

Sustainability experiments in developing Asia. How to foster their transformative potential?

Background paper setting the stage for discussions during an international workshop on **14-16 January 2010** in Kolkata, India

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Abstract

This is a background paper for the first (out of two) scoping workshops that will lead to the development of an international research program on the role of project level experiments in 'sustainability transitions' in South East Asia. The workshops are intended to bring together an international group of academics and practitioners engaged in this unique field in order to give solid ground for the development of: (i) a conceptual framework for: inventorising, classifying and analysing sustainability experiment, (ii) a research strategy to identify opportunities and barriers for successful sustainability experiments and (iii) appropriate governance strategies to assist local level policy makers in up-scaling of experiments. The ultimate aim of the initiative is to understand how experiments can come to influence Asian development pathways and transform some of the unsustainable systems of provision such as energy, water or housing.

Keywords: sustainability experiment, sustainability transition, socio-technical system, South East Asia

1. Introduction

1.1. Rationale

The rationale for this initiative stems from the urgency to investigate opportunities for sustainability transitions in South East Asia.

Transitions to alternative development pathways have become an important theme in research and policy debates in industrialised (Elzen et. al., 2004) and newly industrialising economies (UNESCAP, 2006). These debates have focused on long-term changes across local and global scales, including innovations in technology, institutions and behaviour. Transitions imply major transformations in the way societal functions (e.g. transport, energy) are fulfilled. They are systemic in nature and involve both technological and social dimensions, hence socio-technical transitions (or system innovations). Transitions can occur for various reasons such as persistent problems (e.g. climate change, loss of biodiversity), opportunities offered by new innovations (e.g. the introduction of the motor car, the jet engine, the mobile phone), unexpected events (September 11, Tsjernobyl), because of socio-cultural factors such as changes in lifestyle or limitations and problems in existing systems (e.g. reaching technical limits for further improvements). Examples are the transitions from transport systems from horse and carriage to automobile (Geels, 2005a) or from telegraph to telephone. These transitions in societal functions are at a lower level than transitions from e.g. agricultural, rural to industrial modes of subsistence (Schandl et al., 2009) but at a higher level than changes in the organisations or firms (such as from punched cards to computer at IBM (Elzen et al., 2004) or changes at the level of human being (from child to adult or student to worker (Geels, 2005b).

For analysing innovation taking place in such systems over the longer-term, the literature on 'socio-technical transitions' argues for a multi-level framework (Geels, 2002, 2004, 2005b). The framework highlights the role of 'socio-technical experiments' in protected spaces ('niches') to enable learning in actor configurations that may transform prevailing 'socio-technical regimes' (such as electricity systems or urban transport systems) in favourable 'socio-technical landscape' conditions. In particular, this approach seeks to analyse technological and industrial changes significant to environmental sustainability, placing them in a broader institutional and governance context.

Rapid urbanisation and industrialisation in many parts of Asia is both challenge and an opportunity for global sustainability (Rock and Angel, 2005; Lebel et al., 2007). Up until now much of the current policy and research linked to technology, industry and sustainability in

Asia related to incremental innovations in processes and products, through the adoption of best available technologies (Rock and Angel, 2005). The achievement of higher-level environmental and sustainability targets - including low-carbon or less resource-intensive development pathways – has attracted less attention, partly because Asian economies are still relatively less resource-intensive per capita than industrialised economies (World Resources Institute, 2008, UNESCAP, 2006). A major challenge Asian societies are confronted with is the necessity to decouple the development from the per capita resource intensity while attending to a multitude of social and economic problems occurring simultaneously, stronger and faster (Marcotulio, 2005).

The exploratory application of ideas from the literature on ‘socio-technical transitions’ to the Asian context shows that it is possible to envisage the emergence of new, more resource-efficient socio-technical systems as the basis of more sustainable development pathways in developing Asia (Berkhout et al., 2009). The peculiar characteristics of the developing Asian economies make it a region with a great potential for environmental gains (Rock et al., 2009). A great variety of so called ‘sustainability experiments’ defined as planned initiatives to embody a highly-novel socio-technical configuration likely to lead to substantial (environmental) sustainability gains, holds a promise for change and for creating new, less environmentally burdensome course of industrialisation and urbanisation, which defy the conventional development trajectories (Berkhout et al., 2009). Bai et al. (2009) however, having applied insights from the transition literature to the analysis of a number of local initiatives that could qualify as sustainability experiments, reveal that while theoretically all conditions for a successful transition are fulfilled - there are no signs of a sustainability transition taking place.

1.2. Research agenda

To clarify why this happens and what can possibly be done to empower these local initiatives they first need to be documented, classified and systematically analysed from a transition perspective. There is not much data on the type, size and impact of the various often externally funded local initiatives. There are also no specific criteria developed along which experiments can be classified. The conceptual framework for experiments analysis has been developed and tested in the context of industrialised countries but need to be adjusted to the specific context of Asian countries.

A second re-occurring problem that needs to be addressed systematically, is how successful experiments, can be up-scaled and, more generally, how their impact on prevailing socio-technical regimes can be increased. Recent insights from the field of transition studies provide a promising starting point for tackling this challenge. Over the past years scholars have been investigating how industrialised economies have become path-dependent and locked-in into unsustainable, carbon-intensive production and consumptions systems (Unruh, 2000). Despite continuous incremental innovation, the diffusion of environmental (end-of-pipe) technologies and increasing efficiency gains have not led to substantial reductions of carbon emissions. This phenomenon has been explained by studying the historically grown interrelatedness and co-evolution of technologies, institutions and networks of actors into stable socio-technical systems (Geels, 2004). Once established innovation within these systems tends to be directed towards stability and maintaining of the status-quo rather than towards discontinuity and radical change. That implies that transitions towards sustainability require destabilisation of conditions that maintain the prevailing (environmentally unsustainable) systems, while creating space for alternative development patterns through among the others niche experimentation and a gradual up-scaling. Bai et al., (2009) explain the problem of up-scaling

as a coordination problem between the level of experiments and the stabilised, path-dependent regimes. The authors argue that the nature and timing of linking and coordination processes can result in different (more or less sustainability oriented) transition pathways. The failure of the experiments in the Asian context can be understood as a lack of creating linkages or a lack of coordination between processes on these different levels. A more thorough analysis is therefore needed of the interaction between the experiments in protected spaces, the current unsustainable systems of provision and the wide landscape context. Particularly a research strategy to identify opportunities and barriers for successful sustainability experiments is necessary that will help clarify what blocks the experiments, what is the nature of the barriers and how they can be overcome.

A third relevant dimension is the large variation in the governance structures in Asian countries. In that light, one issue that needs to be better addressed are the specific distinctive features of Asian governance structures and how they limit or increase opportunities for governing sustainability experiments. How can experiments be governed in this context? How can practitioners strategically deal with opportunities or barriers emerging from national or international levels? How does that differ from governing experiments in the context of countries at different stage of development, in particular the well-established OECD contexts?

Summarizing the specific research questions that this initiative aims to address include:

1. What conceptual framework can be proposed for: inventorising, classifying and analysing sustainability experiments in developing Asia?
 - Which sustainability experiments can be identified in the Asian context?
 - Along which criteria can they be inventorised and classified?
 - What adaptations and extensions to the current transitions framework are necessary to analyse sustainability experiments in developing Asia?
2. What is the suitable research strategy to identify opportunities and barriers for successful sustainability experiments?
 - What are the main challenges to and mechanisms for, establishing and pursuing experiments?
 - What forms of protection are needed to create space for their development?
 - How can these more sustainable initiatives be up-scaled, linked to or taken up by the current systems?
3. What appropriate governance strategies can be identified to assist local level policy makers in up-scaling of experiments and increasing their impact?
 - What exactly are the distinctive features of Asian systems with respect to governance and how do they limit or increase the possibilities for governing sustainability experiments?
 - How to govern sustainability experiments in these specific governance contexts?
 - How does that differ from governing experiments in the context of countries at different stage of development, in particular the well-established OECD contexts?

Analysing sustainability experiments in Asia will also be very valuable for a general (theoretical) ‘systems innovation’ perspective. In fact the Asian context may raise several new questions that have not (or at least not sufficiently) been addressed in existing systems innovation literature. There is a clear difference in maturity between the established systems of provision in Europe/USA and those in the emerging economies in Asia. While in Western

societies systems such as transport or energy are deeply rooted and well embedded in society, in Asian countries they are often emergent and qualitatively different (Berkhout et al., 2009). Those developing systems in Asia might be distinctive in terms of being more 'fluid' and part of a wider ongoing transition towards economic growth and globalization. Second interesting theoretical issue is how experiments are (or are not) linked to each other and how linking facilitates or complicates learning. Recent systems innovation literature has emphasized the importance of learning processes by making a distinction between local and global features of an experiment (Geels and Raven, 2006). Any experiment requires local innovation, adaptation and learning. Sustainability experiments with the goal to contribute to wider (disruptive) change towards a sustainability transition, next to local level learning also require the emergence of local and global social networks. Mechanisms such as conferences, workshops, publications, dissemination of results, standardization, and best practices play a role in this development. How does this work for sustainability experiments in Asian countries? What role does local- and global-level learning play in the experiments? What is the role of emerging local and global social networks in this process? What learning capacities and capabilities do sustainability experiments require in the context of increasing globalization? How is local- and global-level learning governed in Asian experiments?

These theoretical questions should be acknowledged while developing the conceptual framework and the appropriate for Asian context research strategy during the workshop.

1.3. Objective

The main objectives of the first workshop to take place in Kolkata, India in November 2009 is threefold: (i) to give grounds for the development of a conceptual framework for: inventorising, classifying and analysing sustainability experiments, (ii) to advance a research strategy for identifying opportunities and barriers for successful sustainability experiments and (iii) to identify appropriate governance strategies to assist local level policy makers in up-scaling of experiments and increasing their impact.

1.4. This paper

This paper is a background document setting the stage for discussions at the meeting and as a call for short papers/reactions from the invited participants. The paper is structured in the following way: Section 2 presents basic insights about sustainability transitions from the system innovation studies point of view. Section 3 discusses ways in which SE Asian sustainability experiments can be inventorised and analysed including an example of such analysis. Section 4 elaborates on elements of research strategy to identify opportunities and barriers for successful sustainability experiments such as construction of niches and up-scaling. Section 5 treats about governance issues and particularly about possible policy strategies that can assist policy makers in the up-scaling of successful policy experiments. Section 6 delineates the focus and the format of the meeting as well as expected outputs and the timeline of the entire process.

2. Transitions from the system innovation perspective

2.1. Understanding transitions

Transitions are very complex, long-term processes. A prominent model in the systems innovation literature to understand transitions has recently attracted increasing scholarly attention (Geels, 2002; 2004; 2005; Smith et al, 2005; Geels and Schot, 2007; Markard and Truffer, 2008). The authors use a multi-level perspective on transitions (MLP) as an analytical and heuristic tool to trace and understand technological transitions. They make a distinction

between the socio-technical regime, the niche-innovation and the socio-technical landscape and define transitions as changes from one socio-technical regime to another in the result of alignments of developments at the multiple levels.

The *socio-technical regime* forms the meso-level in the MLP. It consists of three interlinked dimensions (Geels, 2005): i) network of actors and social groups; ii) formal, normative and cognitive rules that guide the activities of actors; examples of formal rules are regulations, standards, laws; examples of cognitive rules are belief systems, problem agenda's, guiding principles, search heuristics; examples of normative rules are role relationships, behavioural norms, iii) material and technical elements. Existing socio-technical regimes are characterised by path dependence and lock-in, resulting from stabilising mechanisms on the three dimensions (Unruh, 2000; Walker, 2000): i) incumbent actors have vested interests; social networks represent 'organizational capital', ii) regulations and standards may stabilise regimes; cognitive routines may blind actors to developments outside of their focus; iii) existing machines and infrastructures stabilise through sunk investments and technical complementarities between components.

Niches form the micro-level. It is the locus where novelties emerge through socio-technical experimentation. These can be small market niches or technological niches, where resources are provided by public subsidies (Kemp *et al.*, 1998, 2001; Raven, 2005). Niches act as 'incubation rooms', shielding new technologies from mainstream market selection. Such protection is needed because new technologies initially have low price/performance ratio. Protection comes from small networks of actors who are willing to invest in the development of new technologies. Important niche-internal processes are: building of social networks, learning processes and articulation of expectations to guide learning processes.

The macro-level is the *socio-technical landscape*, which forms an exogenous environment that usually changes slowly and influences niches and regime dynamics. It encompasses macro developments such as changes in political ideology, demographic change, globalisation, urbanisations and global climate change agreements as well as exogenous events with large impacts such as recessions or wars.

The relationship between the three levels is a nested hierarchy. Pioneers and innovators always work on novelties, but these usually remain restricted to niches (e.g. small projects). New technologies have a hard time to break through, because the existing regime is stabilised and entrenched. Historical studies have shown that transitions only come about when developments at all three levels link up and reinforce each other (Geels, 2005). As a consequence, management or governance of transitions is extremely difficult. This holds in particular for the SE Asian context, because of the global nature of the change processes and the simultaneous occurrence of different type of problems. This leaves the question open as to what actors can do, what is the role of agency? Or to phrase it differently: how can experiments and the construction of niches contribute to sustainability transitions?

2.2. Niches and experiments

Niches in the multi-level perspective are defined as spaces that offer protection against dominant selection rules. In this way niches are defined from an evolutionary economic perspective. However, it is also possible to look at niches and niche development from a sociological perspective. Whereas regimes usually are characterised by a stable set of institutions or rules that govern the behaviour of actors, in niches the stability of rules is much lower. Niches offer the opportunity to deviate from dominant rules, e.g. to accept a lower or

less efficient performance. Moreover, recent literature on niches and niche development stresses the importance of making a distinction between local projects and experiments and a more global niche level (Geels and Raven, 2006). The central idea is that a sequence of projects gradually leads to the emergence of a stable field or niche. Local projects, even if they can be very big as in the Asian context – are carried by local network of actors. The ideas and expectations that guide these projects initially are diffuse. In fact, the projects serve as a test bed for the elaboration of these ideas. Gradually an aggregation process can occur: a comparison between projects and an aggregation of learning processes can lead to the emergence of more global network of actors, sharing expectations, problem agendas, search heuristics, a more formalised body of knowledge (theories, models). Thus, the cognitive rules at the niche level gradually can become more articulated, specific and stable (Geels and Raven, 2006). In that view, niches can be characterised along two dimensions: degree of protection (high-low) and stability of rules (high-low) (Raven 2005; Schot and Geels 2007).

2.3. Transition pathways

Although niches are critical, still the successful development of niches is not a guarantee for a regime shift. Rather, successful niche development is a necessary but not sufficient condition for transitions. The form and direction of a transition is dependent on the nature of the relation and interaction between niche-innovations and landscape pressure on the regime (reinforcing or disruptive). Timing is in particular relevant in the case of landscape pressure on regimes. If this pressure occurs at a time when niche-innovations are not yet fully developed, the transition path will be different than when they are fully developed. Geels and Schot (2007) distinguish four ideal-typical paths, based on different kinds and timing of multi-level interactions. These pathways are shortly described in box 1.

The pathways suggest that success and failures of niche innovations depend on their interactions and timing with dynamics on other levels. Constructing niches therefore can serve as an important element in a strategy to induce transitions. Particularly, from an actor and policy perspective it offers a feasible strategy. Changing the global trade system can be desirable, but is not within reach of most actors (if any). Successful niche management should therefore include clever anticipation and strategic governance of these multi-level interactions.

BOX 1. Transition Pathways (Geels and Schot, 2007)

1) Reorientation / (transformation)

This pathway is characterized by external pressure (from the landscape level or outsider social groups) and gradual adjustment and reorientation of existing regimes. Although external pressures create ‘windows of opportunity’ for wider change, niche-innovations are insufficiently developed to take advantage of them. Change is therefore primarily enacted by regime actors, who reorient existing development trajectories. Outside criticism from social movements and public opinion is important, because it creates pressure on regime actors, especially when they spill over towards stricter environmental policies and changes in consumer preferences. Although regime actors respond to these pressures, the changes in their search heuristics, guiding principles and R&D investments are modest. The result is a gradual change of direction in regime trajectories. New regimes thus grow out of old regimes through cumulative adjustments and reorientations. Regime actors survive, although some change may occur in social networks. Furthermore, regime actors may import external knowledge if the ‘distance’ with regime knowledge is not too large. Such symbiotic niche-innovations add to the regime rather than disrupt the basic architecture.

2) Reconfiguration

In this pathway, niche-innovations are more developed when regimes face problems and external landscape pressures. In response, the regime adopts certain niche-innovations into the system as add-ons or component substitutions, leading to a gradual reconfiguration of the basic architecture and changes in some guiding principles, beliefs and practices. In the reconfiguration pathway, the new regime also grows out of the old regime it differs from the transformation pathway in that the cumulative adoption of new components changes the basic architecture of the regime substantially. The main interaction is between regime actors and niche actors, who develop and supply the new components and technologies. Hence, this is a more radical transition than in the case of the transformation pathway.

3) Technological substitution:

In this pathway, landscape pressures produce problems and tensions in regimes, which create ‘windows of opportunity’ for niche-innovations. Niche-innovations can use these windows, when they have stabilised and gathered momentum. Diffusion of these new technologies usually takes the form of ‘niche-accumulation’, with innovations entering increasingly bigger markets, eventually replacing the existing regime. In this pathway newcomers (niche actors) compete with incumbent regime actors.

4) De-alignment and re-alignment

Major landscape changes lead to huge problems in the regime. The regime experiences major internal problems, collapses, erodes and de-aligns. Regime actors lose faith in the future of the system. The destabilisation of the regime creates uncertainty about dimensions on which to optimise innovation efforts. The sustained period of uncertainty is characterized by the co-existence of multiple niche-innovations and widespread experimentation. Eventually one option becomes dominant, leading to a major restructuring of the system (new actors, guiding principles, beliefs and practices).

3. Experiments – inventory, classification and analysis

3.1. Strategic Niche Management

Sustainability experiments can be defined as planned initiatives to embody a highly-novel socio-technical configuration likely to lead to substantial (environmental) sustainability gains. They may include ongoing and past local projects and community initiatives, grassroots projects, pilot plants and demonstration plants from industries, etc.

Strategic Niche Management (SNM) is about such socially desirable (sustainable) innovations and aims at radical novelties that have to fight against existing regimes. It is a perspective that understands sustainable innovation journeys as a process of niche development (Schot *et al.* 1994; Kemp *et al.* 1998). The entry point for SNM analysis and governance is technological innovations. Technological innovations are seen as critical stepping-stones in a sustainability

transition, but SNM rejects a technology-push approach. Rather it stresses alignment between technological and socio-economic elements such as user-preferences, behaviour, prices, rules and regulations. Hence, SNM is socio-technical in nature. SNM is aimed at modulating the dynamics of socio-technical change through the creation and management of protected spaces (niches) for the use of a new technology. In these spaces the technology is partly and temporarily protected from the normal selection pressures of the market. SNM involves the real use of technologies (that is outside the R&D-labs), in selected (protected) settings. This actual use of new technologies is 'in particular important for articulation processes to take place, to learn about the viability of the new technology and build a network around the product whose semi-coordinated actions are necessary to bring about a substantial shift in interconnected technologies and practices' (Kemp 2000, 19-20). Schot and Geels (2007) provide an overview of the development and background of SNM.

There are three key processes in SNM. The first process is the building of resourceful new social networks. In particular in early phases of an innovation's life cycle, the social network can be very fragile. Experimentation in niche markets can bring new actors together and make new social networks emerge. The second process is the voicing and shaping of expectations. Firms, users, policymakers, entrepreneurs and other relevant actors participate in projects on the basis of expectations. Articulating and negotiating expectations is important to attract attention and resources as well as new actors, in particular when the technology is still in early development and functionality and performance are still unclear. Expectations also provide direction to development: they act as cognitive frames for making choices in the design process. Hence, when managed well a process of articulating and negotiating expectations can guide innovation processes towards sustainability. The third process identified in SNM-research is learning. This is widely recognised as crucial for successful innovation. It enables adjustment of the technology and/or societal embedding to increase chances of successful diffusion. In particular in cases of 'configurational technologies' such as sustainable energy technologies, where the challenge is to get multiple components to work together, learning by trying in a local project context is crucial (Fleck, 1994). The learning process should be broad - focusing not only on techno-economic optimisation, but also on alignment between the technical (e.g. technical design, infrastructure) and the social (e.g. user preferences, regulation and cultural meaning) - and reflexive - that is there is attention for questioning underlying assumptions such as social values, and the willingness to change course if the technology does not match these assumptions.

The interaction between these three key processes forms the basis within SNM for understanding success and failure of sustainable technology introduction. However, more recent SNM work concludes that the internal niche processes are an important but not sufficient pre-condition for successful niche development. Raven (2005, 2006) explicitly includes linking with the dynamics in established socio-technical regimes and wider socio-technical landscape developments as explanatory variable for understanding success and failure. Niche technologies often face severe competition from dominant designs. The internal combustion engine, for example, has been continuously improved over the past decades in terms of environmental and technical performance, making it harder for alternatives to breakthrough. Also, incumbent firms producing the dominant design may not be interested in the innovation, and even sabotage its introduction. Resistance and opposition are especially likely when radical new sustainable solutions would disrupt not only the present technological knowledge base, but also consumption patterns, industry structures and regulatory frameworks (Schot and Geels, 2007). On the other hand, existing regimes may also face problems (e.g. because of public pressure to improve environmental performance), creating

windows of opportunities for alternatives. As has been mentioned above, dynamics in established regimes are another important explanation for understanding success and failure of sustainable technologies.

3.2. A conceptual framework

An SNM analysis starts with a general historical and contextual overview of the niche under study and mapping experiments conducted in the past (Raven, 2005).

The second part is a critical evaluation of selected experiments. The analysis focuses on three processes that are crucial for successful experimentation. First, experiments are successful when they result in the establishment of resourceful new social networks. These networks would typically include technology holders, producers, users, financiers, regulators and civil society organizations and actors representing not just the prevailing regime, but also regime outsiders (e.g. newcomers on the market). Another positive indicator is many interactions within the network. Second, experiments are successful; when they result in the articulation of shared and specific expectations (involved actors agree on objectives and flexibly (re)negotiate these to allow future agenda setting). Third, experiments are considered successful when they result in a broad and reflexive learning process. This is learning beyond only techno-economic optimisation and includes dimensions such as institutional barriers, environmental effects, cultural meanings, local values and end-user preferences.

The third part is concerned with the conditions in the relevant socio-technical regimes and wider socio-technical landscape that may enable or constrain the wider impact of an experiment. This includes a historical overview of the regime under study and a systematic analysis of barriers in regime-rules, -networks and –technologies. An analysis of the socio-technical landscape involves an appreciation of the macro-level including trends in globalization, urbanization, governance systems, economic growth, global climate change agreements, oil prices and growing depletion of fossil fuels.

The fourth part combines insights and results in the description of 2-3 development pathways showing different dynamics and interactions between levels (Geels and Schot, 2007) and recommendations for promising governance arrangements in different contexts and under different conditions (Smith et al, 2005). A systematic comparison between cases will allow to find cross-case patterns and mechanisms, generalize findings and derive new research questions.

Along these guidelines as well as following the discussions with Asian researchers participating the international workshop on sustainability experiments in Asia that took place in Chiang Mai in 2008, we propose the following conceptual framework to analyse specific case studies. This framework is meant as a starting point for discussion during the Kolkata meeting. Each of the steps includes a set of guiding questions:

1. The general history and context of the niche under study:
 - *What is the niche about (e.g. sustainable rural electricity provision, sustainable urban transport)?*
 - *What are main historical features of the niche?*
2. Mapping and inventory of experiments:
 - *What experiments have been carried in the niche?*

- *How can the experiments be mapped and classified (see box 3 for a proposed set of criteria)?*
 - *What are interesting experiments for detailed case-studies?*
3. Analysis of niche processes :
- a. Analysis of network dynamics:
- *Which actors do participate the experiment(s)?*
 - *What are the critical links and relationships between the actors involved in the experiment(s)?*
 - *What are the resources of the actors involved?*
 - *Which actors were excluded from participation?*
 - *What network changes occur during the experiment(s)?*
 - *What are critical links with networks beyond the experiment(s)?*
 - *Did the experiment have any impact on networks beyond the experiment(s)?*
- b. Articulation and negotiation of expectations:
- *What variety of expectations did actors articulate in the beginning of the experiment(s)?*
 - *How were expectations negotiated?*
 - *Did expectations change? Did they become more shared and specific?*
 - *Did the experiment have any impact on expectations beyond the experiment(s)?*
- c. Analysis of learning processes:
- *What were learning goals of the experiment(s)?*
 - *What are the main lessons learned (important dimensions are technology, knowledge-base and infrastructures, development of user contexts; cultural, psychological or behavioural elements, societal and environmental impact; industrial development; government policy and regulations, etc)?*
 - *How was learning organised?*
 - *Did the experiments alter any existing routines and procedures? Did they result in discussions about and adjustment of existing structures and rules (reflexive learning)?*
 - *What learning occurred beyond the boundaries of the experiment(s)?*
- d. Analysis of interaction between niche processes:
- *Did the niche expand, diversify or change otherwise?*
4. Analysis of regime and landscape dynamics:
- *What are the main (historical) features of relevant prevailing regimes?*
 - *What are main technological features of these regimes such as the prominent knowledge-base, infrastructures, technological trends?*
 - *What are main features of the actors and networks supporting these regimes in relation to the experiment(s) under study? Do they possess critical financial, technical, social or other resources?*
 - *What are the main cognitive, regulative and normative rules of these regimes in relation to the experiment(s) under study?*
 - *What are critical past, current and future landscape developments?*

5. Combining niche, regime and landscape analysis:

- *What development pathways are likely?*

Box 2. Criteria for the inventory of sustainability experiments in Asia – proposal

For a broad overview of the number and the type of sustainability experiments in Asia it is important to make an inventory of them and classify them. Combining insights from the system innovation literature, and building on the set of criteria developed during the Chiang Mai workshop, we propose the following primary set of categories that may help classify the specific initiatives:

- Location and time (Where and when was the experiment implemented?)
- Initiator (Who was the main initiator of the experiment, e.g. state, international funding agency, corporate, civil society, etc.?)
- Actors (are actors global, national or local?)
- Reason and goals (What was the trigger for initiating the experiment, e.g.: natural disaster, accident, public health concerns, policy changes, media, other factors and the related goal of the experiment?)
- Technology used (Which technology was applied? Is the technology small or large?)
- Sector (energy/mobility/food/built environment/health/leisure, etc?).
- Capabilities (high/low?)
- Protection type (How were the experiments protected e.g. by subsidies, strategic firm investments? Did the level of protection change during the experiments?)
- Outcomes (What came out of the experiments? Do they still exist, or were they cancelled? Why the experiments were cancelled (barriers))?
- Type (local/global – initiated locally, supported globally or the other way around?)
- Geo scale (urban/rural?)

The following text box 3 gives an example of an analysis of an experiment in the Korean steel industry (Bell, 2008). The example does not completely follow the proposed framework, but it illustrates nicely several elements of the framework. Please, note that this is a particular case. Hence dynamics and analysis might not be typical depending on the specific technology, sector and country in this case and others.

Box 3. Example of the Korean steel industry

The context of the experiment

This experiment is located in the context of an important connection between the transportation and energy sectors in Asia - the complex of large-scale process industries (steel, petrochemicals, petroleum refining, non-metallic minerals, and so forth) that produce the materials (steel, plastics, fuels, concrete, etc.) needed to construct/produce/operate the transportation sector. These materials industries are very energy intensive, so accounting for a substantial fraction of the growing energy use and CO₂ emissions that are being driven by Asian urban-industrial transformation. Typically also they generate considerable quantities of other pollutants. The steel industry consists of two currently dominant regimes.

- One is the 'Big Steel' blast-furnace regime that has dominated this segment of the industry for more than 200 years, and currently accounts for more than 60% of global steel production and more than 70% of Asian production.
- The other is the 'Small Steel' electric arc furnace (EAF), scrap-recycling regime that has expanded at the expense of 'Big Steel' from a totally marginal position in the 1960s to account currently for about one-third of total global steel production, and about 40% and 55% in Europe and North America respectively.

The experiment outlined here is concerned with the first of these. It is about developing a new process technology for the iron-making step in steel-making – the Finex process, which is a variant on the emerging family of smelting-reduction processes that is expected to substitute for a large part of the mature blast furnace regime.

Expectations

The experiment is expected to offer a major step-jump reduction in GHG emissions and other pollutants. This is an important issue, given (a) the currently expected growth in steel production in Asia over at least the next 2-3 decades and (b) the considerable doubts that must surround prospects that other kinds of change and experiment will lead to a major reduction in the steel intensity of Asian development in the foreseeable future.

The experiment might be described as 'radical' in three senses:

- With respect to the knowledge-base and technological principles underlying the experiment, it marks a step of '*significant novelty*' relative to those that have dominated the blast-furnace regime.
- With respect to the steel production process, it will bring a '*dramatic change*' in structure – not merely substituting a 'novel' process at one step in the process, but totally eliminating two major steps in the process (coke ovens and sinter plants that have been huge pollution generators in the conventional process).
- With respect to the environmental impact, it may have a '*major effect*' – at least relative to the impact of continuing incremental technological improvements in the blast furnace regime over recent decades.

Expectations about the possible environmental impact of the experiment should be considered as arising in three steps or phases, and all three should be considered together.

- First, the initial commercial application of the process resulting from the experiment is likely to yield reductions in pollution as follows: relative to those that would arise from investment in a blast furnace process of similar scale, emissions of SO_x, NO_x and CO₂ are likely to be 3%, 1% and 85% respectively.
- Second, reflecting the experience of other industrial technologies, the step to a radically new principle is likely to open up new opportunities for much higher rates of incremental improvement in successive new plants.
- Third, again reflecting the experience of other industrial technologies, including those in the EAF-based niche/regime in the 1960s–1980s, the installation of a series of plants embodying novel technology usually opens up opportunities for accelerating incremental improvement in performance through the operating lifetimes of the installed plants.

Actor-network analysis

The particular experiment noted here is not the first to explore the potential of smelting-reduction technology. Others have been made since at least the 1980s, mostly by groups of established producers in the advanced economies. However, all except one of these have involved only laboratory or pilot plant experiments, and almost all of those have been discontinued. It is striking that the only one of these experiment to have been carried through to quasi-commercial application (the Corex process) has involved collaborative experiments in relatively small-scale facilities between a European engineering company (Siemens/VAI) and steel producers in emerging economies: Korea, South Africa and India – and more recently in China with a larger scale plant.

From an Asian perspective, one might therefore take two views on this experiment.

- One is to view it as a 20-year-long, globally ‘distributed’ experiment in which Asian actors in Korea, China, and India have become lead players.
- The other is to focus on one of the Asian actors and examine the experiment in its immediate organisational and industrial context.

In the context of this paper we will take the second approach, focusing on the experiment that has been undertaken by the Korean steel company, Posco over the last 15 years to develop its own variant on the process. Essentially, this experiment has moved through three main phases: (a) 1990-93: laboratory scale experiments and studies; (b) 1993-2002: pilot plant experiments based on two successive Corex facilities; (c) 2000-current: semi-industrial and industrial-scale experiments in two successive plants. The total cost of this multi-staged experiment so far is in the region of US\$ 2.5 – 3.0 billion. Viewed at the Posco level, this experiment is being undertaken by one of the globally leading incumbents in the currently dominant ‘Big Steel’ regime. So, in a way that fits recent discussions in some of the system innovation literature, it is being undertaken in an ‘intra-regime’ - not ‘extra-regime’ - niche. But there are two alternative perspectives on this niche.

- First, one might take a global perspective on this and argue that Posco is not an incumbent. It is not one of the established technology developers and suppliers in the ‘Big Steel’ regime that has been dominated by actors in the advanced economies. On the contrary it is an outside ‘newcomer’ that is trying to establish an independent position of strategic leadership in the technology by breaking with the underlying technological basis of the old ‘club’ and forging a challenge in the rapidly growing Asian market.
- Second, one might take a micro-perspective on the issue and argue that the experiment is being undertaken in an intra-corporate niche. As one might expect for a high-risk activity that has so far piled up costs of more than US\$ 2.5 billion, it has had to be protected within the company from considerable scepticism about the prospects and from apparently considerable challenges. This has been achieved via managerial arrangements, which have involved the active support and defence by a particular member of the Posco corporate Board.

At this stage the key element of networking at the regional/global level appears to be the collaboration in innovation between Siemens/VAI and various steel producers in Asia. This seems to be a network with Siemens/VAI at the hub of multiple bilateral links. It is not clear whether there is significant cross-Asia networking between the steel-producing collaborators in the region, nor even whether this might be advantageous. At another level there is also an important element of networking between Posco and an engineering company (Posec, a former subsidiary) to develop a capability to supply engineering services in the new area of technology independently of the Corex suppliers.

Learning processes

At the narrow Posco level, the experiment over the last 15 years has involved successive stages of technological learning – basically trying to get the process to ‘work’ at competitive levels of efficiency at progressively larger scale and with a second shift in technical principle in mid-stream. This has to proceed further, as does the learning by Posec. At the same time, Posco is actively exploring possibilities to move the process out to projects in India and China, and is no doubt learning about markets, organisation, and possibly issues about technical performance with different materials. There is, however, a broader learning process. As noted above, the expected environmental (and economic) impact of this experiment will only be fully realised by a sequence of three kinds of change, and this will require a much more pervasive learning process as the process spreads across Asia.

Interactions with the Asian Context

This particular experiment illustrates a broader issue that is important across much more than the steel industry. This is about the variable ‘depths’ and ‘spreads’ of innovative capability in connection with Asia’s position in the global ‘materials’ sector. This involves links between several simple points. The global distribution of materials production is massively shifting to Asia. For example, steel production in Asia has doubled over the last decade, and its share of the global total has risen from 38% to 52% in only that short period. Materials producers in Europe, Japan and North America appear (?) to have decreasing/zero strategic interest in making major commitments to develop radical innovations. Technology suppliers in these regions continue to have strategic interests in global markets, but they can rarely generate radical innovation on their own without active involvement (and expenditure) by materials-producing users of new technology. The technological dynamic of Asian materials production, and its implications for both local and global sustainability, consequently depends heavily on the extent to which there exists or emerges in Asia two kinds of innovation capability:

- Nodes of globally leading innovation capability to act as the ‘user’ partners in generating major/radical innovation with ‘suppliers’ – perhaps often global suppliers,
- Pervasive technology-following innovation capabilities, spread widely across ‘users’ to drive up rates of incremental improvement in techno-environmental performance in installed plants – a component of the overall innovation process that would become increasingly important if radical forms of innovation open up greater opportunities for incremental advance.

What those capabilities to experiment and innovate consist of in different circumstances, the extent to which they ‘exist’, the ‘ease’ with which they may be created or may ‘emerge’, and the sustainability implications of variation in those issues, seem important and interesting questions in connection with system innovation in the Asian (or any) context.

Governance

The emerging data about the commercial viability of the process technology rising from the Posco niche (and others like it) suggests that the need for protection of the niches in future will not be a major issue – though it is important to bear in mind that the experimental niche has been given protection inside a very large corporation for about 15 years at a cost of perhaps US\$2.5 billion. Possibly much more important are questions about the negative implications of the protection of the incumbent ‘Big Steel’ regime in the advanced countries – perhaps especially in the US. Steel is (increasingly?) an internationally traded product and ‘Big Steel’ facilities in the advanced economies are increasingly out-dated and uncompetitive. Investment in major new facilities in the ‘Big Steel’ sector in those economies is most unlikely. Consequently, global environmental interests would be best served by transferring steel production for advanced country markets as rapidly as possible to production based on the fast expansion of investment in new technology processes in Asia (and Latin America). Protection of advanced country markets slows this process. Scrapping such protection plus global subsidy for investment in the new generation of more environmentally efficient production in Asia would accelerate it (and schemes to encourage the so-called ‘transfer of technology’ are largely irrelevant). Up-scaling of this experiment seems to involve two things in this case: (a) pushing the experiment forward to even more costly stages of large-scale individual units to demonstrate full commercial viability, and (b) extending the use of units across the Asian region – probably a question of capturing a growing share of investment in the growth of capacity, rather than yet being a candidate to replace existing capacity.

Sustainability contribution

At first sight, although the NO_x and SO_x impacts are likely to be ‘dramatic’, the 15% reduction in CO₂ emissions (per ton) may seem less so. However, it is important to recall that the sustainability impact of this experiment will be generated through the three kinds of change noted above in Section 2. Then, the degree to which this will lead to ‘transition’ seems unlikely to be any more discernible at this early stage in developments than it must have been at similarly early stages in all the ‘transitions’ recorded in the system innovation literature. These have taken about 50+ years to complete, and perhaps 30-40 years to demonstrate that they are indeed transitions. The only way to assess whether the experiment sketched above might lead to ‘transition’ is via some form of simulation and scenario building that also takes into account of other kinds of change in the steel socio-technical system.

Source: M. Bell, ‘An Experiment in the Steel Industry in Asia’, Unpublished case-study note prepared for the International Workshop on The role of experiments in sustainability transitions in Asia; Chiang Mai, January 2008. The full text is available from: anna.wieczorek@ivm.vu.nl or m.bell@sussex.ac.uk.

4. Identifying opportunities and barriers

A re-occurring problem in the study of system innovation that yet needs to be addressed systematically, is how successful experiments, can be up-scaled and, more generally, how their impact on prevailing socio-technical regimes can be increased. Recent insights from the field of transition studies provide a promising starting point for tackling this challenge. Over the past years scholars have been investigating how industrialised economies have become path-dependent and locked-in into unsustainable, carbon-intensive production and consumptions systems (Unruh, 2000). Despite continuous incremental innovation, the diffusion of environmental (end-of-pipe) technologies and increasing efficiency gains have not led to substantial reductions of carbon emissions. This phenomenon has been explained by studying the historically grown interrelatedness and co-evolution of technologies, institutions and networks of actors into stable socio-technical systems (Geels, 2004). Once established innovation within these systems tends to be directed towards stability and maintaining of the status-quo rather than towards discontinuity and radical change. That implies that transitions towards sustainability require destabilisation of conditions that maintain the prevailing (environmentally unsustainable) systems, while creating space for alternative development patterns through among the others niche experimentation and a gradual up-scaling. Bai et al., (2009) explain the problem of up-scaling as a coordination problem between the level of experiments and the stabilised, path-dependent regimes. The authors argue that the nature and timing of linking and coordination processes can result in different (more or less sustainability oriented) transition pathways. The failure of the experiments in the Asian context can be understood as a lack of creating linkages or a lack of coordination between processes on these different levels. A more thorough analysis is therefore needed of the interaction between the experiments in protected spaces, the current unsustainable systems of provision and the wide landscape context. Particularly a research strategy to identify opportunities and barriers for successful sustainability experiments is necessary that will help clarify what blocks the experiments, what is the nature of the barriers and how they can be overcome.

In the following paragraphs we discuss elements relevant to consider when building such a strategy. We start with the issue of niche construction and management as a mechanism for experiments development, followed by the question of experiments embeddedness in the local context and their up-scaling.

4.1. The construction and management of niches

The construction of niches can be considered as a mechanism for experiments development. Three issues are important to take into account:

1. The organisation of learning processes, social networks and visioning in a way that they allow for up-scaling of experiments later on in the process;
2. Managing niches (compared to managing projects) and roles of actors and networks. Management of interfaces for creation of common expectations, etc. Managing niches includes among others managing the field as a whole, managing learning and other interactions between experiments and designing clever niche-regime interfaces. The global level of niche development requires other capabilities that the management of experiments.
3. The temporary protection against regular market pressure which raises all kinds of governance questions, as to what should be protected, who should protect, why and how to implement protection, including breaking down of protection measures. What type of protection is the most suitable for successful niche development? Also, the

issue of protection is contested in economic theory and by proponents of free trade, who argue that all barriers to competition should be removed.

4.2. Up-scaling

The second issue relates to the question of how experiments can be embedded in the local context and how the impact of experiments on prevailing regimes and developing pathways can be increased. Increasing the impact of sustainability experiments focuses on changing dominant practices and implementing different, more sustainable development pathways. This involves processes of up-scaling, a research theme that has not received a lot of attention in the system innovation literature. According to the World Resource Institute (2008) the following forms of up-scaling can be identified:

1. *Quantitative up-scaling*. When an experiment and supportive actor-network expands its size, profitability, geographic base, or budget, it is experiencing quantitative scaling.
2. *Functional up-scaling*. As experiments and their supportive networks increase the types of activities they carry out or the scope or integration of these activities with other type of experiments, they are undergoing functional up-scaling.
3. *Organisational up-scaling*. Networks responsible for experiments often strengthen their own capacities substantially, allowing them to take on new responsibilities or to carry on their current activities more effectively.
4. *Political up-scaling*. This type of scaling involves increasing the political power of a network so that it can influence state actors, negotiate for stronger support or greater latitude in its activities, and advocate for policy changes that facilitate the organisation's work or extend the enterprise's commercial or social reach.
5. *Institutional up-scaling*. This refers to growing and strengthening the public institutions necessary for establishing and distributing the benefits of the experiment.

Up-scaling proves an extremely difficult process, especially in the specific Asian context. Bai et al, (2009) in their analysis of a number of Asian sustainability experiments identified the following set of factors that obstruct the up-scaling of experiments:

1. *Externalities*: some of the local successes generate significant negative externalities, which put constraints on duplicating the same success at a larger scale. For example, the environmental success in some cities in China is achieved through relocating polluting industries to other cities or outer suburbs which means the success entails external costs (Bai, 2002).
2. *Failure in governance* at upper level: Successful examples are often the result of good vision and knowledge, strong political will, good policy and management measures, and consistent implementation by the governing body. The success example of Rizhao city in promoting solar energy use illustrates the importance of these factors. Up-scaling of these successful practices often requires the same elements at higher levels as well, which may not always readily exist. The case of Bangladesh rural electrification is a good example of the fact that lack of such elements at higher-level governance not only hampers the up-scaling of the local success; it might get in the way of the successful practice at local level. This is also a good example of a governance regime not creating windows of opportunity for successful local experiments. Even though the government recognises the problem and the necessity to solve it – there is a lack of coordinated and mutually reinforcing action to assure dynamics at all the levels.
3. *Burden of scale*: Success at a smaller scale requires a smaller scale of funding, human capacity, and relatively simple institutional arrangements, which might be relatively

easier to obtain. It often gets much “heavier” when trying to mobilize necessary resources, governance capabilities, and institutional arrangements to achieve the same success at a higher level.

The introduction of new technologies often can evoke opposition, not only from the incumbent actors, but also groups from outside of the analysed regimes such as NGO's from other countries. Issues that are at stake then include:

- Broader sustainability issues (e.g. how sustainable are biofuels)
- The global distribution of advantages and negative impacts
- Dealing with vested interested and the role of regime actors

Also the political economy and environmental governance structures within Asia (that in recent years have generated some success in improving environmental performance and which we discuss in the following section) play important role in stimulating the up-scaling of sustainability experiments.

Overall the various factors that obstruct up-scaling of good practice and downscaling of good policy intentions can be categorised along four dimensions.

1. Technological;
2. Socio-cultural;
3. Institutional;
4. Economic.

The factors may further be distinguished based on their niche or regime origin.

5. Governance of experiments in the Asian context

The third issue relevant to the analysis of the potential for sustainability transition in Asia through experimentation is the large variation in the governance structures in Asian countries (that in recent years have generated some success in improving environmental performance). Particularly important to consider is the role of political economy and the specific distinctive features of Asian governance structures and how they limit or increase opportunities for governing sustainability experiments. They are key to identifying strategies for practitioners to deal with opportunities or barriers emerging from national or international levels. They may also have methodological implication for governing experiments in the countries of different stage of development. We start with the multilevel governance, followed by a short analysis of the distinctive features of Asian governance.

5.1. Multilevel governance

In the last few decades, we have seen a shift from government to governance. State-actors increasingly are interacting with the ‘civil society’ in increasingly complex networks, but decentralisation also has made local and regional governments more powerful and supposedly increased their capacity to formulate and deliver policy. This is referred to a multi-level governance. Multi-level governance can be understood as the exercise of authority and the various dimensions of relations across levels of government. This trend has made governance of public policies both more complex and more demanding, involving multiple actors (both public and private). Multi-level governance and the rise of participatory approaches have been of particular interest in Europe due to the (contested) process of European Integration (Loeber et.a.l, 2005), but it is highly relevant for the Asian context and for sustainability transitions as well. Local and regional governments are concerned that their economies are increasingly exposed to global competition. They try to influence public policies in order to improve the

competitiveness of the regional economy. Factors that contribute to difficulties in dealing with multi-level governance include the following (after Bai et al., 2009):

- *State simplification vs. local particularity*: Policy at the national level often fails to attend to the particular local situation. For example, one of the major factors that contributed to the failure of Huai River Basin pollution control efforts led by the Chinese government was that the national pollution control policy and target setting couldn't attend to the local situations (Bai, 2006). A good policy needs to have resonance with local level context.
- *Conflict of interest*: National policies sometimes are challenged by the conflict of interests between "whole" and "parts", where "whole" is national level success outcome and "parts" can be a particular sector or local entity. Local protectionism often gets in the way of national policy to be implemented effectively at the local level, and competing interest or lack of coordination among different governmental sectors.
- *Implementation capacity*: Good policies in Asia are often challenged by the implementation capacity at the local level, in terms of financial, technical knowledge, and human resources. The lack of knowledge capacity sometimes results in the national policy intention being misinterpreted at local level, and thus "lost in translation". This suggests that there might be a notion of "local readiness" for a policy to be successful.

5.2. Asian governance structures

The industrializing economies in East Asia can be generally characterized first by a relatively high rate of growth of industrial GDP which means high rates of capital turnover and new capital investment. This creates opportunities to influence new technology and investment choices, including replacing older capital stock with less energy and materials intensive products and processes. Beyond this 'technique effect', does the development dynamic also provide an opportunity to promote shifts in socio-technical regimes? Secondly all the changes are occurring within the context of economic globalization, meaning:

- Unusually high levels of foreign direct investment.
- Unprecedented levels of merchandize goods exports.
- Importance of global production networks as a form of industrial production.
- Emergence of Asian markets as global drivers.
- Industrial and technological capability building.
- What does this imply for innovation in socio-technical regimes?

Angel and Rock (2009) in their review of trends in environmental governance in South and East Asia identified a pattern of initial efforts to strengthen environmental regulatory regimes along the lines of the policy models of OECD economies. The degree to which these initial efforts have operationalized varies from country to country in the region. The authors however also identify a more recent phase of environmental governance reform in which a variety of pragmatic policy innovations, often quite novel and attuned to the institutional contexts of individual countries, are beginning to emerge. An important characteristic of this second reform in environmental governance is an attempt to harness the institutional capabilities of the development state quite directly toward goals of environmental improvement (e.g. by integrating environmental goals into the mandate of development agencies). Secondly, Rock et al. (2009) argue that the capitalist developmental states in East and Southeast Asia have been better able to harness global economic forces for technological and sustainability transitions through their openness to trade and investment and effective public-private institutions able to link cleaner technologies and environmental standards to

production activities in firms. What is interesting is that experimentation in Asia is emerging as part of the 2nd wave of environmental governance reform in the region which is more attuned to local context. The first phase involved strengthening of basic institutions of environmental regulation at the national and local level.

5.3. Methodological implications

One of the issues is that of temporary protection against regular market pressure that raises all kinds of (methodological) governance questions, as to what should be protected, who should protect, why and how to implement protection, including breaking down of protection measures. What type of protection is the most suitable for successful niche development? Also, the issue of protection is contested in economic theory and by proponents of free trade, who argue that all barriers to competition should be removed (links to the developing economics. literature).

6. Process and the workshop guideline

6.1. Focus

Sectoral focus: Energy and mobility
Geo focus: Rapidly industrialising countries of South East Asia excl. Japan, South Korea and very poor countries such as Myanmar.
Time scale: The last 15 years.

6.2. Format and reactions

This document is circulated to invited participants. Invitees, to be eligible to participation and the reimbursement of their workshop travel costs are invited to submit 1-2 page reactions to this background paper by 15 October 2009. Specifically we request invitees to specify which of the three objectives they can most contribute to. Then pls select one or two research questions and write a short reflection from your own experience. The reaction may have a form of a short essay or a list of issues important to consider.

1. What conceptual framework can be proposed for: inventorising, classifying and analysing sustainability experiments in developing Asia?
 - Which sustainability experiments can be identified in the Asian context?
 - Along which criteria can they be inventorised and classified?
 - What adaptations and extensions to the current transitions framework are necessary to analyse sustainability experiments in developing Asia?
2. What is the suitable research strategy to identify opportunities and barriers for successful sustainability experiments?
 - What are the main challenges to and mechanisms for, establishing and pursuing experiments?
 - What forms of protection are needed to create space for their development?
 - How can these more sustainable initiatives be up-scaled, linked to or taken up by the current systems?
3. What appropriate governance strategies can be identified to assist local level policy makers in up-scaling of experiments and increasing their impact?

- What exactly are the distinctive features of Asian systems with respect to governance and how do they limit or increase the possibilities for governing sustainability experiments?
- How to govern sustainability experiments in these specific governance contexts?
- How does that differ from governing experiments in the context of countries at different stage of development, in particular the well-established OECD contexts?

For example if you work for the national ministry or an international organization, you may have a very good overview of the type of local projects supported by your organization over the last 15 years. What are these? Can they be classified along the criteria delineated in Box 2? What is the general characteristics of these initiatives – e.g. have they spread or died out once the funds were consumed? If you are a practitioner working on site with implementation of these projects – perhaps you can identify a set of common barriers that the projects you know came across as well as the ways in which the various actors addressed them. Which strategies worked which not? Another example – being a researcher you may have comments on the analytical framework and its applicability to the SE Asian context – perhaps there is something missing or inappropriate or maybe you want to add to the issues relevant for governance of experiments in the given set up?

In general the reactions should bring us closer to specifying the three elements of the proposed research agenda. Reactions on the agenda itself are also most welcome.

We emphasise that the focus is on experiments connected to a sustainability transition rather than a simple experiment in environmental improvement.

Based on this input a workshop agenda will be constructed and the contributions discussed. No presentations are scheduled except for one-two setting the stage for discussions. The workshop is a working session.

6.3. Expected outputs

1. A draft research agenda including:
 - a. A conceptual framework for inventorising, classifying and analysing sustainability experiments in selected Asian countries in the field of energy and mobility.
 - b. A research strategy to identify opportunities and barriers for successful sustainability experiments.
 - c. A set of appropriate governance strategies to assist local level policy makers in up-scaling of experiments.
 - d. A fundraising strategy.
2. An international workshop and a network
3. (A/a set of) journal paper(s) with most relevant contributions (co-authorship possible) on researching the role of experiments in sustainability transitions in Asia

6.4. Timeline

15th December 2009 – deadline for reactions

5th January 2010 – final agenda

14th January 2010 (Thur) - workshop starting at about 10:00-11:00 to allow Asian participants fly in. Lunch, coffee breaks and dinner included.

15th January 2010 (Fri) - workshop starting 9:00, incl. lunch, coffee breaks and dinner

16th January 2010 (Sat) - workshop ending at about 16:00, incl. lunch and coffee breaks. The end time can also be slightly adjusted to allow for participants departure.

6.5. Basic transition literature

The following is the list of most important references released till 2009) on transitions towards sustainability and system innovation approach. With *) we marked the four most relevant pieces for a quick acquaintance with the field. Please let organizers of the workshop know if you would like to receive a copy.

- *)Angel D., Rock, M. (2009). Environmental rationalities and the development state in East Asia: prospects for a sustainability transition, *Technological Forecasting and Social Change*, Vol 76(2)
 - *)Berkhout, F. (2002) Technological regimes, path dependency and the environment, *Global Environmental Change*, No 12, 1-4.
 - *)Berkhout, F., Angel, D., Wieczorek A.J. (2009). Asian development pathways and sustainable socio-technical regimes, *Technological Forecasting and Social Change*, Vol 76(2), 218-228
 - *)Geels, F., (2002). Technological transitions as evolutionary reconfiguration processes: a multi level perspective and a case study. [Research Policy](#) ,(31)8-9, 1257-1274
 - *)Kemp, René, Johan Schot and Remco Hoogma (1998), 'Regime Shifts to Sustainability through Processes of Niche Formation. The Approach of Strategic Niche Management', *Technology Analysis and Strategic Management*, 10(2), 175-195.
 - *)Raven, R.P.J.M., Mourik, R.M., Feenstra, C.J.M., Heiskanen, E. (2009), Modulating societal acceptance in new energy projects. Towards a toolkit methodology for project managers. *Energy*, 34(5), 564-574.
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 - *)Verbong, G.P.J., Geels, F.W., Raven, R.P.J.M. (2008), Multi-niche analysis of dynamics and policies in Dutch renewable energy innovation journeys (1970-2006): hype-cycles, closed networks and technology focused learning, in: *Technology Analysis & Strategic Management*, 20(5), 555-573.
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