Pilot projects and their diffusion: a case study of integrated coastal management in South Africa

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Abstract: Pilot projects are policy instruments mainly applied to introduce or test new practices, concepts or technologies. Pilot projects can lead to a broader policy transition. However, the diffusion process associated with the pilot projects is not well understood. In this paper, we investigate the diffusion of pilot projects, focusing on the nature of the diffusion (the innovation itself, cooperation, methodologies or institutional designs), the channels of diffusion (internal and external) and the patterns of diffusion (dissemination, expansion and institutionalisation). The analytical framework developed for pilot project diffusion is applied to the Saldanha Bay project in South Africa, yielding additional insights on the functioning of the pilot, its contribution to the diffusion of the innovation and so to a policy transition in South African coastal zone management. Finally, we identify types of pilot project and the accompanying design choices that are most suitable for transition management.

Keywords: pilot project; integrated coastal management; ICM; Saldanha Bay; South Africa; innovation; diffusion; transition management; policy change; policy implementation.

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1 Introduction

Pilot projects are often used in policy and management contexts to apply and adapt an innovation to a real-world situation (Lee, 1999). Pilot projects are seen as means to test innovations and to develop knowledge about the interactions of the innovation and the context (Lee, 1999; Raven 2007). Pilot projects are particularly considered as means to deal with the complexity of socio-ecological systems (Dehnhardt and Petschow, 2008; Ker Rault, 2008; Olsson et al., 2004), to enhance communication across actors and domains, to set the agenda and to streamline resources (Pahl-Wostl, 2006; Pawson and Tilley, 1997). Within the pilot projects social and policy learning can be realised, leading to changes in perceptions and practices (Brown et al., 2003; Weiss, 1980). As such, pilot projects function as ‘the stepping stones for societal change’ (van Sandick and

Weterings, 2008) and stimulate transitions (Frantzeskaki et al., 2008; Loorbach, 2007; Van den Bosch, 2010).

Pilot projects can serve multiple goals, including implementing policies and exploring policy alternatives (Vreugdenhil et al., 2010), but in the light of transition management, pilot projects are considered successful when they have clear follow up (van Mierlo, 2002). This 'diffusion' is manifested in different forms and in different places (Douthwaite et al., 2003; Vreugdenhil and Ker Rault, 2010). For example, the innovation itself or the supporting cooperative structures can be diffused. The diffusion can be to new pilot projects or can be a scaling up to full-scale projects or institutions. Pilot projects have been designed and applied in diverse policy domains such as health care (Baumgartner and Jones, 2002), social policies (Greenberg and Shroder, 2004) and mobility (Hoogma et al., 2002), but in this paper we focus on water management. Water management is facing increasing challenges owing to developments such as globalisation, climate change and increasing demand. These ongoing developments require new approaches that allow testing on a small scale to prevent the possibility of larger policy flaws and that also allow the system to remain flexible (Pawson and Tilley, 1997; Pahl-Wostl, 2006).

Despite the promising nature of the potential contributions of pilot projects to policy development, their actual impact on policy development is often limited, constituting no more than 'learning from failure' (Bennett and Howlett, 1992; De Groen et al., 2004; Sanderson, 2002; Raven, 2007). The nature, patterns, channels and conditions of diffusion are little understood because despite their wide use, pilot projects are rarely studied in depth. The objective of this paper is to deepen understanding of the diffusion process of pilot projects. The research question addressed is: How does a pilot project diffuse into policy-making and practice and thereby contribute to a transition process?

More specifically, the nature of the diffusion, the different patterns of diffusion and the factors influencing the diffusion process are researched and analysed using both theory and case study methods. Additionally, we identify which types of pilot projects are the most suitable for transition management. The classification of Vreugdenhil et al. (2010), who distinguish nine different types of pilot projects, is used in this analysis. Further, an understanding of pilot projects and their diffusion provides policy developers with insights to develop strategies for applying and diffusing pilot projects.

After briefly describing the approach adopted in the study (Section 2) we go on to develop a framework for analysing the nature (characteristics and uses) of pilot projects (Section 3) and their diffusion processes (Section 4). The framework is used to analyse a water management case study in Saldanha Bay, South Africa (Section 5). The case study provides insight into the pilot project's dynamics and the mechanisms contributing to its diffusion. In the discussion, the suitability of different pilot project types for transition management are assessed (Section 6).

2 Study approach

The study is undertaken in three major steps. The first step is the development of a framework that describes the characteristics and uses of pilot projects and the patterns, nature, and channels of diffusion. The second step is the application of the analysis framework to a case study of an integrated coastal zone management project in Saldanha

Bay, South Africa. The third step involves reflecting on the insights from the case study and distilling further insights on the use of pilot projects for transition management.

The development of the framework is based on a literature study, drawing from fields such as innovation studies (Rogers, 2003), evaluation (Campbell, 1975; Martin and Sanderson, 1999; Pawson and Tilley, 1997; Sanderson, 2002; Weiss, 1975, 1980), transition management and adaptive management (Gunderson, 1999; Hoogma et al., 2002; Huitema et al., 2009; Lee, 1999; Pahl-Wostl, 2006; Rotmans, 2003). By applying the analysis framework to the case study we test its usability, learn more about the specific case study and its diffusion patterns, and develop insights into the pilot project diffusion process.

Additionally, explanations of the identified diffusion mechanisms and the hurdles to diffusion encountered in the case study are offered. Case study research in general can be useful in developing context-dependent knowledge and as such can contribute to the body of knowledge on pilot projects and diffusion (Flyvbjerg, 2006). The case has been selected because it provides an example of a conceptual innovation in the water and coastal management field with a strong focus on participatory approaches. In the case study we follow the approach of analytic progression as described by Miles and Huberman (1994), meaning that we first reconstruct the story line after which we converge towards more specific analyses. Data have been derived from the grey literature and through the active participation in the project of the second author. The author actively participated in the development of a marine water quality management framework for the particular study area from 2001 to 2003 in consultation with local stakeholders. Thereafter interaction with local stakeholders occurred mainly through attendance of the annual local forum meeting or responding to *ad hoc* enquiries. As such, the project development and group dynamics could be observed from inside and decisions could be discussed to increase understanding of the motivations. Additionally, views on more generic water policy and the hurdles to diffusion of the project could be discussed with the stakeholders.

3 Nature of pilot projects

To understand the role pilot projects can play in water policy transitions, we first discuss the nature of pilot projects. Following Vreugdenhil et al. (2010), we discuss the nature of pilot projects on the basis of pilot characteristics, how they are used, how they evolve through interaction with their context and which effects they achieve. The insights provide the input for the description of the diffusion process developed in the following section.

3.1 Characteristics and uses of pilot projects

Pilot projects are widely present in water management even though formal descriptions of the construct are lacking. Practitioners and citizens involved in the pilot mainly attribute innovation, testing and small scale to pilot projects. However, the study from Vreugdenhil et al. (2010) reveals that pilot projects manifest wide variety in their design (e.g., variety of the level and type of innovation, types of actors are involved, scheduling of involvement) and a broad scope of uses.

Shared characteristics of pilot projects include their application in the field (in contrast to laboratory experiments or desk research) and their 'spirit of experimentation' (Weiss, 1975) (in contrast to 'normal' management projects). In addition to these shared characteristics, six main characteristics can be identified that vary in their presence and nature across pilot projects. Every pilot has different 'values' for each of these characteristics, thereby making every pilot project a custom-made design for the policy domain to which it is applied [for an extensive discussion on the characteristics and uses of pilot projects, see Vreugdenhil et al. (2010)]. These characteristics include:

1 scale

2 innovation (level, driver, type)

3 knowledge orientation (monitoring type and intensity, knowledge and learning types, knowledge stance)

4 special status (attitude, flexibility, resource allocation)

5 relation to policy and local context (local dependency, connection to policy, incidence of occurrence)

6 actor network (initiators, participants, governance style).

In our research, we conceptualise pilot projects as an umbrella term for projects that are undertaken in the 'spirit of experimentation' in a field setting. This means they are built around the application of an innovation and can be differentiated from 'routine' management projects, desk research and laboratory experiments and thus have some special status, resulting in 'different than normal' attitudes and possibly, also different than normal treatments. Their flexible nature makes them applicable in different situations; but at the same time this flexibility can lead to different expectations. From the characteristics we can identify both design dimensions, i.e., those characteristics that can be actively designed, and contextual dimensions that are determined by the context (see Table 1). Note that characteristics that are a design dimension in one project can be a contextual dimension in another.

Table 1 Design dimensions and contextual dimensions

Characteristic	*Design dimension*	*Contextual dimension*
Relation to policy and local context	-	Position towards policies and management
		Local contextual dependence
		Incidence of occurrence
Scale	Scale limitations	-
	Reversibility	
Innovation	Level of innovation	Type of driver of innovation
	Type of innovation	
Knowledge orientation	Knowledge creation design	-
	Learning design	

Table 1 Design dimensions and contextual dimensions (continued)

Characteristic	*Design dimension*	*Contextual dimension*
Special status	Flexibility	Attitude towards pilot
	Resource availability	
Actor network	Initiator	External actors
	Involved actors	External governance style
	Governance/management style	

Among the different types of knowledge development tools, such as mathematical modelling or laboratory experiments, pilot projects are distinctive in the fact that they are undertaken in a field setting (Lee, 1999). This means that there is always an interaction of the pilots with the context. Context includes the biophysical, socio-economic and institutional components. The biophysical context consists of factors such as the water system and infrastructures; the institutional context consists of factors such as rules, policies or organisations (North, 1990), and the socio-economic context consists of problem perceptions, attitudes and economic structures. Contexts are dynamic, causing the character of the pilot to change over time.

Besides their characteristics, as a second aspect of the nature of pilot projects, different pilot project types can be identified on the basis of their use for different purposes. The research of Vreugdenhil et al. (2010) and Huitema et al. (2009) reveals that pilot projects can be used for at least nine purposes within the categories of research pilot, management pilot and political-entrepreneurial pilot. Research pilot projects focus on knowledge development. They aim to fill knowledge gaps identified using research techniques other than mathematical modelling (Walters, 1997) and can inform policy-making (Weiss, 1975). This knowledge development can take place through early evaluation of policies at small scale before they are rolled out (Cabinet Office, 2003) or through exploration of innovations in practical settings. Management pilot projects are used for communication, problem mitigation, policy implementation and as insurance. This implies that communication and accompanying social learning processes are initiated by the pilot, practical problems are resolved with innovative solutions, the implementation of policies is facilitated and risks are reduced which allows actors to participate. Political-entrepreneurial pilot projects are used to influence a policy process for personal or strategic reasons. The pilot projects are used for political games, incentive and advocacy. This implies that pilot projects are used as a diversionary tactic, to delay decision-making or to save political face, to create conditions to support innovation processes, and to convince opponents or potential users to apply the innovation on a large scale. Different types of state and non-state actors can use this type of pilot project to diffuse their ideas (Stone, 2000).

In Table 2, an overview is given of the three categories and nine uses of pilot projects.

Table 2 Nine pilot project uses

Type of pilot	*Pilot project use*
Research pilot project	*Exploration* (innovation testing and refining, gaining experience)
	Evaluation (early policy evaluation)
Management pilot project	*Communication (*triggering dialogue, setting up new cooperation)
	Problem mitigation (resolve a practical problem for which tools are lacking)
	*Policy implementation (*policy enforcement, creating favourable conditions for implementation)
	Insurance (allow for (personal) failure, small impact, prevent large policy flaws, dealing with uncertainties)
Political-entrepreneurial pilot project	*Incentive* (creating favourable conditions for society to innovate)
	Political game (hidden intentions, e.g., delaying policy decisions, shifting attention, commercial interest in pilot itself)
	*Advocacy tool (*convincing, demonstrating, accumulating evidence, lobby for its use after the pilot)

3.2 The evolution of pilot projects

Within a pilot project, different activities can be recognised after the *initiation* in which the idea is transformed into a formal pilot project with a project plan to which resources are dedicated. The five activities include

1 *process design*: setting up actor participation and planning activities to be undertaken

2 *design of the intervention*: shape, duration, scale of measure

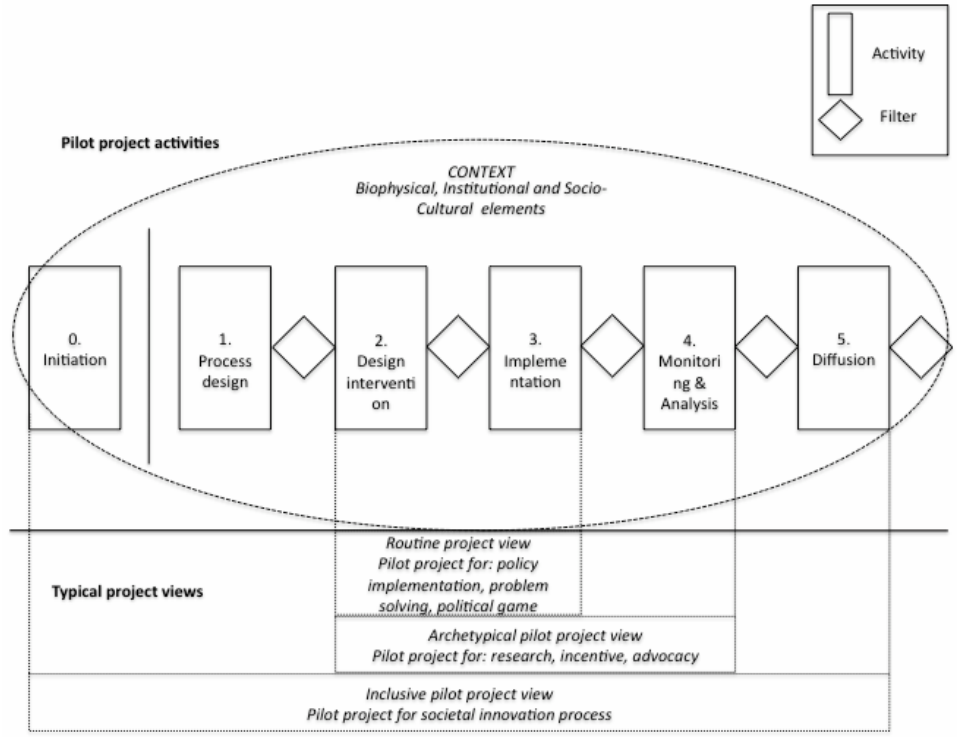
3 implementation of the intervention in the field

4 *monitoring and analysis*

5 *diffusion*: the spread of the innovation or feedback of knowledge from the pilot into practice and policy-making and so reconnection of the pilot with broader innovation development.

The activities are depicted in Figure 1. Despite the depiction of the activities as a sequential process, in practice activities can be initiated earlier or in parallel. For instance, monitoring can commence prior to implementation to gain insight in the reference situation, or during initiation both process and design intervention questions may have been already addressed. Moreover, in a pilot not all activities have to be undertaken. Most commonly the activity ‘implementation of an intervention in the field’ is considered the core of a pilot and it is this most narrow meaning that is typically accorded to the term ‘pilot project’.

Figure 1 Pilot project activities and typical project views on inclusion of activities for different pilot uses



A basic assumption of the pilot process as depicted in Figure 1 is that it is a process of reduction and adjustment. The 'filters' are indicated by diamonds. Not all ideas make it into the initiation of a pilot project and even when the hurdle to get approval for the initiation of a pilot has been achieved, the level of innovation of the ideas has been reduced. Biophysical and particularly social constraints become evident during the process and intervention designs. Some projects will encounter such hurdles that the decision is made not to continue. The same holds true for monitoring and analysis, which, despite the seemingly rational nature of the activity, is subject to interpretation. Lastly, even if all previous activities have been undertaken, diffusion can be very limited due to various reasons such as disappointing results, bad relationships, shifts in policy attention and limited marketing. Additionally, in pilots used as end goals in themselves (e.g., to resolve a local issue) diffusion is not of interest and the pilot is not intended to be part of an innovation process. Accordingly, the pilot process works as a filter for broader societal innovation processes.

In the lower part of Figure 1, typical project views are depicted with the type of pilot project uses that fit these views. It shows that in a narrow routine project view, a focus exists on design and implementation. This works well when the project is a means to achieve policy implementation or as a political game to divert attention. In a typical pilot project view, the routine view is expanded to include monitoring and analysis, even though in reality this activity is often the first to be reduced when time or finances are tight. Pilot project uses that fit into this view include research pilots, as well as incentives

for innovation and advocacy pilots. Nevertheless, in this paper, we apply an inclusive project view for the purpose of transitions. Under this view diffusion is an explicit part of a pilot project, and all knowledge related activities should also be included in the initial project plan. Only in this way can the connection to broader societal innovation processes be established. However, if the purpose is explicitly not to do this, a more narrow view suffices. This inclusive view does not mean that all activities are necessary for diffusion to occur or to consider a project as a pilot project. For instance, some projects show diffusion into management before implementation and monitoring; the initiation, process and intervention design providing sufficient triggers to initiate diffusion. Moreover, diffusion can be of a diverse nature (e.g., the concept, associated knowledge or cooperation). Diffusion is discussed further in the next section.

3.3 Effects of pilot projects

Pilot projects can result in three different types of effects. The first lies in the responses of the biophysical and actor-network systems. Second, knowledge is developed through knowledge creation and learning. Third, and of direct importance for policy transitions, the pilot project can diffuse into routine management and policy. Since the three types of effects are interdependent, we first address the system's response and knowledge development to grasp a pilot's impact on its context. In section 4 we follow this by going into diffusion in more detail.

3.3.1 System's response

The first and most direct effect a pilot project generates is the change in, and consequent response of, the biophysical system and actor-network that are affected by the pilot project (Vreugdenhil et al., 2009; Vreugdenhil and Slinger, 2009). The implementation of a pilot project influences the biophysical system, at least at the pilot project site and possibly beyond. For example, when a pilot concerns the excavation of a secondary channel in a floodplain, the site and possibly also the present infrastructures are adapted. Immediately after, the river system starts to respond with sedimentation and vegetation colonisation processes to find a new 'equilibrium'. In addition to the biophysical response, actor-networks respond to the pilot project. Actor-networks are social structures of actors and their relationships (Quist, 2007). The actors in the network have different goals, interests and resources and depend on each other for the realisation of their goals. Actors can be individuals, groups of individuals, organisations, groups of organisations or units of organisations in both the public and private sector (Adam and Kriesi, 2007; de Bruijn and ten Heuvelhof, 2008). In pilot projects, different disciplines and interests meet, and so they are often developed by project teams with different actors (Van den Bosch, 2010). Each of the actors, whether they are user, developer or stakeholder or are governmental, non-governmental or commercial, has their own motivation to participate in or initiate a pilot project (Raven et al., 2008). The actor-network response is not only a response to the intervention, like the biophysical response, but can take place even when only discussing the initiation of a pilot. Due to the initiation and development of the pilot, the actor-network is activated (e.g., actors start cooperating), triggered by expectations (van Lente, 1993), or altered whereby new forms of cooperation emerge. Ongoing development of the pilot (e.g., the implementation) might also attract new actors and make others decide to leave the network. Additionally,

the network creates its own dynamics whereby actors respond to earlier changes in the actor-network, because actors learn from, and about, each other and the system. As a result, problem perceptions, interests, resource structures and relationships change. Except for insight in responses of actor-networks as an effect of pilot projects, understanding these effects is crucial in understanding how pilot projects can foster or hinder change in decision-making and diffusion of the innovation that occurs through the network (Rogers, 2003). Actor-networks function as mirrors of change (Quist, 2007) and diffusion occurs through the network.

3.3.2 Knowledge development

Knowledge development is often claimed as the main goal of pilot projects and provides them legitimacy (Pawson and Tilley, 1997; Vreugdenhil et al., 2010). With the knowledge developed, questions can be answered, opponents convinced, 'evidence' provided for policies and competitive advantages developed. Therefore, knowledge is a source of power (Nonaka and Takeuchi, 1995). However, the intensity of focus on knowledge can vary and the knowledge that is eventually developed can be diverse. Knowledge development includes which knowledge has been created as well as what has been learned by whom as a result of the pilot, including how it is distributed and revised (Bhatt, 2000, Vreugdenhil et al., 2009; Vreugdenhil and Slinger, 2009).

The quality and quantity of created knowledge depends not only on the design of the pilot and the type of monitoring, but also on the monitoring intensity, analytical process and identification of research gaps. Moreover, frames and ambiguity influence what is focussed on and recognised (Sabatier, 1988; Schön and Rein, 1994). The nature of knowledge developed in pilot projects can be described along three dimensions. A first distinction can be made between substantive and process knowledge (Dosi et al., 1988). Examples of substantive knowledge include knowledge on the biophysical system, on methodologies and on technologies. Examples of process knowledge include knowledge on developments of the project, on interactions between actors and on management approaches. A second distinction can be made between theoretical or generic knowledge and contextual knowledge (Flyvbjerg, 2006). Where theoretical knowledge is generically applicable, or at least it is known in which situations it is applicable, contextual knowledge is directly related to a particular context. Examples of contextual knowledge include the presence of interests and the interaction of the innovation with the context, such as the response of the biophysical system at that location and time. Contextual knowledge is in the first place not meant to be transferable, but if it is, it only keeps its value if it remains contextualised. Decontextualised knowledge loses its value. A third distinction can be made between hard and soft knowledge (Nonaka and Takeuchi, 1995). Hard or 'objective' knowledge is often written down in detail in manuals, articles and study books, which often contain hard, quantifiable data (Nonaka and Takeuchi, 1995) or explicit qualitative data such as organisation structures. Soft or 'subjective' knowledge is embedded in individuals, such as intuition, experience and ideals, or between actors and is mainly learned through practice, social interactions and practical examples. Examples include experience and shared values. In pilots, the tacit knowledge of participants is sometimes explicated, but the formulation of principles and theories is often incongruent with the understanding of practice (Flyvbjerg, 2001). As a result of the interactions in pilot projects, new soft knowledge, such as building relationships, is developed.

Knowledge only becomes valuable when it is being learned. For the purpose of this paper learning means that knowledge is internalised and applied (Argyris and Schön, 1996; Bhatt, 2000; Muro and Jeffrey, 2008). Note that 'applied' can also mean a deliberative choice to not use the knowledge. Both actors within the pilot and external actors can learn, but internal actors are more in contact with the knowledge and so are more likely to learn more. So, depending on the actor involvement design of the pilot, the group of learners can be adjusted. The level of what is being learned is limited by the quality and quantity of knowledge that is created. The type of learning varies between rule-based learning, social learning and gaining experience (e.g., Dreyfus and Dreyfus, 1984; Muro and Jeffrey, 2008; Pahl-Wostl, 2006; Pahl-Wostl et al., 2008). Rule-based learning mostly focuses on hard knowledge, while through social learning shared meanings and values are developed at the actor level, which provides a basis for joint action. In all instances, actors learn through experiencing, although the nature can differ. This is a powerful aspect of pilot projects that is very convincing both for participants and external actors (Flyvbjerg, 2001). In practice, all three modes of learning can take place in one pilot project, but it is the emphasis that changes across pilots. Furthermore, the extent and type of learning not only depends on what is transmitted, but also by whom it is received and how (Sabatier, 1988). For instance, quantifiable factors between which easily causal relations can be observed are more easily accepted than less obvious causal relations (ibid.) and every actor has their own mind-frame that works as a filter and so guides what is recognised (Nilsson, 2005). Who learns and what they learn further determines what is done with the knowledge and so whether goals such as policy learning or diffusion of the innovation can be achieved.

3.3.3 Diffusion

As a consequence of the system's response and actors' knowledge development, pilot projects can form the starting point for changed action. This can be done within the pilot project to improve the innovation itself or its application at the pilot site. Diffusion of an innovation has been extensively described by Rogers (2003). He defined diffusion as the process by which the innovation is communicated through certain channels over time among the members of a social system. Adoption is the actual decision of an individual to use the innovation. However, the diffusion of pilot projects in public space, dealing with complex problems, is of a different nature. Different forms of diffusion can take place, either actively or passively induced. The pilot project itself can be expanded in time and place and the innovation or developed knowledge can be spread in new or existing projects and into policies. We elaborate on the diffusion of pilot projects in water management in the following section.

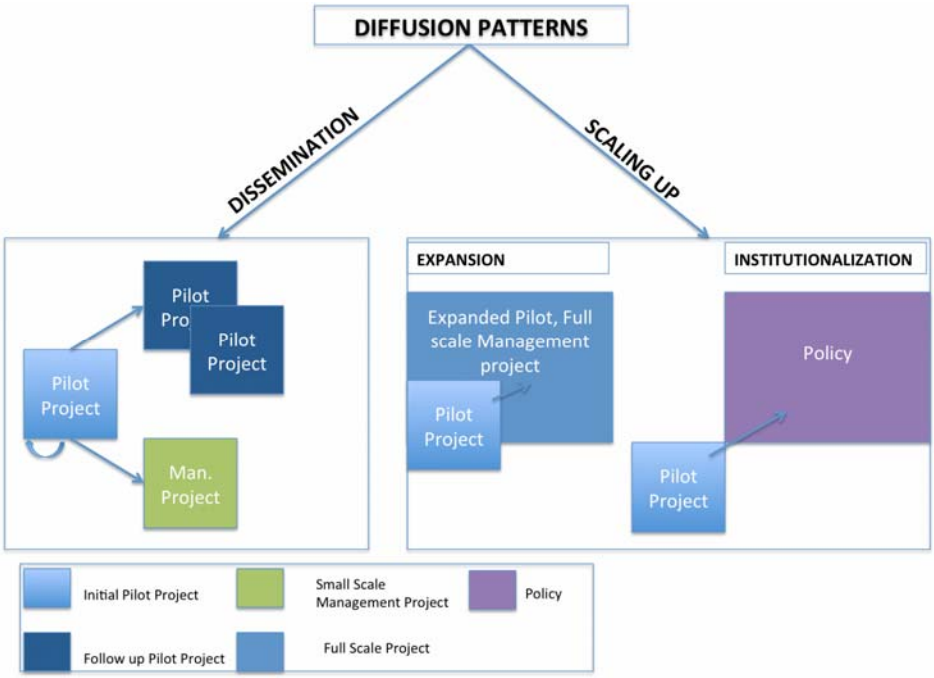
4 Diffusion of pilot projects

A policy transition can be realised by the diffusion of small-scale innovations such as pilot projects. By 'diffusion' we mean the broader application of (elements of) the innovation first applied in a pilot project. We deliberately exercise a broader definition than that commonly used in the literature, where diffusion focuses on the innovation per se (e.g., Rogers, 2003; van Mierlo, 2002), and we instead describe diffusion in terms of the patterns, nature and channels of diffusion.

4.1 Patterns of diffusion

Diffusion patterns are conceptualised as *dissemination* and *scaling up* (see Figure 2). 'Dissemination' includes the replication of the 'translated' pilot project to other pilot projects or to comparable management projects in other locations or at other times. The context changes while the scales and accompanying types of issue addressed and levels of complexity remain comparable. The stakeholder group also remains comparable (e.g., from farmer to farmer) (Douthwaite et al., 2003; Van den Bosch, 2010). Dissemination can also refer to dissemination of related knowledge that is, for instance, used within the pilot to improve the innovation or adapt the pilot to local circumstances. In contrast, 'scaling up' refers to increasing the scale dimensions of the pilot project, whereby the qualitative and quantitative nature of the problem changes. More actors, interests and administrative layers are included and different biophysical processes start to play a role. Consequently, scaling up increases the number of relationships and uncertainties and so the complexity of the problem addressed. In the case of "*expansion*", the initial pilot is expanded in the scale dimensions of time, space (e.g., from floodplain to river branch) and problem scope (e.g., more issues included) and consequently more administrative bodies and layers are included (Douthwaite et al., 2003). The pilot can also be the basis for a full-scale management project that is grounded in the lessons of the pilot. Here, the diffusion remains at the operational level. In the case of "*institutionalisation*", in contrast, full-scale regional or national policies and regulations are initiated or adapted based on the pilot project. The knowledge becomes part of the standard practice of governmental bodies. Again, the different scale dimensions (time, space, problem scope) are expanded.

Figure 2 Diffusion of pilot projects consists of dissemination and scaling up (see online version for colours)



4.2 Nature of what is being diffused

The nature of what is being diffused can be considered narrowly or broadly. By narrow diffusion the adoption and use of the innovation is meant, which makes diffusion a tangible indicator of pilot effectiveness (van Mierlo, 2002). However, this view works for artefacts but does not take into account the soft or partial aspects of the pilot that can be diffused. We therefore adopt a broad view of what can be diffused, and include artefacts as well as hard and soft knowledge. Examples of artefacts include specific types of dykes or groynes, and also specific designs. Artefacts are of particular importance in commercial contexts and in pilots that are initiated to test technologies. Examples of hard knowledge, which is generally explicated in handbooks or articles, include knowledge about the design of the innovation, quantifiable impacts such as changes in water quality, and also formal institutional structures. Soft knowledge includes knowledge often in the form of experience on power structures, actor relations, shared values and dilemmas over scarce resources, possibly clustered in participative structures. Pilot projects dealing with water management concepts often have the potential for the development of both hard and soft knowledge and so have the potential for this knowledge to be diffused, either in formal or in informal ways. This may include both what is considered successful and what is considered a failure. However, in practice the emphasis often lies on the development and diffusion of formalised hard knowledge – if any emphasis is given to diffusion at all. The lack of emphasis on diffusing soft knowledge arises because soft knowledge is itself not recognised and is also particularly difficult to diffuse as it is context-dependent and embedded in individuals. An additional complicating factor is that for diffused soft knowledge to become visible, it needs to be made explicit (e.g., through cooperation with a certain actor).

4.3 Channels of diffusion

Channels of diffusion refer to the actors promoting the diffusion of pilot projects (Rogers, 2003). The channels of diffusion are based on who takes ownership of diffusion. This is of particular importance for soft knowledge because the experience gained and the social values are embedded in individuals, more than in reports. We identify three different channels of diffusion (Vreugdenhil and Ker Rault, 2009). On the one hand, the channel of diffusion is based on the actors that experienced the pilot: the "*internal channel*". The people involved in the pilot project expand the pilot or develop new projects. On the other hand, the channel of diffusion relies on actors external to the pilot project: the "*external channel*". External actors decide to adopt the concept, independently of the initiators of the pilot project. They have seen and heard about the pilot and decide to use it. In between these two types of actors, we propose a third type of diffusion channel: "*internal-external partnership*". The diffusion is promoted by a joint partnership between actors with experience in the pilot and those willing to promote the innovation, but external to the pilot. This broadens the network of actors familiar with the newly developed concept.

5 Example of a pilot project in coastal zone management: the development of the Saldanha Bay Water Quality Trust

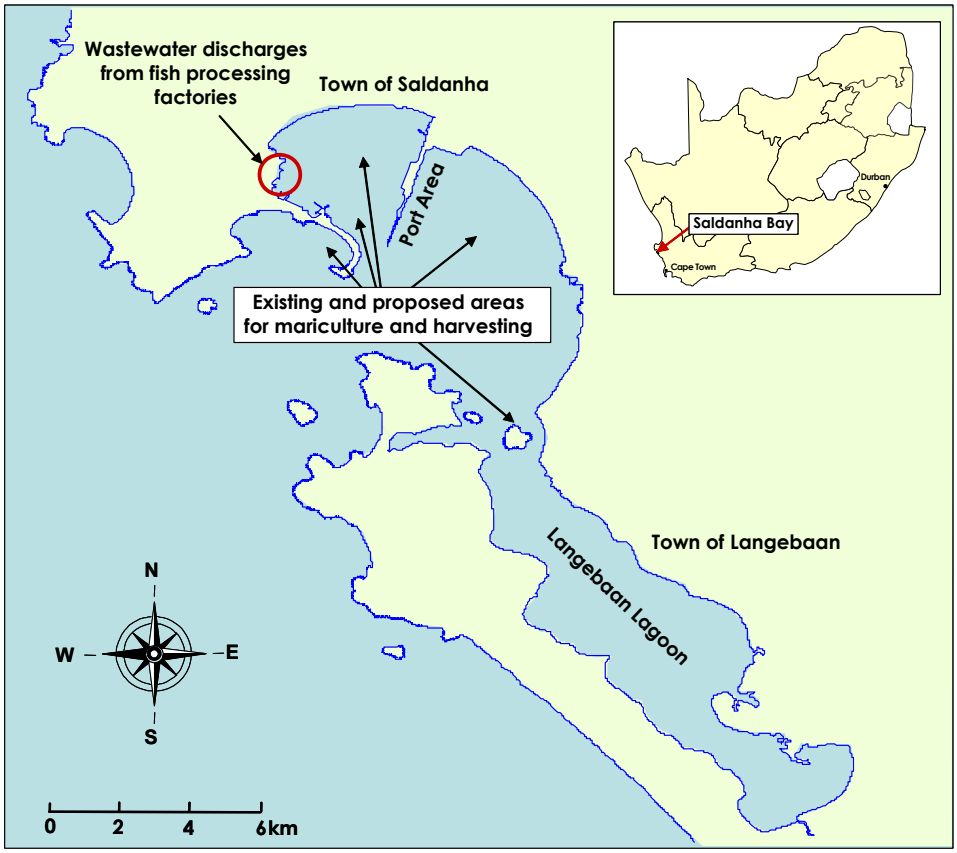
Overall, the analytical framework develops the understanding of pilot projects and their functioning and provides a lens to study examples, such as the Saldanha Bay Water Quality Trust. In using this lens, we first identify the nature of the pilot project by assessing the type of pilot, its position in, and interaction with, its context, and the effects achieved. Second, we identify the patterns and nature of diffusion. Third, we identify dynamics influencing the diffusion.

5.1 The Saldanha Bay Water Quality Trust

Saldanha Bay is a coastal embayment located on the west coast of South Africa approximately 100 kilometres north of Cape Town (see Figure 3). The system is directly linked to the Langebaan Lagoon, a shallow tidal area of great conservation importance (i.e., a Ramsar site under the Convention on Wetlands of International Importance especially as Waterfowl Habitat). In the early 1970s, the bay was targeted for development as a major international port when a jetty was built for iron ore export. Further developments followed, which included dredging to permit entry by large ore-carriers, and construction of a multi-purpose terminal and a small-craft harbour to cater for an increase in recreational and tourism activities in the area. Currently, oil is also imported through this harbour. Since 1984, mussel mariculture ventures have been established in the sheltered waters of Small Bay and Big Bay, giving rise to a potential threat of organic loading. In addition, the area receives effluent discharges from fish processing industries, as well as urban runoff from the adjacent towns (Saldanha Bay Water Quality Forum Trust, 2004).

In the 1990s, individuals with an interest in the area started to create awareness of the need to address these potentially conflicting uses. This led to the establishment of the Saldanha Bay Water Quality Forum Trust (SBWQFT) in June 1996 (Taljaard and Monteiro, 2002; Van Wyk, 2001). The SBWQFT is a voluntary organisation comprising officials from local (municipality, nature conservation organisation), regional (regional office of the Department of Water Affairs and Forestry) and national authorities (Department of Environmental Affairs and Tourism), representatives from all major industries in the area (e.g., National Ports Authority, seafood processing industries, marine aquaculture farmers) and other groups who have a common interest in the area (e.g., tourism organisations). The main purpose of the SBWQFT is to work towards maintaining water quality and ecosystem functioning so as to keep Saldanha Bay fit for all its designated uses. Although the SBWQFT does not have legislative powers, it acts as an advisory body to legislative authorities that are also members of the forum. The SBWQFT is a pilot project that has developed bottom-up. An approach has been put in place to implement existing national policy and to deal with local coastal management issues, thereby stimulating innovation. Accordingly, the pilot can initially be characterised as a management instrument to deal with conflicts and stimulate innovation.

Figure 3 Saldanha Bay, South Africa (see online version for colours)



As a result of the establishment of the SBWQFT, water quality in the Bay has improved significantly, while the different activities could still be undertaken. Pollution hotspots have been identified and there has been pressure, for instance on the Department of Water Affairs, to license wastewater discharges from fish processing factories, mandated under South Africa's National Water Act. This is a result of the new interactions between stakeholders. People learned about other uses in the area and moreover, how their uses affected each other.

Within the SBWQFT some social control exists. For instance, when there was an oil spill, the polluter had the chance to explain what happened and to promise improvements. Local experts willing to invest time in the activities of the SBWQFT were also welcomed. A financial mechanism was put in place by the SBWQFT that allowed for commissioning of scientific investigations and monitoring programs and the results of which are communicated through platforms such as the public meetings and the SBWQFT's annual publication *Bay Watch*. Scientifically sound information is therefore disseminated to the broader community, facilitating transparent and informed decision-making on the management of the area (Saldanha Bay Water Quality Forum Trust, 2004; Taljaard and Monteiro, 2002). Overall, with the SBWQFT, a mechanism has been put in place to deal with the coastal management issues of the area.

Initially, the SBWQFT was installed as a pilot project, but gradually the SBWQFT evolved as an important NGO. The nature of the organisation has not changed significantly, although the issues addressed have changed over time, reflecting the ongoing communication amongst the stakeholders. The feeling of success is probably best explained by a quote from *Bay Watch*

> "This is a most unique forum in that, as far as I am aware, it is the only non-government body that is totally successful in melding the private sector with their contributions and the government with their overseeing capacity, to form a unit that is ultimately functional and effective" [Saldanha Bay Water Quality Forum Trust, (2004), p.1].

However, there is concern that the activities of the SBWQFT may still be driven by committed and enthusiastic individuals (e.g., their chairperson). It may thus not have outgrown its dependence on individuals and is still fragile. There was no explicit pre-defined programme to monitoring the progress of this pilot, although evaluative studies on the SBWQFT have been undertaken [e.g., MSc thesis by Van Wyk (2001)]. This pilot is now widely promoted in national best practice guides as a model for local institutional arrangements, e.g., in '*South Africa's operational policy of the disposal of land-derived wastewater to the marine environment'* (Taljaard et al., 2006a; Taljaard et al., 2006b).

The SBWQFT provides a good example of a means to support the implementation of the Integrated Coastal Management Act soon to be promulgated in South Africa. So far, there has been no real dissemination in the sense of replication in other areas, but the SBWQFT has certainly enabled more effective implementation of policy in the Saldanha Bay area.

5.2 Discussion of the SBWQFT project

In this section, we first analyse the project according to the analytical framework developed, after which we provide preliminary observations regarding the hurdles and dynamics surrounding pilot projects that guide the evolution of the pilot project and so influence how it contributes to policy transitions. In Table 3, an overview of the nature of the pilot, its effects and its diffusion is provided. It shows that the pilot was confined in space and scope, that the innovation was of a conceptual nature regarding bottom-up approaches, that monitoring was lacking but that evaluative and explorative studies were done, and that as a result of the special status of the pilot, project stakeholders wanted to participate and made resources available. In terms of its relation to its context, the pilot project was specifically undertaken in the policy periphery as a means of finding an alternative way to implement policy. The project was designed in such a way that local stakeholders would participate actively in cooperation with the governmental agency. The pilot was used to establish communication between actors and to encourage innovation. In terms of effects, improved water quality was observed, cooperation developed and a financial instrument was developed by the participants to support continuation and increase commitment. In terms of knowledge development, social learning was considered to be very strong; participants learned about each other's water needs and how their actions influenced other participants' activities. Additionally, the project encouraged and enabled the study of human impacts on the water system, which had only been done in a limited fashion before. In terms of diffusion, we observed that there was no dissemination (there were no new comparable projects initiated), but there

was expansion in time and problem scope and some form of institutionalisation occurred through the inclusion of experiences in the best practices guidelines of the policy.

Table 3 Overview of the nature and effects of the SBWQT pilot project

Pilot element		
Nature	Character	Scale: confined in space and scope
		Innovation: conceptual, bottom-up, high level
		Knowledge orientation: evaluative and explorative studies, no monitoring
		Status: participation, resources
		Relation to context: in periphery, accommodates policy implementation
		Actor-network: local stakeholders and governmental agency, open style
	Use	Communication (conflict management)
		Incentive for stimulating innovation
Effects	Systems response	Improved water quality
		Actor interaction, installed financial mechanism, social control
	Knowledge development	Strong internal social learning: knowledge of existence other uses and interdependencies
		Stimulus for research on impacts of human uses for water quality
	Diffusion	No dissemination
		Expansion in time and problem scope, new financial instruments
		Institutionalisation: Inclusion in national policy guidelines on best practices, development of Trust into NGO

From the case study, several remarks and observations on pilot projects and their use in transition management can be made.

First, knowledge management is a substantial claim of all pilot projects. However, the case shows that knowledge development does not necessarily mean that there are clear monitoring and evaluation programs to capture the newly created knowledge. Instead, in this project studies were undertaken to assess ideas and learning was facilitated through the interaction of actors that did not know of each other's activities, let alone how they impacted upon each other. Their interactions were supported by experts in water management.

Second, we found that scales are not necessarily confined in all dimensions of space, time and problem scope in a pilot. Additionally, whether something is considered confined depends on the reference taken. In this pilot, the spatial scale was not confined from the concept point of view. When the same concept would have been implemented

by policy makers with the idea that the concept could be used for the implementation of the entire policy, the pilot would have been considered confined.

Third, the pilot and its diffusion seem to be dependent on the initiator and the actor involvement. This is revealed particularly by the fears of participants that when the initiator (the person putting in a lot of energy and making others enthusiastic) retires, the SBWQFT might not continue. Additionally, it was the inclusion of critical actors holding executive powers that contributed to the functioning of the pilot itself and its inclusion as best practice in the legislation (Taljaard et al., 2006b).

Fourth, the effects of the pilot contribute to further diffusion when strong and explicit social learning takes place. Previously unaware actors realised how they influenced water quality and so they subsequently influenced the use of the water system by other actors in the region. This confirms that knowledge is often recognised as a source of power and legitimacy (Nonaka and Takeuchi, 1995; Pawson and Tilley, 1997) and that it induces changes. Taljaard et al., (2006b) found that a key to the success of the SBWQFT was a sound scientific information base, containing explicit scientific assumptions and outcomes, by which authorities as well as local actors were empowered to participate in the decision-making process.

Overall, the contribution of the pilot need not be sought in the substantive assumptions of integrated coastal management (ICM) but rather, in the process aspects of how it is achieved – the outcomes of which are unknown in advance. The SBWQFT has been extremely innovative in this respect, contributing through its diffusion to a transition in South African ICM. Through its knowledge development effect, the SBWQFT pilot even has the potential to contribute further to the transition in South African ICM. Nevertheless, to really achieve influence in all coastal areas much more diffusion is needed. Critical for diffusion, and therefore for transitions, are key persons transferring their enthusiasm and knowledge to other actors and institutions. Institutionalisation contributes to disconnecting the pilot from the initiator. Institutionalisation provides a more stable continuation of the use of the innovation and reduces the dependency on individuals (Zonneveld, 1991). However, the risk exists that the flexibility of the concept gets lost or that initiators as the main channels of diffusion withdraw too early, immediately after the pilot. Flexibility is a necessary condition, however, for adapting practices to local contexts and should thus be guarded.

6 Discussion: meaning of pilot projects for transition management and insights for pilot project initiators

Pilot projects have the ability to contribute to transitions. The accompanying mechanism is ‘broad diffusion’ as conceptualised in this paper to include the diffusion of artefacts, as well as hard and soft aspects. The soft aspects, such as values and perceptions, are especially difficult to change, but are necessary conditions for transitions (Van den Bosch, 2010). This is also referred to as ‘second order learning’ (Argyris and Schön, 1996). However, as evidenced in the case of the SBWQFT, pilot projects offer a platform to apply, and practice with, mechanisms influencing the soft aspects (such as social learning and participative governance) without directly challenging power structures or enhancing personal risks. This type of participation fosters the diffusion of pilot projects, because more actors become internal to the project and can use the experience they have

gained and the perceptions they have developed towards each other and towards the concept (Edelenbos et al., 2010; Vreugdenhil and Ker Rault, 2009). Equally important is the notion of multi-level governance, meaning that actors at different levels of the water management system should be involved. Their knowledge can be used, their goals included and their learning facilitated (Hooghe and Marks, 2003). Not acknowledging the distribution of power could lead to undesired, and therefore ineffective, policy actions and implementation problems. The Saldanha Bay pilot project demonstrates clearly, as it is the first project in which multi-level governance is acknowledged and applied, that ICM can be effectively implemented, and also in such a way that it is highly supported by stakeholders. The stakeholders experience the 'added value' of their actions and recognise the effectiveness and legitimacy of the governance process.

However, not every pilot project is as suitable for transition management as every other. Some pilot projects are not intended to be diffused, the initiators do not put effort into diffusion, or the focus of the pilots is only on first order learning (learning about the technology). Accordingly, we will discuss the suitability of different pilot project types for transition management in terms of the nine different pilot uses that were introduced in Section 3.1. Use of this classification, in combination with an awareness of the design dimensions detailed in Table 1 and the insights in diffusion mechanisms derived from the case study, can help transition managers in their design choices when they are considering a pilot project.

First, we discuss an 'ideal' pilot project from a transition management point of view. Second, we explore the relationships between the nine different types of pilot projects and the 'ideal' transition management pilot project. Third, we discuss the extent to which the different pilot project types and the 'ideal' transition pilot project match, and identify which pilot project types and which accompanying designs would be most suitable for transition management.

From a transition management perspective, learning and knowledge development are dominant aspects of pilot projects (Hoogma et al., 2002; Rotmans, 2003). Moreover, pilot projects are seen as a means to move towards societal change and therefore provide inputs to change policy-making. The complexity of systems is acknowledged and so also the need for inclusive governance processes. In a pilot project, innovations can mature. Pilot projects therefore provide a confined and protected context. Lessons are used to further develop the innovation process. Additionally, freedom is needed to depart from conventional thinking. To describe a transition management pilot project more specifically we use the criteria related to the pilot project characteristics presented in Table 1 as well as expectations about their functioning. To provide a protected context, the scales are confined and the special status of a pilot project is used to enable the project. Obviously, the level of innovation is high because transition management pilot projects are expected to initiate or contribute to transitions. There is a focus on knowledge development and the governance processes are intended to be open and inclusive (Van den Bosch, 2010). This should provide the basis for its diffusion. Presence in the policy core is not important. If the pilot takes place in the periphery there is more freedom to experiment, although this may prove problematic when diffusing the pilot. When the innovation is not close to existing institutions, goals and ways of thinking, it is less likely that policy makers will adopt the innovation. Feedback into the policy-making process is very important, because it is through institutionalisation that transitions are established. The pilot project is thus not an end in itself but a means to encourage change.

To summarise, Table 4 provides an overview of the characteristics of an ideal a transition management pilot project.

Table 4 Ideal pilot projects from the viewpoint of transition management

Confined scale	+
Innovative	+
Strong knowledge orientation	+
Open and inclusive governance process	+
Use of status	+
In policy core	0
Feedback to policy-making/ innovation process	+
Pilot as an end	-

Notes: + (presence is important), 0 (neutral), - (absence is important)

As a second step, we explore the nine different pilot project types presented in this paper by evaluating their profile on the basis of the criteria in Table 4. *Evaluative pilot projects* are undertaken to evaluate policies in an early stage, when the scale is confined and as a means of developing knowledge to feed the policy. In this way they are a strong means for policy development, rather than a goal in themselves. Open processes are not of high importance because ideas are already well worked out and noise is avoided. *Explorative pilot projects* also have a strong focus on knowledge development, but derive more from the periphery where more space for innovation exists. Explorative pilot projects can be ends in themselves when they are primarily used for (scientific) research and have only a weak feedback into the policy process. Open processes are the core of *communicative pilot projects* to enable social learning, through which knowledge development and learning take place. Pilot projects used for *problem mitigation* strongly focus on resolving existing problems in a possibly innovative way. Scales should thus be full, the pilot project status is used to convince actors to allow for, or participate in, the pilot. The implementation of the pilot is thus also the end goal. Pilot projects for *policy implementation* are comparable in the sense that they use the special status to ensure initiation of the pilot; they are applied at full scale and are used as an end in themselves. However, they take place in the policy core. Pilot projects used as *insurance* explicitly use the protective status to enable actors to participate, because one can always use the argument that the initiative was intended as an opportunity for learning and therefore failure has no consequences, as well as to reduce the risk of large impacts. Pilot projects initiated as an *incentive* intend to encourage innovation processes. Scales are thus confined and feedback into the innovation process is very important. Subjects of the pilot projects are issues that may benefit from an extra push, because they are not yet recognised by users and therefore are highly innovative. *Political games* are somewhat difficult to assess, because it is in their very nature to include hidden behaviour. Nevertheless, strong aspects are the use of the special status, and the use of the pilot to influence a broad policy field. Like *advocative pilot projects*, convincing actors is of importance although the innovative aspects are more dominant and they do not necessarily take place in the policy core.

As a third step, when comparing the profile of a transition management pilot project with the nine pilot project types, we infer that advocative, incentive and communicative pilots are very useful for transition management. Reasons include the focus on diffusion

into society and so the potential to contribute to a transition, to encourage new approaches that both result from and encourage policy change, and the acknowledgement of the need for second order learning in which the focus lies on perceptions and values. These are all core values of transition management and are addressed in these pilot projects. In contrast, pilot projects used for policy implementation and problem mitigation are not relevant for transition management, because these pilots focus on the present and do not intend to establish change, nor do they pay much attention to learning. The design consequences of knowing that advocative, incentive and communicative pilot projects are suitable for transition management, in combination with the lessons from Saldanha Bay, include:

1 that the actor network should be open so as to establish social learning and increase the number of experienced people

2 the initiators should remain engaged ambassadors both during the pilot and during its diffusion, because diffusion is not an autonomous process

3 bottom-up initiatives for institutionalisation should be encouraged

4 the pilot projects should remain flexible to adapt to local circumstances.

7 Conclusions

Pilot projects are frequently used policy instruments in diverse policy domains. The purposes for which they are used vary greatly, but there is a common desire on the part of the initiators who believe strongly in the innovative concept or who have large (commercial) interests, to diffuse the innovation further. In striving after a transition, pilot projects are specifically used to encourage large scale change. Indeed, the pilot project is seen as a 'stepping stone for societal change' (van Sandinck and Weterings, 2008). In transition theory, pilot projects are considered one of the few means to actively influence policy change. This paper focused on the nature and functioning of pilot projects and particularly the dynamics that influenced their further diffusion so that strategies to enhance their diffusion can become well grounded.

We conceptualised pilot projects as socially constructed processes that continuously interact with their context. Viewing pilot projects as processes allows us to see how early developments influence later stages. Diffusion was conceptualised as a combination of dissemination and scaling up. The elements of interest that can be diffused include the ideas and artefacts, as well as hard and soft knowledge. The framework was applied to the Saldanha Bay case study. We found that diffusion did not occur autonomously, but takes place primarily within the direct context of the pilot through internal channels. Therefore, strategies to enhance the diffusion process can be implemented. The strategies need to be undertaken at an appropriate time, which is often earlier in the process than expected. Ideas that could form part of such strategies include having all relevant stakes represented by their legitimate stakeholders and making enthusiasm initiator-independent. In future research on multiple case studies, relations between the design and the dynamics of pilot projects as transition management instruments could be identified, and could be used to derive insights for the enhanced design of pilot projects. A first key has been provided by identifying that advocative, incentive and communicative pilot projects are particularly useful for transition management, but that pilots for policy

implementation are not. Additionally, future research could include study of pilot projects that are not conducted in a single occurrence but as a series, as literature suggests that policy transitions are the outcome of accumulation (Raven, 2007).

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