

**A mission statement and research agenda for the
Sustainability Transitions Research Network**



developed by the steering group of the STRN, 20th August 2010

1. A mission statement for the STRN

The Sustainability Transitions Research Network (STRN) was inaugurated in June 2009 at the 1st European Conference on Sustainability Transitions. The mission of the network is:

- to provide a **meeting place** for the international and multi-disciplinary community of scholars working in the field of sustainability transitions;
- to **deepen the scientific understanding** of sustainability transitions through a program of networking, research coordination and synthesis activities;
- to be a **leading resource for practitioners** such as actors in the arenas of policy making, civil society, and business who are working to advance societies into more sustainable directions.

STRN is a wholly independent research-driven network governed by a steering group composed of leading researchers in the field. Membership of the STRN is open to researchers from any field who are actively engaged in researching sustainability transitions. The network aims to provide a space where researchers can engage in a vibrant intellectual exchange on the challenges of sustainability and find help and support in accessing resources, research topics and audiences for their work.

STRN works to improve scientific understanding of sustainability transitions through a program of networking, research coordination and synthesis activities organized around eight research themes (see the network's Research Agenda) that together define the research and policy challenges that the network is currently engaged with. The network promotes an active, energetic and well connected research community with an associated international journal (the Journal of Environmental Innovation and Societal Transitions).

STRN also aims to extend transition studies to countries that until now have been under researched (e.g. eastern and southern European countries, Asia, Africa and Latin America). Research across a broader range of countries and diversity of contexts will improve our understanding of the dynamics of transitions, in order to both inform policy and practitioners appropriately, and to improve concepts and theory.

STRN coordinates scientific capacity within the network towards the production of foresight reports on strategic sustainability policy questions. The ambition of the network is to support the development of a sustainability transitions research community internationally, and provide an independent, authoritative and credible source of analysis and insight into the dynamics and governance of sustainability transitions.

2. A research agenda for the STRN

The purpose of this research agenda

The STRN aims to deepen the scientific understanding of sustainability transitions through a program of networking, research coordination and synthesis activities. Transitions research is now entering a new and exciting phase where we argue the fundamental research priorities are:

- 1) To deepen the empirical basis for sustainability transitions research, deepening our answers to the questions – what are transitions and how can we steer them?
- 2) To move from concepts to theory, implying a deepening of the set of concepts already developed rather than the developing of many more concepts.
- 3) To explore transition processes occurring across multiple regions and outside of Europe.
- 4) To take the transitions approach into new problem domains such as health, education, and social security and the welfare state.

In this STRN research agenda, we set out eight research themes that respond to these top-level priorities. This document has been developed by the steering group¹ of the STRN with the themes emerging from a series of workshops and discussions led by members of the STRN network over the last three years. They aim to represent the most relevant, innovative and exciting challenges in this new and emerging field of research at this point in time. A great strength of transitions research is that it addresses change at the systems level and it is important not to lose this focus; so the intention is that multiple themes should be addressed in any one particular empirical case study or research project.

The purpose of this research agenda is to act as a manifesto for the new network and to provide a point of departure in developing future research proposals, workshops, conferences and other activities of the network.

This document proceeds next with a short overview of the novelty of transitions research in the debate on sustainable development. Then in section 3, each of the eight themes is briefly outlined with a summary of the key research challenge and articulation the broad research questions that pertain to transitions research in that thematic area.

The novelty of transitions research in the debate on sustainable development

The starting point for transitions research is a recognition that many environmental problems, such as climate change, loss of biodiversity, resource depletion (clean water, oil,

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forests, fish stocks), are formidable societal challenges, whose solution requires deep-structural changes in key areas of human activity, including our transport, energy, agri-food, housing, manufacturing, leisure and other systems. Furthermore we recognise that the crucial challenge for sustainable development is the fact that existing systems tend to be very difficult to ‘dislodge’ because they are stabilized by various lock-in processes that lead to path dependent developments and ‘entrapment’.

A variety of (highly institutionalised) processes tend to perpetuate existing systems:

- the knowledge, capabilities and employment of various actors relevant to the maintenance of existing systems;
- the technical infrastructures and institutions (that have developed over time to service those systems);
- the economies of scale and markets of incumbent systems;
- the social significance of these systems, and their links to political power;
- the mutually reliant clusters of technologies used by these systems; and,
- the everyday practices and lifestyle values that have come to rely on these systems.

In transitions research we call these mutually reinforcing processes a ‘socio-technical regime’. This situation in socio-technical regimes makes it difficult for innovative sustainability alternatives to find the space to develop and influence radical structural transformations. Nevertheless, historical experience tells us that transitions do happen. The task is to develop concepts and theories that can help us to understand how to unlock processes, and stimulate path-breaking changes towards more sustainable systems. Transitions research adopts a broader perspective than other approaches to sustainable development, which it can encompass and complement by shifting the focus to interactions between approaches in wide-scale system transformation. Other approaches tend to emphasise one of three aspects of sustainability:

1. ‘Technical expertise and administration’. The administrative leg of sustainability emphasises the importance of formal goals and targets, which are translated into regulations and policy programs, which in turn are monitored and controlled by experts and backed up by sanctions. Important administrative elements in this approach are international treaties, voluntary programs, environmental management standards (e.g. ISO14001), performance reporting, and environmental impact assessments. The second leg of this approach emphasises the role of technical experts in developing green technologies, cleaner production processes, recycling, dematerialization, and the closing of material loops (e.g. industrial ecology), which enable firms to meet environmental targets.

2. ‘Market reforms’. Economists argue that markets will address environmental problems if negative external costs are internalized. This approach assumes that, if the prices are right, private actors (firms and consumers) will find individual optimal (profit or utility maximizing or cost-effective) solutions, which are supposed to lead to socially desirable outcomes. The government has a role to play by creating incentives and frame conditions (e.g. taxes, emissions trading), but should then let private initiative do the real work.

3. 'Behavioural change'. A third position is that sustainable development requires people to change their behaviour. Psychologists (and behavioural economists) focus on individuals and adhere to the ABC-program (attitude, behaviour, choice). Assuming that behaviour is caused by attitudes, social psychologists emphasise the importance of information provision, advertising campaigns and education. Assuming that consumer behaviour is caused by rational choice and cost-benefit calculation, economists argue for taxes, subsidies and other incentives. More radical behaviour changes are advocated by deep ecologists, who focus on collective behaviour (communities, streets, villages) and argue for deeper changes in values and life styles (e.g. localism, community-based initiatives).

Each of the above approaches tends to focus its explanation of (un)sustainability around a limited set of dimensions. . **Transition research instead develops co-evolutionary approaches** that highlight multi-dimensional *interactions* between industry, technology, markets, policy, culture and civil society. Transition research argues that **transformative and structural changes** derive from mutually (though not equally) influential changes to institutions, economics and practices. Wide-scale, path-breaking transitions to new food, energy, mobility and other systems requires us to encompass multiple approaches in ways that can understand them in interaction.

Transitions research shares with ecological modernization (Hajer, Spaargaren, Mol) its focus on the potential of social, technological and political innovations to seed transformations to greener economies. We also recognise that innovations imply different directions of development, not all of which are sustainable, and which should be subject to democratic debate.

Transition research investigates substantial changes in social networks and in the development of practices, routines, capabilities, preferences and interests of various social groups in transport, energy, agri-food and other systems. Increasingly there is also an interest among the transitions research community to take the transitions approach into new problem domains such as health, education, and social security and the welfare state.

Aspects of other approaches to sustainability remain important to our analysis, such as markets, technologies, political institutions, behaviour and values. However, when explaining structural changes, these approaches often have to resort to factors exogenous to their core analytical frameworks. Where transitions research may complement all these approaches is in its attempt to provide an analytical framework where 'contexts' become internal and central to the analysis, and thereby allow us to get a better grasp on the various sources of agency at play in structural transformation.

Transition research conceives markets, technologies, political and social institutions, behaviour and values as temporary, changeable outcomes of evolving long-term co-evolutionary processes. Because transitions research perceives sustainable development as an open-ended journey, the analytical emphasis is on *processes* such as learning, radical innovation, experimentation, searches for new paths, participatory approaches, multi-actor interactions, selection processes, reactions, and network evolution.

2.1. Understanding transitions

This theme focuses on the theoretical concepts and frameworks that can be applied to the analysis of sustainability transitions. In particular it focuses on synthesizing perspectives and approaches that can help to frame the study of transitions.

The core problem regarding sustainability transitions is how green innovations and sustainable practices (in behaviour and policy) struggle against existing systems or regimes. Incumbent systems in transport, energy, and agri-food domains are difficult to dislodge because they are stabilized by various lock-in mechanisms (related to vested interests, low costs, established beliefs, sunk investments, favourable institutions) that lead to path dependence and entrapment (Unruh, 2000; Walker, 2000). Green innovations and new practices therefore tend to face an uphill battle, which is played out on economic, technical, political, scientific, and cultural dimensions.

Against this background, this theme puts forward the following research questions: 1) How and why do existing systems or regimes endure and re-produce; what are the mechanisms that destabilise them, and open up space for new development pathways? 2) How do new innovations and practices emerge? How do they gain momentum in niches, adapt, grow and become mainstream? 3) How is the struggle between green innovations and incumbent systems/regimes played out? Under which conditions can green innovations exert greater influence? What are the responses within regimes (e.g. appropriation, incremental improvements)? What are recurring patterns and mechanisms?

Transitions research tries to provide multi-dimensional answers that are more comprehensive and synthetic, i.e. bring different disciplinary insights together. Two important frameworks, which many researchers in the STRN network use, are the 'multi-level perspective' (MLP) and the 'technological innovation systems' (TIS) approach (see Markard and Truffer (2008) for a recent comparison and review of the two frameworks).

The MLP (Rip and Kemp, 1998; Geels, 2002; Smith *et al.*, 2005) argues that transitions come about through interacting processes within and between three analytical levels: 1) niches, the locus for radical innovations, 2) socio-technical regimes, which are locked in and stabilized on several dimensions, but which nevertheless exhibit incremental innovations, and 3) an exogenous socio-technical landscape. Radical innovations emerge in niches, where pioneers and entrepreneurs nurture their development on multiple dimensions, e.g. social organisation, business models, technological artefacts. These niche-innovations may break through more widely if external landscape developments create pressures on the regime that lead to cracks, tensions and windows of opportunity. Subsequent interaction between niches and regimes occur on multiple dimensions (e.g. markets, regulations, cultural meanings, infrastructure) and are enacted by interpretive actors that fight, negotiate, search, learn, and build coalitions as they navigate transitions.

The TIS approach (Bergek *et al.*, 2008; Jacobsson and Johnson, 2000; Hekkert *et al.*, 2007; Negro *et al.*, 2008) focuses on emerging technical innovations. A technological innovation system is defined as a network of agents interacting in the economic/industrial area under

a particular institutional infrastructure and involved in the generation, diffusion, and utilization of technology. The development of a new technology is understood as resulting from the positive fulfillment of seven functions: 1) entrepreneurial activities, 2) knowledge development, 3) knowledge diffusion through networks, 4) guidance of the search, 5) market formation, 6) resources mobilization, and 7) the creation of legitimacy.

Possible topics and questions for a future research agenda are:

1. What other types of transition pathways are possible besides technical substitution? Some transitions may entail new interactions between *multiple* regimes, e.g. between electricity and heat in CHP, between oil, agriculture and cars in biofuels, or between transport and electricity in the case of battery-electric vehicles. We can also investigate interactions between *multiple* niches, which may compete with each other, but also collectively undermine existing regimes or form hybrid intermediate forms. Geels and Schot (2007) made a start here by differentiating MLP-thinking, but much more needs to be done.
2. Further conceptual work is needed to develop both the MLP and TIS. The TIS could be developed to better connect emerging innovations with broader regimes and institutions (Markard and Truffer, 2008), and investigate how various functions may interact to produce particular patterns in TIS-development (Suurs, 2009). The MLP could be developed to better specify the precise constitution of regimes and niches, and their shifting boundaries and inter-sections over time, in response to some criticisms in the literature that these concepts (which highlight abstract notions such as stable and fluid 'rules' and the size of networks) are currently not clearly operationalized empirically (Genus and Coles, 2008; Markard and Truffer, 2008; Shove and Walker, 2007; Smith *et al*, 2010). Stronger connections with organization theory and sociology should prove fruitful in this respect.
3. Both the MLP and TIS could benefit from stronger explication and incorporation of various types of agency (e.g. power and conflict, interpretation, entrepreneurial strategy, organizational resources and capabilities, cost-benefit calculation, routine reproduction). There is scope for new theoretical work that better resolves 'on-the-ground' agency.
4. Further elaboration of the interaction between niches and regimes is also important. This interaction is not just economic and technical. Smith (2007) already proposed various types of *translations* between niches and regimes (e.g. how incumbents may adapt lessons from niche experiments), but more can be done on this topic.
5. How do different socio-technical regimes relate to each other? How do such multi-regime contexts influence the emergence of new technologies (Raven and Verbong, 2007) or the transformation of entire sectors (Konrad et al., 2008)?
6. The landscape level in the MLP is still under-theorised. How do various types of landscape influence transition patterns? Do sudden shocks have different effects to gradually increasing pressures? What happens if multiple landscape pressures pull regimes in different directions? And how can stabilizing landscape developments be incorporated?
7. What are appropriate methods for investigating transitions? The TIS approach has developed a useful mapping approach, which assists empirical research. The MLP often uses interpretive methods (such as case study research), which require creativity from the researcher, but may create challenges for replication and rigour. So, more can be done here.

2.2. Governance, power and politics

Research that focuses on improving our understanding of how purposeful governance processes can actively engage with and shape sustainability transitions; with a focus on the politics that are involved and the ways in which power plays out.

A key challenge in sustainability transitions research is to understand the extent to which fundamental societal change is susceptible to purposeful governance intervention, and following on from this to ask: What governance patterns could be adapted to better support sustainability transitions? In addressing this challenge with a governance perspective (on sustainability transitions) three major areas of research are suggested:

Diverse patterns of distributed governing. In focusing on the governance of sustainability transitions we need to adopt a broad perspective which neither focuses solely on the role and capacities of governments nor solely on the so called 'new forms of governance' which involve a diversity of societal actors. We rather have to devise approaches which are able to take account of: the empirical diversity of different patterns of governance; the distributed governing activities across many different actors; and, the interplay of different (overlapping) modes of governing such as persuasion, regulation, bargaining, negotiation, pricing, subsidising, commodification, auditing, experimental learning etc. A governance perspective on transitions also calls attention to the wider set of ongoing societal transformations and their respective governance patterns – including, individualization, Europeanization, the politicization of side effects and neo-liberalization. These 'landscape' trends influence not only the governance system directly but also social practices more broadly (and their energy consuming consequences), and not necessarily in a sustainable direction. Research on the governance of sustainability transitions should then ask how these changes may be oriented towards a more sustainable development.

Politics and power. In analyzing and conceptualizing governance in relation to sustainability transitions a key concern must be with the inherent conflicts in wide-scale socio-technical change and the contestedness of sustainability as a normative concept for directing such change. The politics of distributed governing and the analysis of different forms of power that come to effect (as resources of particular actors or dispositions incorporated in structures such as network constellations, institutions, infrastructure, or discourse) become essential to the study of governance in relation to sustainability transitions. This is a prerequisite to the assessment of the legitimacy of existing or proposed patterns of governance. A governance perspective essentially pays attention to powering, legitimizing and trust building. Power and legitimacy are not just 'carried' by actors but are also embedded in the regime; thus a transition involves mobilizations of power and legitimacy whilst simultaneously changing the sources of power and legitimacy.

Innovation and path dynamics in governance. As in socio-technical systems there are path-dependency dynamics in governance which may lead to situations of lock-in in terms of problem framings, policy paradigms, particular instruments, institutions or powerful coalitions. Studying governance in relation to sustainability transitions needs to include the analysis of path-dependency and path creation dynamics in governance in order to assess the potential for innovation and change in governance itself.

Against this background possible topics and questions for a future research agenda include:

1. Research is needed to better understand how the multi-level, multi-loci transition dynamics interact with the dynamics of power, legitimacy and trust. (Grin, 2010). The research should cover the analysis of patterns and effects of *de facto* governance including diagnosis of governance problems:

- analysis of different sources of political power to be mobilized by actors in favour of change and in favour of stability of socio-technical regimes;
- comparative analysis of public policy and governance of sustainability transitions in different countries and sectors;
- analysis of blocking coalitions, iron triangles;
- lobbying, campaigning of newcomers and incumbents for favourable public policy.

2. Research on the development of alternative forms of governance to help overcome problems:

- public mobilization strategies;
- practical pathways towards policy integration;
- new forms of environmental regulation;
- new forms of innovation policy for SD;
- approaches for auditing, ranking of sustainability performance.

3. Research on the processes of innovation in governance (i.e. the patterns and dynamics of emerging new forms and governance in interaction with established governance regimes):

- emergence, development and expansion of new forms of governance;
- creation of new social movements;
- reframing policy problems;
- cases of success and failure;
- interplay of design and dynamics in governance change;
- institutional and discursive innovation interacting;
- path dependence and creation;
- local, sectoral, national and transnational dynamics intertwined.

4. Supporting the development of strategies to engage with innovation in governance in order to bring about patterns which are supportive of sustainability transitions:

- Long-term policy design;
- experimentation with new forms of governance;
- managing governance transitions;
- policy foresight.

This research theme then will analyse and reflect the capacity of different forms of governance to actively engage with and shape sustainability transitions. Combining insights from the policy sciences with literature from other social sciences and transition studies, it will investigate relevant processes of governance with the goal of identifying starting points for more innovation-minded, reflexive, long-term approaches to the governance of sustainable development (Meadowcroft, 2005; Voß et al, 2009).

2.3. Implementation strategies for managing transitions

Research focused on assessing the impact and effectiveness of instruments that aim to influence sustainability transitions in practice. And, building on lessons learnt, research that focuses on the design and testing of a next generation of instruments for managing transition processes.

In recent decades a large number of instruments have emerged that aim to address the various aspects of the challenges posed by sustainability transitions and sustainable development. These instruments, ranging from modelling and innovation projects to envisioning and scenario exercises, are often not linked together and focus on specific innovation processes rather than over-all societal transitions. Examples are Constructive technology assessment (Schot, 1997), Strategic Niche Management (Kemp et al., 1998), Transition arena's (Loorbach, 2010), Innovation Systems (Hekkert et al., 2007), Complexity Governance (Teisman et al., 2009) and Backcasting scenario's (Robinson, 1990). Based on the multi-level, multi-phase conceptualisation of transitions, and the evolved understanding of the basic patterns and dynamics of transitions (Geels and Schot, 2007; De Haan, 2010), these instruments do focus on influencing transition dynamics, but are often not linked together to influence a transition as a whole through combination and interlinking.

The objective of this research-theme is to evaluate a broad range of approaches and instruments that explicitly seek to manage or assess processes that are part of the macro-level dynamics of a sustainability transition. Firstly to assess their impact and underlying method, but also secondly to understand what they contribute to the over-all notion of transition governance. The governance of a transition can be understood as the sum of actions influencing the speed and direction of a transition process; this research theme will focus on actual implementation strategies that aim to influence both the speed and direction of a transition. The research goal will be to identify, assess and further develop methods and instruments that focus on different dimensions of transitions.

The framework of transition management (Loorbach, 2010) provides one relevant example of such an approach. It identifies four types of governance dimensions through which the speed and direction of transitions are influenced:

- Strategic/discourse (focus on over-all transition, problem structuring and envisioning),
- Tactical/structure (activities related to changes in actor and institutional structures),
- Operational/practices (experiments and actions), and,
- Reflexive (monitoring, evaluation and learning).

There are many established instruments that have previously been developed outside the transition research domain but that now are being usefully applied in transition contexts: back-casting, scenario-building, community engagement, innovation portfolios, network-management and so on. Also, there are large numbers of instruments that are already available and that could now be evaluated from a transition perspective.

In addition, new transition-focused ‘systemic’ instruments have been (further) developed as part of a recent transition research programme in the Netherlands (KSI): transition arena’s, backcasting and transition scenarios, strategic niche management and transition experiments, integrated sustainability assessment and transition evaluation/monitoring. These instruments have produced substantial output in terms of actual innovation, new discourses, shared transition-visions, -agenda’s and -programs, and policy learning at various policy levels.

These instruments have mainly focused on stimulating, guiding and accelerating the predevelopment phase of transitions. Based on these experiences, there is a need for a more general assessment of the effectiveness and impact of these instruments as well as a more general integrated implementation strategy for this phase of a transition. But as a number of societal domains now seem to destabilize and enter into a period of transformation of acceleration, there is an increasing need for new systemic instruments that focus on the up-scaling of innovations, on the breaking down of existing barriers, and on achieving fundamental changes in the dominant structures of societal systems (laws and regulations, organisational structure, financial and economic conditions, spatial infrastructures and so on).

Possible topics and questions for a future research agenda are:

1. What are the methods and instruments that aim to influence dynamics within the context of transitions? What is their underlying methodology and impact? How do/could they contribute to integrated implementation strategies for transition governance?
2. What can be learnt from the transition instruments developed over the past decade? How can they be improved? How can they be better aligned and integrated within a broader transition governance framework? How can they be implemented in other contexts?
3. What kind of ‘systemic’ instruments are required for the acceleration or breakthrough phase? What are the currently available strategies and instruments (for this phase)? What are the design criteria for these instruments from the understanding of transition dynamics? How can they be developed and implemented and what can be learnt from that?

Research addressing the first question focuses on mapping the empirical basis of transition governance, identifying and assessing the instruments explicitly and implicitly linked to managing transitions and making an over-all assessment with regard to their effectiveness, usability and further development.

Research addressing the second question has a more explorative character: it should identify the necessary effects of instruments in light of the necessity for guiding a desired transition through a turbulent and chaotic phase.

Departing from recent reviews of existing instruments, this research agenda involves developing new ideas in co-production with societal actors leading to next generation of instruments for the governance of transitions. These will be experimentally tested, refined and improved, in much the same manner as the first generation of transition instruments were developed.

2.4. Civil society, culture and social movements in transitions

This theme addresses the role of civil society, culture and social movements in the initiation and acceleration of sustainability transitions.

Until recently the literature on transitions has neither adequately conceptualised nor understood the role for culture, civil society and social movements in current transition processes - addressing this gap will be the focus of this research theme. Research covering three distinct types of interaction between cultural dynamics and transition is required:

Firstly, research is needed on the role of 'mainstream' cultural trends and discourse in promoting or hindering sustainability transitions. In the past decades many cultural trends have been directly associated with increasing unsustainability while more recently there has also been some tentative indications of a shift in certain trends towards more sustainable practices (as 'greener' lifestyles and low carbon living, for example).

Secondly, research is needed on the role of civil society in lobbying for change, including both formal organizations (i.e. NGOs, charity organizations, social enterprises, cooperatives) and more informal networks and initiatives (i.e. activist movements, community-projects, citizen initiatives, etc.). Specific points of interest are how civil society 1) creates pressure on governments and business, 2) lobbies for change towards more sustainable practices (in effect, 'unsettling' the regime) and 3) experiments with and develops alternative forms of organization (e.g. solidarity economics).

Thirdly, research is required to better understand the agency of informal civil society activities (e.g. social movements and community projects) in promoting system-wide transitions through the innovation and uptake of new 'socio-technical' rules or practices. Community-based social initiatives can lead to innovations in lifestyles and social practices, which may influence a sustainability transition (either through niche growth or the uptake of new practices by the regime). Social movements do not solely consist of 'anti-society' or 'anti-establishment' movements (such as the anti-globalization-movement), but also include activities that can be described in terms of 'revitalization movements', which specifically aim to construct a more satisfying culture and/or seek to serve as 'emissary' and 'exemplary' models of organization (Brown, 2002, Wallace, 1956).

All three types of interaction are likely to be important to an understanding of the agency of cultural change and civil society in transition dynamics. Recent research by members of the network has explored the role of civil society in processes of transition and 'grassroots' innovation (Seyfang and Smith, 2007; Smith, 2005, 2007; Avelino and Kunze, 2009; Haxeltine and Seyfang, 2009) and has identified an emerging policy interest in community-based initiatives such as Ecovillages, local food projects, community-owned renewable energy generation, and other projects which aim to engage people in action for sustainability through community action. There is a growing interest in the hypothesis that civil society and grassroots social movements in particular, may be important in sustainability transitions through their ability to develop innovative social practices and influence changes in wider cultural norms.

Recent research (Smith, 2010) has argued that the sheer scale and ambition implied by current transition narratives means civil society will have to be involved. The multi-level perspective on socio-technical transitions provides a framework for mapping and ordering the diversity of civil society moves for sustainable development. Clusters of activities can be conceived as contributing towards unsettling regimes and opening windows of opportunity for sustainable alternatives, nurturing niche activities and helping innovative solutions translate from marginal to mainstream settings. However, understanding how those contributions work requires additional analytical frameworks and empirical research.

We suggest that social movement theory and other literatures on civil society, involving concepts such as the Third Sector (Birch and Whittam, 2008), solidarity economics (Moulaert and Ailenei, 2005) and social entrepreneurship (Mair and Martí, 2006, Alvord et al. 2004, Seelos and Mair, 2004) can be employed to extend the analytical frameworks available for empirical research on how civil society interacts with socio-technical regimes.

Finally, it is important to view civil society as constantly engaging with market and state spheres. Partnerships, lobbying, and so forth all suggest civil associations need help from business and government, and visa versa. An advantage of the transitions perspective is that it allows analysis to bring together actors whose centres of gravity are in these different spheres, and consider their respective contributions to the development of sustainable practices. Possible topics and questions for a future research agenda are:

1. Theoretically and conceptually the agenda will be to draw upon approaches from other areas of the social sciences that have hitherto not been used in transitions research, including social movement theories and social practice theory. Each of these, we argue, offers new ways of understanding societal agency and, therefore, offers valuable insights for understanding the potential role of civil society actors within transition processes.
2. Empirically, the agenda will be to review the current evidence on cultural trends, civil society and social movement activity in different local, national and international contexts and to then initiate new empirical research (on civil society activity associated with sustainable development agendas). The aim will be to explore: how current cultural trends are influencing transition processes; how civil society is influencing transition processes; and, how it is influencing both politics and cultural trends.
3. Research also needs to make progress in conceptualizing and understanding how social movements interact with incumbent regimes (in different geographical and thematic contexts). Of particular importance is to explore the role of social movements in the “unsettling” of regimes, and the interactive responses of both to “unsettling” events (indeed, the role of problematic regimes in generating social movements is also of interest).
4. An emerging area of interest lies in the geographical and spatial dimensions of social movement activity. The importance of place in the study of social movements is manifested in local community activity, local geo-politics and ‘terrains of resistance’, and it has been argued that the further development of civil society depends on spatially contingent factors (Routledge, 1996). Moreover, many ‘sustainability oriented’ social movements explicitly have ‘localism’ as a core issue (e.g. New Urbanism, Slow City, Transition Towns, Eco-village movement, etc.) Last, but not least, more than any other phenomena, social movements are characterized by an interaction between local grass-root initiatives and global networks.

2.5. The role of firms and industries in transitions

This theme addresses the role of firms and industries in developing markets that can help to initiate and enable sustainability transitions.

Firms and other business-related actors will be crucial players in transitions to sustainability, because they have many assets and resources (such as financial and human capital, capabilities, contacts, production units), which they can use to hinder change (e.g. by lobbying against legislation, or not developing green alternatives) or stimulate transitions (e.g. supportive marketing campaigns or 'green' R&D).

In terms of the multi-level perspective, firms and industries can try to protect the existing regime or stimulate the development of 'green' niches. Much of the literature on technological discontinuities suggests that entrepreneurs, start-ups and new entrants tend to develop radical niche-innovations, and that incumbents are inert 'dinosaurs' that will be overthrown by them (Foster, 1986; Christensen, 1997). This view is also present in much of the transitions literature.

However there is also work that points to the possibility of productive alliances between incumbents and new entrants (Tripsas, 1997; Rothaermel, 2001). This possibility is particularly relevant for sectors such as transport, energy and food, where incumbent firms possess many 'complementary assets' such as specialized manufacturing capability, experience with large-scale test trials, access to distribution channels, service networks, or complementary technologies (Teece, 1986). These assets give incumbent regime actors powerful positions vis-a-vis niche-actors, who either face high entry barriers or need to collaborate with regime actors in order to access complementary assets relevant for developing, scaling-up and commercializing 'green' niche-innovations. It is therefore important to study strategic alliances between niche actors and incumbents from a business and management perspective.

Another fruitful link can be the management literature on emerging technological fields that has, among others, dealt with the issue of how innovating entrepreneurs and other actors actively shape their environment as they create new standards (Garud et al., 2002; Rao, 1994), values (Kaplan and Murray, forthcoming) or collaborate in networks (Garud and Karnoe, 2003), or work towards a supportive infrastructure (e.g. van de Ven et al., 1999). This research may also be linked to recent advances in the field of institutional entrepreneurship (see e.g. Battilana et al., 2009 for an overview).

Relevant topics and questions for a research agenda are:

1. How do entrepreneurs and firms go about developing green niche-innovations? The probe-and-learn approach (Lynn *et al.*, 1966) to the development and marketing of radical innovations seems relevant here, emphasising how firms probe and test new markets with experimental designs that they sequentially improve through feedbacks and interactions with customers. Although possible first-mover advantages form an incentive to pioneer green innovations, firms also face many uncertainties, e.g. about the seriousness of policy

makers to introduce policies and the consumer willingness to pay for sustainability. Delay is therefore also a rational option, which may lead to inertia and a ‘cartel of fear’, in which no firm wants to take the first step because of the risks involved. But when one firm does make a move, this situation can turn into an innovation race (as happened with the Toyota Prius).

2. Why and how do incumbent firms reorient their strategy and become seriously interested in green niche-innovations? When does the emphasis on *exploitation* of existing technologies (i.e. incremental change) move towards more attention for the *exploration* of new options (March, 1991)? Strategic reorientation of big firms is not an easy process, because of internal resistance and power struggles, and because major changes increase the risk of economic failure. The literature suggests that strategic reorientation is often preceded by a long period in which firms build up new capabilities and competencies (Levinthal, 1992). Capabilities provide the internal resources for reorientation, as argued in the resource-based view of the firm, but new knowledge tends to accumulate gradually. Interpretive strategy scholars further argue that strategic reorientation also tends to be *preceded* by changes in belief systems and interpretive schemes, which alter the perceptions of existing regimes and green niche-innovations (Grinyer and McKiernan, 1990; Barr et al. 1992). Future research could investigate how firm strategy, perceptions and technological knowledge co-evolve in major reorientations.

3. Other important topics include how industries relate to political and cultural environments. According to the literature on corporate political strategy (Hillman and Hitt, 1999) industries can use many strategies to influence policy makers, e.g. information strategies (e.g. use expertise to contest problems), financial incentives strategies (e.g. financial contributions to political parties), organized pressure strategy (e.g. via industry associations), direct lobbying strategy (e.g. hiring lobbyists to work politicians), and confrontational strategies (e.g. litigation). Industry actors also engage in cultural entrepreneurship’ (Lounsbury and Glynn, 2001), ‘symbolic management’ and ‘storytelling’ to influence discourses on public stages such as television, Internet, newspapers. Research could investigate how these industry strategies influence public debates and regulations.

4. How do industries contribute to their own infrastructures and standardize innovations and practices?

5. How do firms and other actors strategically shape their institutional environment? How important are networks in fostering such ‘institutional entrepreneurship’?

6. Do different actors play different roles in innovation and transition processes, e.g. as they have different sets of resources and / or organizational capabilities at their disposal?

In sum, a focus on firms and industries has much to offer that could be creatively linked to the multi-level perspective in order to greatly enrich transitions research.

2.6. Sustainable Consumption: Transitions in practice and everyday life

This theme focuses on the importance of consumption patterns in research on sustainability transitions, highlighting the need for a debate about what exactly sustainable consumption might entail and study of the ways in which sustainability transitions are played out in changes to everyday life, consumption and practices.

Improvements in production technologies alone are unlikely to meet the sustainability challenge: despite relative improvements in eco-efficiency, the absolute rate of consumption growth is still outweighing efficiency gains (Jackson, 2009). Attention must turn to the factors which influence and might transform consumption (demand) at the individual, household and community level. However, the sustainability transitions literature has hitherto largely neglected demand-side factors: “the role of consumers and grassroots initiatives in transitions is underrated and under-conceptualised” (Grin et al, 2010:331). This theme aims to address the deficit by developing a more robust knowledge base around questions of sustainable consumption.

Seyfang (2009) outlines two competing approaches to sustainable consumption: a reformist, ecological modernisation approach which aims to deliver ‘greener’ economic growth, and a radical ‘new economics’ alternative which questions the growth paradigm altogether and proposes new understandings of wealth, prosperity and progress (Jackson, 2009). Many of the innovations considered in the literature to date have been of the former type, and there is now great scope for investigating genuinely radical – as new economic paradigms and conceptions of the ‘good life’ – innovations in consumption and lifestyles.

One current line of research asks how individuals can be encouraged to ‘accept’ major sustainability innovations, for example by consuming greener and more efficient products. Work in this area has explored the motivations and drivers of everyday consumption behaviours, considering how individuals consume in pursuit of status, meaning, and happiness. It has researched the ways in which unsustainable patterns of consumption are socially ‘locked-in’ and continue to ‘ratchet’ upwards as consumers are stuck in work-spend cycles, and explored how consumers might be encouraged to adopt greener attitudes/values and so change their consumption behaviour to drive sustainability transitions through their purchasing power. Whilst this is an interesting and valuable line of research, it tends to separate consumers from the system, positioning them outside of a system which governments and businesses operate and to which they can only react. An alternative approach recognises that individual citizens and consumers and the social practices they ‘perform’ are fundamentally intertwined with socio-technical systems in diverse ways. For example, lifestyles and social patterns form around particular infrastructures of provision and new technologies and infrastructures are designed based around assumptions about existing lifestyle needs/wants and projections of future trends. The work of social practice theorists (Giddens, Bourdieu, Shove, Spaargaren, etc) identifies the processes of structuration through which practices are co-constitutive with socio-technical systems and, accordingly recognises that it is only through the routine, regular and faithful reproduction of various social practices (like cooking, driving, watching TV etc) that socio-technical systems are (re)produced and maintained. In short, far from being

passive respondents to 'the system', individual consumers and citizens are its co-producers. Although differing in their targets and approach, these two lines of research on consumption both stress the importance of exploring the inter-relations between socio-technical systems and lifestyle practices and of considering how future transitions will be played out in everyday life.

The following areas represent the broad contours of a possible future research agenda:

1. Careers of practices and practitioners: How do practices emerge, form, stabilise and die out over time? What processes of lock-in and path dependency are there, and how might these be challenged? How do individual practitioners take up and later abandon practices over the course of their lifetimes? How do these 'careers' of individual practitioners intersect with the broader 'career' of whole practices? What assumptions do projections of future transitions contain about the evolution and development of social practices e.g. how might practices be affected by shifts to decentralised and renewable energy systems?

2. Coordination between practices: In what ways do different practices come into contact with one another and interact? Do they cooperate and form coherent systems of practices or do they compete and conflict with one another? How do individuals coordinate the wide range of different practices that make up everyday life? How might more sustainable practices be coordinated with existing bundles of practices?

3. Interventions in practices: Is it possible to intervene directly in practices to bring about transitions in sustainable directions? How might more sustainable practices be created and practitioners encouraged to adopt them? How might unsustainable practices be dismantled and practitioners encouraged to defect from them? Who has agency to change practices? How do existing interventions e.g. new policies, new infrastructures, behaviour change campaigns etc influence practices? How are new technologies/attitudes/values/ideas incorporated or 'domesticated' into existing routines and systems of practice?

4. Intrinsic Motivation for Sustainable Practices: One of the major challenges for sustainability transitions is how to trigger intrinsic motivation amongst individuals for sustainability practices, rather than (only) resorting to mechanisms that reinforce extrinsic motivation (e.g. restrictive regulations, pricing policies etc). Organizational psychology and other forms of applied psychology offer concepts, analytical frameworks and methods that enable us to study the mechanisms of intrinsic and extrinsic motivation amongst individuals, how this affects their everyday (un)sustainable practices both in the private and professional sphere, and what this in turn means for sustainability governance (theme 2.2.) and transition management strategies (theme 2.3).

5. How do sustainable lifestyles emerge, and how are they sustained? Social identity literature demonstrates the highly inconsistent nature of 'sustainability identities', their susceptibility to fashion and advertising, and the underlying 'aesthetic-epic-emotional' motives that often overpower 'moral-rational-logical' arguments (Strannegård and Dobers, 2010, Woodward & Emmison, 2001). Furthermore, personal development is influenced by social movements, which in turn are influenced by 'cultural creatives' and 'transformational leaders' (Hay, 2010). A challenge for transition studies is to understand the 'emotional' and 'aesthetic' aspects of lifestyle practices and choices, how this correlates with personal development over time, and the aggregated role that this plays in sustainability transitions.

2.7 The geography of transitions

Until now transition theory has paid too little attention to the spatiality of transitions - Why do transitions occur in one place and not in another? What is the role of cities and regions in transition processes?

This is a rather notable gap, especially given the many spatial connotations in the conceptual toolkit being used in the field such as multi-level theory, local-global interactions and the scaling-up of niche innovations.

We identify two major shortcomings in the implicit treatment of geography in studies of transition processes. Firstly, existing analyses, drawing predominantly on single or comparative case studies, fail to explain if and how (spatial) contexts matters. Even though there is increasing interest by transition analysts into the role played by differing contexts in shaping the co-evolution of technologies, actors and institutions, geographical context is treated at best as a passive background variable providing little causal explanation or theoretical purchase. We argue instead that adopting an explicit geographical perspective is necessary to disclose the contingencies and particularities of the various contexts where transition pathways evolve and take place in order to develop a better theoretical understanding of factors enabling or impeding these processes.

As a second, related, issue, we question the problematic usage or lack of scale in existing transition analyses. The absence of concrete scalar territoriality in the levels of transitions (inter alia the global being ubiquitously 'out there' and accessible), suggest that transitions can take place anywhere, thereby neglecting the advantages, conflicts and tensions constituted by the uneven spatial realities within which transition processes are embedded. We argue instead that "places produce transitions and transitions produce places". As an illustration consider the (hypothetical) case of Melbourne being the first place where new regime structures for a sustainable urban water infrastructure will become apparent (i.e. Melbourne "produces" the transition). As a consequence, much of what would be referred to as "global" aspects of this transition process in other parts of the world would most likely also be connected to the pioneering city of Melbourne (i.e. the transition defines the city as a central hub in a global network). Tying these critiques together we suggest to conceive of spaces and places in an institutional-relational perspective that has gained a lot of purchase in Economic Geography over the past few years (Asheim and Coenen, 2006; Bathelt and Gluckler, 2003; Boschma & Frenken, 2006; Martin, 2000). Starting from that background, transitions may be conceptualized as interdependent governance processes playing out simultaneously in local nodes and global networks.

Research on sustainability transitions should address the global networks and local nodes of transition pathways in conceptual, methodological and empirical terms. Conceptually this means that transition analyses, whether through the lens of technological innovation systems or the MLP, should explore the role played by particular places as concrete contexts in the evolution of transitions (Legendijk, 2006). Methodologically, we point to two sets of issues:

Firstly, a “local node, global network” framework helps to open up the scalar boundaries and hierarchies that implicitly have been drawn in many comparative TIS and MLP case studies (Law, 2004).

Secondly, a “local node, global network” framework provides a useful heuristic for delineating systems, by following the network to wherever it leads, instead of setting system boundaries in an arbitrary and closed-off way (Brenner, 2001). Empirically, such a framework would allow us to address the increasingly “global” reality of transition processes (Amin, 2002), including transition experiments in emerging and developing economies, the role of transnational companies in influencing and impeding environmental innovation and sector reforms (Berkhout et al., 2009).

Finally, acknowledging the socio-spatial construction of transition paths may contribute to a more reflexive understanding for the conditions under which findings from one spatial transition context may be transferred to another one. This might increase the practical relevance and policy advice of transition research (Cooke, 2009). Unfolding the global networks and local nodes that are involved in particular transition paths clarifies which actors are involved in its governance. Trans-local and trans-national network relations and institutional interdependencies need to be acknowledged by policy-makers and ‘transition managers’ even though they may extend beyond their sphere of direct influence. Transitions research should focus on generating empirical insights about the local and distinctive conditions that can stimulate (or impede) transitionary evolution, while also accounting for the wider relations of control, dependency, competition and cooperation.

The following list of research questions indicates promising areas for future transitions research that would be more sensitive to the spatiality of transitions:

1. “The variety of socio-technical regime structures”: How broad is the spatial variation of socio-technical regimes as implemented in specific places? How much interpretative flexibility do local actors have to translate the core aspects of regime structures? Which impacts might these differences have regarding the flexibility to respond to landscape pressures or challenges from upcoming regimes and niches? How large is this variety within specific countries, across the globe, etc.
2. “The spatial (im)mobility of resources”: How important are locally bound competencies, cultures, cooperation styles for the development of radically new innovations? Which of these resources may be transported into different regional contexts? How can we explain the uneven spatial diffusion trajectory of technological innovation systems or the proliferation of certain niches? How could success conditions be translated from one region/country to another? Are locally bound resources more important in certain periods of technology development than others (windows of locational opportunity)?
3. “Local governments as transition managers”: How can specific cities, regions or countries support, modulate, steer transition processes? Which role can be attributed to experiments with socio-technical innovations by these different actor constellations compared to transnationally operating firms? To what extent do cities/regions act in transnational networks and constitute an important “global” force to support transition processes?

2.8. Modelling transitions

Research on the modelling of transitions is aiming to reproduce social complexity in formal mathematical models drawing upon the science of complex systems and evolutionary economics. The goal is to develop a capacity to undertake formal analysis of transition policies and management.

In the context of sustainability transitions, formal modelling has some particular advantages over other approaches. It can accurately address the complexity of system dynamics and transitions, which are the result of multiple interactive mechanisms, dynamics, feedback, and synergy. This is important for counterfactual policy analysis and forward looking studies, notably when these involve radical, structural changes, as is the case with transition management and scenarios. Theoretical model analysis can generate testable hypotheses or 'confront' theoretical explanations of historical phenomena with historical data, to examine whether the theory indicates relevant variables and processes.

Looking into the future, models can simulate the implications of social structures and environments, to generate scenarios of possible future developments. Furthermore, these scenarios can be used to provide policy guidance. In addition, combinations of instruments and their interactions through the complex economy can be tested on their effectiveness in terms of improving the likelihood of desirable transition patterns. Likewise, the combined effect of different transition policy instruments in different phases can be examined using formal models. It should be noted that because transitions deal with the dynamics of complex processes, it is not realistic to claim to make forecasts or predictions. However, it should be possible to indicate the range of possibilities and likelihood of future outcomes, and the influence of social actions and policy on the direction and nature of the transition process.

There are various modelling approaches which might contribute to this broad agenda. Agent Based Models (ABMs) are now a mature methodology, with the capability of representing multiple decision makers in a complex dynamic system (Bergman et al., 2008). Related to this is evolutionary economics and formal models which stress populations with internal diversity of strategies or technologies, selection, retention and innovation process. This gives rise to such phenomena as diffusion, coevolution, path-dependence and lock-in, and group selection. Applications are mainly found in the areas of transport and energy. Integrated assessment models have been developed for some of the transition contexts, such as water management. The geography modelling literatures employing GIS (for geographical data management) and cellular automata (as a geographically founded representation of the dynamics of social systems) might make an important contribution as well.

There is a well-established literature in modelling social dynamics, such as Epstein and Axtell's Sugar Scape World and Thomas Schelling's models of ethnic geography. There is also an extensive literature on modelling technology dynamics. The literature on modelling networks and their dynamics is relevant for examining the structures within the regime and niches in transitions.

In general, the approaches of complex systems analysis will be required to address the dynamics of structural change in hierarchical systems represented in transition theory. Safarzyńska et al. (2010) identify four types of relevant model streams, namely dealing with increasing returns to adoption (Alkemade et al., 2009), coevolution of technical subsystems (so far not applied to sustainability transitions), demand-supply coevolution (Windrum et al., 2009), and broader models (Atkeson and Kehoe, 2007). Safarzyńska and van den Bergh (2010) combine increasing returns with coevolution of demand and supply to provide a system for the analysis of the impact of a combination of policy instruments on transition paths. So far only a few of these model types have seen application to transitions research. Applications have focused on climate change and renewable energy (Nannen and van den Bergh, 2010) and transport (Bergman et al., 2008).

This research theme will aim to use these different modelling methodologies that have been applied to dynamic technological and social processes as a basis from which to develop models of structural social and economic change, using concepts and insights from transitions theories.

The goal will be to develop formal (analytical and numerical) methods that respond to the following questions:

1. How can the different levels – landscape, regime and niches – and their interactions and dynamics be represented?
2. How can decision making by individuals, firms and other agents be incorporated?
3. Since transition theory covers multiple levels of society, how should large scale (macro) ideas be combined with small scale (micro) methods? And which macro-level feedbacks to micro-level processes are most essential to describe or predict transitions?
4. What is a desirable level of diversity of technologies in view of the benefits and costs of diversity in terms of foregone increasing returns to scale, keeping option open and recombinant innovation (van den Bergh, 2008).
5. What is the combined effect of policies like environmental regulation, innovation policy and unlocking policies on the speed and direction of transitions?

3. The next steps in taking this research agenda forward

This research agenda serves as a manifesto for the STRN network and provides a point of departure in developing future funding bids, workshops, conferences and other activities of the network. The aim is to both create new connections within the transitions research community and to facilitate engagements with disciplines that have not hitherto had a strong link to transitions research (but where a potential for collaboration has been identified). We have argued that transitions research is now entering a new and exciting phase where the research priorities are:

- 1) To deepen the empirical basis for sustainability transitions research, deepening our answers to the questions – what are transitions and how can we steer them?
- 2) To move from concepts to theory, implying a deepening of the set of concepts already developed rather than the developing of many more concepts.
- 3) To explore transition processes occurring across multiple regions and outside of Europe.
- 4) To take the transitions approach into new problem domains such as health, education, and social security and the welfare state.

The eight research themes described above aim to respond to these challenges; however they are by no means meant to be exhaustive. We see the research agenda as a living document and intend that it will be updated and revised as emerging interests and research priorities develop among the membership of the network. A major strength of the transitions perspective is to address change at the systems level and it is vital not to lose sight of that in taking the research forward. Hence the themes should not be seen as the basis for separate or isolated research efforts; the intention is rather that multiple themes will be addressed in the context of any particular empirical case study or research project.

The next step in taking this research agenda forwards is to facilitate a debate within the transitions research community in the run up to the network's next international conference in Lund in June 2011 (see the STRN website for details). Our vision is that this debate will in turn inform the development of a range of new networking and research activities, including funding bids for collaborative research on sustainability transitions.

The aim will be to connect research on sustainability transitions using the topics identified in this research agenda as a guide. Our vision is that this networking will include both research projects initiated as a result of the STRN and research initiatives underway irrespective of the network but which stand to gain from sharing insights and expertise. The network will not be initiating new research projects in a top-down manner: it will not be the aim of the network to develop an international research program in a formal sense. Rather the ambition will be for the network to provide an environment within which members are able to self-organise into sub-groupings in order to write research proposals for specific funding opportunities that respond to elements of the STRN research agenda. This is in addition to the network providing a forum (via the website and email lists, etc) for news about transitions-related projects and events, and helping everyone keep abreast of developments in this exciting and rapidly developing area of research and policy.

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