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Evaluating a systemic instrument.

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Learning towards system innovation.

Evaluating a systemic instrument.

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Abstract

In this paper we develop an analytical framework for studying learning processes in the context of efforts to bring about system innovation by building new networks of actors who are willing to work on a change towards sustainable development. We then use it to evaluate two specific intervention programmes carried out by a self-proclaimed 'system instrument'. The framework integrates elements from the Innovation Systems approach with a social learning perspective. The integrated model proposes essentially that these kinds of systemic instruments can serve to enhance conditions for social learning and that such processes may result in learning effects that contribute to system innovation by combatting system imperfections. The empirical findings confirm the assumption that differences in learning can be explained by the existence or absence of conditions for learning. Similarly, the existence or creation of conducive conditions could be linked to the nature and quality of the interventions of the systemic instrument. We conclude that the investigated part of the hypothesised model has not been refuted and seems to have explanatory power. At the same time we propose that further research is needed among others on the relation between learning, challenging system imperfections and system innovation.

Keywords: social learning, system innovation, systemic instruments, system imperfections, innovation systems

1. Introduction

The concept of 'learning' has received considerable attention in different theoretical strands of thinking about how radical change may come about and/or be stimulated in the face of complex problems that our society is confronted with. In the literature on Strategic Niche Management for example, it is argued that radically new technologies require the adaptation and/or combating of socio-technological regimes [1,2]. Whether or not such change comes about depends amongst others on the occurrence of learning processes within protected spaces (or niches). Through experimentation and learning in niches (and/or between the niches and regime level), innovative ideas and technologies may 'mature' and become better suited to change or replace the until then dominant regime. Scholars of Actor Network Theory too advance the idea that learning is an important process in arriving at new socio-technical configurations, even if they regard niche protection as an obstacle rather than a stimulant of learning (e.g. [3]). In approaches such as Transition Management learning is portrayed as a critical process that needs to be managed and steered within multi-stakeholder and multi-level transition arenas in order to develop visionary solutions and work towards them in a dynamic environment [4]. And in the literature on innovation systems, it is argued that systemic instruments are needed to fulfil systemic functions beneficial to supporting system innovation as a collective endeavour [5]. Several of the proposed systemic instruments centre around the idea of enhancing dialogue, vision building, strategic intelligence, demand articulation and experimentation, and hence have affinity with learning. Despite this general interest in the phenomenon of learning, the concept is still rather poorly defined and operationalised in the context of innovation and technology studies.

A clearer and more refined conceptualisation of learning may help to shed more light on inter-human processes at the 'grassroots' (or niche) level where change eventually needs to begin. Potentially, an additional benefit of such endeavour may be that it helps innovation scholars to link higher level notions like transitions, regime and/or system change to the sphere of everyday human interaction. The present paper seeks to develop a more elaborate conceptual apparatus for looking at learning processes in the context of system innovation trajectories. We then take the first steps in exploring whether the apparatus helps to understand and monitor processes towards system change in a context of deliberate systemic interventions.

The outline of this paper is as follows. In the second section we will elaborate on the analytical framework in which insights from learning theories and the innovation systems perspective are used to formulate hypotheses on the relation between learning in small-scale networks and system innovation. Subsequently, the section of this framework that focuses on systemic interventions, conditions for learning and learning is further operationalised for empirical research. These operationalisations will be used in section three to analyse two cases in which there was a deliberate attempt to support learning in newly formed small-scale networks, a strategy to achieve system innovation. Against the background of the analytical model, we seek to assess the nature and quality of the induced learning processes in view of their supposed relevance to system innovation in each of the cases. In the last section we will draw conclusions and reflect on the proposed theoretical framework.

2. Analytical framework

The research reported on in this paper was initiated by NIDO (the Dutch Initiative for Sustainable Development) which was a public and privately funded collaborative programme aimed at stimulating leaps to sustainable development via system innovation (see Box 1). NIDO itself aspired to fulfil the role of a 'systemic instrument'; its strategy has been articulated as a strategy for system innovation. The overall research question that guided our research was whether the interventions by the self-proclaimed system instrument NIDO indeed resulted in learning towards system innovation. In order to be able to answer this broad question we first developed an analytical model based on ideas from the innovation systems approach and learning theories. More refined research questions based on this model are presented towards the end of this section.

2.1. Systemic instruments for system innovation and sustainable development

According to the innovation systems (IS) approach innovation is an interactive, non-linear process in which multiple actors (e.g. firms, research institutes, intermediaries, customers, authorities, financial organisations) depend on each other in realising innovation. Metcalfe explains a national innovation system as follows:

> *"A system of innovation is that set of distinct institutions which jointly and individually contributes to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such it is a system of*

interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies." ([6], p.38)

As Klein Woolthuis et al. state, the basic conceptual underpinning of the IS approach is that innovation does not take place in isolation [7]. A main presumption is that the performance depends on formal and informal institutions and a market structure, that form the 'rules of the game' which reduce uncertainty for the actors involved in a dominant system [8]. These rules are shaped by actors, even though they may be perceived as structures by other actors. In addition, in evolutionary processes variety is generated, selections are made across that variety, and feedback is produced from the selection process to the creation of variation. The creation of novelties is necessary to maintain the diversity that makes selection possible [9]. This process of novelty creation is the result of constant interaction among heterogeneous actors in a population, whereby cooperation and interactive learning are regarded as important processes [10].

In all these spheres, system imperfections can occur. These system imperfections may block learning and innovation by actors.. Klein Woolthuis et al. in their *Innovation Systems Framework* summarize these imperfections or 'failures' into four basic categories [7]:

1. Infrastructural failures (concerning the physical infrastructure, such as railroads, telecom);
2. Institutional failures: hard (laws, regulation) and soft (norms, values, implicit rules of the game);

3. Interaction failures (too strong or too weak networks); and
4. Capability failures (entrepreneurship, adequate labour qualifications and the like).

In order to overcome such obstacles, it is argued that actors involved in innovation processes not only need instruments that focus on individual organisations (e.g. financial and managerial instruments) or on the relation between two organisations (e.g. diffusion and mobility oriented instruments), but also on instruments that focus on the system level [5]. Although already instruments exist that function at system level, like for instance product standards [11] and foresight programs [12], the conclusion still is that system innovation processes ask for more instruments that support systemic functions: so called *systemic instruments.* Smits & Kuhlmann distinguish five key functions [5]:

1. The management of interfaces;
2. Constructing and deconstructin (sub) systems;
3. Providing a platform for learning and experimenting by creating conditions;
4. Providing an infrastructure for strategic intelligence; and
5. Stimulating demand articulation, strategy and vision development.

In actual practice, 'systemic instruments' take the form of specific interventions that in one way or another need to address relevant system imperfections and failures as categorised e.g. by Klein Woolthuis et al. [7].

While most studies of innovation systems focus on the dynamics and innovative performance of national knowledge economies or economic sectors, our study looks at a case where sustainable development is strived for. This implies that it is not mere innovation that programmes like NIDO seek, but a change of complete socio-technological systems. Various authors have argued that change towards sustainable development takes place at various levels, individual practices, regimes, and the broader context, the landscape (see e.g. [13]). A common understanding of what system innovation (as a catalyst for change towards a sustainable development) may entail is also emerging. For system innovation, actors need to change not only their own current thinking and practices, but also their practices vis-à-vis each other and underlying social institutions. Grin and van Staveren define this reorientation of practices and structure, aimed at a broader societal ambition, based on the work of Beck [14] as "*the reflexive modernization of a socio-technological system*" ([15], p. 137).

Thus, imperfections in the innovation system that may block learning and innovation can be seen as barriers towards a sustainable development as well. An elimination of system imperfections in general will coincide with system innovation, because the imperfections are institutional by their nature and because their elimination involves changes in the roles and interrelationships of heterogeneous actors. However, the elimination of system imperfections alone does not necessarily mean a system change in a more sustainable direction. Therefore in this research the IS framework of systemic failures has been used as a tool to analyse those systemic imperfections that block learning and innovation towards a more sustainable system according to programme

participants, and to investigate which imperfections were addressed by the interventions of NIDO.

2.2 Emergent systemic properties and social learning

In essence, the suggestion in the above line of thinking is that systemic instruments help to stimulate networks of interdependent actors that do not exhibit system-like properties at first to act in a more synergistic manner, and thus effectively become 'a system' (see also [16]). The other way around, they may help unlearning, and the deconstruction of incumbent systems. The scope of NIDO is the former only and more specifically to build up new networks to enhance learning and to stimulate a new knowledge infrastructure (see Box 1) in order to contribute to system innovation.

The innovation systems perspective can be characterised as having affinity with a 'soft systems' approach [17]. This perspective proposes that 'human activity systems' must be looked at as complex wholes, in which people have different world views or 'Weltanschauungen' [18] and therefore have different interpretations of the problems that exist, the goals to be achieved in relation to these, and the boundaries of the system itself. Efforts to change the functioning of systems (i.e. achieve system innovation), then, must be geared towards reaching (explicit or implicit) agreement on relevant models of reality, problems, ends and boundaries with the view of identifying desirable, feasible and acceptable options for change. Dialectical debate and joint learning are proposed as the main route towards achieving this [19] since overlapping, congruent [20] or even fully shared meanings and understandings do not arrive out of the blue. In connection with this, several authors have coined the term 'social learning' ([21 – 24]). Röling defines social learning as "*a move from multiple to collective or distributed cognition*." ([23], p.

35). In the case of 'collective cognition' coordination is forged primarily through shared perceptions resulting in and from truly 'collective' action. The idea of 'distributed cognition' recognizes that actors may well work together and engage in complementary practices while significant differences in perception remain. Here ideas, values and aspirations may be overlapping or mutually supportive, but are not necessarily 'shared'.

In our view, 'collective cognition' and 'collective action' are more likely to emerge within groups of homogeneous actors categories (i.e. staff of a particular organisation), while 'distributed cognition' and 'coordinated action' are the best achievable in a setting of heterogeneous actors who each have their own interests, values and perspectives [25]. In a system innovation context especially the latter can be seen as an indication of *learning towards system innovation* in that it allows a network of actors to develop system-like properties.

2.3 Refining the concept of learning

The question of whether or not social learning occurred eventually needs to be studied by looking at the relations (e.g. in terms of congruency) between the learning that took place at the level of individual actors. In this section we refine the concept of learning, and also point to a number of social conditions that may affect its occurrence in a wider social process.

2.3.1 Areas of learning: different reasons for action

Commonly, people would say that 'learning' has occurred when there is evidence that individuals or groups have changed their knowledge and understanding about the state or

functioning of social, economic, biophysical or technical systems. When looking at (system) innovation as a phenomenon of the emergence of system-like properties in a new network whereby different actors start to coordinate their practices in a different way, it becomes clear that other forms of perception and perceptual change need to be considered as well. Thus, learning should not be understood in narrow cognitive terms only, but include a wider array of social drivers as well as point to the intricate relationships between 'knowing' and 'doing' [26, 27, 23]. Sociological and social-psychological theories suggest that what actors do and do not is not just influenced by their knowledge, but also by perceptions regarding their own and other agents' aspirations, capacities, opportunities, responsibilities, identities, duties, etc. (see Figure 1).

Figure 1

When deciding about whether or not to shift over to organic farming, for example, a farmer may (consciously or not) consider: the existence of a relationship between organic farming and environmental sustainability (knowledge), the attitudes of neighbouring farmers (social pressure), the availability of sufficient knowledge and skills to succeed as an organic farmer (belief in own capacities), the reliability of supermarkets and consumers in buying produce (trust in social environment), and how organic farming will affect (the balance and trade-offs between) important aspirations such as income, spare time, peace of mind, good relations with the neighbours, etc. In view of the above we define learning more broadly as involving a change in any of the perceptions indicated in figure 1. That is, a change in the reasons that shape human practices. In line with the earlier presented definition by Röling, *social learning* can be

seen to have occurred when different actors more or less simultaneously change their 'mindset' in such a manner that it leads to new patterns of effective coordination of action.

2.3.2 Levels of learning and types of negotiation

In an innovation context, we can distinguish between different levels of learning. An often used distinction is that between 'single loop' and 'double loop' learning [28]. Single loop learning typically involves learning on 'how to do things better' within the framework of pre-existing aspirations, assumptions and principles. When basic aspirations, assumptions and principles themselves become subject of learning Argyris & Schön speak of 'double loop' learning [28]. This type of learning is much more demanding (and sometimes threatening), because it involves questioning and perhaps letting go the basic certainties, goals and values that one acted upon previously. If, for example, a farmer who is used to applying fertilisers, pesticides and herbicides in a mono-cropping system changes over to organic farming, (s)he will have to totally re-design farming systems, and learn how to deal with farmyard manure, intercropping, complex rotations, biological pest control and, last but not least, a totally new network of people and institutions. Evidently, there is a close relationship between the required level of learning, and the kind of innovation that is desired. 'System innovations' clearly cannot be expected to occur without double loop learning on the side of a variety of interdependent actors.

Working towards system innovation inherently goes along with conflicts of interest between the parties involved, and also with the established social and technological

system or ‘regime’ that in many ways needs to be ‘conquered’ [13]. In such contexts, therefore, learning in newly formed networks needs to be understood as taking place against the background of a wider political process of conflicts and societal negotiation [29]. Also, within the networks negotiations will take place. A relevant distinction in connection with this is that between distributive and integrative negotiation [30, 31]. In distributive negotiations, the parties hold on to their existing perspectives and positions and the negotiations are mainly used to ‘divide the cake’. ‘Integrative’ negotiation processes, however, involve social learning in which new problem definitions, perceptions and creative solutions are developed (see [30]. Thus, social learning and negotiation are closely intertwined. As Leeuwis puts it:

> “*Effective social learning is unlikely to happen if it is not embedded in a well-managed negotiation process. At the same time, effective negotiation is impossible without a properly facilitated social learning process.” ([29], p. 169)*

2.3.3 Conditions for social learning and negotiation

It is not difficult to point to problem situations in society that might benefit from learning and negotiation. It is equally clear, however, that problems are often ignored, that groups and individuals are not always inclined to participate actively in trajectories aimed at fostering social learning, or that the results of such trajectories are disappointing. Theories about social learning and negotiation suggest a number of conditions and circumstances which affect the probability of achieving a productive learning process. Learning, for example, takes time and energy and often fosters uncertainty [32]. It is, therefore, something that actors only tend to do under certain circumstances. In order to engage in social and double loop learning, people need to

experience a serious problem, for example, preferably one that is urgent and visible. It is also important that actors feel responsible and are confident that their learning will bear fruit, and that their social environment welcomes and gives space to a different perspective [33, 25]. Thus, we see that some of the variables mentioned in figure 1 can at the same time be regarded as conditions for learning. Negotiation literature provides additional preconditions, such as the insight that productive negotiation is only possible between parties who feel dependent on one another for solving a problematic situation [30], which implies simultaneously that there exists a certain balance of power. Other conditions relate to the formation of new networks, characteristics of the participants and representatives involved in the process (e.g. in terms of mandate and heterogeneity), the presence of legitimate facilitators or other process leaders, and the nature and quality of process facilitation (see [34, 29] for more elaboration on these conditions). Clearly, the kinds of conditions outlined here are not static, but may change in the course of time. Actors, for example, may change their perception of the urgency of a problem situation, or develop greater feelings of mutual dependence in the course of time.

2.4 Integrated analytical model and research questions

In this paragraph we bring together the main concepts and assumed relations between them in a hypothetical, analytical model that guided us in formulating more specific research questions for our empirical work. Subsequently we indicate how we have operationalised our analytical model in the NIDO case-studies.

Our central starting point has been that an important contribution of 'systemic instruments' may be that they serve to enhance social learning processes in a variety of ways. This assumption is consistent with the strong emphasis on knowledge, debate, experimentation, strategic intelligence and vision development that characterise systemic instruments, and also with the ambitions and discourse of NIDO. We argue that systemic instruments are translated in specific interventions that in one way or another affect (and if effective: improve) the conditions for social learning. As one of these conditions we hypothesize that the induced learning processes must somehow address specific system imperfections; this in order to be relevant to system innovation as well as to address problems deemed as serious by actors involved. The induced learning processes can lead to changes in human perception and action at the level of individual actors, the emerging networks created by a systemic instrument (that we call *temporary networks*, because the close cooperation often stops after the programme has been stopped), represented organisations and -eventually- systems. This line of thinking is reflected in figure 2.

Figure 2

The analytical model led us to formulate three more specific empirical research questions line with our overall research interest:

1. To what extent can NIDO's activities and interventions be characterised in terms of functions of system instruments?

2. To what extent did interventions by the self-proclaimed system instrument NIDO address system imperfections as identified by the actors involved?
3.To what extent did NIDO interventions contribute to the establishment of conducive process conditions for social learning?
4. What kind of learning occurred within NIDO induced processes in terms of different areas of learning, the level of learning and the social aggregation level at which learning occurred?

Due to the limitations in the time horizon of our study, the question of whether learning actually contributed eventually to the vanishing of system imperfections and system innovation is outside the scope of the present paper. A concern that is within the scope of this article, however, is whether the empirical findings are in line with the hypotheses on the relations between interventions of a systemic instrument, conditions for learning and learning itself.

2.5 Operationalisation

Below we describe more in detail how we have operationalised the core variables that were used to study the contribution of NIDO to social learning in temporary networks [35].

2.5.1 Characterising learning effects

For the purpose of describing and categorising learning effects we grouped together some of the learning areas described in figure 1, and integrated these with two other dimensions. The first is the level of learning as described by Argyris & Schön ([28]; see

also the previous section). Although different levels of learning could be described in connection with each of the areas of learning, we have conformed to other studies which speak of double loop (or second order) learning only when there is a clear change in perceived goals, values, norms and interests. We have connected this with a second dimension, which is the social aggregation level to which learning has extended. When system innovation is the purpose, it is clear that learning will need to move beyond the individual, and that coherence and congruency needs to be developed in the perceptions and practices of different actors involved [23, 20]. In the activities organised by NIDO, such actors (in the form of representatives of organisations) where brought together at different moments, thus forming a temporary network. The idea was that learning processes in the temporary network would have a spin-off in and between the organisations represented, and thus contribute to change at the system level. Against this background, and also taking into account the short time path of NIDO interventions, we decided to focus the attention to assess learning effects at the level of individuals and of the temporary network. Table 1 summarises how we have combined and operationalised the various dimensions of learning effects.

Table 1

As can be noted from the table, we speak of single loop learning when new insights have emerged regarding the way in which a given goal can be accomplished, respectively in which a specific problem may be solved. Changes in problem definitions too can be regarded as single loop learning when they are based on a change in perception regarding the causes (and thus the solutions) of a problem [36]. We speak of

double loop learning when actors change their goals and/or the norms and values on the basis of which they evaluate problems and solutions. Learning at the level of the temporary network is considered to have taken place when there is a certain degree of alignment regarding (single or double loop) changes in knowledge and aspirations.

An important aspect of learning involves (changes in) the way in which actors perceive their own role in a problematic context, as well as that of others. Several dimensions can be distinguished, including one's perceived personal involvement, the estimated urgency, feelings of responsibility and the confidence one has in the own capacities and possibilities to influence the situation. Such variables influence the motivation and readiness of actors to actively engage themselves in solving a problematic situation [37]. At the level of the temporary network we can speak of learning in this area when feelings of mutual involvement, joint responsibility, trust, competence and interdependence have emerged.

Finally, in view of the intricate relations between perception and action, changes in individual or collective action can also be considered as indicative for learning. Such changes can be visible in the form of new practices and procedures, which may or not be coherent with those of other actors and/or institutionalised in the form of new policies, agreements, contracts and rules.

2.5.2 Process conditions for learning

As indicated earlier, learning regarding the own role and that of others can at the same time be considered as affecting conditions for learning. In addition, we have looked at conditions relating to the formation of the temporary network and several characteristics of the interaction that are known to be conducive to productive learning [38, 39, 34],

and which might be within the sphere of influence of NIDO facilitators. The (additional) characteristics and conditions which we have assessed in the two NIDO programmes are summarised in table 2.

Table 2

2.5.3 Connection with system imperfections

To be able to analyse whether NIDO's interventions addressed system imperfections that are perceived by the participants of the programmes, we used the IS framework of Klein Woolthuis et al. [7] as a basis. In this framework that has the form of a table, in the vertical axis system imperfections are discerned, such as related to the physical infrastructure and regulation. On the horizontal axis actors are identified that cause, are impacted by or try to resolve system imperfections. In the cells we can see more in detail how a specific actor is related to a specific type of systemic imperfection. See tables 4 and 7 for examples.

The IS framework is expected to be useful for analysing the characteristics of the incumbent system that hinder innovation towards a sustainable development and, because of that, for evaluating interventions at a system level, since interventions need to address these system failures in one way another.

Another main strength of the IS framework is that it not only looks at systemic features but also at the actors that cause and reproduce these barriers in daily practices. Thus, this kind of system analysis can help to orient intervention and action. It can be determined which actors, inside or outside of the network are involved in the main

perceived barriers, which offers the possibilities of involving them in the temporary network or addressing them with lobbying activities. For these reasons the IS framework seems relevant from a system perspective, when used to evaluate innovation programmes' interventions and results.

After relating the original IS framework with the list of systemic instruments of Smits and Kuhlmann [5] we adapted the original IS framework (see table 3) by adding a column in which system imperfections are linked to possibly relevant system instruments. As can be seen in the table the systemic instruments and system imperfections are not related one to one. For a detailed discussion of the (im)possibilities of combining the IS framework with the systemic instruments, we refer to our original research report [35].

The adapted IS framework has been used to characterise (a) how participants portray core problems of sustainability and system imperfections, (b) the focus of NIDO interventions, and (c) the fit between these two.

Table 3

3. Intervening for system innovation: two cases in practice

The analytical framework developed thus far, was tested on its ability to explain the extent and nature of learning among participants of short-term programmes and projects that aim at system innovation .

3.1 Case selection and methodology

For our study we selected two (out of many) NIDO programmes as case-studies. We looked for programmes that had more or less ended at the time of study, but which differed in terms of the intervention approach adopted by NIDO. It is important to note that the cases are not representative for 'the' NIDO approach, and that our study was neither aimed at nor was designed to draw conclusions about the effectiveness of NIDO interventions in stimulating system innovation in general.

The core of the empirical research geared to answering the research questions (see section 2.3) consisted of in-depth interviews with almost all participants of one of the projects within the selected programmes (11 interviews). A second round of interviews was conducted with actors who participated indirectly, for instance in the sounding board committee of the programmes that functioned on a national level (an additional 9 interviews). The two main topics of the interviews were learning and system imperfections.

The interviews started out identifying what the participants considered important learning experiences in order to see whether and how their 'mindset' had changed. The interviews were then continued to reconstruct together with the respondents how learning had come about, what characterised the process and what circumstances had influenced the process. In the last part of the interviews the role of NIDO was discussed. In the interviews the participants were also asked to identify what they thought to be the key problems in the system the project concentrated on. Afterwards, these problems were characterised in terms of system imperfections by the researchers by using the

IS framework. On the basis of relevant documentation, such as programme proposals and evaluation reports the researchers also characterised the interventions of NIDO and the activities of the temporary networks by identifying which system imperfections they addressed. This was done with the intention of comparing them with the system imperfections as experienced by the participants.

The findings of the two case studies, named Value of Water and Market Chances for Sustainable Products, are presented below. Each case description starts with a brief introduction of the goals and the global set-up of the programmes in order to identify how they planned to contribute to system innovation. Thereafter the four research questions mentioned above will be answered one by one.

3.2 Value of Water: a local subsystems approach

The first experimental programme for system innovation to be discussed is Value of Water (VoW). The overall goal of the programme was to give an impulse to the development of sustainable water management in cities. This was considered to be of high importance because of the excessive drinking water usage, diffuse contamination of surface water and contaminated sewerage sludge. Furthermore, other values of water, such as its recreational and ecological values, were to become more prominent, visible and capitalised upon. The problems to resolve these issues were perceived to be related to the too strict division of the responsibilities for watermanagement in the Netherlands over different parties: the water boards[1], the companies for drinking water and the local government [40]. The choice for existing housing areas in cities inherently implied that the aim was to change local subsystems rather than a whole sector or branch.

Value of Water consisted of two projects dealing with topics on a local level and a series of meetings of a national committee that acted as a sounding board. In Zaandam-Oost (project 1) an optimisation study that sought to investigate ways to decrease the costs of management of water in the water chain, was going to be conducted in a joint effort by the three water management parties (the water board, the drinking water company and the local government). Because of worries about ecological aspects, these parties decided also to conduct a sustainability study in order to develop a shared, long term vision (for 2030). This decision can be seen as the start of the first local project. As part of the project a pilot was developed: for an existing housing estate in Zaandam-Oost a sustainable water system was designed and some of the measures proposed were implemented. For this project many stakeholders and experts were consulted in workshops and interviews.

The second project (2) consisted mainly of a desk study on the value of the surface water in cities. This was done by a researcher accompanied by a committee of stakeholders in the city of Leeuwarden. The results were not implemented. On the national level the main activities in Value of Water consisted of interviews of the programme managers with important stakeholders to consult them on the ideas for the projects and meetings of an extensive sounding board committee in which knowledge institutes, (local) authorities, NGO's and firms were represented. In this article we draw mainly on the experiences in Zaandam-Oost.

With the resources and back up supplied by NIDO the programme manager used many kinds of systemic instruments thereby addressing all building blocks of the system as well as their mutual relations (see table 5). The most extensive were the development of a supporting knowledge infrastructure by involving universities to do research on the

topic and the management of interfaces in order to stimulate cooperation. The latter was mainly done by organising a project team of the three water management parties supported by consultants and researchers. This can be seen as a systemic instrument aiming at solving the systemic imperfection of the type: weak interaction. Especially in and around the project in Zaandam-Oost many different instruments were used in an integrated manner. Heterogeneous actors were stimulated to cooperate and to learn from a pilot project and long term visions on sustainability were developed (providing a platform).Mutual exchange between the two projects and between the national meetings and the projects was limited however. Finally, the requirements for the water market became clearer through an integral exploration of the water chain that was conducted with the help of a simulation model (stimulating strategy).

3.2.1 Match with perceived system imperfections

Table 4 shows how system imperfections that were mentioned by at least two interviewees are linked to the actors involved. It appears that the imperfections all have to do with the managers of water, in our terms the 'producers'. Among the system imperfections mentioned the most important are: too little knowledge on sustainability because of disintegrated thinking about water; dominance of economic and short-term thinking; and too many actors (and departments) involved who do not cooperate sufficiently. It was also suggested that 'water comes at the bottom of the list of environmental planning', and, in connection with this, that the added value of surface water remains unnoticed. Although these ideas about bottlenecks in the system of local urban water management were expressed separately, they all have apparent linkages to each other and to the major cause underlying the environmental problems as described

in the programme plan: the too strict division of responsibilities for water management in the Netherlands over different parties.

An important system imperfection of a different nature relates to the physical infrastructure. Since both housing estates and the infrastructure for water (such as the pipes for the sewerage) have long lives, it is hard to implement innovative measures shortly after they have been developed and agreed upon.

Table 4

The activities of NIDO in this programme addressed quite well the system imperfections as seen both by the participants of the project Zaandam-Oost and by the programme manager (see table 5). Parties who usually manage the water chain separately were stimulated to cooperate by jointly performing the sustainability study and the pilot. Through these and other activities the participants were confronted with (and became actively engaged in) many system imperfections, such as the long life of the unsustainable physical infrastructure, the costs involved in the management and maintenance of the water chain and the dominant, contemporary thinking about water in which ecological aspects are not integrated.

Table 5

3.2.2 Good process conditions for learning

With regard to the process conditions, the formation of the network seemed to be favourable to learning. Most process conditions mentioned in table 2 were present.

There were two prime movers: the programme manager from a research centre who took the initiative for the programme and the water board who took a leading role in realising the project and coordinating the project team. Furthermore, the project group consisted of heterogeneous parties. The three actors who were supposed to solve the problem of separated responsibilities and insufficient cooperation (leading to low effectiveness and efficiency) were involved: the water board, the drinking water company and the local government. Moreover, they agreed on the problem definition, and hence felt interdependent. Since these parties (especially the drinking water company) had never cooperated before, new perspectives were brought in. The input of new perspectives was also stimulated by the joint research activities and by organising workshops with a housing corporation, an angling association and water parties operating at a national level. Third parties, such as the programme manager and two consultancy firms supported the process. The only serious problem felt was that the background of the representatives in the group was very technical.

Whether the interaction contributed to learning is hard to assess in retrospective[2]. The opinions of the participants about the quality of the negotiation process varied enormously, especially regarding the role and contribution of the programme manager. While some judged that the participants understood each other very well, others had a different opinion. There were some moments of tension, mainly between people who were interested in abstract long term plans and visions and participants who preferred a more concrete approach. One of the ways in which these tensions were dealt with was to start the (concrete) pilot project. Another was to keep the long-term sustainability study separated from the optimisation study instead of integrating them. Overall, the responses by participants suggest that the process was quite open and that they felt

sufficiently ‘safe’. They experienced enough room to generate creative ideas. Also important is that the participants indicate that they had influence on the process design and that they felt committed to the project. Moreover, they attribute results mainly to the project and most of them agreed that NIDO played an important and positive role in obtaining them.

Altogether, our conclusion is that both network formation and interaction characteristics were favourable to learning in the Zaandam-Oost project.

3.2.3 Learning in the network

Most respondents of the project Zaandam-Oost as well as those involved in the programme on the national level, were convinced that they had learned from the project (see table 6). Many participants changed their ideas about solutions and problems within the framework of existing goals (single loop learning). Moreover, it was observed that three participants undertook new forms of action. The water board, that previously tended to wait until it was approached by local governments, decided to actively approach four large cities that were about to renovate parts of the town in an effort to stimulate the wider implementation of innovative measures that were developed in the project Zaandam-Oost. Likewise, the water board decided upon which additional areas could be approached. Moreover, they started paying more attention to process facilitation, which culminated in the decision to engage a professional process facilitator. The local government provided new conditions in its sewerage pumping system in order to allow for decentralised sanitation in the future. However, the third water management company involved, the drinking water organisation, did not significantly adapt its

practices as a result of the project; it stayed with its earlier policy of central preparation of drinking water and remained uninterested in local alternatives.

In terms of the other learning areas (double loop learning and learning about roles) only the water board has learned. It was the only actor that changed its mindset in a fundamental way in the sense that radically new future perspectives became an integral part of its thinking and policy (double loop learning).

At the network level it became obvious that the participants learned to some extent. In the sustainability study the participants had reached consensus on desirable future scenarios. Other important learning effects at the network level are the continuing cooperation of the participants as a network after the project ended, the collective implementation of specific measures in the pilot and the joint search for funding (see also table 6).

Table 6

Whether the learning effects of the project Zaandam-Oost will contribute to system innovation, remains to be seen. However positive the learning effects and the broadening of the network around this project, it is still a vulnerable niche which can easily be overruled by disadvantageous changes in the existing socio-technological regime. Chances for system innovation do continue to exist since the ambition of the project was kept high and also because of the structural character of the changes in the relations both among participants and between the water board and local governments that are not involved in the project.

3.3 Market Chances for Sustainable Products: a cross-sectoral system approach

Our second case study, the NIDO-programme Market Chances for Sustainable Products, ran from September 2001 until December 2003. It was supported by a programme manager and a process manager, with the aim to transform existing niche markets of sustainable products into mainstream markets. This was to be achieved by increasing the understanding of marketing by producers of sustainable products and by informing consumers in order to be able to distinguish between sustainable and less sustainable products. The programme was conceived by a group of experts who assumed that a considerable group of producers and consumers did not feel at ease with contemporary modes of production and consumption [41]. The idea was to stimulate long-term vision building, and in doing so provide a basis for future change.

With Market Chances for Sustainable Products NIDO deliberately did not focus on networks in which heterogeneous parties are or become interdependent in an organic way, as is the case in a branch, an industry or a market. In such sectoral systems actors have to deal with one another because they are organised around a specific product or service in relation to which they fulfil complementary functions. Instead, in this NIDO-programme a choice was made for a cross section of sectors. The underlying assumption in the most important project, the Companies for Companies project was that by bringing together marketers of green niche companies learning effects would spread in different fields of application. In addition, marketing itself was considered to be a (cross sectoral) system with its own dynamics and explicit or implicit rules. However, the actors belonging to this system, such as marketing education institutes, market researchers, advertisers, media and managers of the companies or sales departments were not brought together in this programme [42]. Instead, NIDO brought

together actors who they considered to perform key functions in this system. In addition to the marketers who were brought together in the Companies for Companies project, NIDO set out in a second project (2a and 2b) to facilitate interaction among organisations providing information on the 'greenness' of products in order to bring about better coordination among these information services.

The activities within this programme were very diverse. In the course of the programme some activities were abandoned (in some instances due to disappointing interest of participants) and new ones were developed. Project 2a that aimed at combining information services was stopped because of resistance of the organisations involved who were afraid it would threaten their own existence. It was followed up by another project (2b) aimed at describing criteria for sustainable products. The idea behind a third project (3) was to stimulate the cooperation between large brands and NGOs.

The longest lasting and most intensive intervention was the project Companies for Companies aiming at enhancing the professionalism of the marketing of niche players.

In the interventions mentioned two systemic instruments can be recognised: the management of interfaces (that should be addressing the system imperfection weak interaction) and providing a platform for learning and experimenting (that should be addressing the system imperfection lack of capacities).

In addition, a lot of consumer research was carried out in order to enhance the transparency of the market. Furthermore, the programme tried to influence the rules of the game by presenting innovative ideas to the national government by way of policy advise. With all these activities within the programme many elements of the system were somehow dealt with (see table 8).

3.3.1 No match with perceived system imperfections

The participants perceived many different kinds of problems concerning the market for sustainable products. The perceptions regarding bottlenecks and opportunities, were very diverse. Those mentioned more than once are: i) there is a lack of knowledge about potential customers and (niche) markets in the long run, and uncertainty about implications and requirements related to this; ii) customers are not willing to pay more for just the sustainability of products; and iii) the definition of 'sustainability' is unclear and hard to measure in relation to a specific product (see table 7). The last bottleneck was not only referred to in relation to consumer values and demands, but also in relation to other companies (competitors) and the government.

Table 7

In addition to these general problems related to the market for green products, issues were mentioned that are specific for the branches in which the participants are involved. The company Echte Energie (Real Energy) had to compete with main brands, large energy distributing companies, who also sell 'green' energy. The company Greencab who wanted to introduce the idea of stopping a (sustainable fuel) taxi anywhere on the streets struggled with the Dutch habit of phoning for taxis or going to a taxi rank.
The problems that were addressed in the programme were not those mentioned by participants (see table 8). The activities focused on a lack of professionalism of the marketing of green products by niche players. Enhancing this professionalism was the core activity of the Companies for Companies project, and took the form of education on marketing for the green companies by a marketing expert. Furthermore, although

some studies were done on consumer behaviour, the participants in this project did not feel they benefited from them.

Table 8

3.3.2 Inadequate process conditions

In connection with conditions regarding network formation, an important observation is that from a systemic perspective - the temporary network of Companies for Companies was formed by homogeneous actors. They were all marketers of green products. Some invited mainstream producers had abandoned the project at an early stage. There was no self-evident interdependency among the participants. Neither did feelings of interdependence evolve, as could have been the case if, for example, the aim had been to join forces to set up a new distribution channel. The larger companies within the project did not have ideas about the added value of cooperating with the smaller companies. Participants found it hard to apply the learning experiences of others in their own practice, since they experienced important differences between selling e.g. 'fair' coffee and 'green' electricity. The small parties signalled that they were more interested in the expertise brought in by a marketing expert than by the expertise of their fellow participants. The problems with the network formation were mirrored in the quality of the dialogue and the negotiations. There was no consensus about the goal of the project and neither about the parties that should be involved. The respondents indicated that they felt limited commitment to the project and most of them did not have the feeling that they owned the project, although some were satisfied with the decision of NIDO to bring in a marketing expert at the moment the meetings were perceived to be

unconstructive. NIDO remained the prime mover and made use of the learning experiences of the participants to communicate the do's and don'ts of green marketing to a wider public. In all, neither network formation nor interaction characteristics were favourable to learning in the project.

3.3.3 Uneven results in terms of learning

In this case study too learning occurred in various areas (see table 9). The small green parties of Companies for Companies were able to improve the marketing of their products by implementing a marketing format that was introduced by the marketing expert. The companies also changed their vision on marketing (double loop learning) and their vision on their own role in the market. In addition to implementing the marketing format they also changed the prices of their products. Other participants explicitly denied to have learned. This is the case for all but one of the larger niche players who employ professionals for marketing. As one of them explained, the marketing knowledge brought in by the marketing expert was not interesting because it was too general and not related to issues regarding sustainable products.

An important observation, however, is that none of the participants learned at the level of the marketing system. Individual actors that learned, mainly gained knowledge in connection with their own specific problems, but system change was not addressed. The participants neither developed congruent visions on the longer-term future, nor on the character of 'green' products.

Table 9

4. Analysis, reflections and conclusions

4.1. Comparative analysis of cases

When comparing the two cases in the light of our research questions, we can see some important differences (see table 10). In terms of the occurrence and nature of learning, we have observed that the Zaandam-Oost project of Value of Water (the VoW project) was quite successful as it resulted in learning both by individual actors and on the level of the network, especially in the area of action. In the Companies for Companies project of Market Chances for Sustainable Products (the MSP project) the smaller companies of the project group did learn about marketing in general, but not about the marketing system. The larger companies explicitly denied that the project led to any kind of learning. At the level of the network hardly any learning occurred.

Table 10

When looking at the presence of conditions for social learning we can also conclude that the VoW project was much more effective than the MSP project (see table 10). First of all, it can be noted that in the VoW project learning indeed seems to have been stimulated by a good match between the systemic interventions and system imperfections, as perceived by participants. In other words: the interventions by NIDO matched system imperfections as identified by the participants quite well. In the MSP project we found that the interventions did not address some of the most important perceived system imperfections, although it involved many different activities. Of course, participants in an innovative project do not necessarily have a balanced and

complete overview of system imperfections. A proper integral system analysis is dependent on the involvement of all kinds of actors and visionary people both from the existing system and from the (potential) new systems [43]. Nevertheless, the results confirm that for people to feel committed to a project it is important that they have the feeling that it focuses on problems and aims that they can identify with.

Secondly, the extent to which adequate process conditions for further learning were established in relation to network formation in the VoW project was larger than in the MSP project. The network formation in the VoW project seemed to be more favourable to learning than in the MSP project. A feeling of interdependency was lacking in the latter. Therefore participants felt no need for learning and negotiation. In contrast, participants in VoW felt interdependent as they agreed that poor cooperation among them was an important problem.

Thirdly, the characteristics of the interaction also were more favourable to learning in the VoW than in the MSP project. The main difference was that in the VoW project participants had the perception that they owned the process, while the MSP project remained very much NIDO-owned. As far as learning occurred in the MSP project this was not stimulated by the interaction with the other participants, but by the marketing expertise brought in by an outsider. Thus, although both projects were aiming at fostering learning, NIDO was more effective in creating favourable process conditions in the VoW project than in the MSP project.

From the perspective of stimulating system innovation, we can conclude that in the programme VoW intervening with systemic instruments indeed stimulated double loop and social learning in the temporary network, and that learning was facilitated by a good

match between interventions and perceived system imperfections and by a conducive network formation and interaction characteristics. Opposite conditions have hampered social learning in the MSP-project. Taking this all together, network composition and formation can be regarded as being of utmost importance. Our findings support insights from negotiation and network theories that emphasize the importance of feelings of interdependence to bring about productive social dynamics [44, 30]. Such feelings were lacking largely in the MSP project, mainly due to the cross sectoral approach adopted for the selection of participants. This lack of 'natural' interdependency was not compensated for by an existing or emerging feeling of interdependence among the participants. In contrast, the local subsystems approach adopted in the VoW project resulted in a network in which feelings of mutual interdependence developed organically.

On the basis of this experience alone, however, we can not conclude that social learning is inherently impossible in a cross sectoral temporary network. In another NIDO-programme too companies from different sectors were brought together in an effort to stimulate learning, in this case about corporate social responsibility (CSR). An analysis of this programme suggests that the setting of meetings with unusual partners stimulated critical self-reflection in this case, mainly because the participants were taken out of their 'comfort-zone' [45]. At the same time, the evaluation of this programme indicates important differences with the MSP programme in terms of learning conditions. The participants in the CSR programme had a general sense of urgency with respect to the need of implementing corporate social responsibility. Moreover, they had in common that they all struggled to get their views and ideas accepted within their respective firms. In addition, dealing with this shared problem took place in the participants' own sphere

of influence. The group meetings showed a high level of trust and the agenda of the meetings was determined by the participants themselves.

The above shows how closely the condition of mutually felt dependency is related to the condition that activities must address the system imperfections as perceived by the participants. In order to stimulate learning the composition of a temporary network must be meaningful in view of experienced urgencies and system imperfections, otherwise feelings of interdependence are bound to be weak, which poses an additional disincentive for social learning.

4.2 Conceptual and methodological reflections

We can conclude that the differential findings in the two cases seem to confirm the relations between interventions and learning as hypothesised in the integrated analytical model (see figure 2). This model proposes essentially that systemic instruments can serve to enhance various conditions for social learning and negotiation, and that such processes may result in learning effects that contribute to system innovation by confronting system imperfections. Our study has shown that this set of concepts can be operationalised and has allowed us to observe and identify meaningful differences between two deliberately supported innovation trajectories.

Although in terms of double loop learning by participants there was hardly any difference between the programmes, differences in learning could be identified at the level of the groups of participants. This supports our expectation that conceptualising and operationalising learning at both the actor and the network level is helpful in understanding the relation between learning and system innovation.

Furthermore, the variation in learning at the network level signalled between the two cases could indeed be explained by differences regarding the existence or creation of conducive conditions for learning. These conditions, in turn, could be linked plausibly to the nature and quality of the interventions carried out by NIDO, the functions of which were understood in terms of the systemic instruments. Moreover, both the process conditions, such as mutual dependence, and the condition for content (i.e. a match between interventions and perceived barriers) proved to be relevant. In the case of the NIDO programmes it can be assumed that the chosen interventions had great influence on both types of conditions, because they were made predominantly before the building of the networks started. Hence, we conclude that ensuring a proper match between the intentional activities and the systemic flaws or barriers as perceived by the actors involved, is an relevant condition supplementary to process conditions like mutual dependence and heterogeneous network development which are generally seen as important for people to learn and change.

Although the investigated part of our model has not been refuted and seems to have explanatory power with regard to the occurrence of social learning, it is too early to generalise and draw definite conclusions. After all, we are dealing with only two cases that took place in different system environments, and which may have differed with respect to other potentially explanatory variables that were not systematically investigated in our study (e.g. nature of pre-existing relations, power configurations, quality of process facilitation, etc.).

At the same time we can conclude that the model has made progress in forging a hypothetical, analytical link between higher level notions like changes in systems and/or

institutions, and the sphere of everyday human interaction and intervention in social networks. In doing so, we did build especially on the innovation systems perspective, which was a logical choice given the perspective adhered to by NIDO and the questions it had about its own performance. However, the innovation systems perspective makes less explicit reference to political processes and dynamics as part of radical change processes. Moreover, theories of social learning too have been criticised for giving credence to the idea that meaningful change comes about through collaboration and consensus rather than through conflict and social struggle [25]. We recognise that our model and our methodological approach, in combination with the intervention approach adopted by NIDO, did also not lead to the surfacing of power dynamics in the temporary networks studied, neither between the participants and the organisations they represent, nor between the participants and actors in the incumbent system. This presents a serious challenge for the further elaboration of the analytical framework.

Finally, we wish to point to several methodological issues that need further attention and improvement. The first is that the time horizon of both our cases and our study did not allow us to investigate the relation between learning within the networks (as a necessary condition for learning towards system change) and the influence on system imperfections themselves, let alone the relation with system innovation. In order to find out about this, we would need a methodological set-up with a longer time horizon, and also a strategy to assess learning and change beyond the immediate participants in the networks. Secondly, our approach may need to elaborate more on the relation between system imperfections based on a system analysis and the perceptions of system imperfections of participants. In this study, we took the perspectives of participants as

leading, but even if these perspectives are important in terms of conditions for learning (i.e. the motivation to work on problems that are deemed serious) we feel that in a next study outsider perspectives and analysis should play a role as well since it is quite likely that the actors involved do not have a complete and/or a sufficiently critical view of the system of which they are part.

A final issue is that our study is an ex-post evaluation of the interventions. This means that learning (and other variables in the model) was not monitored systematically during the interventions but had to be assessed and reported mainly by means of recollection of the participants. This implies a greater risk of (possibly strategic) bias and selectivity on the side of the respondents. It would be good to develop additional methodological strategies by means of which learning and negotiation can be observed and analysed as it takes place in social interaction. This would have as an additional advantage that the results of a study like this could be in time to inform the further design and adaptation of systemic interventions. In fact, one might argue that the availability of such reflexive monitoring capacity can be regarded as a systemic instrument in its own right.

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Areas of learning/ social level	Individual actor (representative and organisation involved)	Temporary network
Aspirations and knowledge – singe loop	Changes in problem definitions and perceived solutions regarding pre-existing goals.	Common vision on problem definitions and perceived solutions regarding pre-existing goals.
Aspirations and knowledge – double loop	Changes in goals, values, norms or perceived interests, going along with radically new problem definitions and search directions.	Agreement on a desirable future image based on changed goals, values, norms or perceived interests.
Perception of own role and that of others	Increase in feelings of involvement, urgency and responsibility, or enhanced belief in own competencies and freedom of manoeuvre.	Collective engagement and responsibility in the temporary network. Mutual feelings of dependence. Trust in the efforts, competencies and capacities of members in the network.
Action	Changes in behavioural patterns of individuals or internal organisational adaptations.	Coordinated action.

Table 1: Learning effects according to area and level (vertical) and social aggregation level (horizontal)

Interaction characteristics	Network formation
Open process Creative process Adequate provision of information from outside Agreement on process design	Mutual dependence Availability of new perspectives and/or confrontation between different systems Representatives with appropriate mandate Presence of 'prime movers' Optimal heterogeneity

Table 2: Relevant conditions for learning grouped according to interaction characteristics and network formation

System imperfections\ Actors	Con-sumers	Producers	Regula-tors	Knowledge institutes	Organisa-tions of interests	**Systemic instruments**
Infrastructure- - physical - knowledge						4. Providing an infrastructure for strategic intelligence 2. Building and organising systems
Institutions - hard						2. Building and organising systems
Institutions - soft						2. Building and organising systems
Interaction - too strong						1. Management of interfaces 2. Building and organising systems
Interaction - too weak						1. Management of interfaces 5. Stimulating demand articulation, strategy and vision development 3. Providing a platform for learning and experimenting
Capacities						3. Providing a platform for learning and experimenting
Market structure						5. Stimulating demand articulation, strategy and vision development

Table 3: Adapted IS framework: Relationships between systemic instruments (far right, compare the numbers in the list in section 2.1) and system imperfections (first column). In the empty cells systemic imperfections can be visualized in relation to the actors, system domains and systemic instruments involved.

System imperfections\ Actors	Consumers	Producers	Regulators	Knowledge institutes	Organisa-tions of interests
Infrastructure		Long lives of new housing estates and infrastructure for water Too little knowledge on sustainability because of disintegrated thinking about water			
Institutions hard					
Institutions Soft		Dominance of economic and short-term thinking			
Interaction too strong					
Interaction too weak		Too little cooperation relevant actors + too many actors Water board end-of-pipe			
Capacities					
Market		Water comes at the bottom of the list of environmental planning			

Table 4: System imperfections as perceived by the participants of the project Zaandam-Oost – Value of water

System imperfections\ Actors	Consumers	Producers	Regulators	Knowledge institutes	Organisa-tions of interests
Infrastructure		Long lives of new housing **Projects 1 and 2 and national**		**Project 1**	
Institutions hard				**Project 1**	
Institutions Soft		**Projects 1 and 2**			
Interaction too strong					
Interaction too weak		**Projects 1 and 2 and national**			
Capacities		**Project 1**			
Market		**Project 1**			

Table 5: : Interventions (grey) and match with perceived system imperfections (white) in the the programme Value of Water

Areas of learning/ Social level	Actors	Network
Aspirations and knowledge: single loop learning	Almost all participants learned individually about the importance of the processes within and in the context of their temporary network to reach their goals. Some participants specified their idea on 'sustainability', learned how and where measures for sustainability could be implemented and one participants learned how to specify social-cultural values of water.	The network developed a shared vision on the possibility to find extra ways for financing by bringing in innovative ideas at departments of the local government that so far had not been involved.
Aspirations and knowledge: double loop	The water board experienced a cultural change by paying attention to perspectives on the future and on ecology in policy.	Consensus was reached on several scenario's for a sustainable future.
Perception of own role and that of others	The water board redefined its role as a project leader: they had to facilitate a process instead of manage instrumentally. The water board realised its dependency on many local actors (e.g. the fishing association) and not just the water management parties.	-
Action	Several participants changed their policy because of their learning experiences within the project.	The cooperative continued working together after the project finished. In a housing estate some of the developed measures have been implemented.

Table 6: Learning among participants (direct and indirect) of the project Zaandam-Oost – Value of Water

System imperfections\ Actors	Consumers	Producers	Regulators	Knowledge institutes	Organi-sations of interests
Infrastructure					
Institutions Hard					
Institutions Soft	Definition of sustainable product is unclear				
Interaction too strong					
Interaction too weak					
Capacities					
Market	Customers not willing to pay more for sustainable products	Lack of knowledge about potential customers in the long term			

Table 7: System imperfections as perceived by the participants of the project Companies for companies – Market Chances for Sustainable Products

System imperfections\ Actors	Consumers	Producers	Regulators	Knowledge institutes	Organi-sations of interests
Infrastructure					
Institutions hard					
Institutions Soft					
Interaction too strong					
Interaction too weak					
Capacities					
Market					

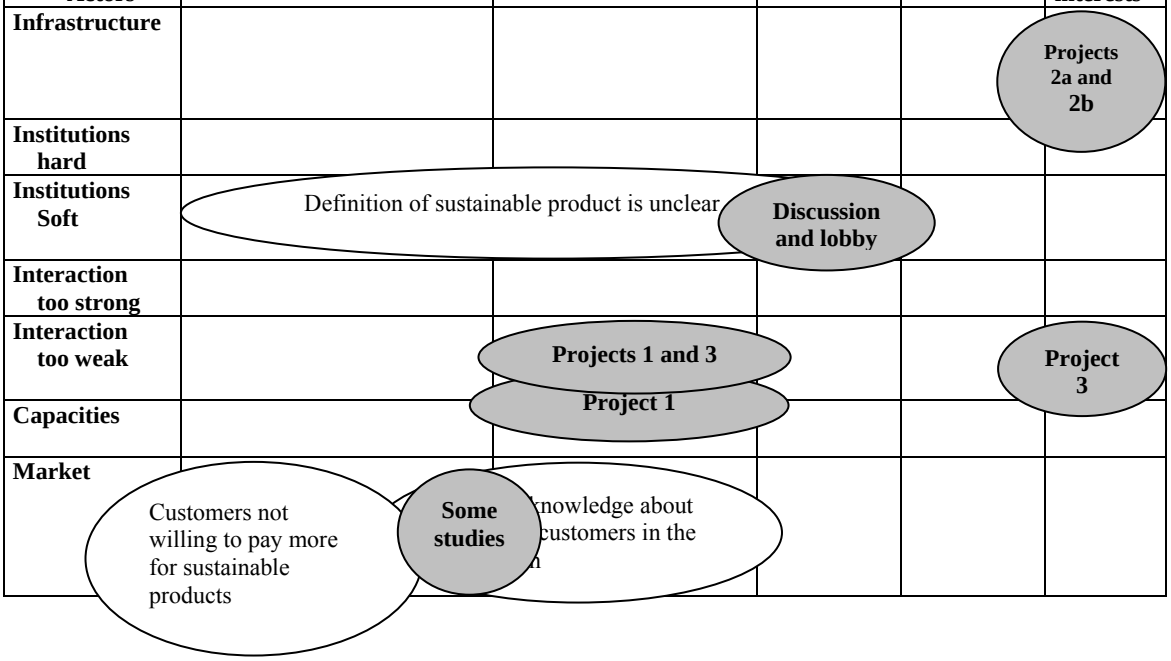

Table 8: Interventions (grey) and match with perceived system imperfections (white) in the programme Market Chances for Sustainable Products

Areas of learning/ Scale	Actors	Network
Aspirations and knowledge: single loop learning	The small companies learned how to market green products in a better, professional manner. The larger companies did not learn.	The small companies changed their perception on the motivation of consumers to buy green products.
Aspirations and knowledge: double loop	The small companies changed their vision on their products, they learned that sustainable/ green can be 'glossy'. The larger companies did not learn.	-
Perception of own role and that of others	Some small companies started feeling more autonomous. One started seeing itself as a real business instead of a company dependent on subsidy. The larger companies did not learn. The larger companies got less trust in the small companies.	-
Action	The small companies implemented a 'marketing format' and changed price/quality. The larger companies did not learn.	Cross-selling between 2 actors. Small companies keep cooperating within the framework of Social Venture Network (a network stimulating sustainable business).

Table 9: Learning among participants of the project Companies for companies – Market Chances for sustainable products

	VoW		MSP	
LEARNING	**actor**	**network**	**actor**	**network**
Aspirations and knowledge – single loop	++	0	+	0
Aspirations and knowledge – double loop	0	+	0	-
Perception of own role and that of others	0	-	0	-
Action	++	++	0	+
CONDITIONS FOR LEARNING		**network**		**network**
Match with system imperfections		++		-
Network formation		++		-
Interaction characteristics		+		-

Table 10: Comparative overview of the cases: learning, match with system imperfections and process conditions

Figure 1: Different areas of perception (reflecting simultaneously reasons for action) that may be subject to 'learning' i.e. perceptual change (Leeuwis 2004a, adapted and expanded from Röling 2002 and Leeuwis 2004b).

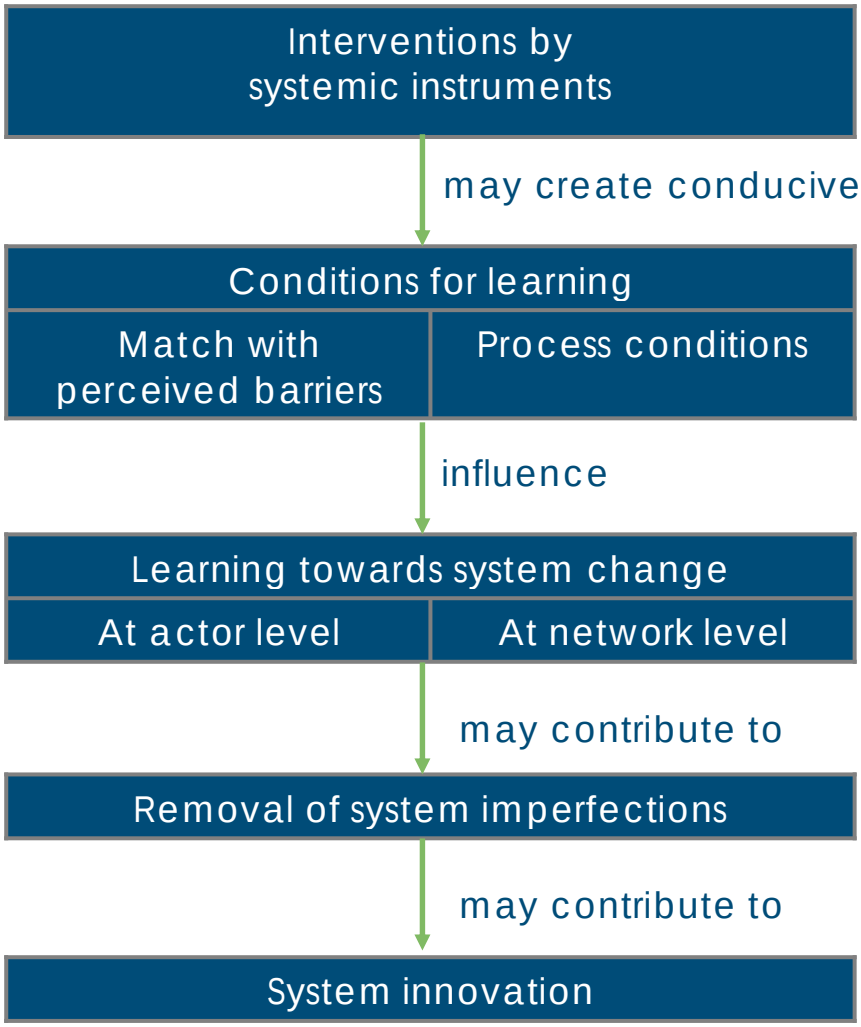
Interventions by systemic instruments
may create conducive
Conditions for learning
Match with perceived barriers
Process conditions
influence
Learning towards system change
At actor level
At network level
may contribute to
Removal of system imperfections
may contribute to
System innovation

Figure 2: Analytical framework reflecting the relations between interventions by systemic instruments, learning and system innovation.

Box 1: NIDO

The Dutch Initiative for Sustainable Development (NIDO) was an innovative, independent project organisation existing from 1999 until December 2004 when the subsidy was stopped. It was funded by the national government to enhance the Dutch knowledge infrastructure. NIDO coordinated several programmes, that ran for two to three years, in order to accelerate sustainable development in particular contexts. The areas of the main part of these programmes were selected by a group of invited experts. While learning by doing, NIDO developed a specific approach. It was a typical process approach with NIDO as facilitator and 'translator'. The programmes were organised as multi-stakeholder platforms where stakeholders could meet with one another and experts. These platforms were stimulated to come to a joint context-specific interpretation of the concept sustainable development. Hence NIDO intended realising system innovation by taking existing dynamics as a starting point. NIDO's approach can also be characterised by its concrete activities: 1) activities for analysing in order to generate context-specific knowledge; 2) activities of intervening in networks and of creating favourable circumstances for learning; and 3) activities for embedding the results of the programmes [46].

Footnotes:

[1] Water boards are regional governments managing the public water in a region such as an area within dikes or the catchment area of a river. Their main tasks consist of maintaining dikes, taking care of the quality of surface water, and managing the quantity of water in order to let people make use of it and preventing water trouble.

[2] We investigated the processes by interviewing the participants about it shortly afterwards. We were not able to observe the processes ourselves and therefore could not see how tensions were solved.