Transition management as a model for managing processes of co-evolution towards sustainable development

Paper for special issue on (co)-evolutionary approach to sustainable development of *The International Journal of Sustainable Development and World Ecology*

This version August 2005

René Kemp (MERIT, TNO and DRIFT[1]), **Derk Loorbach** (DRIFT) and **Jan Rotmans** (DRIFT) r.kemp@merit.unimaas.nl, loorbach@fsw.eur.nl and rotmans@fsw.eur.nl

1. Introduction

Sustainable development is about the redirection of development (WCED, 1987). It is not about an identifiable end state. Sustainable development is a never-ending process of progressive social change. It involves multiple transitions. Each transition is made up of processes of co-evolution involving changes in needs, wants and the institutions that coordinate choices.

In this paper we argue that sustainable development requires radical changes in functional systems and changes not only in government policy but also in current systems of governance (the orientation of society and patterns of interaction over collective issues).[2] In our view, the existing policy frameworks with fragmented policy areas are not suited for dealing with social complexity and desired long-term change. Different types of governance are needed: more open, oriented towards learning and innovation with adaptive capacities to deal with surprises. In the paper we compare two

[1] The paper is a product of the Kip Governance project of TNO.
[2] Governance implies a less state-centric view of politics and gives attention to issues of negotiation, deliberation and self-governance (Pierre, 2000). It is about the structured ways and means in which the divergent preferences of inter-dependent actors are translated into policy choices to allocate values, so that the plurality of interests is transformed into coordinated action and the compliance of actors is achieved (Eising and Kohler-Koch 2000:5).

approaches: a bottom-up approach based on strategic niche management and the approach of goal-oriented modulation for shaping transitions (of which the Dutch model of transition management is an example). We will argue that there is a need for policy to stimulate experiments but this best done within an approach of transition management involving long-term goals and adaptive programmes for system innovation. The model of transition management (developed by the authors) used in the Netherlands for 'managing' transitions to sustainable energy, mobility, agriculture and sustainable use and management of natural resources is an example of goal-oriented modulation, aimed at shaping processes of co-evolution. In our view it constitutes "the third way" political scientists have long been looking for, overcoming limitations of both (disjointed) incrementalism (partisan mutual adjustment) and planning. Transition management is a promising model for sustainable development, allowing societies to explore alternative social trajectories in an adaptive, forward-looking manner.

Special attention is given to co-evolution, where different subsystems are shaping but *not determining* each other (relative autonomy). We will argue that a co-evolution perspective is the proper perspective for thinking about governance for sustainable development (Norgaard 1994; Van den Bergh and Stagl, 2002; Rammel et al., 2004), but that there will always be a tension between the reality of fundamental and practical uncertainties from unpredictable interaction processes and the desire for "objectives, targets and time-tables." (Kemp et al., 2005)

The paper consists of three parts. The first part of the paper examines the notion of sustainable development and its relation with co-evolution. The second part then describes the model of strategic niche management and experiences with it. The third part describes the notion of transition management and compares it with other models for policy and governance, planning (relying on control) and incremental politics (relying on small steps). As we will see, in terms of governance, transition management makes use of what Lindblom (1979) calls "partisan mutual adjustment" but with special attention given to problem structuring, long-term goals and learning about system innovation. It combines the capacity to adapt to change with a capacity to *shape change* (Rammel et al. 2004) and is concerned with positive goals (collectively chosen by society following a process of problem structuring). The first element – of adaptivity of systems to its environment – is well-established within the literature on co-evolution (looking at

resilience), the second element, of shaping the system as a whole and its environment (and thus shaping the evolution of various subsystems) received far less attention.

2. Sustainable development as co-evolution

Following the Brundtland report *Our Common Future* (WCED, 1987) sustainable development came to be defined as redirection of trajectories of change in ways that combine economic wealth, environmental protection with social cohesion. After the initial optimism about win-win opportunities it is increasingly understood that there are tradeoffs between the three goals in any type of development (at least in the short term) and that each development tosses up new problems for society. Car-based transport was once much more clean than horse-drawn carriages which filled the street with horse excrements, giving rise to the occupation of road sweepers, clearing the road for people to walk (Kemp and Soete, 1992).[3] These days, we have ozone problems caused by automobiles, congestion problems, noise problems and 250,000 traffic deaths worldwide.

Approaching SD as a continuous process of change means that it cannot be translated into a blueprint or a defined end state from which criteria could be derived and unambiguous decisions be taken to get there: as a multi-dimensional and dynamic concept sustainable development can neither be translated into the narrow terms of static optimisation nor is it conducive to strategies based on direct control, fixed goals and predictability (Rammel et al., 2004, p.1). We face a dynamic process where the starting point cannot be a fixed idea of sustainability, rather it must be a social consensus what we consider to be unsustainable (Wilkinson and Cary, 2002 quoted in Rammel et al, 2004). The consensus view is that sustainability "refers to a process and a standard—and not to an end state—each generation must take up the challenge anew, determining in what directions their development objectives lie, what constitutes the boundaries of the environmentally possible and the environmentally desirable, and what is their understanding of the requirements of social justice" (Meadowcroft 1997, p. 37).

The notion of sustainable "landing places" that is sometimes used is therefore misleading. It suggests that the problem of sustainable development can be "solved"

[3] It is estimated that in London there were 6000 road sweepers around the year 1900.

whereas in reality only specific issues can be resolved and managed. There always will be “problems” and a need for change. The challenge for governance is to build capacities for adaptation and capacities for change (Rammel et al., 2004, p. 11). Multi-player governance regimes should embody capacity for sustainability-oriented coordination, direction and re-direction (Kemp et al. 2005). Norgaard (1984) sees the solution in a co-evolutionary potential based on diversity in the widest sense (including diversity in governance). Voss and Kemp (2005) propose to incorporate *feedback* in social problem-solving (as part of a model of reflexive governance) for which they propose the following five strategies:

1) Integrated knowledge production on problems and their dynamics, including different scientific disciplines and practice perspectives, to get more robust knowledge and strategies based on shared understanding.
2) Adaptive strategies and strategic experiments to actively deal with uncertainty
3) Systematic anticipation of long-term and indirect effects e.g. through explorative foresight exercises
4) Iterative, participatory formulation of governance objectives, taking account of diverse and changing social values
5) Interactive strategy development by actors with various sources of influence.

In sustainability discussions, the term co-evolution is frequently used. A co-evolutionary view indeed is important for thinking about governance for sustainable development for two reasons. First, it accepts that we have *cause-effect-cause* loops across different scales and systems, with effects becoming causes of other developments (developments feed upon another).[4] A good example is the use of cars, which facilitated travel and urban sprawl which in turn increased the demand for cars. This simple example also shows that people’s needs are partly endogenous to other developments. The same is true for policy which is not independent from economy but a response to problems, pollution for instance, with the policies giving rise to new problems (high costs or waste).[5] Second, very paradoxically, a co-evolutionary (?) perspective sees developments in different subsystems as partially independent. Co-evolution is a special type of interdependency: *A* influences but not determines *B* and *C* which in turn influence

[4] C.f. the notion of ‘contingent necessity’ of Jessop (1997).
[5] This selfconfrontation of development with its consequences, sparking policy responses, is called reflexive modernization (Beck, 1994)

but not determine *A*. The different units of evolution enjoy relative autonomy in development (Schneider and Welke, 1998). Technical change co-evolves with institutional change (within systems of governance and organizations and culture), they are shaping *but not determining each other*.

In the literature on societal change different types of co-evolution have been noted: supply and demand (Nelson and Winter, 1982); technology and users (von Hippel, 1988, Leonard-Barton, 1988); technology, industry structure and institutions (Nelson, 1994, Rosenkopf and Tushman, 1994;); actor and structure (Giddens, 1984); technology and society (Rip and Kemp, 1998); and ecology, economy and society (Norgaard, 1984, Kemp and Soete, 1992, Gowdy, 1994, Kemp and Rotmans, 2005).[6]

Not every type of interaction should be called co-evolution. Strictly speaking, co-evolution occurs when two *evolutionary* processes are interlinked (van den Bergh and Stagl, 2003) but as some people will say that processes with teleological elements (as in human/social evolution) cannot reasonably be viewed evolutionary (because in economic evolution there is purpose and no gene type), we propose to use the definition of mutual shaping with relative autonomy. The co-evolution idea has been taken up by many authors outside biology but the management and governance aspects remain underdeveloped. Useful attempts at that are provided by Lee (1993), Rammel and van der Bergh (2003), Rammel et al. (2004), Bleischwitz (2003) and Van den Bergh et al. (2005). These co-evolutionary approaches all build on the model of punctuated equilibrium in which periods of slow change are punctuated by periods of radical change. This means that in evolution we have panarchy (Gunderson and Holling, 2002) or transitions (Rotmans et al., 2001, Geels, 2002, 2005), shifts to other system states or

[6] The best worked-out model of co-evolution in human systems probably is the streams model of Kingdon about political agendas. Kingdon (1984) argues that policy solutions are not the automatic response to predefined problems or an automatic reflection of the power of the participants in the policy process (Cf. John, 1995, p. 174), instead, policy solutions get defined through the interaction of events and processes in three streams: problems, policy, and politics--which interact but which also have their own autonomous dynamics. In his view, the linear scheme of *existence of physical problem → recognition of problem --> invention of alternatives → behavioural consequences* does not capture the messiness or evolving nature of the policy process. In Kingdon's conception, problems and policy ideas are floating in the 'policy primeval soup'. Some ideas are taken more seriously and survive, they are taken up institutionally, giving rise to new outcomes. Kingdon did not use the term co-evolution. The person most famous for its use is Norgaard (1984, 1994).

trajectories of development. Transitions in society or societal subsystems are the outcome of processes of co-evolution in the above sense (Rotmans et al., 2001).

In the next two sections we will examine two approaches for promoting processes of co-evolution: strategic niche management and transition management.

3. Strategic niche management

SNM refers to the process of deliberately managing niche formation processes through real-life experiments. The core idea is that through experiments with new technologies and new sociotechnical arrangements processes of co-evolution can be stimulated (Hoogma et al., 2002). Technologies – for example electric vehicles or smart car?s - as well as the contexts (user preferences, networks, regulation, complementary technologies, expectations) in which they develop are worked upon simultaneously. In other terms, SNM aims at *aligning* the technical and the social. As a consequence new, more sustainable patterns might emerge, partly embodied in hardware (new technologies) and in new practices based on new experiences and ideas. Such experiments can be envisaged as (part of) a niche in which technologies are specified and consumers are defined and concretised. Experiments make it possible to establish an open-ended search and learning process, and also to work towards societal embedding and adoption of new technology (Hoogma et al., 2002). It is thus based on the assumption that user needs and wants are not fixed. Rather, consumer wants are based on their reflection of what they experienced in the past (Hinterberger, 1984), new experiences may alter perceived needs.

The inventor of the concept is Arie Rip, a philosopher and sociologist of technology interested in evolutionary approaches of sociotechnical change. The concept has been further developed by Dutch scientists Johan Schot, Remco Hoogma, René Kemp and Frank Geels and by Matthias Weber and Bernhard Truffer in joint publications. Experiments were studied in various projects of which the most important project was the project SNM as a tool for transition, an international project funded by the EU, the results of which are being published in Hoogma et al, 2002) .

In this project, SNM was defined as *strategic niche management is the creation, development and controlled phase-out of protected spaces for the development and use of promising technologies by means of experimentation, with the aim of (1) learning about the desirability of the new technology and (2) enhancing the rate of application of the new technology* (Kemp et al. 1998, 2001). Strategic niche management is a concentrated effort to develop protected spaces for certain applications of a new technology. It differs from the "technology-push" approach that underlies most of today's technology promotion policies, by bringing in knowledge and expertise of users and other actors into the technology development process and to generate interactive learning processes and institutional adaptation (Hoogma et al., 2002). The focus upon learning is an important aspect of strategic niche management. A second aim of SNM is to foster institutional connections and adaptations, to align technology and user environment (Leonard-Barton, 1988). More specifically the aims of strategic niche management are:

- to articulate the changes in technology and in the institutional framework that are necessary for the economic success of the new technology;
- to learn more about the technical and economical feasibility and environmental gains of different technology options – that is, to learn more about the social desirability of the options;
- to stimulate the further development of these technologies, to achieve cost efficiencies in mass production, promote the development of complementary technologies and skills, and stimulate changes in social organization that are important to the wider diffusion of the new technology;
- to build a constituency behind a product – of firms, researchers, public authorities – whose semi-coordinated actions are necessary to bring about a substantial shift in interconnected technologies and practices.

Much was expected from experiments. But did the experiments contribute to these aims? What the SNM project found was that they indeed contributed to learning but contributed little to institutional embedding beyond the creation of new networks. Through the experiments with alternative mobility a great deal was learned about the technical functioning of electric vehicles, scheduling software and electronic reservation and accessing systems for vehicles and about user satisfaction and behaviour. For instance, it was learned that electric vehicles did not hold great appeal to consumers as

a substitute for traditional cars, but that lightweight vehicle (electric assisted bicycles, electric scooter and three-wheelers) are quite attractive, both from a user point of view and from a sustainability point of view. They promote silent and cautious driving and the careful planning of trips (the shortest route). Many things could not have been learned in another way, i.e. from surveys or controlled laboratory experiments. In some cases the experiments had unexpected effects. The use of electric vehicles boosted consciousness of energy consumption that led to reductions in energy use in the household through energy conservation measures. The experiments also generated a great deal of attention from information media and specialists.

At the same time it was found that on certain issues not much was learned. Most of the experiments suffered from weaknesses that prevented the actors from obtaining useful knowledge, especially concerning the conditions for alternative systems of mobility. Of the 8 innovations described in Hoogma et al. (2002) only one diffused successfully: organised car sharing in Switzerland where the company Mobility carsharing has 59,400 members as of May, 2005.

The reasons why the experiments learned little on wider system change were the following (Hoogma et al., 2002):

- Insufficient user involvement.
- Too much focus on technical learning
- The predominance of first-order learning.
- Minimal involvement of outsiders.
- The projects were overly self-contained

The experiments were relatively isolated events. It seemed difficult for the actors to build bridges for instance with policy makers. It also was found that the virtuous circles of feedback by which a technology comes into its own and escapes a technological niche are far weaker than expected and appear to take longer than expected (five years or more). There are lead times in decision-making and existing ownership structures very much act as an inhibiting factor. The experiments did not make actors change their strategies and invest in the further development of a technology in a big way; efficiency improvements resulting in cost reductions were small (due to the small production scales); and apart from organised carsharing there has not been a takeoff or significant

upscaling (Hoogma et al., 2002).

One important conclusion from the study is that the transformative power of experiments is small unless they are linked to long-term strategies for structural change involving policy makers. SNM should be expanded to include diffusion policies and policies for exploring structural change through system innovation (Hoogma et al., 2002). Foresight may be used to promote a coupling between viewing and doing (Truffer et al., 2002). So far it has been used as an intelligent form of incrementalism (learning by doing) for technology development.

In our view, the focus should be more on the co-evolution between innovations and their context for it to have transformative power. experiments should not only be embedded into a portfolio of experiments, but this portfolio should in turn be derived from over-all strategic goals and ambitions. This way, the experiments will not only generate new insights regarding the experiment and it's direct context, but also regarding the long-term goals and visions. From a co-evolutionary perspective, a continuous reflexive learning cycle between experiments and innovations (learning-by-doing) and long-term strategic visions and goals (doing-by-learning) should be at the heart of Sustainable Development.

4. Transition management for sustainable development

To bridge the gap between top-down planning and bottom-up incrementalism and overcome the shortages of experimental approaches like SNM, the Dutch model of transition management appears useful. The model of transition management tries to utilize bottom-up developments in a more strategic way by coordinating different levels of government and fostering self-organisation through new types of interaction and cycles of learning and action. Transition management views social change as a result of the interaction between all relevant actors on different societal levels within the context of a changing societal landscape. It is thus concerned with the coordination of interaction and co-evolutionary processes.

Transition management is developed as a model for governance based on a number of principles and instruments described below. Before we describe them we should first

discuss key problems in managing processes of societal change. The problems are common problems for any type of steering. The novelty of transition management is that it sets out to deal with them in an integrated way, something that is important for sustainability transitions.

Problem 1. Dissent

Complex societal problems related to sustainability are characterized by dissent on goals and means. Different people have different perspectives on the (nature) of the problem and preferred solutions. For example, there is no consensus on what sustainable energy or agriculture means in real practical terms. For some biological agriculture is sustainable; for others the larger land requirements of biological farming makes it not sustainable in a global context. Each option has its own setbacks. Over and above this, there is uncertainty about long-term systemic effects. A proximate solution for this is: continuous and iterative deliberation and assessment. Even when it there is dissent about appropriate solutions, it may be possible to come to define key parameters for a future system, such as that a sustainable energy system is reliable, affordable and CO2-low. Other parameters could be added such as that there should be no biodiversity loss (relevant for bio-energy). Problem structuring methods (Rosenhead and Mingers, 2002) may be used for getting to a shared problem definition about the current system (the non-sustainable aspects). Assessment of long-term systemic effects of various sociotechnical options may lead to at least a better understanding of systemic effects. Through such assessments visions of sustainability may be revised or made more concrete.

Problem 2. Distributed control.

In pluriform societies control cannot be exercised from the top. Control is distributed over various actors with different beliefs, interests and resources. Influence is exercised in at different points, also within government, which consists of different layers and silos, making unitary action impossible. The distributed nature of control calls for cooperation and network management. Current modes of network management are not equipped for long-term change. They are too little concerned about long-term ends. We need another form of network management which is concerned with expressing long-term aims and the management of transition processes. We need a kind of partisan mutual adjustment

against long-term transition goals. The formulation of joint visions and common goals helps actors to coordinate their actions.

Problem 3. Determination of short-term steps.

It is unclear how long-term change may be achieved through short-term steps. Short-term action for long-term change presents a big problem to policy makers. There exists little theory on this. Here we propose a dual strategy of forward reasoning and backward reasoning. The reasoning forward would first be based on trend-analysis and forecasting excersises. Second, reasoning forward consists of the identification of useful steps, short-term actions which generate useful lessons and facilitate further change. Experiments can be used to learn about user satisfaction a range of technical issues. They help to identify problems and to create networks for cooperation. Backcasting may help to identify strategic experiments and help to set goals for new sociotechnical systems. Integrated system analysis may help to identify pathways, help identify robust options, and help set goals.

Problem 4. Danger of lock-in

There is a danger that one gets locked in to particular solutions that are not best from a longer term perspective. A solution for this is the development and use of a portfolio of options. When there is a lot of uncertainty about which option is best this is a good strategy which is widely practiced in business. Support for options could be based on promises and specific benefits for the nation or region in which it is used. The support should be regularly reviewed and adapted.

Problem 5. Political myopia.

From historical studies (Geels, 2005) we know that transitions in sociotechnical systems take one generation or more and thus span various political cycles. Transition management in some way must survive short-term political changes. There is no simple solution for this except that policy makers and politicians have to accept that a transition takes one generation or more and be willing to wait for long-term results. For this to happen they have to be convinced that a problem needs fundamental change and that time is needed for such a change to occur. The transition-arena (Loorbach and Rotmans, 2005) is proposed as an instrument that can be used when the sense of urgency is relatively high, but the room for change is minimal due to domination of

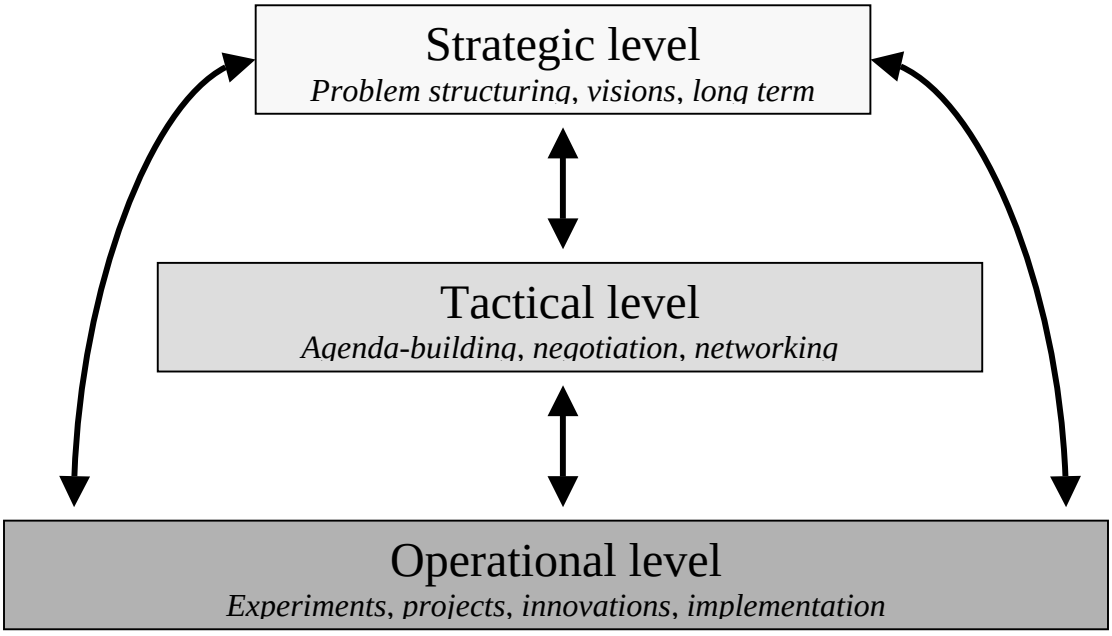
vested interests and institutions. The transition-arena forms the context in which the focus is on the long-term and on in-depth analysis of the problem at hand with debate about preferred long-term development. By creating a transitionarena outside the regular political short-term cycles, more innovative and radical solutions can emerge as well as novel coalitions and consensus decisions. The change process should then be instituted, through transition agendas and laws and be made adaptive, to deal with changing circumstances and political wishes (co-evolution).

From this the following strategies emerge as useful strategies for managing sustainability transitions: problem structuring, participatory integrated assessment, system analysis, vision-development, portfolio-management, iterative decision-making and adaptive policy, experiments, cooperation, and commitment to transitions.

For managing transitions in sociotechnical systems, a form of multi-level governance is needed in which the above elements are integrated in some way. The way in which this is done in transition management is through the interaction between three levels (Loorbach, 2004):

- **Strategic level**: processes of vision development, strategic discussions, long term goal formulation, etc.
- **Tactical leve**l: processes of agenda-building, negotiating, networking, coalition building, etc.
- **Operational level**: processes of experimenting, project building, implementation, etc.

The processes and outputs of the processes differ at each level (visions, strategies, agenda's, projects) and co-evolve throughout the process. Transition management relies on the interaction between processes at three levels. Transition management tries to align these processes through a combination of network-governance and process management leading to modulation of ongoing dynamics. At each level, specific types of actors participate, specific (policy) instruments are used and different competencies are needed. Transitions are the outcome of the interactions between actors on one level and interactions between levels.



Operationally, transition management consists of four different clusters of activities: the strategic transition arena (problem structuring and vision development), tactical transition coalitions and networks (agenda-building, transition-paths), operational experiments and projects and finally the monitoring of progress (both in terms of process as well as content), evaluation and adaptation[7].

This helps to deal with the issue of distributed control because every actor is 'managing' or influencing at least some part of the system. Through a process of partisan mutual adaptation against collectively chosen goals new interaction patterns, policies and socio-technical trajectories emerge, in a self-organised manner rather than through steering from the top.

Transition management can be considered as a specific form of multi-level governance (Scharpf, 1999; Hooghe and Marks, 2001) whereby state- and non state-actors are brought together to co-produce and co-ordinate policies in an iterative and evolutionary manner on different policy levels, adhering to the aforementioned principles. Transition

[7] Operational aspects of transition management are worked out in Rotmans et al, 2001, Loorbach and Rotmans (2005).

management tries to improve the interaction between different levels of government for the sake of certain transitions. Transition management offers thus a framework for policy integration with the following types of policies.

- science policy: sustainability assessments of system innovations, transition road mapping, studies of past and ongoing transitions, focusing on the role of policy and usefulness of various governance models;
- innovation policy: the creation of innovation alliances, R&D programmes for sustainable technologies, the use of transition-experiments, and alignment of innovation policies to transition goals;
- sector policy: niche policies (through procurement, regulations or the use of economic incentives), the removal of barriers to the development of system-innovations, and formulation of long-term goals and visions to give direction to research and innovation.

In short, the activities of transition management are aimed at influencing, organizing and coordinating processes at different (strategic, tactical, operational) levels so that these processes are aligned and reinforce each other. Transition management is concerned with the co-evolution of technology and society in a broader sense through creating various cycles of feedback between subsystems, which have been poorly connected. The subsystems may be functional systems such as energy and mobility or housing and care, or different domains and levels of government. The space for innovation is opened up and there is less short-termism. Partial solutions are forgone for options offering a greater suite of benefits.

Transition management thus comes down to dealing with a multiplicity of steering activities by different actors and driving the activities in a shared and desired direction. Actor roles will change over time. In the course of transition processes, oil companies may decide to become energy companies. Transition management will give rise to altered actor-system dynamics, leading to altered power-constellations and institutional arrangements that form a different selection environment wherein social innovations can mature more easily.

Transition management thus tries to develop a different governance context enabling processes of co-evolution. Co-evolution between different experiments and projects through portfolio strategies, between different agenda's, institutions and actors through common agenda-building and networking and between different visions, goals and ambitions through strategic transition arenas. Furthermore, transition management enables co-evolution through alignment of these different levels of governance activities. Embedding niche-experiments within a context of programmes for system innovation and transition and vice versa adjusting these programmes based on lessons learned gives rise to a reflexive learning process necessary for Sustainable Development.

The transition in the Dutch waste management system as a result of multilevel developments

An example of a coproduced transition is the transition in Dutch waste-management (Loorbach, Parto and Kemp, 2003). Today around 80% of the total amount of waste produced is re-used (also through incineration), leading to a sharp decline of the amount of landfilling sites and a increase of incineration capacity since the 1970s. The current waste-management system is characterized by a high degree of efficiency throughout the whole chain; collection, transport, treatment and recovery. This transition was very much problem-driven: shortages in waste capacity and the need to find better ways of managing waste at affordable costs. A sustainability vision in the form of a waste hierarchy was guiding decisions. The transition was not planned but the outcomes of many decisions and policy events. The Dutch waste management council (AOO), established in 1990, played an important and central role in the transformation process. Negotiations between different layers of government and with private waste companies took place within the AOO with the actors agreeing on the general direction of creating a modern and efficient system of waste management with less waste being landfilled. The overall development was the result of interactions at various levels, with arrows of influence in both directions.

Strategic level

At the strategic level there was a change in thinking about waste. At the end of the 1980s environmental authorities realized that in order to effectively deal with the continuing increases in waste volumes and the negative effects of common waste management practices (mainly landfilling), long-term, integrated policies were required, replacing fragmented, locally organized management. Central to policy thinking was the "waste hierarchy" proposed in the parliamentary motion of Ad Lansink in 1979. This hierarchy prioritized between different management options and went from prevention, through re-use (of products), recycling (of materials), incineration (with energy-production) and landfilling as the last option. The motion became law in 1986 and was an important cognitive institution (Parto et al, 2003).

The fragmented governmental waste-management structures were coordinated through the establishment of a new coordinating body (Waste management Council, AOO),

which was to coordinate policies between the ministry (VROM), the provinces (IPO) and the municipalities (VNG) and play an important role in the modernization of the waste system. The players were willing to cooperate because the waste management subsystem was in a state of crisis because an acute capacity problem, dioxin problems from incinerators and problems of leaking landfills.

Tactical Level

The big changes that occurred during the '90s were enabled by both active governance efforts at the strategic level and by societal trends and developments such as the growing environmental awareness and a number of (toxic) waste-scandals. There was however a very specific management context in which these institutional and regulatory changes occurred. An important event was the "law on wastes" in 1979 (Afvalstoffenwet), which defined the structure and the procedures for the management of waste in the production and composition of products, the use of packaging materials, treatment and disposal of waste, and the separated-waste collection system. In general, the government in the seventies tried to both limit the total amount of waste produced and take innovative steps going beyond landfilling in the management of waste. "Producer responsibility" was introduced to minimize consumer-generated waste, and a number of packaging convenants were devised to minimize packaging by suppliers of packaged goods and professionalization of recycling. Environmental protection became more institutionalized, as did practices such as separating organic from non-organic waste and recycling glass and paper. The AOO provided a coordinating framework for governmental bodies (municipalities, provinces and national government) and had a very clear agenda related to the long-term goals of the first national environmental policy plan of 1989 and the *Ladder of Lansink*. A year later the waste-industry, which at that time also was fragmented, also organized itself at the national level through the VVAV (1991).

Operational

Operational changes consisted in the closing of old landfills sites and incinerators and creation of new ones with controlled disposal and incineration with heat recovery. In 1994 household waste-separation was introduced, which also stimulated the environmental (waste) awareness leading to changes in consumer behaviour. This change in behaviour was accompanied by changes in the practices of waste operators and the structure of the waste subsystem. Waste operators had to learn how to accommodate regulatory requirements regarding collection and handling of waste while structurally deposit depots (milieuperrons) were established to facilitate maximum citizen participation in waste elimination / minimization efforts. In 1994 so called VAM-vats (green boxes for organic waste) were distributed to every household. Differentiated tariffs (Diftar) were introduced by some municipalities to stimulate recovery and re-use. This innovation diffused widely, also thanks to the information services provided by the AOO.

One can say that the waste management subsystem reacted to pressing problems in an adaptive ánd anticipative (forward-looking) manner in which the regulatory system for waste and governance system was changed (towards a mode of network management) and in which room was given to innovation, especially in waste separation.

---

5. Transition management as a third way

Transition management combines elements of planning with incrementalism and relies on markets and network management. It is an example of goal-oriented modulation or process management against a set of societal metagoals using quality visions and images. In the below table we compare transition management with incrementalism and planning, where we will see that goal-oriented modulation is not a simple mix of the other two models but a distinctive model (in the same way network management was distinctively different from markets and hierarchy as a model of economic coordination).

Transition management uses goals but does not aim to control the future (to use Wildavsky's term). It relies heavily on market forces and decentralized decision-making. It does not blankly rely on market forces, but is concerned with the conditions under which market forces operate, by engaging in "context control" so as to orient market dynamics towards societal goals. It consists of government acting to secure circumstances that will maximize the possibilities for progressive social movement by promoting innovation and mitigating negative effects (Meadowcroft, 1997, p. 27).[8] Private initiative is thus not curtailed but rather reoriented towards those activities that serve not only private goals but also serve social goals. This is done through programmes for system innovation and through the use of policy goals providing guidance to societal actors.

Transition management uses advantages of incrementalism, which are the following. First, it is do-able because it is not disruptive from the viewpoint of special interests, second, the costs of a certain step being a mistake are kept low, third, it allows changing course to prevent lock–in from unwanted solutions[9] and fourth, useful lessons may be learned informing further steps. Transition management is not a strategy of incremental politics but is rather *an incrementalist strategy for changing functional systems*. The reason is that with new technology systems, as with politics, it is impossible to move to the desired state in a straight line since there are too many variables. The best strategy

[8] Context control may be viewed as a form of planning (see Meadowcroft, 1997, p.27).
[9] We take the view that path dependencies cannot altogether be prevented, each act will influence future acts in ways that are not entirely clear. Incrementalism, portfolio-management and the stimulation by policy of robust solutions help to circumvent but not altogether prevent the problem of sub-optimal solutions. Lindblom (1997) proposes to rely on the "intelligence of interaction" by relying on partisan mutual adjustment with politics partly substituting for analysis.

is to take small steps in what is generally perceived "the right direction", to try different solutions and to alter course when needed. Like politics, technologies are not born perfect (Latour, Rosenberg) but require adaptation before they constitute a good solution. It is often insufficiently realized that the efficiency of markets rests on the weeding out of sub-optimal designs of products and technologies through market competition (Nelson). Evolutionary change, founded on trial and error, while wasteful in the short term, leads to better outcomes in the long run.

Transition management is different from Lindblom's model of incremental politics and does not opt for disjointed incrementalism as the policy analysis method. Integrated problem analysis and system analysis are part of transition management, which is also concerned with positive goals. For this reason it is better viewed as "logical incrementalism' (Quinn, 1978, 1980).[10] Logical incrementalism is a strategy development process where managers have a view of where they want the organisation to be in years to come and try to move towards this position in an evolutionary way. They do this by attempting to ensure the success and development of a strong, secure, but flexible core business, building on the experience gained in that business to inform decisions about the development of the business and using experiments. In transition management there is also a sense of where one want to be in the future, based on collective goals for functional systems, but without specifying the means for fulfilling them. Like incremental politics, transition management opts for steps but the policy steps are chosen to get closer to collectively chosen goals and visions of sustainability.[11]

The use of adaptive evolutionary steps helps to deal with the criticisms voiced against anticipatory rationality, based on backward reasoning from anticipated consequences. As March and Olsen write in their book on Democratic Governance:

> "Too many atrocities of stupidity and immorality have been based on anticipatory rationality, and too many efforts to improve human action through importing technologies of decision engineering have been disappointing" (March and Olsen, 1995: 198-199)

[10] Another label would be "directed incrementalism" (Grunwald, 2000).
[11] Opting for a step-based approach is less threatening to policy and vested interests. Part of the appeal of transition management in the Dutch government was that it did not call for a complete upheaval of policy but for small steps, in the context of a process of longer term, structural change.

To them the solution lies in adaptive management, in particular in developing capabilities to respond. They propose the creation of mechanisms capable of organizing experience in the service of improved learning (March and Olsen, 1995: 199). In our view, their criticism of anticipatory rationality should probably not be taken as criticism of anticipation or a call for short-sightedness but rather as a criticism of a particular method for dealing with the future: strategic planning. A nicely worked-out application of the model of adaptive management is the "compass and gyroscope" model of Lee (1993) for combining science with politics. Conflict is kept within bounds but is accepted and even viewed necessary. Transition management also tries to keep conflict within bounds, through the orientation to social learning based on problem structuring and strategic experiments (as in the model of Lee).

The steering philosophy is the modulation of ongoing societal developments against a set of collective chosen goals.[12] The role of the government is that of facilitator and mediator. The structuring form is *heterarchy*, centralised, cooperative context-steering oriented to producing controlled structural change (Jessop, 1997, p. 109) in which there is modification of structural links and modifaction of the self-understanding of actors (identities), strategic capacities and interests of individuals and collective actors and hence their preferred strategies and tactics (Jessop, 1997, p. 109-100). Reinstitutionalisation is an important aim of transition management for which it relies on reflexivity (selfconfrontation and learning).

In our view, our model of transition management combines the advantages of both types of approaches. It inserts a strategic element in incrementalism and makes planning more adaptive (open with regard to outcomes) and participatory (open to stakeholders). In the following table we delineate the key features. From the table it is clear that goal-oriented modulation is not a simple mix of incrementalism and planning but has a set distinctive features: problem structuring, second-order learning, portfolios and strategic experiments, transitions arenas for visioning and institutionalisation of learning and capacity building in government and society. Perhaps it constitutes the third way political scientists have been looking for (c.f. Etzioni, 1986).

[12] The term modulation was introduced in the literature on innovation and regime changes by Arie Rip in Rip and Kemp (1998). It is applied to environmental issues in Kemp (2000) and to steering issues of sustainable development in Kemp and Loorbach (2003), Kemp and Rotmans (2004), and Voss and Kemp (2005).

	Incrementalism	**Goal-oriented modulation** ***—of which transition management*** *is an example*	**Planning**
Key actors	Private and public actors	Private and public actors, experts	Bureaucrats and experts
Steering philosophy	Partisan mutual adaptation, learning-by-doing	Modulation of developments to collectively chosen goals, government is facilitator and mediator	Hierarchy
Structuring form	Polyarchy	Heterarchy	Hierarchy
Role for anticipation	Limited (no long-term goals)	Dynamic, adaptive anticipation of desired futures as basis for interaction	Future is analysed and implemented through blueprint plans
Type of learning	First-order: learning about quick fixes for remedying immediate ills	Second-order and first-order (rethink following problem structuring)	First-order (instrumental)
Resilience of outcomes	Medium	High	Low
Mechanism for coordination	Markets and emergent institutionalisation	Markets, network management, institutionalisation (both designed and emergent)	Hierarchy (top-down)
Degree of adaptivity	Adaptive	Highly adaptive thanks to especially created adaptive capacity	Hardly adaptive
Role for strategy and plans	Limited role	Important role for goals and strategic experiments for exploring social trajectories, undertaken as apart of adaptive programmes for system innovation.	Plans with steps
Things against which policies are evaluated	Individual goals and short-term gains	Policy goals and learning goals, helping to determine what to do next	Predefined outcomes
Interest mediation/ conflict resolution	Individual gains for everyone	Rewards for innovators, phase out of non-sustainable practices through markets and politics (collective choice)	Little mediation (implementation and enforcement)
Policy integration	Minimal	Important but typically evolving	High
Type of change that is sought	Incremental, non-disruptive change (system improvement)	System innovation (renewal) and system improvement	Predetermined outcomes which could be an improved old system or a new one

6. Conclusions

In this paper we examined co-evolution aspects of sustainable development, focussing on possibilities for managing processes of co-evolution into more sustainable direction. We examined two approaches for shaping co-evolution: strategic niche management as a bottom-up approach and transition management as a bottom-up, top down approach of goal-oriented modulation. Both approaches are concerned with the normative orientation of socio-economic processes and seek to overcome the conflict between long-term imperatives and short-term concerns. Based on what we know, strategic niche management is useful but not enough; experiments are best pursued as part of a broader approach such as transition management.

Transition management employs an integrative and multi-scale framework for policy deliberation, choice of instruments, and actions by individuals, private and public organizations, and the society at large. It comprises elements of network management, process management, portfolio management, planning, and market coordination. Transition management is inclusive and calls for setting long-term and intermediate goals, alignment of policies short- and long-term policies, and strategic experimentation besides traditional policies. Because it aims for long-term change through small steps it is do-able in a society in which interests are well organized and steering from the top is basically impossible. It is used in the Netherlands for managing the transition to sustainable energy, sustainable mobility, sustainable agriculture, and the biodiversity and natural resource transition.

The presented concept of transition management has been derived from the complex systems approach and new forms of governance. These management principles have been translated to an operational model. This management concept is both descriptive and prescriptive in the sense that it can be used to analyse as well as to structure transitions and transition management. Looking at different levels of governance, the way innovations at each level are organized and developed will provide understanding of their effects in the context of transition. But perhaps even more importantly, the concept can be used to prescriptively to formulate a governance model to select, organize and structure the appropriate governance styles and tools. This governance-mix is context-specific, but its general outlines and framework are generic.

Transition management is possibly best described as goal-oriented incrementalism[13], taking on board criticisms voiced against incrementalism of lack of orientation, conservatism, and negative stance against analysis noted in Weiss and Woodhouse (1992). It is an interesting model for shaping multilevel change in a reflexive manner.

References

Beck, Ulrich (1994) ,The Reinvention of Politics. Towards a Theory of Reflexive Modernization', in Ulrich Beck, Anthony Giddens and Scott Lash, *Reflexive Modernization. Politics, Tradition and Aesthetics in the Modern Social Order,* Polity Press, Oxford, pp. 1-55.

Bleischwitz, R. (2004), 'Governance of sustainable development : co-evolution of corporate and political strategies', in *International journal of sustainable development*, 7 (2004), 1: 27-43.

Dirven, Jan, Jan Rotmans and Arie-Pieter Verkaik, (2002) Samenleving in Transitie. Een vernieuwend gezichtspunt, LNV, ICIS en Innovatienetwerk Groene Ruimte en Agrocluster, April 2002.

Eising, R., and B. Kohler-Koch (eds.), *The Transformation of EU Governance,* Routledge.

Etzioni, Amitai, (1986) 'Mixed Scanning Revisited', *Public Administration Review*, Jan/Febr, 8-14.

Geels, F.W. (2002) 'Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study', *Research Policy*, 31(8/9): 1257-1274

Geels, F.W. (2005) *System Innovation and the Transition to Sustainability. Theory, Evidence and Policy,* Edward Elgar, Cheltenham.

Giddens, A. (1984) *The constitution of society. Outline of the theory of structuration*. Cambridge: Polity Press.

[13] In Kemp and Rotmans (2001, 2002) it is called "goal-oriented modulation". An alternative concept is that of "directed incrementalism" (Grunwald, 2000). Transition management could be called a "mixed scanning approach", a hierarchical mode of decision-making that combines higher-order, fundamental decision-making with lower-order incremental decisions that work out and/or prepare for the higher order ones (Etzioni, 1986). The fundamental choices are the long-term goals, the creation or abandoning of programmes for system innovation, reliance on certain ways of decision-making. The fact that we can use different labels for transition managements shows that several of the ideas behind it are not new; what is new is the operationalisation of these ideas and integration of elements into a comprehensive model.

Gowdy, J.,(1994) *Coevolutionary Economics: The Economy, Society and the Environment*. Dordrecht: Kluwer Academic Publishers.

Gunderson, L.H., and Holling C. S. (2002) *Panarchy: Understanding transformations in human and natural systems*. Washington DC: Island Press.

Grunwald, Armin (2000), 'Technology Policy between Long-term Planning Requirements and Short-ranged Acceptance Problems. New Challenges for Technology Assessment', in John Grin and Armin Grunwald (eds.) *Vision Assessment: Shaping Technology in the 21st Century Society. Towards a Repertoire for Technology assessment*, Springer, Berlin-Heidelberg.

Hinterberger, Fritz (1994) On the Evolution of Open Socio-Economic Ssytems, in R.K. Mishra, D. Maass and E. Zwierlein (eds.) *On Self-Organization*. Springer, Berlin/Heidelberg.

Hoogma, Remco, René Kemp, Johan Schot and Bernhard Truffer (2002), *Experimenting for Sustainable Transport. The Approach of Strategic Niche Management*, EF&N Spon, London.

Jessop, B. (1997) The Governance of Complexity and the Complexity of Governance: Preliminary remarks on some problems and limits of economic guidance, in A. Amin and J. Hausner (eds.) *Beyond market and Hierarchy. Interactive Governance and Social Complexity*, Edward Elgar, Cheltenham.

Kemp, René, and Luc Soete (1992), 'The Greening of Technological Progress: An Evolutionary Perspective', *Futures* 24(5): 437-457.

Kemp, René (1994), 'Technology and the Transition to Environmental Sustainability. The Problem of Technological Regime Shifts', *Futures* 26(10): 1023-46.

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.

Kemp, René (2000), Technology and Environmental Policy—Innovation effects of past policies and suggestions for improvement, OECD proceedings *Innovation and the Environment,* OECD, Paris, 35-61.

Kemp, René, en Derk Loorbach, Governance for Sustainability Through Transition Management, paper for EAEPE 2003 Conference, November 7-10, 2003, Maastricht, The Netherlands.

Kemp, René, and Jan Rotmans (2004), Managing the Transition to Sustainable Mobility, in Boelie Elzen, Frank Geels and Ken Green (eds.). *System Innovation and the Transition to Sustainability: Theory, Evidence and Policy*, Cheltenham: Edgar Elgar, 137-167.

Kemp, R., and J. Rotmans (2005) 'The management of the co-evolution of technical, environmental and social systems', M. Weber and J. Hemmelskamp (eds.) *Towards Environmental Innovation Systems*, Springer Verlag, 33-55.

Kemp, René, Saeed Parto and Robert B. Gibson (2005), Governance for Sustainable Development: Moving from theory to practice, forthcoming in *The International Journal of Sustainable Development*.

Kenny, Michael, and James Meadowcroft (1997) *Planning Sustainability*, London and NY: Routledge.

Kingdon J. (1984) *Agendas, Alternatives, and Public Policies*, Scott, Foresman.

Lee, Kai N. (1993) *Compass and Gyroscope. Integrating Science and Politics for the Environment*, Island Press, Washington D.C.

Leonard-Barton, D. (1988) 'Implementation as Mutual Adaptation of Technology and Organisation', *Research Policy*, 17: 251-267.

Lindblom, Charles (1965) *The Intelligence of Democracy*, New York: Free Press.

Lindblom, Charles E. (1979), 'Still Muddling, Not Yet Through', *Public Administration Review*, Nov/Dec, 517-526.

Lindblom, Charles (1997) 'A Century of Planning', in, Michael Kenny and James Meadowcroft (eds.) *Planning sustainability*, London and NY: Routledge, 39-65.

Loorbach, Derk, Saeed Parto, and René Kemp (2003). "From Waste Disposal to Waste Management: Transitions in waste management in the Netherlands". Paper presented at the Netherlands Organization for Scientific Research (NWO), May 2003.

Loorbach, D. (2004). Governance and transitions: a multi-level policy-framework based on complex systems thinking. Paper read at Conference on Human Dimensions of Global Environmental Change, at Berlin.

Loorbach, D. and J. Rotmans (2005) Managing transitions for sustainable development. In *Industrial Transformation - disciplinairy approaches towards transformation research*, edited by A.J. Wieczorek and X. Olshoorn. Dordrecht: Kluwer Academic Publishers.

March, James G., and Johan P. Olsen (1995) *Democratic Governance*, New York: The Free Press.

Mayntz, Renate (1994) 'Governing Failures and the Problem of Governability: Some Comments on a Theoretical Paradigm', in Jan Kooiman (ed.) *Modern Governance. New Government-Society Interactions*, Sage, London, 9-20.

Meadowcroft, James (1997) 'Planning for sustainable development: what can be learned from the critics?', in Michael Kenny and James Meadowcroft (eds.) *Planning sustainability*, London and NY: Routledge, 12-38.

Mesarovic (2001) Evolution of Sustainability Concept, mimeo.

Nelson, R.R., 1994. The Co-evolution of Technology, Industrial Structure, and Supporting Institutions, *Industrial and Corporate Change* 3: 47–63.

Nelson, R.R, and S.G. Winter (1982) *An Evolutionary Theory of Economic Change*, Bellknap Press, Cambridge Mass.

Norgaard, R., (1984) Coevolutionary Development Potential, *Land Economics*, 60: 160-173.

Norgaard, R., (1994) *Development betrayed: The end of progress and a coevolutionary revisioning of the future*. Routledge.

NMP-4 (2000), Een wereld en een wil. Werken aan duurzaamheid. (A World and a will. Working on Sustainability), The Hague.

Pierre, J. (2000) *Debating Governance. Authority, Steering and Democracy*, Oxford University Press.

Quinn, James B (1978) Strategic Change: "Logical Incrementalism" *Sloan Management Review*, Fall, 7-21.

Quinn, B. (1980). *Strategies for Change: Logical Incrementalism*, Irwin, Homewood

Rammel, Christian, Fritz Hinterberger, and Ulrike Bechthold (2004), Governing Sustainable Development—A Co-evolutionary Perspective on Transitions and Change, GoSD working paper 1.

Rammel, C., and van den Bergh, J. (2003) 'An evolutionary perspective on policies for sustainable development', *Ecological Economics* 47(2-3): 121-133.

Rip, A. and Kemp, R. (1998), 'Technological Change', in: S. Rayner and Malone, E.L. (eds), *Human Choice and Climate Change*, Columbus, Ohio: Battelle Press. Volume 2, 327-399.

Rosenhead, J and Mingers, J. (Eds) (2002), *Rational Analysis for a Problematic World Revisited: Problem Structuring Methods for Complexity, Uncertainty and Conflict*, John Wiley and Sons

Rosenkopf, L., Tushman, M., (1994) The Coevolution of Technology and Organization. In: Baum, J., Singh, J. (Eds.), *Evolutionary Dynamics of Organizations*, Oxford University Press, Oxford, pp. 403–424.

Rotmans, Jan, René Kemp, Marjolein van Asselt, Frank Geels, Geert Verbong en Kirsten Molendijk (2000) Transities & Transitiemanagement. De casus van een emissiearme energievoorziening. Final report of study "Transitions and Transition management" for the 4th National Environmental Policy Plan (NMP-4) of the Netherlands, October 2000, ICIS & MERIT, Maastricht.

Rotmans, Jan, René Kemp, and Marjolein van Asselt (2001) 'More Evolution than Revolution. Transition Management in Public Policy', *Foresight* 3(1): 15-31.

Scharpf, F. (1994), 'Community and Autonomy. Multi-Level Policy Making in the EU', In: *Journal of European Public Policy 1*, 219-242.

Scharpf, F. (1999) *Governing in Europe: effective and democratic?* Oxford: University Press.

Truffer, B., A. Mesner and R. Hoogma (2004) 'The Coupling of Viewing and Doing: Strategic Niche Management and the Electrification of Individual Transport', *Greener Management International,* 37, pp.

Van den Bergh, J.C.J.M, and S. Stagl (2002) 'Coevolution of economic behaviour and institutions: towards a theory of institutional change', *Journal of Evolutionary Economics*, 13, p. 289-317.

Van den Bergh, J.C.J.M., A. Faber, A.M. Idenburg, F.H. Oosterhuis (2005) Survival of the greenest. Evolutionaire economie en het energie-innovatiebeleid, RIVM, Bilthoven.

Van de Ven, A.H., Garud, R., (1994) The Coevolution of Technical and Institutional Events in the Development of an Innovation. In: Baum, J.A., Singh, J.V., *Evolutionary Dynamics of Organizations*, Oxford University Press, New York/Oxford, pp. 425–443.

von Hippel, Eric (1988) *The Sources of Innovation* (New York: Oxford University Press).

Von Tunzelmann, N. 2001: Historical coevolution of governance and technology. Presented at the Conference "The Future of Innovation Studies" Eindhoven University of Technology, the Netherlands, 20th-23h September 2001.

Voss, J-P., R. Kemp, and D. Bauknecht (2005) 'Reflexive Governance: A View on the Emerging Path, forthcoming in J-P. Voss, D. Bauknecht and R. Kemp (eds.) *Reflexive Governance for Sustainable Development*, Edward Elgar, Cheltenham.

Walker, Warren E., S. Adnan Rahman, Jonathan Cave (2001) 'Adaptive Policies, Policy Analysis, and Policy-Making', *European Journal of Operational Research*,128: 282-289.

WCED (1987), *Our Common Future*, Oxford University Press, Oxford.

Weiss and Woodhouse (1992) Reframing Incrementalism: A constructive response to the critics. *Policy Sciences* 25 (3):255-73.

Wilkinson, R. and Cary, J., (2002) Sustainability as an Evolutionary Process, *The International Journal of Sustainable Development*, 5(4): 381- 391.