, supportive infrastructures, institutional support
(Clayton et al, 1999)



Transitions and system innovation as new policy and business discourse



The UK Low Carbon Transition Plan

National strategy for climate and energy



SYSTEM INNOVATION: SYNTHESIS REPORT



European Environment Agency (2014)

Multiannual Work Programme 2014–2018

Expanding the knowledge base for policy implementation
and long-term transitions

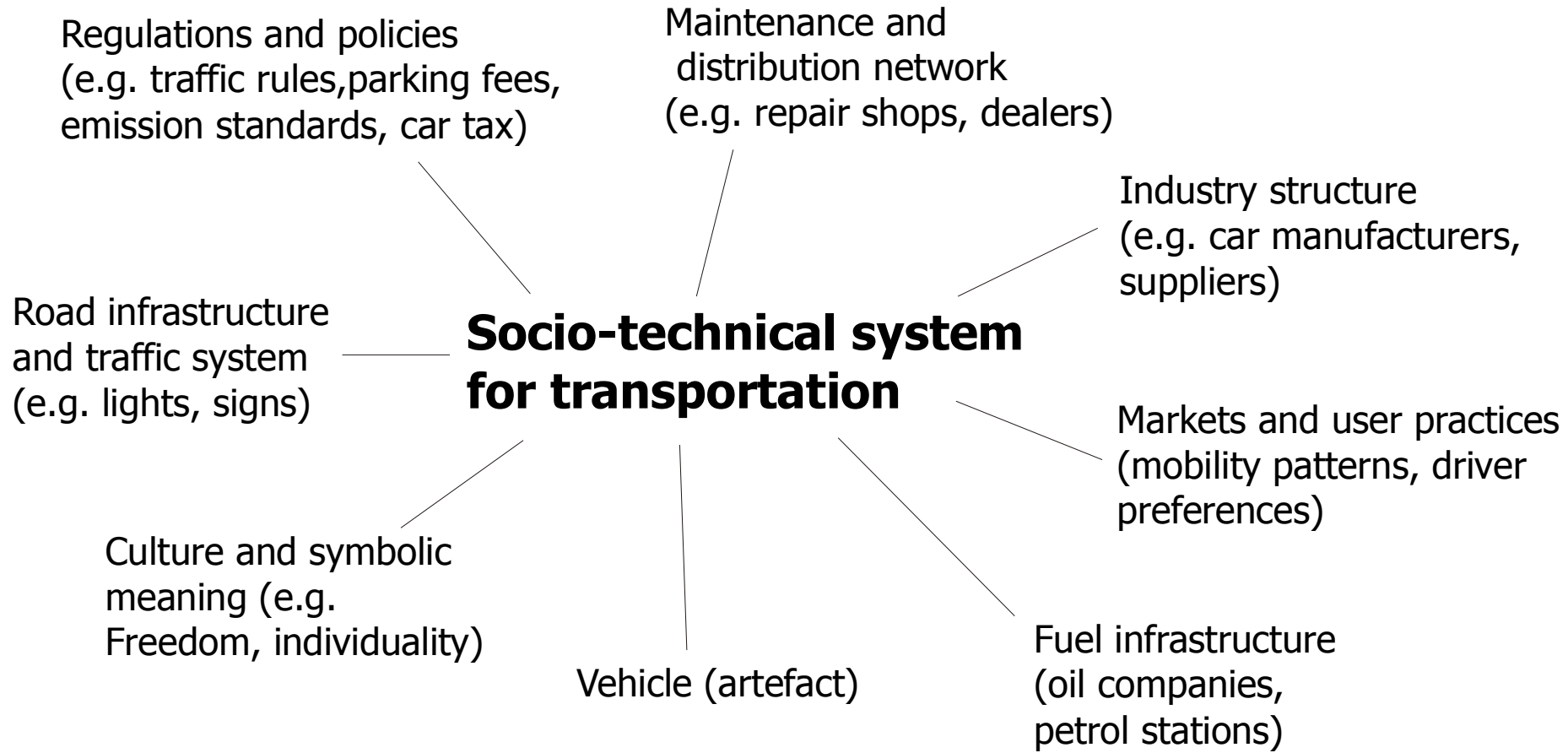


2. Conceptual perspective on system innovation and socio-technical transitions

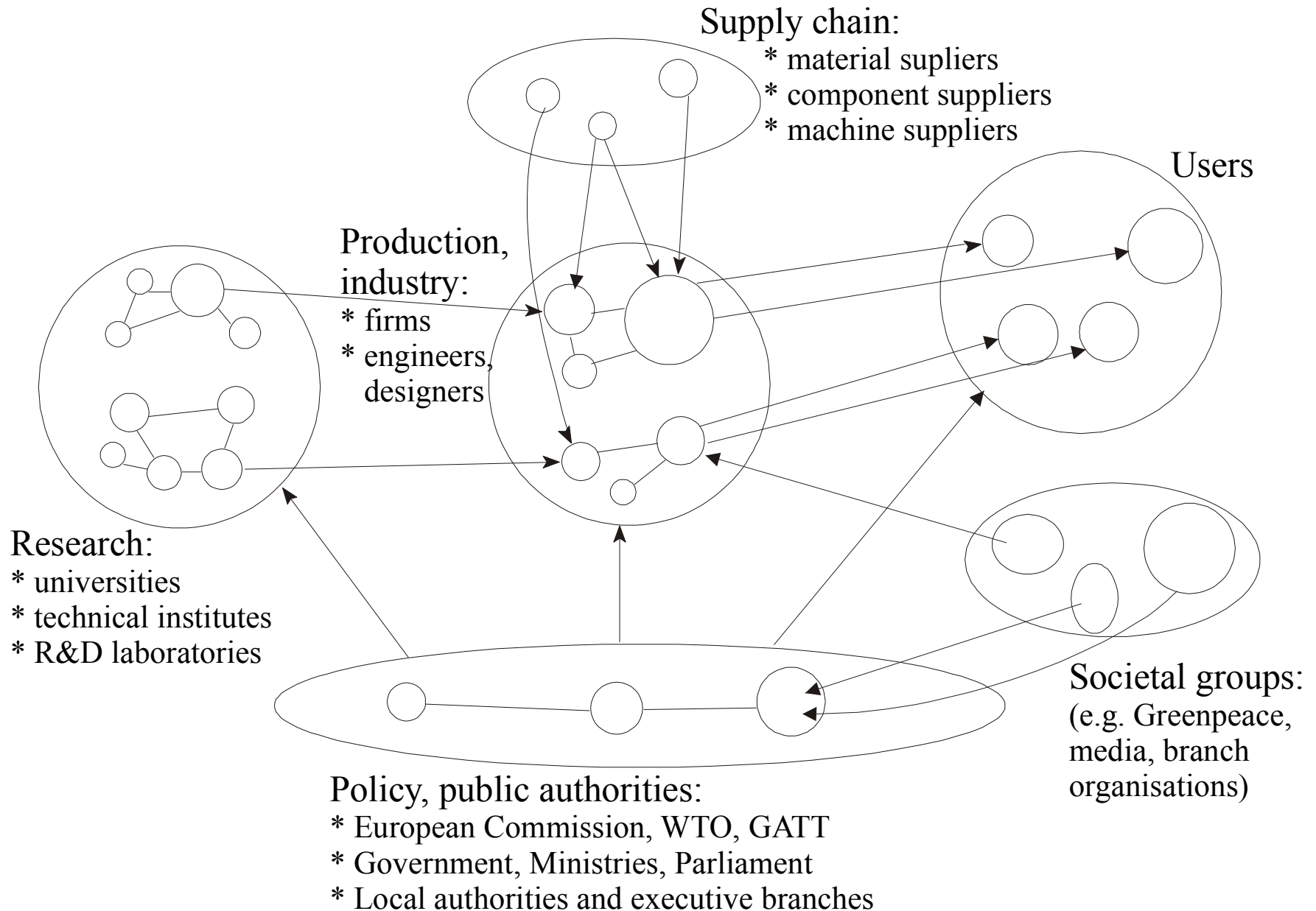
Based on ideas from

- Evolutionary economics
- Innovation studies
- Sociology
- Institutional theory

Unit of analysis: Socio-technical systems

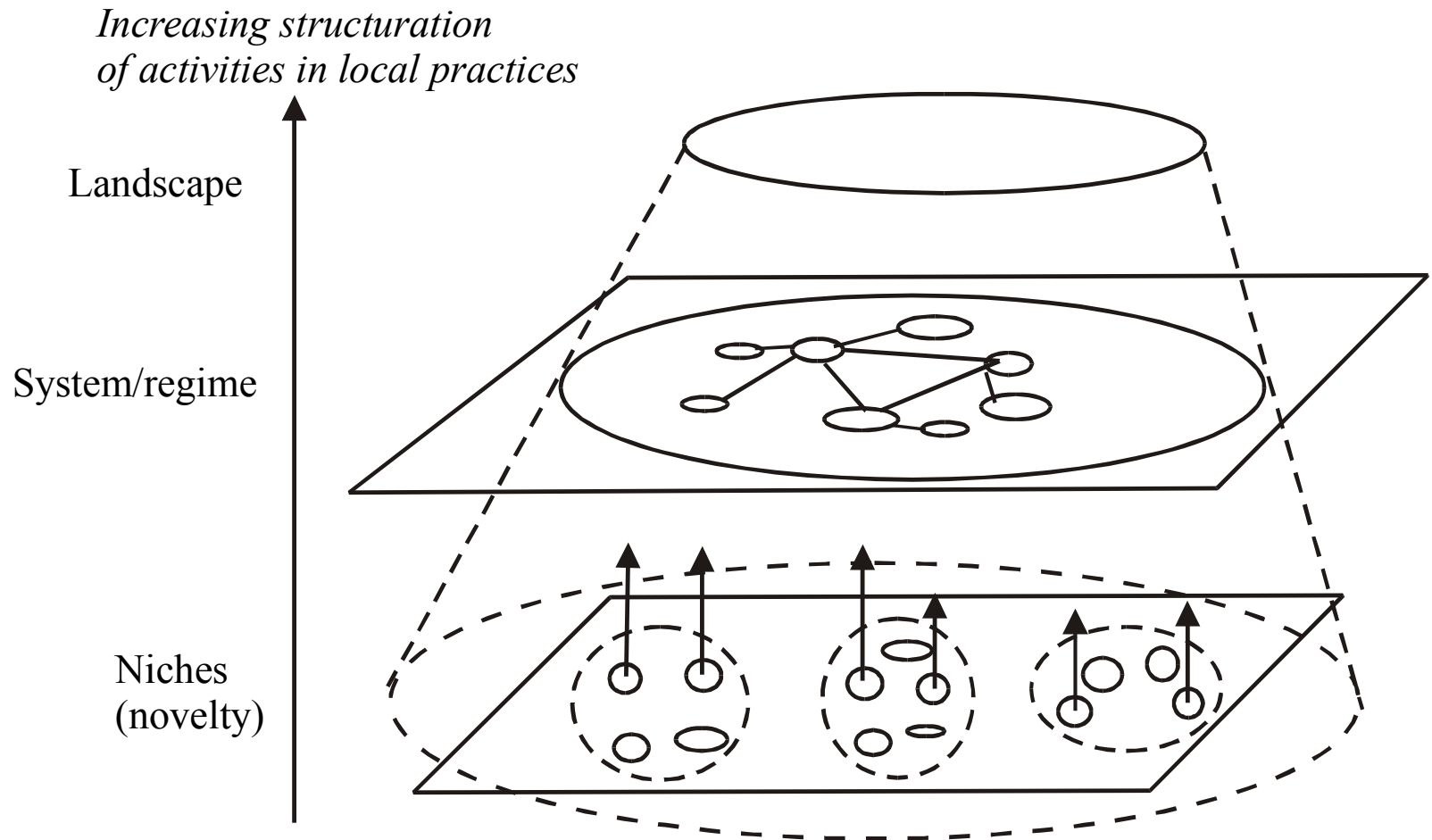


Actors involved: Organizational field



Static multi-level perspective (nested hierarchy)

- * Radical innovation in niches (variation/novelty)
- * Struggling against existing regimes
- * In context of broader 'landscape trends'



a) Problem: Existing regime is locked-in path dependent

Economic:

- a) vested interests
- b) sunk investments (competence, infrastructure)
- c) scale advantages, low cost

Social/organizational:

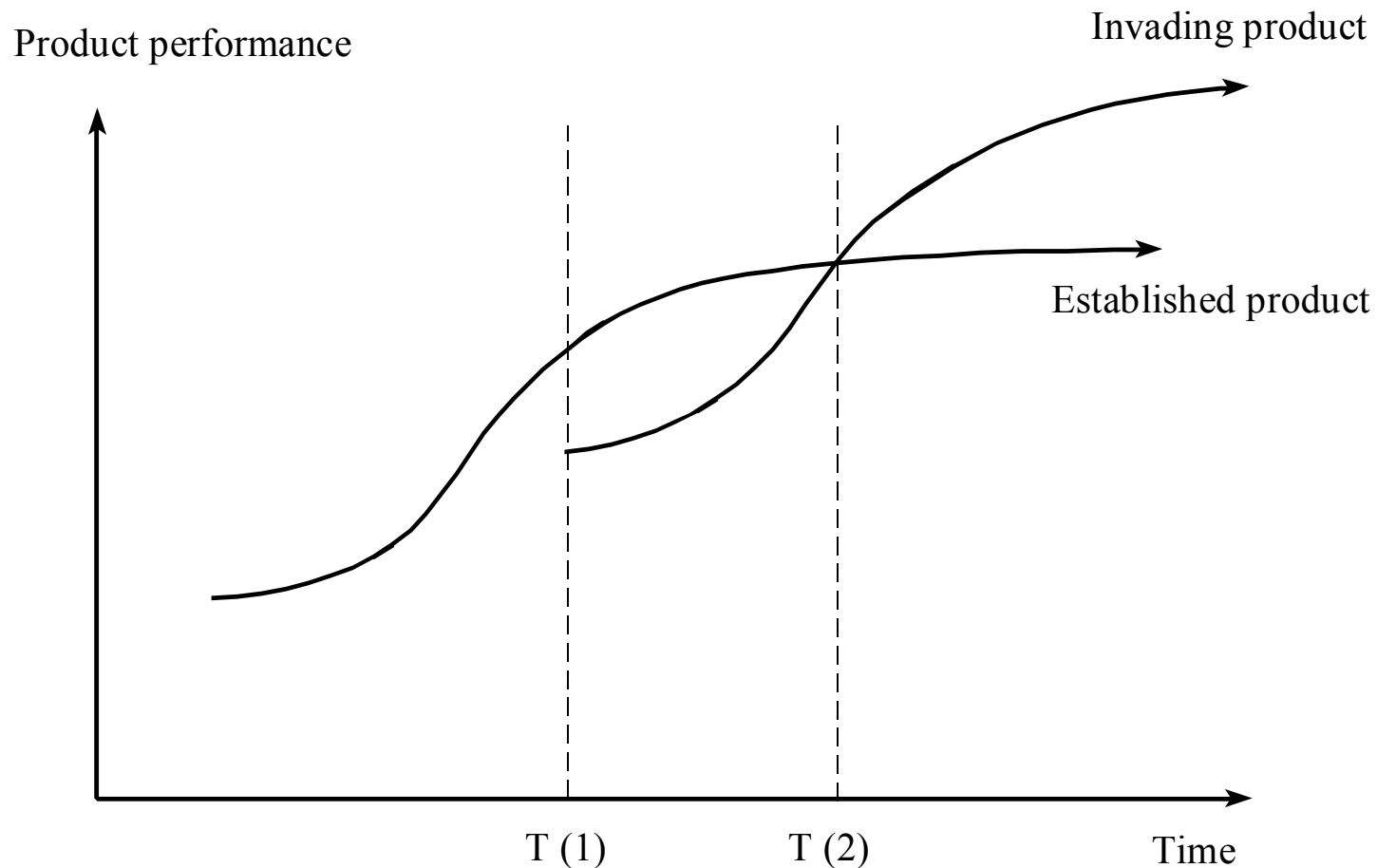
- a) established industry mind-sets, routines, ways of doing things
- b) alignment between social groups ('social capital')
- c) user practices, values and life styles

Politics and power:

- a) Uneven playing field (policies favour status quo)
- b) Opposition to policy change from vested interests

b) Niches for radical innovation

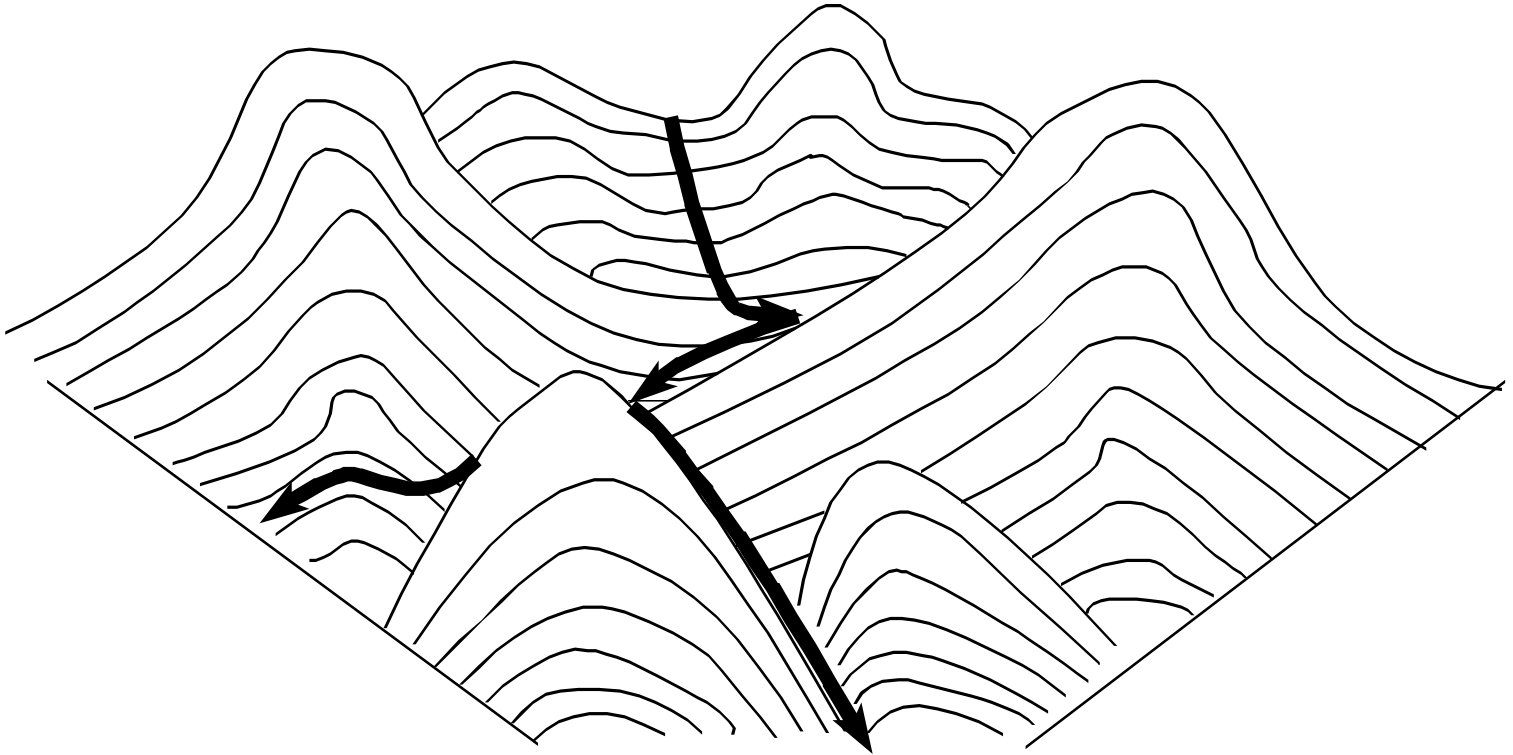
- Nurturing of 'hopeful monstrosities' (Mokyr)
- Protection from mainstream market selection
- Carried by entrepreneurs, outsiders, small social networks



Time lag between invention and innovation (Clark, Freeman, Soete, 1981)

	Invention	Innovation	Time lag (years)
electronic digital computers	1939	1943	4
float glass	1902	1943	41
fluorescent lighting	1901	1938	37
helicopter	1904	1936	32
jet engine	1928	1941	13
magnetic tape-recording	1898	1937	39
radar	1925	1934	9
radio	1900	1918	18
synthetic detergents	1886	1928	42
television	1923	1936	13
transistor	1948	1950	2
zipper	1891	1923	32

c. Situated in exogenous socio-technical landscape



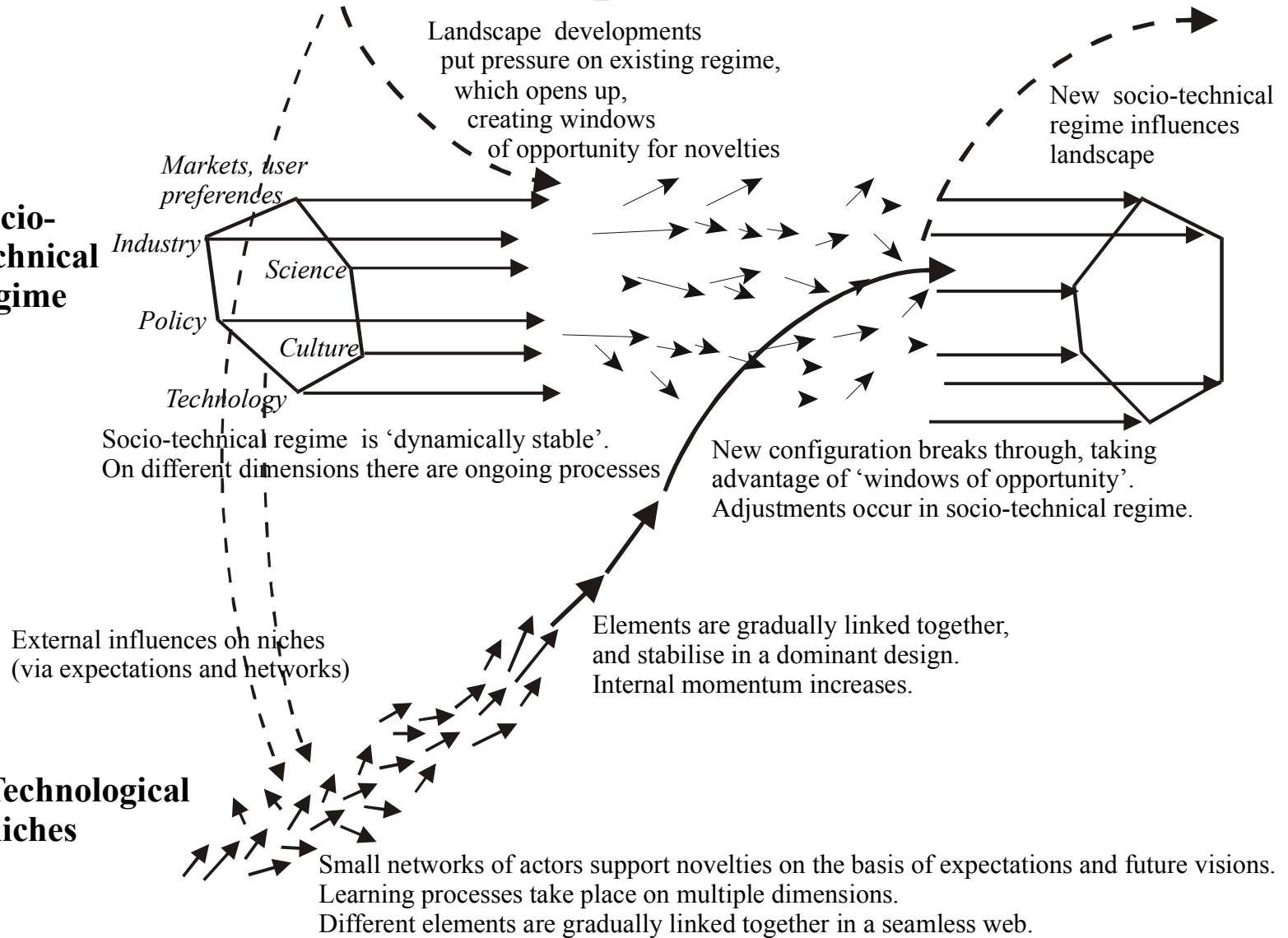
Exogeneous context

- Slow-changing secular trends: demographics, macro-economics, ideology, climate change
- Rapid shocks: recession, wars, oil shock

Socio-technical landscape

Socio-technical regime

Technological niches



3. Circular economy as niche-innovations

- 'Circular economy' goes back to 1990s: industrial ecology, closing materials loops in industrial parks
- Now applied more generally, both upstream (supply chains) and downstream (consumers, recycling)

Attracts policy (EU) and business attention:

- Positive discourse: who is against efficiency and waste reduction?
- Win-win examples: economic opportunities
- Requires change, but not too disruptive/radical

Different forms of circular economy

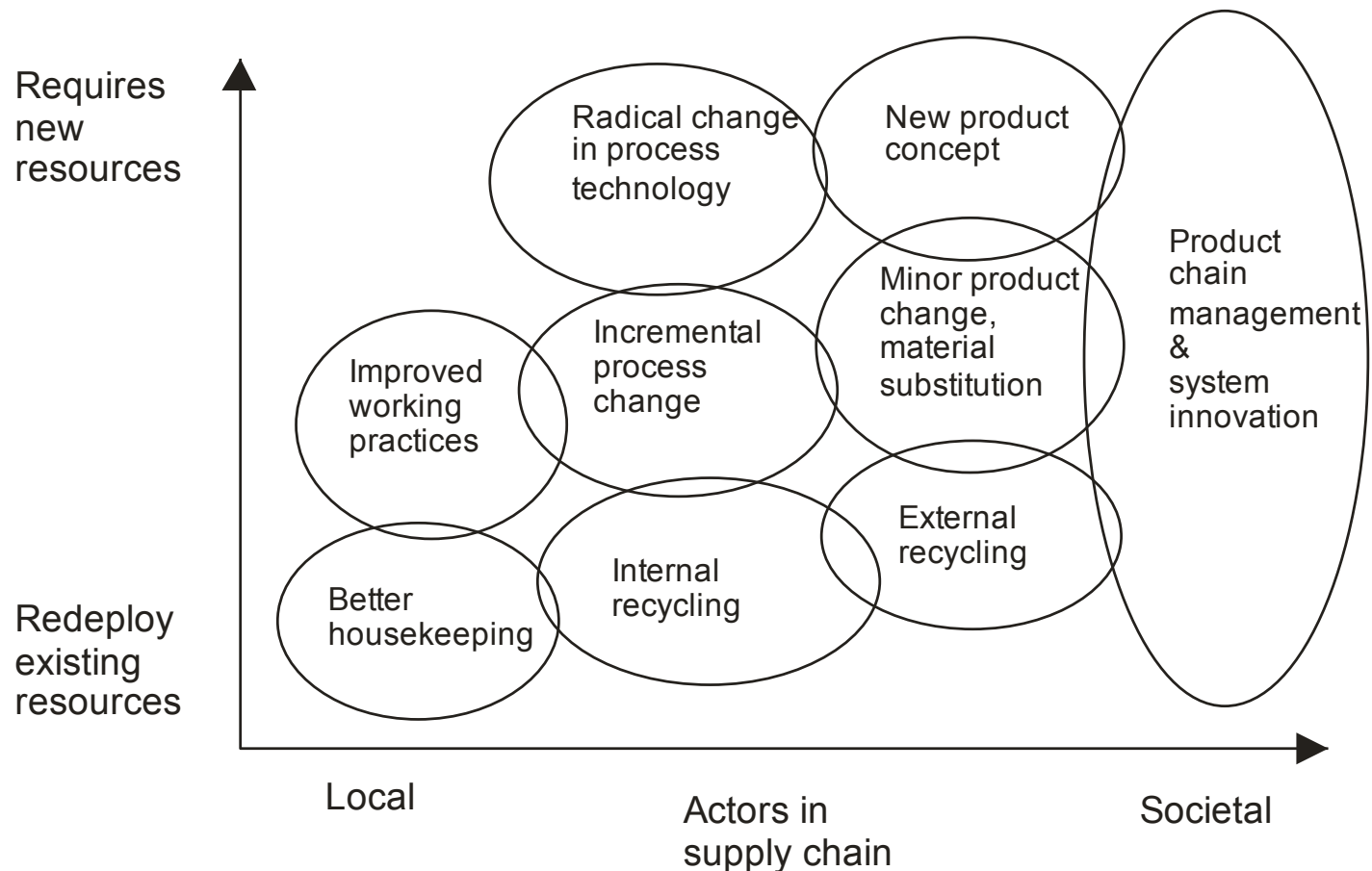
(degrees of radicality?)

1. Circular supply chain: upstream waste outputs form downstream inputs (different firms)
2. Recovery and recycling: extract resources from waste or use waste for different purposes (same firm)
3. Product life extension: re-design products to make them last longer, organise downstream repairs, upgrades, remanufacturing
4. Sharing platforms: renting, sharing, swapping idle goods or capacity (Airbnb, Uber)
5. Product as service: firms responsible for production, functionality and waste; PSS business model

Circular economy requires much **social change** (new networks, routines, procedures, interactions)

With some **product** and **business model** change

Resources = equipment, skills, finance, supportive infrastructures, institutional support
(Clayton et al, 1999)



Implementation challenges

- Not 'one size fits all'
 - Feasibility of 'circular initiatives' vary per sector:
 - a) price developments
 - b) complexities of product/process
 - c) costs of 'circular initiative'
- Need for learning (trial-and-error) through concrete projects and best practice articulation

Three implementation variables (Mylan et al 2015):

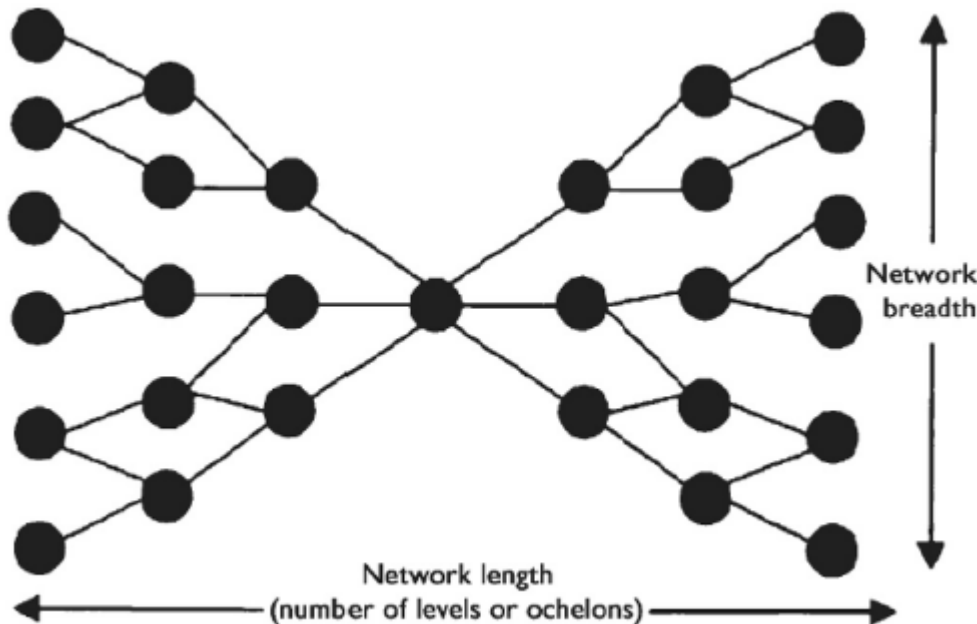
- a) Motivations of firms
- b) Supply chain characteristics
- c) Implementation mechanisms

a) Firm motivations ('why')

- External pressures: Policy pressure, customer requirements, wider public debate
- Internal considerations: Cost/benefit calculation, brand/reputation, defensive hedging ('prepare for possible future')

b) Supply chain characteristics (context)

- Social: degree of trust, collaboration (or tensions, struggle, price wars, squeezing suppliers)
- Structural: breadth and length of chain



c) Implementation mechanisms ('how)

- Economic: Pay partners to collaborate
- Networks, learning (innovation system):
Exchange information, knowledge flows,
interactive learning, demonstration projects
(learning-by-doing)
- Socio-cognitive: Creation of shared visions,
beliefs, roadmaps.

4) Management and policy implications for transitions and niche-innovations

Two 'modes of innovation' (Jensen, Lundvall, 2007)

1) STI (Science, Technology and Innovation)

- Learning via R&D + 'trickle down'
- Big firms, universities, research institutes
- Dominant policy model

2) DUI (Doing, Using, Interacting)

- Learning by doing (project-based)
- **Reconfiguring concrete systems 'on the ground'**
- Technical, institutional, social innovation
- Wider set of actors

Strategic Niche Management

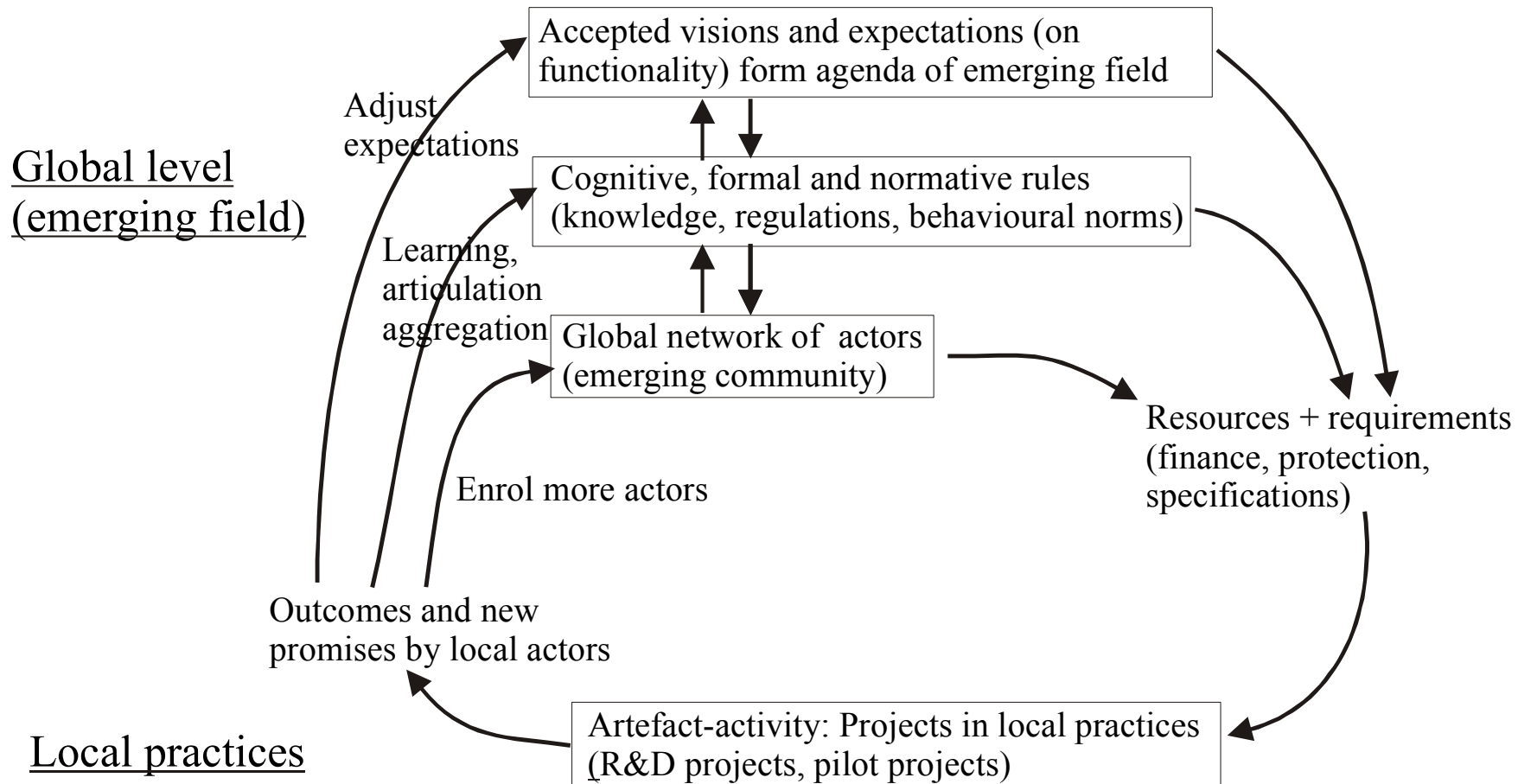
(Schot, Geels, Raven, Kemp)

Radical innovations develop through **real-world projects** that enable:

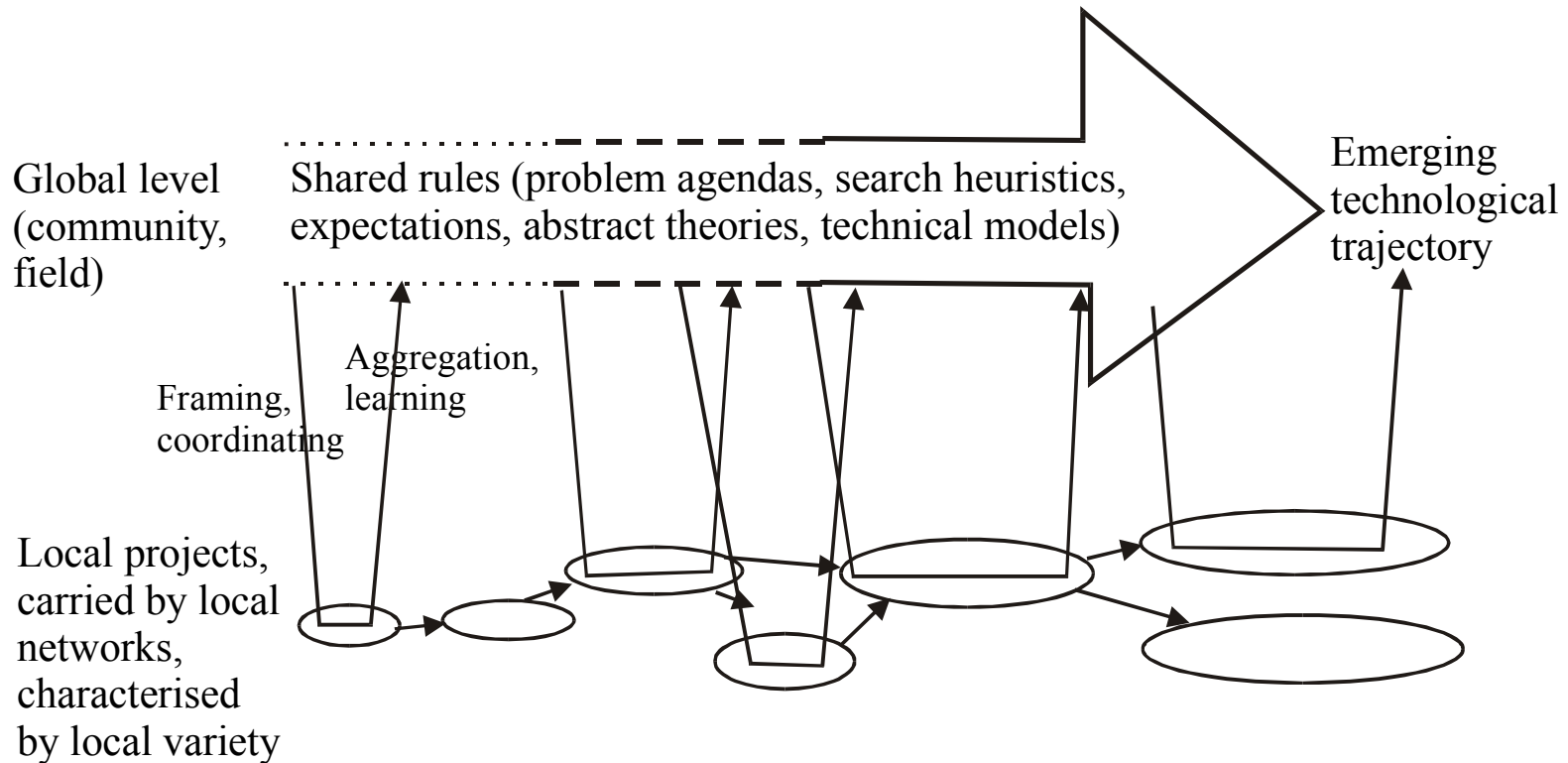
- **Learning** processes: technology, consumer preferences, infrastructure requirements, public debate
- Building **social networks**: firms, policymakers, NGOs, cities, consumer organizations
- Articulate and refine future **visions**: to guide technical development and attract attention + funding

Increasing momentum through successive 'rounds':

- a) Learn and articulate generic lessons and 'best practices'
- b) Articulate and adjust visions
- c) Expand social networks and enrol more actors



Innovation trajectories emerge through sequence of projects (Geels/Raven, 2006)



Trajectories gain momentum through:

- a) **up-scaling**: more and larger projects, linking to wider regime processes
- b) **deepening**: articulation of rules/best practices by aggregating lessons
- c) **broadening**: include more actors, expand application domains

Two-pronged transition policy strategy

1) Niche-level: Stimulate variety/innovation

- Long-term visions + short-term action (projects)
- Technical + social/behavioural change (system innovation)
- Incumbents + outsiders

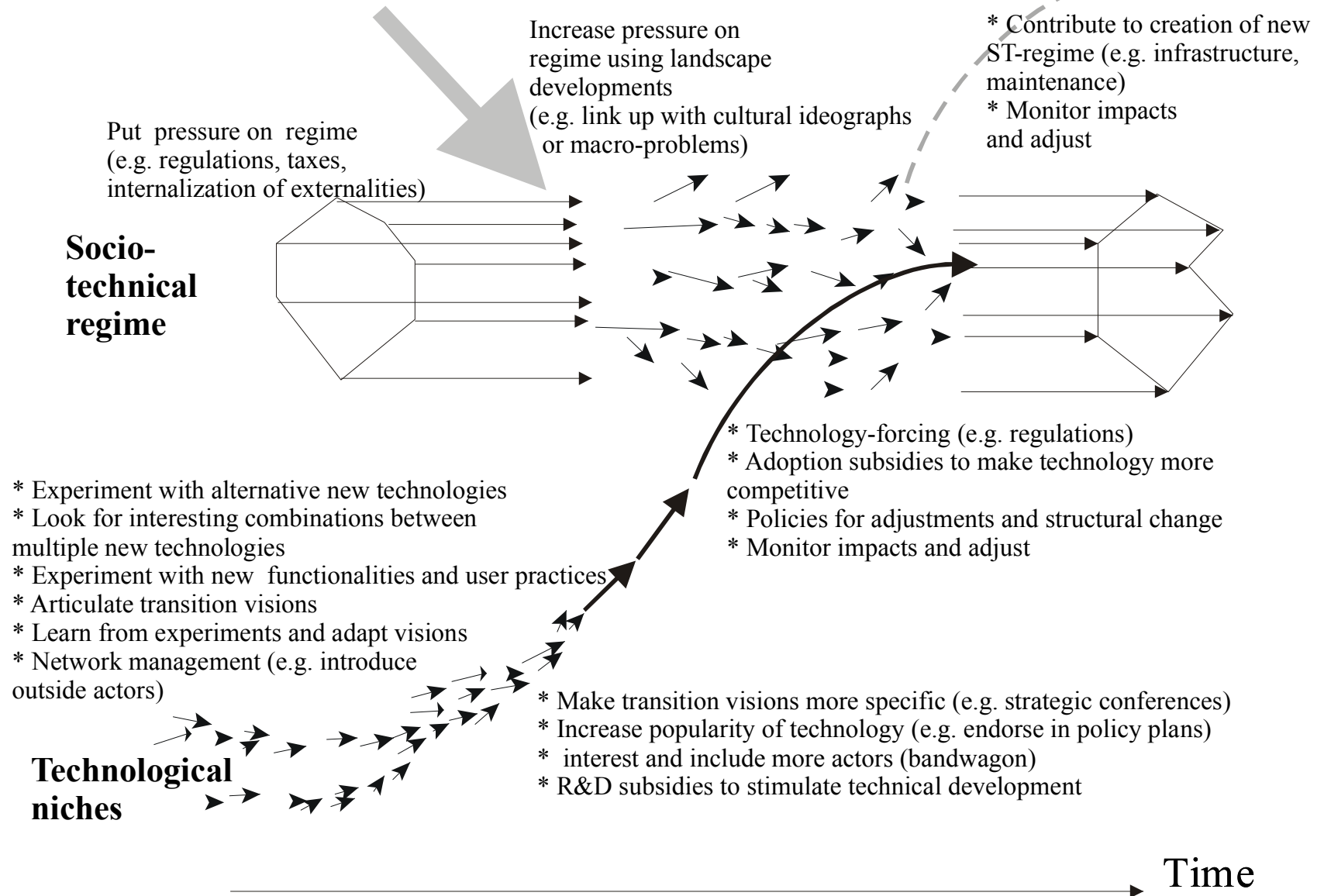
2) Regime-level: Tighten selection environment

- Financial incentives, taxes, subsidies
- Regulations, standards, principles

Different policy mixes and instruments

	Command-and-control (top-down steering)	Market model (incentivize bottom up agents)	Policy networks (convening, orchestrating processes)
Governance instruments	Formal rules, regulations, laws	Financial incentives (subsidies, taxes)	Learning processes, projects/experiments, vision/scenario workshops, strategic conferences, public debates, platforms
Foundation scientific disciplines	Classic political science	Neo-classical economics	Sociology, innovation studies, neo-institutional political science

Landscape developments



5. Concluding remarks

- Sustainability transitions as new strategic discourse
 - Transitions are starting to unfold in ‘circular economy’
 - Specific forms moving from ‘emergence’ to ‘diffusion’
 - Drivers: 1) Increasing policy interest, 2) positive public discourse, 3) some industry interest, 4) resource prices
 - But also still uncertainties: 1) techno-economic feasibility, 2) specific designs, 3) fit with wider regimes (requires changes in procedures, routines, institutions)
 - Transitions theory offers a ‘big picture’ framework to understand dynamics and challenges
 - But policy relevant discussion requires specific analyses
- Hence this workshop