



UvA-DARE (Digital Academic Repository)

Acting locally, developing knowledge globally: a transitions perspective on designing climate change adaptation strategies

Grin, J.

Publication date
2010

Published in
From climate change to social change: perspectives on science-policy Interactions

[Link to publication](#)

Citation for published version (APA):

Grin, J. (2010). Acting locally, developing knowledge globally: a transitions perspective on designing climate change adaptation strategies. In J. Driessen, P. Leroy, & W. van Vierssen (Eds.), *From climate change to social change: perspectives on science-policy Interactions* (pp. 95-108). International Books.

General rights

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

5

Acting locally, developing knowledge globally: a transitions perspective on designing climate change adaptation strategies

John Grin

5.1 Introduction

In the first decade of the 21st century, climate change has come of age. No longer is the question: how serious a problem is climate change? Rather, the issue is what should societies do about it? In 2007, the Council for Housing, Spatial Planning and the Environment of the Dutch Government published a report with the telling title, *Beyond the hype – climate change as a structural spatial issue*. Equally tellingly, especially in view of the Low Countries' track record in water management, was the warning that current knowledge is insufficient for defining local responses to climate change, and that changes in the knowledge infrastructure would be needed in order to remedy this problem. How is it that climate change poses questions that, apparently, require fundamentally novel types of knowledge? What, more precisely, is the nature of these new types of knowledge? And, finally, what types of new arrangements may help to develop the novel types of knowledge needed to design adaptation strategies? These are the questions this essay seeks to address. Drawing on recent insights from the rapidly developing field of transition studies, we will argue that, once we recognize that the answer to the first question is fundamentally non-trivial, it becomes possible to identify a range of very practical responses to the second and third ones.

Transition studies are a rapidly expanding field of trans-disciplinary research, engaged with understanding transitions and how they may be influenced. While the field largely originated from the Netherlands (Rotmans et al., 2001; Elzen et al., 2005a), meanwhile the field has drawn attention from international scholarship in a variety of disciplines (cf. e.g. Berkhout et al. 2009; Voß et al., 2009; Smith et al,

2010). Transitions refer to a fundamental type of societal change: a change both in practices and in the structural context (institutions, physical infrastructure) in which these are embedded. The underlying assumptions are, first, that some of the more persistent problems confronting contemporary societies are so persistent because they are the (unintended) effects of dominant social practices, which, second are firmly rooted in the structures that have historically co-evolved with these practices. The corollary, third, is that resolution of such problems requires a change in both dominant socio-economic-technological practices and the structures that nurture them. (Grin et al., 2010)

While it would be wrong to claim that climate change adaptation strategies are bound to involve such radical change, we will argue in the next section that in many cases the problems to be overcome are structurally embedded to an extent that makes a transition perspective appropriate. Adopting the well-known insight from the sociology of science that knowledge practices and knowledge infrastructure tend to co-evolve with societal practices, this implies that truly novel types of knowledge may be needed for developing and implementing such strategies. This, put briefly, is the answer to our first question above.

In the next section, we will then deal with our second question by elaborating more precisely what kind of new knowledge is needed. Eventually, the arguments made in these two sections together lead to new demands on the interaction between science and policy and thus to a need for novel institutional arrangements, between social practices, science and policy. These new intermediaries are the subjects of the final section. Throughout this chapter, we will employ London's Thames Estuary 2100 Project as an empirical referent.

5.2 Novel types of knowledge for climate adaptation: why?

How is it that climate change adaptation poses questions that, apparently, require fundamentally novel types of knowledge? As we just claimed, from the perspective of transition studies the answer comes in two steps. First, problems of climate change adaptation often require fundamental change, in the sense of a transition; and, second, because scientific knowledge co-evolves with society, it is clear that existing knowledge and the incumbent knowledge infrastructure have been shaped by earlier societal practices; a transition is therefore likely to involve different types of knowledge and knowledge development practices, and novel pieces of knowledge infrastructure may be needed to nurture these.

Climate adaptation may involve transitions: the example of the Thames estuary

In order to further develop this still rather abstract answer to our first question, we will draw on the example of water management. Modern water management has

developed a tremendous capacity to make 'nature' serve societal demands. In London for instance, water management was to protect the city against potential Thames' flooding, to allow it the use of the river for economic and leisure purposes and to simultaneously use drainage and other systems to sustain the carrying capacity for buildings and the integrity of the metro network. This particular task division between water management and other practices has stabilized in physical structures, institutionalized rules, resource distributions, dominant discourses and actor identities.

However successful the accompanying modes of water management have been, the progress achieved has been accompanied by risks, side-effects and surprises. These have started to feed back into the mission statement of water management, and their relation to social and economic activities. The first surprise was that water managers had to learn to take into account a wider set of considerations than just controlling the water, as had always been their core business. When, in the mid 1970s, following prolonged debate and a series of advices, the Thames Barrier was being designed, it was clear that it could not only prevent flooding without hampering shipping. The winning design was chosen because, in addition, it minimised interference with the natural flow of the water.

The main reason for discussing these changes at some length is that it enables us to show how much more radical the changes are that may be involved in climate adaptation. To be sure, climate change has triggered discussions to whether the Thames barrier should be expanded in order to withstand higher amounts of water. But much more fundamental changes may be implied as well. There may be many different reasons for that. For instance, control mode water management in many instances had become counterproductive - for instance, if one drains a particular area strongly for long enough, the land gets low enough to make natural water flows revert, which may literally undermine structures such as dikes. And even apart from that, there is the question of the cost-effectiveness of measures to protect existing activities compared with adapting these activities. Whatever the precise circumstances and arguments, with the additional flows of water that climate change may bring from both the sea and the sky, water management's traditional, 'control mode', mission statement may become seriously disputed or even outright impossible.

Adaptation to climate change may then require that the tables are turned even more radically. No longer does it merely follow the demands of the socio-economic functions; on the contrary, water management demands start to co-determine social and economic functions. This awareness is indeed reflected in the current Thames Estuary 2001 Project, launched in 2002, with the aim to "develop an adaptable long term plan in the context of a changing estuary" as a response to the fact that the Thames is "changing in relation to its climate, people and property in

the floodplain and an underlying essential but ageing flood defence system” (www.thamesweb.com).

Upon closer scrutiny of the many plans at the project’s website, we see that under these wordings is a rather radical message: adaptation to climate change requires that water managers should no longer consider themselves as the mere the servants of ‘given’ social and economic practices; they – as well as the societal actors involved - have to learn that these practices might have to serve the demands of water management. This becomes clear, for instance, from the fact that commercial users of the area are stimulated to “set back from the riverside” all new riverside developments that do not require direct river access, in order to “enable the provision of public access between the proposed development and the river.” This is one measure out of several that should ensure that commercial activities thrive and grow “in harmony with the valuable nature conservation, heritage, recreation and landscape resources of the estuary.” Similarly, set aside of arable land and organic farming are promoted for the rural areas around the estuary. And, as a third example, planners are asked to encourage, amongst other things, “development proposals and changing land management regimes to maintain the traditional character and features of the estuary, particularly estuarine grazing marshes.”

Thus, in the Thames estuary, climate change adaptation strategies require paradigmatically new approaches of dealing with the relations between social and economic activities and their physical environment. They imply a fundamental change, not only in those practices that are relatively directly connected to the consequences of climate change - water management - but also in practices that have consequences for water management, such as industrial activity, agriculture and recreation. Because, as we noted, these practices and their relations have stabilized into physical and institutional structures, climate adaptation requires also structural change. Thus, it may be fruitful to consider climate change adaptation strategies as part of a transition.

While it is certainly true that adaptation strategies do not by definition imply the need for structural change, we will limit ourselves in this essay to those cases in which they do. As the above discussion suggests, these are certainly not exceptional cases. In such cases, a transition perspective may shed relevant new light on the nature of climate change adaptation strategies. More specifically, this perspective helps to appreciate that in these cases such strategies require different kinds of knowledge. By now, we are able to understand why this is the case. Basically, the reason is that the knowledge needed for adaptation strategies must be instrumental in understanding these changed relations between human activities, as well as between each of these activities and the environment.

5.3 Novel types of knowledge for climate adaptation: but what types,

more precisely?

A small chapter of modernization theory.

Let us now develop this tentative answer to our 'why' question a bit further. Modernization theory may help to both deepen our understanding of the example just discussed, and help generalize the implications which it suggests. For present purposes, the following, admittedly somewhat simplistic, account suffices. Since Enlightenment took off in the 16th and 17th centuries, the institutions of science and society (including the market and the state) have developed around a common orientation: the belief that scientific progress would yield social and economic progress. More precisely, the core of that faith consists of two dogmas. The first one is that it is possible to know Truth on the basis of universal knowledge, grounded in some Archimedal point. The second dogma is that it is possible to control reality on that basis, and that this capacity to control will yield social progress.

While this faith in progress through control was, in the trail of the work of Galileo, Newton and other natural scientists, initially primarily related to nature, it soon evolved into what Stephen Toulmin (1990) aptly calls a "cosmo-polis", a worldview that also included the idea of a controllable social reality. Guided by that worldview, institutions of state and society took shape and reached a mutual alignment that was tailored to nurture knowledge-driven progress. Functional differentiation occurred between domains, such as food production, water management or housing. Within such domains, 'society', especially the market's supply side and government, were supposed to help 'science' to realize advance on basis of 'autonomous' knowledge development. In addition, 'society', especially the user side of the market, would be ready to adopt the knowledge and technology thus produced. By and large, the first and second industrial revolutions have largely been guided by this paradigm. Both the particular, control-mode type of water management that prevailed until recently and its institutionalized relations to other domains may serve as an illustration.

Since around 1970, however, society has noted that this development has also brought with it risks and side effects. The well-known central thesis of Beck's (1992; 1999) theory of risk society is that these risks are nothing more than the reverse side of the coin of control mode, early modernization processes, and is thus intimately embedded in late modern society. The institutions of modern nation states that have co-evolved with simple modernisation processes, have developed blind spots for risks and side effects (constituting "unawareness", Beck 1999) and lack capacities for designing and pursuing strategies which are able to deal with them effectively. As a corollary, responses to risks and side effects require a critical scrutiny of society's practices and institutions, and a new mode of societal development. This re-orientation is designated as "reflexive modernization." As I have argued more extensively in Grin et al. (2010), the notion of reflexive

modernization may provide the normative orientation for sustainable transitions. The need to redefine, around the Thames estuary, practices from various domains, as well as their relations and their structural embedment, illustrate the point.

More specifically, the nature of knowledge may have to change in the process. Knowledge cannot plead 'not guilty' to the risks and side effects associated with early modernization. Modernisation processes promote, in the words of Scott, a "logic of homogenisation and virtual elimination of local knowledge" or, with an Aristotelian notion, of *mētis* - the craft to take contextual conditions into account (Scott, 1998, pp. 302, 309-341). This logic has on the one hand helped to generate risks and side effects, and on the other has reduced society's institutional capacity to be timely aware of them.

Therefore, according to Beck, 'subpolitics' is important for reflexive modernization. In practices of subpolitics, awareness of side effects and their root causes are attained and novel solutions may be designed. Such practices are located between domains, and may connect state, science and market in novel ways. Thus, they may help to overcome the functional differentiations that have come with early modernizations. They are informed by an increasingly knowledgeable civil society. Subpolitics does not rely on 'standard' expertise, but mobilizes a plurality of experts as well as sources of more informal or local knowledge in order to design modes of development driven by the desire to pre-empt risk. Subpolitics in his view is Habermasian communicative rationality, but freed from the constraints of Latourian dominance of dominant, institutionalized discourses. The Thames estuary 2100 project may be seen as a space, created to nurture such subpolitics.

The nature of novel knowledge for climate adaptation

Against this background, we may look again into the nature of the new knowledge required in our example. As we concluded above, new understanding is needed both of individual practices and their relations to the environment, and of these practices' relations to each other. Regarding the former, let us start with knowledge pertaining to water management practices. Metaphorically speaking, classical water knowledge involved theoretical models, water was conceived as the dependent variable, and socio-economic activity was treated as a constant or a parameter with a given, locally determined, value. In cases like the one just discussed, socio-economic activities become a variable as well. It is not difficult to imagine that this requires different models and methods for water management. For instance, in recent years, complex adaptive systems theory has been frequently used as the basis for integrally managing the water system and its social environment.

In a similar way, new theories may also be necessary for other practices, such as agriculture, to conceive of themselves and their environment in ways compatible with climate change adaptation. If the water cannot just be assumed to fulfil the demands of farming, agricultural practices need to be conceived of as partly

dependent on their environment. In fact, this awareness may be seen as the defining characteristic of organic farming, or other alternatives, such as system-oriented farming. This is of course why organic farming is now being promoted in the Thames estuary. We know from experiences within such practices that they indeed require very different conceptualizations of, for instance, animal health. In organic farming, health is maintained by mobilizing natural behaviour and natural interaction with the environment ('recursive control'; Bos et al., 2003) rather than through control through human interventions on organisms that are viewed apart from their environment ('directive control'). In a similar vein, the ecologically engineered, self-maintaining ditches now being proposed for the Thames estuary, are based on an integral understanding of social and ecological systems, as conceptualized in recent ecological work.

Against the background of Beck's notions of reflexive modernization and subpolitics, and Scott's plea for the restoration of *mētis*, there is reason to conclude that such knowledge needs are not unique for the Thames case (as other cases also indicate). Much more generally, the design of climate change adaptation strategies will require, first, the development of formal knowledge that does not depart from the control paradigm but rather is able to take in to due account local circumstances and needs. Second, they require the involvement of local stakeholders, who as Hodson & Marvin (2009) note in their evaluation of urban sustainability initiatives, bring as much knowledge and insight as they represent interests. Third, novel methods are needed in order to synthesize formal and informal knowledge in a locally sensible way. Clearly, by their nature, the precise knowledge needs may best be defined on basis of the experiences gained in innovative practices where formal and local, old and new knowledge is being mobilized to explore solutions.

The second type of new knowledge concerns the changed relations between water management and other social practices. Consider for instance a farmer who, in switching to a different mode of production, becomes also a water manager. That is, in addition to food production, he also co-generates a sound water system. In order to assess the economical implications, the concept of 'return-on-investment' should be broadened. This more integral definition is, however, not covered by existing calculation methods from agricultural economics', as similar cases in the Netherlands exemplify (Grin et al., 2004). In order to resolve such difficulties, economists would have to develop novel concepts and methods. Here again, it seems plausible that it may be beneficial to inform such efforts by the experiences of local innovative practices.

5.4 Knowledge development for climate change adaptation: where?

This takes us to our third question: where may the needs for the novel types of knowledge needed for adaptation be best defined? We have just seen that local, innovative practices seem to be the right spot. This, of course, is well in line with Beck's claim that subpolitical practices are the prime movers of reflexive modernization.

Yet the answer is too simple or, rather, too limited. The reason is that, as we have also noted, such local practices would be helped significantly if they could draw on a broader repertoire of theoretical concepts and methods. This is a task that goes beyond the competence of the actors engaged in such practices in and of themselves. To be sure, they may be able to identify to a significant extent missing knowledge, crucial uncertainties and disputed knowledge claim. Also, they may contribute their own local, experiential, praxeological knowledge to resolving this problem. But for identifying, with the required specificity, what (paradigmatically) new concepts and methods might be needed requires the co-operation of experts and scientists.

Yet, precisely because dominant knowledge practices co-evolve with dominant societal practices, defining the knowledge needs of novel practices is far from a trivial task, even (or: especially) for established experts. They may well rely on established knowledge rather than appreciate the 'alternative' types of knowledge that might help. To be sure, 'alternative' here should not be equated with 'esoteric.' Rather, it refers to different paradigms and professional discourses, as may be typically found at the outskirts of disciplines. Therefore, it seems quintessential for identifying novel knowledge needs to involve experts who are broadly knowledgeable about the various strands of understanding in their discipline, or to involve a diversity of experts each with his or her peculiar professional views.

Yet, while this is a necessary condition, it is not sufficient. How to distinguish between irresponsible claims on the presumed effectiveness of an ecologically engineered structure for water defence, and justified claims that development or application of different knowledge may help to demonstrate, or improve, its effectiveness? How to distinguish between a poor business proposition and a justified claim that a bank rejects an investment because its standard routines are based on an understanding that does not do justice to innovative practices? Answering such questions requires significant understanding of the nature of these practices, in relation to incumbent structure (Grin et al., 2004; Grin et al., 2010). Also, as Regeer (2010) has argued in her PhD thesis, it requires an understanding of the relation between different types of (traditional, novel) practices on the one hand, and different knowledge practices and associated claims on the other hand. Such 'translation work' is a far from trivial task, that which requires a specific set of competences. It does not seem reasonable to expect that this work be properly done by either practitioners or experts. Rather, it seems that there is a need for an entirely new kind of intermediary. A second crucial task of these intermediaries is

to contextually synthesize, on that basis, these different bits and pieces of formal and experiential, established and 'alternative' knowledge.

Such intermediaries may provide the institutional capacity to formulate, in a precise way, the knowledge needs associated with adaptation strategies. Related, they act as brokers between innovative practices and scientific research and facilitate exchange between different practices. In order to fulfill this role, intermediaries may develop, test and disseminate methods to support learning through monitoring of novel practices. Here again, insights into the substantive aspects of these practices may be synthesized with a historical-sociological understanding of how they relate to each other, the environment and societal structures (Schot & Geels, 2008). Over the past years, some experience has been gained with such analysis in the field of transition studies (Grin et al., 2004, Grin et al., 2010). More rigorous methods are currently being developed.

Over time, intermediaries may also start to fulfil other, further reaching tasks. Ideally, they may provide a particular project with *ex ante* advice on the concepts and methods that may be of help. While transition studies have yielded techniques like envisioning (Van Asselt et al., 2005), socio-technical scenarios (Elzen et al., 2005b) and vision assessment (Grin & Grunwald, 2000), the successful application of such techniques co-depends on substantive understanding of the problematic. Professionals with experience in a variety of transition practices may provide such understanding. Also, they may facilitate learning between projects at different loci.

Where may such intermediaries be located? To be sure, national programmes for climate adaptation may make significant contributions. But it seems better to conceive of these contributions as inputs in a wider, transnational process of research programming and knowledge development; science is an essentially transnational undertaking, and policy makers increasingly recognize the need to learn across borders. In fact, there is a range of transnational initiatives that recognize the need to connect local projects for actually 'doing' adaptation to identifying and developing the necessary knowledge. Returning to our London case, there are actually interesting candidates to fulfil this translation function: European intermediaries for urban responses to climate change. These have emerged as globalization has led to an increased commonality in the challenges that global cities face, as well as to a new set of opportunities of dealing with them through mobilizing global interconnections. These intermediaries tie together world cities that share a sense of urgency to adapt to climate change in order to maintain their global economic position, maintain their capacity to accommodate societal need and preserve their cultural heritage.

In an evaluation of these intermediaries, Hodson & Marvin (2009) conclude that in order to succeed, such "intermediaries must constantly work at developing and re-developing the knowledge base which they have access to" in order to help cities to integrate a wide variety of formal and local forms of knowledge and societal

perspectives: recreation, eco-stability, water management, urban economics etc. Also, they need to connect to local practices as well as transnational science and policy venues. Their work confirms both that this requires a peculiar set of non-standard competences, and that it is not an easy task to develop such institutional capacity. In fact, Hodson & Marvin have found that maintaining personnel with the required experience, competences and lived insight, is a crucial condition for success of such intermediaries.

5.5 Concluding remarks

In the preceding sections, I have drawn upon both theoretical presumptions and the case of the Thames Estuary Project to argue that (and why) climate adaptation strategies will often require radically novel practices – practices that also demand changes in social structure. Whenever this is the case, it may help to consider such practices as part of a transition: a process of change in both practices and structures. This poses specific demands on strategies for climate adaptations: they should go beyond the ‘self-evident’. Obviously, designing such strategies require a significant degree of reflexivity.

More specifically, we have argued that sustainable transitions imply a departure from the typically modern ‘control-mode’ patterns of development and associated structures. Designing strategies that may contribute to such a transition thus requires a departure from the exclusive focus on the types of knowledge that have co-evolved with these control-mode patterns. The contextual, experiential knowledge of practitioners is likely to become more important. Also, more than in designing ‘normal’ strategies, it becomes necessary to appreciate the diversity in knowledge practices, and their relations to alternative social practices. This implies a demand for novel types of intermediaries, with special competence in ‘translating’ between them. As we have seen, such intermediaries are indeed developing, especially at the transnational level.

To sum up, a transition perspective draws attention to the need to draw on a diverse knowledge base when designing climate change adaptation strategies; in addition to established experts, also experts who are knowledgeable on less dominant paradigms, a variety of practitioners, and, last but not least, intermediaries who may skilfully broker between all these actors. It is important to realize that the development of social practices in response to climate change may depend to a significant extent on the degree to which this new knowledge infrastructure will actually emerge, as well as on the precise ways in which the actors involved act and interact. It is essential to further reflect on the democratic ramifications of this state of affairs. How to legitimately define inclusion or exclusion of particular types of knowledge? How to warrant accountability of the

main players involved? This issue, crucially important in further shaping knowledge society, was recently put on the agenda through a conference on 'knowledge democracy' (www.knowledgedemocracy.nl). It requires much more critical scrutiny than it has hitherto got. It is a crucial responsibility of those involved in designing climate change adaptation strategies and associate knowledge to contribute to this debate as well as to take into account the insights and warning signs that this debate will undoubtedly generate.

References

- Beck, U (1992) *Risk Society*, Polity Press, Cambridge
- Beck, U (1999) *World Risk Society*, Polity Press, Cambridge
- Berkhout, F, Angel, D, Wieczorek, A J (2009) Special issue on 'Sustainability transitions in developing Asia: Are alternative development pathways likely?', *Technological Forecasting and Social Change*, vol 76(2)
- Bos, B, Groot Koerkamp, P & Groenestein, K (2003) 'A novel design approach for livestock housing based on recursive control - with examples to reduce environmental pollution', *Livestock Production Science*, vol 84, pp 157-170
- Elzen, B, Geels, F W & Green, K (eds) (2005a) *System Innovation and the Transition to Sustainability. Theory, Evidence and Policy*, Edward Elgar, Cheltenham
- Elzen, B, Geels, F W, Hoffman, P S & Green, K (2005b) 'Socio-technical scenarios as a tool for transition policy: an example from the traffic and transport domain', in: Elzen, B, Geels, F W & Green, K (eds) *System Innovation and the Transition to Sustainability. Theory, Evidence and Policy*, Edward Elgar, Cheltenham, pp 251-281.
- Grin, J & Grunwald, A (eds) (2000) *Vision Assessment: Shaping Technology in 21st century society. Towards a repertoire for Technology Assessment*, Springer Verlag, Heidelberg
- Grin, J, Felix, F, Bos, B & Spoelstra, S (2004) 'Practices for reflexive design: lessons from a Dutch programme on sustainable agriculture', *International Journal for Foresight and Innovation Policy*, vol 1(1-2), pp 126-149
- Grin, J, Rotmans, J & Schot, J (2010) *Transitions Toward Sustainable Development. New Directions in the Study of Long-term Change*, Routledge, New York
- Hodson, M & Marvin, S (2009) 'Cities mediating technological transitions: understanding visions, intermediation and consequences', *Technology Analysis and Strategic Management*, 515-34
- Regeer, B (2010) *Evaluating the Development of Strategies to deal with Persistent Problems. Changes in Knowledge Production for Sustainable Agriculture and Urban Development*, Free University, Amsterdam (dissertation)
- Rotmans, J, Kemp, R & Van Asselt, M B A (2001) 'More evolution than revolution: transition management in public policy', *Foresight*, vol 3(1), pp 15-31

- Smith, A, Voß, J-P & Grin, J (eds) (2010). Special section on 'Innovation and sustainable development: the allure and challenges in adopting a multi-level transitions perspective', *Research Policy* (forthcoming)
- Schot, J W & Geels, F W (2008), 'Strategic niche management and sustainable innovation journeys: Theory, findings, research agenda and policy', *Technology Analysis & Strategic Management*, vol 20(5), pp 537-554
- Scott, J (1998) *Seeing like a State*, Yale University Press, New Haven.
- Toulmin, Stephen (1990). *Cosmopolis. The hidden agenda of modernity*. Chicago: University of Chicago Press.
- Van Asselt, M, Rotmans, J, & Rothman, D S (eds) (2005) *Scenario Innovation: Experiences from a European Experimental Garden*, Francis and Taylor, London
- Voß, J-P, Smith, A & Grin, J (eds) (2009). Special issue on 'Transition Management as Long-Term Planning', *Policy Sciences*, vol. 42(4)