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Stakeholder and user involvement in backcasting and how this influences follow-up and spin-off

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ABSTRACT

This paper reports on the first study that has systematically investigated the follow-up, impacts and spin-off of backcasting experiments in the Netherlands seven to ten years after completion, while this is linked to the characteristics of the backcasting experiments themselves (Quist 2007). It presents three cases dealing with subsystems within the food and agriculture production and consumption system: (1) Novel Protein Foods and meat alternatives; (2) Sustainable Households and Nutrition; and (3) Multiple Sustainable Land-use in rural areas.

The cases show that participatory backcasting may, but does not automatically lead to substantial follow-up and spin-off. If substantial follow-up has been found after 10 years, it is still at the level of niches that are potential seeds for system innovations. Emergence of niches and spin-off also comes along with the diffusion of the visions generated in the backcasting experiment, though these are influenced by the exits and entries of stakeholders. The paper identifies what factors explain the extent of follow-up and spin-off of backcasting experiments, with a strong focus on stakeholder-related characteristics, such as stakeholder participation, actor learning and participatory vision development.

It is concluded that stakeholder participation aspects show a strong link with the extent of spin-off and follow-up. However, different roles and groups can be distinguished in different phases, which have to be taken into account when preparing and designing a specific backcasting experiment. It is discussed how stakeholder involvement in sustainability issues and user involvement in design may learn from each other in order to become more effective.

KEY WORDS

Impact of backcasting; stakeholder participation, end-users; system innovations and transitions to sustainability; meat alternatives; multiple land-use, sustainable food consumption; meat alternatives,

1. Introduction

In the last decade the focus of researchers, policymakers and many other stakeholders involved in environmental and sustainability issues has shifted strongly towards system innovations and transitions. These are required to achieve larger environmental improvement and needed for dealing with sustainability problems at a societal level, including mitigation and adaptation to climate change. Several terms are currently used to describe this type of system change for the pursuit of sustainable development, such as system innovations towards sustainability (Elzen *et al.* 2004, Quist and Vergragt 2004, Tukker et al 2008), transformations of socio-technical systems, industrial transformations (Olsthoorn and Wieckzorek 2005), transitions towards sustainability (Rotmans *et al.* 2001, Elzen *et al.* 2004), and shifts or radical changes to sustainable consumption and production (Tukker et al 2008).

Addressing complex sustainability problems by system innovations towards sustainability requires participatory integral approaches (Quist 2007: 11) like transition management (Rotmans et al 2001, Loorbach 2007) and backcasting. Such approaches have a long-term system orientation and take a broad notion of sustainability into account, as well as the social dynamics of complex social change processes. Stakeholder involvement is crucial: their stakes are affected, while stakeholders also have essential knowledge and necessary resources are such approaches.

Since the early 1990s sustainable futures have been explored in a considerable number of backcasting experiments, numerous stakeholders have been involved and steps have been planned in line with envisaged sustainable futures. But what is the impact of these so-called backcasting experiments ten years later? And can these impacts and spin-off contribute to larger system innovations to sustainability on the longer term? In the Netherlands several dozens of backcasting experiments have focussed on system innovations towards sustainability, while some of these also emphasised achieving follow-up and spin-off in line with the envisaged system innovation. However, there are considerable differences in the degree to which the various experiments have led to follow-up and spin-off after a few years, as well as how this relates to the stakeholder involvement in the backcasting study.

As yet, there has been no systematic evaluation and comparison of the impact of backcasting experiments after five to ten years, while conceptual and analytical frameworks to analyse the follow-up and spin-off have been lacking till very recently. Figure 1 depicts how the impacts after 5 to 10 years can be seen as an intermediate phase in the originally envisaged system innovation. In this paper three questions are addressed to deal with this topic. The first one is what factors determine the impact and spin-off of backcasting experiments after five to ten years? Secondly, what is the relationship of this impact and spin-off with stakeholder involvement in the backcasting studies as well as how participatory backcasting should be applied for achieving follow-up and spin-off and how this could become a stepping stone for system innovations towards sustainability or contribute significantly to this?

Moreover, it is interesting not only to look different practices of stakeholder involvement in sustainability issues, but also to look into participatory practices in other disciplines, such as co-design and user involvement practices in design studies (e.g. Sanders and Stappers 2008, Wever et al 2008, Bakker et al 2008, Scott 2008). The hinter-lying rationale is here that different stakeholder and user involvement oriented practices can learn from each other in order to improve their quality and effectiveness.

This paper deals with these questions by reporting on the first study that has systematically investigated the follow-up, impacts and spin-off of backcasting experiments seven to ten years after completion. In Section 2 a methodological framework for participatory backcasting is presented, while it also discusses stakeholder and user involvement. Section 3 develops a conceptual framework that includes both the backcasting experiment and the impact after five to ten years. Section 4 describes and analyses the three case studies from the Netherlands about (1) Novel Protein Foods and meat alternatives; (2) Sustainable

Households and Nutrition; and (3) Multiple Sustainable Land-use in rural areas. Conclusions are drawn in Section 5 whereas Section 6 gets back to the stakeholder and user involvement and relates this to co-design and user involvement practices in design. Finally, Section 7 discusses recommendations and provides some system innovation theoretical reflections.

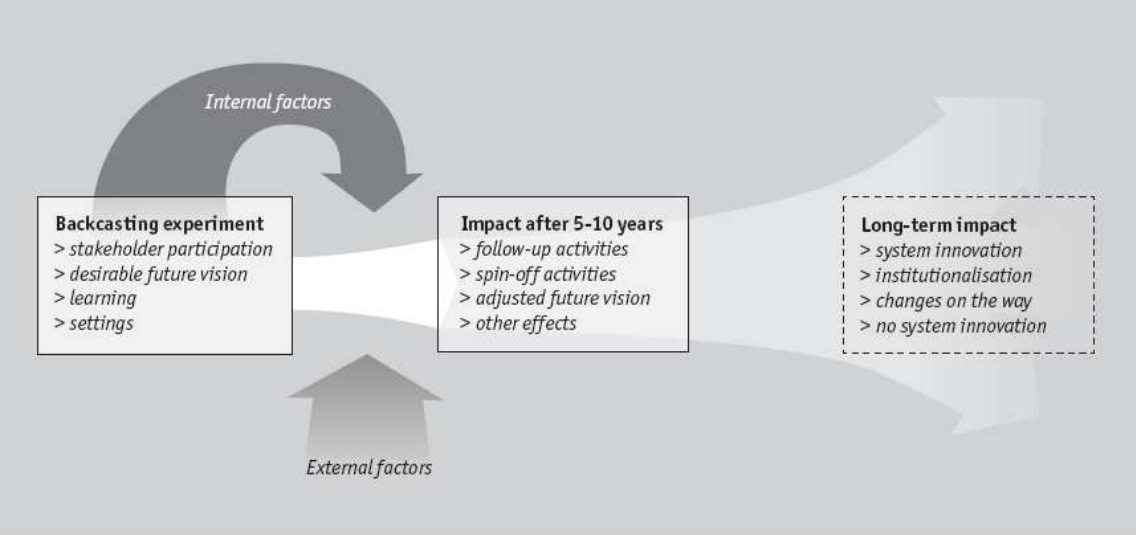

Figure 1 The backcasting experiment, its impact after 5-10 years and on the long-term.

2. Backcasting for sustainability: a methodological framework

2.1 Methodological framework

Backcasting was proposed in the 1970s in energy studies (e.g. Lovins 1977, Robinson 1982) and later also applied to sustainability planning (e.g. Robinson 1990) and to sustainable organisations (Holmberg 1998). Since the early 1990s it has developed into a participatory approach, especially in the Netherlands (Quist and Vergragt 2006), Canada (Robinson 2003) and Sweden (Holmberg 1998, Carlson-Kanyama et al 2006), the former also focussing on implementation and generating follow-up activities that contribute to bringing about the generated desirable sustainable futures. In the Netherlands participatory backcasting was for instance applied at the Sustainable Technology Development Programme (Weaver *et al.* 2000), the 'Strategies towards the Sustainable Household (SusHouse)' (Quist *et al.* 2001, Green and Vergragt 2002), the COOL project dealing with options preventing climate change (Van de Kerkhof 2004), sustainable industrial paint chains (Partidario 2002), livestock breeding research (Grin *et al.* 2004) and in education (Quist *et al.* 2006).

An overview of the development of backcasting has been provided elsewhere (Quist and Vergragt 2006, Quist 2007). These reviews have shown that there is a considerable variety in backcasting approaches and how they are turned into methodologies. Variety can be found in if and how stakeholder participation has been organised and what kind of methods have been applied within a backcasting framework and the kinds of topics that have been dealt with, on what scale and the number of steps that are distinguished. Therefore, four different backcasting approaches and their frameworks have been analysed and compared in order to develop a more comprehensive framework (Quist 2007: 24-30). The selected approaches were the sustainability backcasting approach developed by John Robinson (1990), the backcasting approach of The Natural Step, as reported by Holmberg and Robèrt (Holmberg 1998, Holmberg and Robèrt 2000), the backcasting approach applied at the Dutch STD programme (Weaver et al 2000, Aarts 2000, Vergragt 2005) and the one applied

in the international so-called SusHouse (Sustainable Households) project (Quist et al 2001, Green and Vergragt 2002, Vergragt 2005). Using the four approaches as a starting point, a more comprehensive methodological framework for participatory backcasting could be developed (Quist 2007), which is depicted in Figure 2.

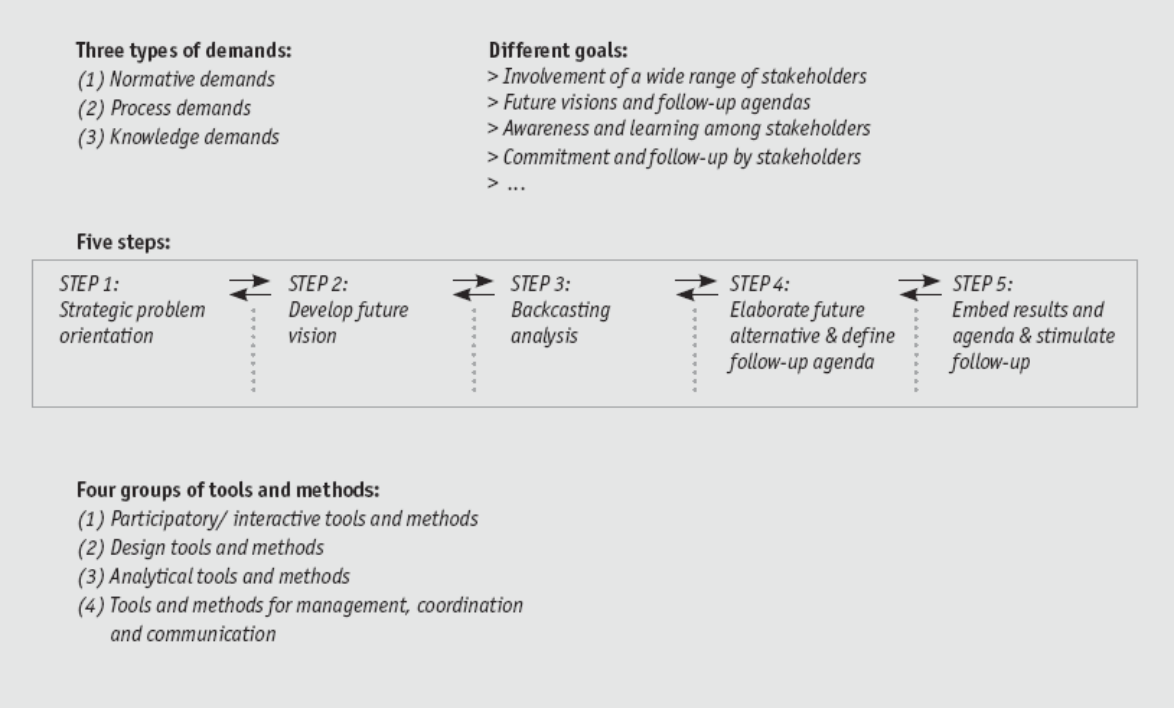

Figure 2 A methodological framework for participatory backcasting (Quist 2007)

The developed framework consists of five steps (that allow for iteration and moving forth and back between steps) and the outline of a toolkit containing four groups of methods and tools: (1) participatory tools; (2) design tools; (3) analytical tools, and; (4) management, coordination and communication tools. The backcasting approach reflected by the framework is not only inter-disciplinary (combining and integrating tools, methods and results from different disciplines), but also trans-disciplinary (through the involvement of stakeholders).

The framework also distinguishes three types of demands: normative demands, process demands and knowledge demands. Normative demands reflect the goals requirements for the future vision. Process demands are requirements for stakeholder involvement and their level of influence in how issues, problems and potential solutions are framed and decided upon in the backcasting study. Knowledge demands are needed to deal properly with trans-disciplinary as well as contextualised stakeholder knowledge and how to evaluate that.

In addition, different goals can be distinguished in backcasting studies, which may relate to process aspects, content aspects or both. In general stakeholder heterogeneity is high, which usually achieved by involving stakeholders from different societal groups that should include business, research, government as well as the wider public and public interest groups. Despite the fact that the steps are presented in a linear fashion, iteration of steps and moving forward and backward between steps is possible and in fact likely to occur.

Finally, three key concepts can be identified in participatory backcasting (Quist 2007): (1) desirable futures, also called future visions, (2) stakeholder participation, and (3) learning by stakeholders. The next section focuses on stakeholder involvement before moving to developing a conceptual framework.

2.2 Stakeholder involvement

Already the Brundtland report (WCED 1987) has called for sustainable development as a broad participatory process including bottom-up participation by citizens. Stakeholder involvement is a necessity, as sustainable development requires knowledge, support and actions from many actors in all societal groups like business, government, research, public interest groups and the general public, while the impact may affect them too.

A well-known definition of a stakeholder has been provided by Freeman (1984) in the field of strategic management (for a recent review see Freeman and McVea 2005). Freeman (1984: 5) defined stakeholders as *"…any group or individual who is affected by or can be affect the achievement of an organisation's objectives"*. Although various other definitions can be found, the definition by Freeman can easily be reformulated in such a way that it can be used in other fields and contexts. A more general version of the definition could be the following: *a stakeholder can be defined as an individual, organisation, group of individuals, or group of organisations that can affect or be affected by a certain topic (theme, decision, or achievement of an objective)*. For some discussions on stakeholders and sustainability issues, see elsewhere (e.g. Van de Kerkhof 2004: 20, Van Asselt M, Rijkens-Klomp N 2002).

Van de Kerkhof (2004: 26-27) has provided three major arguments for stakeholder involvement in (public) decision-making: (1) increased legitimacy of the decision, as more stakeholders have been involved; (2) Increased accountability, as the stakeholders involved have become co-responsible for the decision and related activities and action plans, (3) increased richness of the process, due to the input a wider range of viewpoints, interests, information and expertise about the topic under consideration. She continues (2004: 27-31) that stakeholder participation in science can contribute positively to dealing with uncertainties, contextualisation of knowledge and also for structuring and defining complex unstructured societal problems.

In the case of sustainability problems and system innovations towards sustainability, I would like to add that (1) stakeholders are experts in their own field and that this expertise is necessary for structuring the problem and finding possible solutions, (2) stakeholders may not only support to outcomes, thus provide legitimacy, but are also needed and indispensable for putting solutions into practice, as many system innovations towards sustainability require active contributions from government, companies, research bodies and public interest groups.

Table 1 Degrees of participation (based on Van de Kerkhof 2004: 44)

Degree of participation	*In policy-making (Arnstein 1969)*	*In science (Mayer 1997)*
High	Stakeholder control Delegated power Partnership	Mutual learning Co-production of knowledge Coordination
Moderate	Placation Consultation	Mediation Anticipation Consultation
Low	Information Therapy Manipulation	Information

Different degrees of participation can be distinguished. Van de Kerkhof has distinguished high, moderate and low degrees of stakeholder participation, building on the accounts by

Arnstein (1969) for participation in policy-making and by Mayer (1997) on participation in science (as shown in Table 1). However, this scheme is especially about the degree of influence in a rather formalised way, whereas other dimensions like the type of involvement and the intensity of involvement might be relevant too (Quist 2007). In addition, different groups may have different levels of influence.

3. Conceptual framework and research methodology

3.1 Introducing the framework

A backcasting experiment is defined here as the (project) activity (or various related projects), in which backcasting is applied explicitly, and in which a range of stakeholders is involved. A backcasting experiment thus always includes stakeholder participation. If there is no stakeholder involvement, the term backcasting study is preferred. A backcasting experiment may thus consist of a single project, but also of several successive or parallel projects.

In order to conceptualise the backcasting experiment as well as its impact, spin-off and other effects after 5-10 years, an extensive literature review has been conducted on which has been reported elsewhere (Quist 2007). It appeared that no single theory or model could be found that would incorporate all relevant aspects of both the backcasting experiment and its follow-up and spin-off. However, the following findings (Quist 2007) could be derived from this literature review, which bring together a number of relevant insights from various theories and models, which are used for developing a conceptual framework in the next subsection:

- Broad stakeholder participation can help increase legitimacy and accountability, structure complex unstructured problems like sustainability problems, broaden issues with a range of aspects and values and increase support and involvement (also in follow-up).
- New emerging future visions can become guiding images shared by groups of stakeholders that provide guidance and orientation to the supporting stakeholders in line with the future vision in a process of diffusion and further elaboration of the vision.
- Emerging visions face competition from other emerging visions and their supporters, as well as from the regular dominant vision supported by vested interests and actors.
- Visions may have strong normative and ethical assumptions and be generated deliberatively by groups of stakeholders.
- (Higher order) learning may encourage actors to reformulate problem definitions and shift their preferred ways and approaches to dealing with a certain problem. Increased insight into the values and views of other stakeholders may be another result.
- Both the way the backcasting has been applied and the organisational settings of the backcasting experiment are likely to affect the nature and degree of follow-up.
- Network theories provide a promising way for analysing follow-up and spin-off activities.
- Successful networks around follow-up and spin-off activities may lead to instances of institutionalisation in which institutions change, as well as to instances of institutional resistance from vested interests and backing actors who feel threatened.

3.2 A conceptual framework for backcasting and its impact

Figure 3 gives a more detailed view on the backcasting experiment and its follow-up and spin-off after 5 to 10 years. It also shows various elements in both phases, which make up the conceptual framework. The proposed conceptual framework as shown in Figure 3 comprises thus (i) the backcasting experiment and (ii) the follow-up and spin-off after five to ten years. The backcasting experiment addresses the sustainability problems that cannot be solved through incremental changes. The socio-technical system in which both phases occur can be defined differently, depending on the sustainability problem(s) targeted; it can be a

production and consumption system, an entire geographical region, or an industry. Both phases are conceptualised by building blocks (Quist 2007) that are described below.

As mentioned above, no single comprehensive theory or model has been found so far that would include all relevant aspects of both the backcasting experiment and its spin-off phase. This necessitates composing a framework elaborating upon building blocks from a heterogeneous set of models and theories. As a consequence the backcasting experiment phase can be seen as consisting of four building blocks: (1) stakeholder participation, (2) future visions, (3) learning, and (4) settings and methodological aspects. The building blocks are based on various theories about actor and stakeholder participation, the *Leitbild* concept from German sociology of technology, theories about higher order learning and the methodological framework for backcasting, respectively. The building block **participation** includes various aspects derived from a number of actor and stakeholder participation theories, including stakeholder heterogeneity, stakeholder influence and the degree of involvement. The building block **future visions** includes the aspects 'guidance' (where to go) and 'orientation' (what to do), which are derived from the *Leitbild* concept (Dierkes et al 1996, see also Grin 2000), while the aspect 'competing visions' has been added (see also Berkhout 2006 and Smith et al 2005). The building block **learning** emphasises higher order learning by actors in line with Brown et al (2003) and includes shifts in (i) problem definitions, perceived solutions and principal approaches to dealing with the problems at the level of individual actors, as well as joint and congruent learning at the level of groups of stakeholders. Whereas joint learning refers to consensus and joint opinions, congruent learning reflects non-conflicting issues. The building block on **settings and methodological aspects** comprises various aspects reflecting how the participatory backcasting approach has been applied based on the developed methodological framework, as well as aspects covering the settings (Quist 2007).

The follow-up and spin-off phase can be seen of consisting of three building blocks: (1) network formation, (2) future visions (3) institutionalisation. The building block **network formation** is based on industrial network theory proposed by Håkansson's (1987, 1989) and contains the aspects 'activities', 'actors' and 'resources'. Like in the phase of the backcasting experiment the building block **future visions** comprises the aspects 'guidance', 'orientation' and 'competing visions' in the same way as in the phase of the backcasting experiment. The building block **institutionalisation** uses institutional theory (e.g. Oliver 1996, Scott 2001). 'Institutionalisation' reflects changes in institutions and rules, whereas the aspect 'institutional resistance' is resistance from vested interests and institutions and the actors backing them.

The conceptual framework also proposes **internal factors** and **external factors** that both exert influence on the emergence of follow-up and spin-off. Internal factors are characteristics of the backcasting experiment. External factors are exerted by the socio-technical system and its context, which surround the backcasting experiment and its follow-up and spin-off. The socio-technical system 'enters' the backcasting experiment through the participating stakeholders, but at the same time the backcasting experiment is to some extent an organised, albeit rather isolated space for experimentation within the socio-technical system. The context of the socio-technical system consists of other sectors and socio-technical systems in the Netherlands, as well as abroad. Internal factors and external factors can have both a positive (enabling) and a negative (constraining) influence on follow-up and spin-off. Four domains are distinguished in which follow-up and spin-off may occur and are shown in Figure 3: (1) research, (2) business, (3) government, and (4) the public domain that includes public interest groups as well as the wider public.

Finally, the broad arrow in Figure 3, which connects the backcasting experiment and the follow-up and spin-off after five to ten years, depicts the process in which stakeholders are attracted to the future vision and the agenda generated in the backcasting experiment, and start turning them into action and activities that result in 'spin-off and follow-up'.

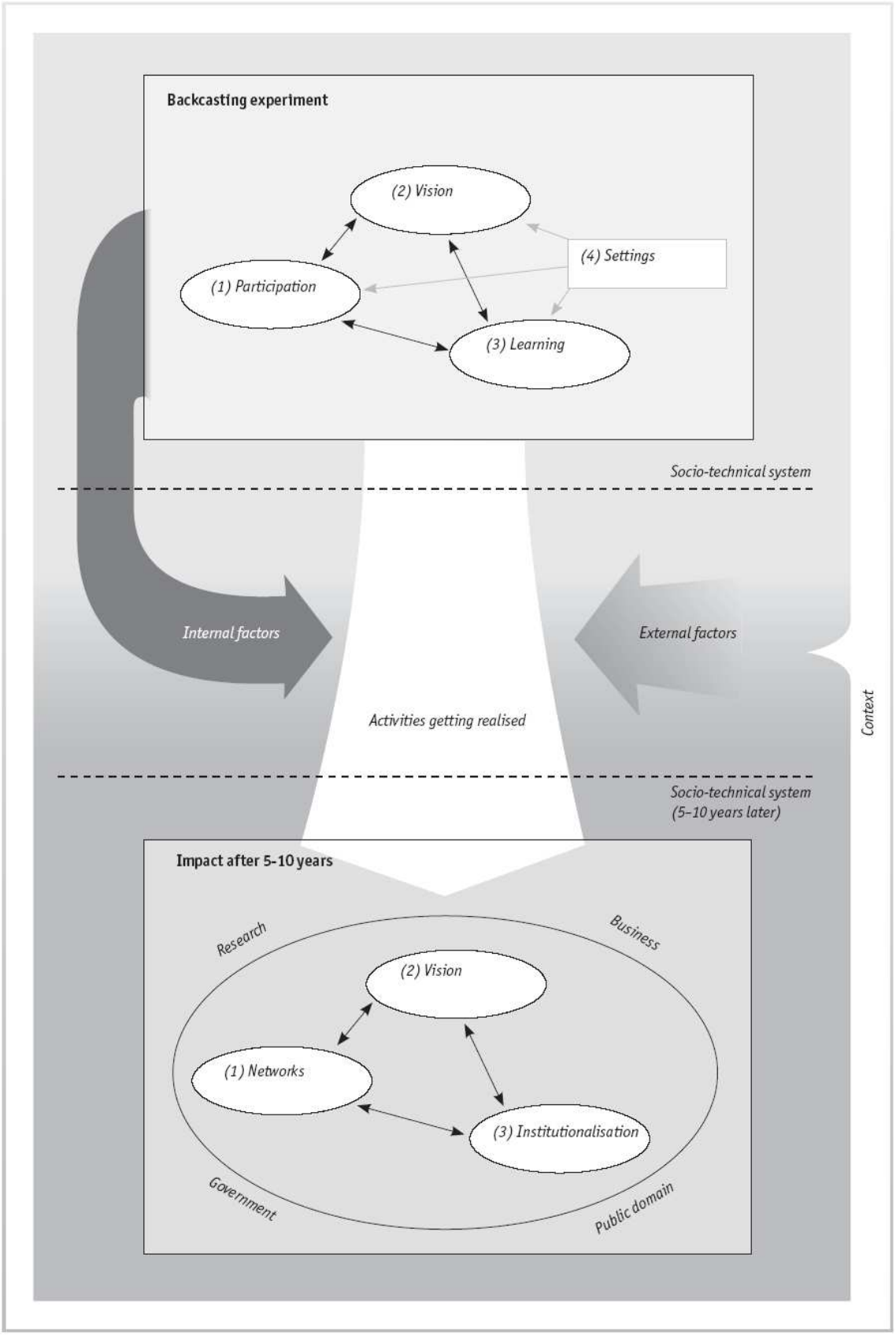

Figure 3 The conceptual framework for the backcasting experiment and its impact

3.3 Research methodology

An empirical ex-post case study approach has been applied to evaluate the three cases. The cases were studied through: (i) through the use of (internal) documents and reports from the backcasting experiment and included various internet sources; (ii) the use of (internal) documents and reports from follow-up activities and other spin-offs including internet sources; (iii) 10-15 semi-structured in-depth *interviews* for each case (mostly face-to-face, sometimes by telephone) with key persons covering the four domains, as well as numerous briefer telephonic contacts. Interviewees had been involved in either the backcasting experiment, or in follow-up and spin-off activities, or in both. Starting point for interviewee identification was available case material, while interviewees were also asked about other key persons relevant to be interviewed. A more detailed description of cases and analyses can be found elsewhere (Quist 2007).

4 Case results and case comparison

4.1 Three cases

Three case studies have been conducted, each consisting of a completed backcasting experiment and its follow-up and spin-off after five to ten years. The first was the Novel Protein Foods (NPF) case, which focused on sustainable and attractive meat alternatives and which envisioned a system innovation in which a substantial share of meat and meat products is replaced by protein foods from non-animal sources. The second was the Sustainable Household Nutrition (SHN) case. The third was the Multiple Sustainable Land-use (MSL) case, which dealt with function integration in rural areas involving agriculture and other functions related to landscape, nature, recreation, water production and water management. The NPF case and the MSL cases were based on backcasting experiments that were conducted from 1993 to 1997 at the Dutch governmental Sustainable Technology Programme (STD). The SHN backcasting experiment was conducted between 1998 and 2000 as part of the international project on 'Strategies towards the Sustainable Household (SusHouse)'.

While all cases relate to the food production and consumption system in the Netherlands, each case focuses on a different socio-technical system with different characteristics. The NPF case focuses on a production and consumption system of protein foods, which includes meat alternatives, meat and meat products, and in which food companies are the central players. The SHN case views food consumption and production from the viewpoint of households and consumers. Finally, the MSL case focuses on a regional system in which the agricultural function was integrated with other functions and as a consequence spatial planning aspects are important. More details are provided elsewhere (Quist 2007).

4.2 Case results: spin-off and impact after ten years

With regard to the extent of follow-up and spin-off after five to ten years the cases also showed strongly different outcomes, as shown in Table 1. The SHN case showed very limited follow-up and spin-off. By contrast, the MSL case and the NPF case showed considerable follow-up and spin-off across the four societal domains distinguished, as well as instances of institutionalisation. Some aspects are summarised in Table 2.

For the SHN case it was found that spin-off attempts were undertaken, but that submitted proposals were not approved. As a consequence, visions did not keep supporting networks and faded away.

With regard to the NPF case a large multidisciplinary research program entitled Profetas (Aiking et al 2006) was initiated involving several relevant Dutch food companies, while

funding was provided by research councils, companies and the Ministry of Agriculture. In addition, related R&D activities involving companies and research bodies were initiated too, while SME's in the field of vegetarian protein foods extended their activities and market share too. Furthermore, vegetarian protein foods became the topic of policy-making at the Ministry of the Environment as part of sustainable consumption policies as well as at the Ministry of Agriculture, while environmental organisations became as a result more positive about meat alternatives and extended their activities on this topic. Vegetarian organisations used the NPF activities as a bandwagon for their own agenda and activities.

In the MSL case a large follow-up research programme ran between 1999 and 2003 (Akkerman et al 2003), involving research, policy, business and ngo actors; the programme focused on imitating and demonstrating multiple sustainable land-use in the region of Winterswijk. A related policy and implementation programme was led by regional authorities, while also various spin-off activities of both programs could be found. MSL participatory vision development was replicated in other regions where multiple sustainable land-use was seen as a major development option.

The emphasis of follow-up and spin-off was in both the MSL and NPF cases especially in the research domain, whereas in the NPF case considerable follow-up also occurred in the business domain. Both cases also showed instances of initial institutionalisation. In both the MSL case and the NPF case visions provided guidance and orientation and were still clearly around and in the mindset of actors involved, though at the same time competing visions were around. Furthermore, nearly all activities in the MSL and NPF cases involved often actors from more than one domain. It is possible to cluster follow-up and spin-off activities into groups of activities that relate to shared adjustment in the future vision. All clusters included actors from the backcasting experiment, as well as newly mobilised actors. The main share of financial resources at follow-up and spin-off activities in all domains involved government funding and budgets. In the NPF case a second major source of mobilised resources involved investments by companies for R&D, product development and market introduction. External factors were of influence too, but are dealt with in 4.4.

Table 2 Comparing some impact results of the three cases

	NPF	***SHN***	***MSL***
1. Networks: activities, actors, resources	Clusters of networks in all four domains	Very limited, attempts not granted	MSL program, replication in other areas, no NL network
2. Vision: guidance, orientation, competition	Core guides, but decentralised adjustments	Visions faded away	Vision lives on in the region, new MSL visions also elsewhere.
3. Institutionalisation	Is starting	No	Is starting
4. External factors (case specific)	Important	Not important	Important

4.3 Case results: backcasting experiment and stakeholder involvement

All three backcasting experiments involved a wide range of stakeholders, developed one or several desirable future visions, proposed follow-up activities and action agendas and induced higher order learning among participating stakeholders. Higher order learning occurred on the topics under study in the backcasting experiments, as well as on the backcasting approach itself. Follow-up agendas included R&D-activities, strategy development, policy recommendations and short-term proposals.

Despite these similarities, the three backcasting experiments varied considerably in terms of stakeholder influence, the degree of stakeholder involvement, whether a vision champion and institutional protection emerged, whether other types of participation than the capacity to

participate were mobilised (e.g. co-funding or providing additional capacity, knowledge, or otherwise). There are also differences in joint and congruent learning at the level of groups of actors. Table 3 provides an overview of some stakeholder and learning aspects.

With regard to stakeholder and user or consumer involvement, the SHN backcasting experiment included an initial round of face-to-face interviews, two stakeholder workshops, an intermediate round of written feed back on constructed visions and three focus groups to evaluate the consumer aspects and attractiveness of the generated visions. The NPF backcasting experiment included a limited number of expert and stakeholder interviews in the beginning, large involvement of different research stakeholders in different phases of the experiment, as most research was commissioned to research groups, consumer research, a high level advisory board in which funding ministries and companies were involved, a series of three stakeholder dialogue workshops focusing on social and consumer aspects and intensive stakeholder communication by the project team. The MSL backcasting experiment had similar kinds of stakeholder involvement, though it can be mentioned that early stakeholder involvement was broader, while there was no end-user or consumer involvement as the focus was on land-use at the regional level.

Table 3 Some stakeholder participation, user involvement and learning results

	NPF case	*SHN case*	*MSL case*
Participation:			
- Number of individuals	100 - 150	40 - 50	100 -150
- Number of stakeholders	50 - 60	20 - 30	50 - 60
- Heterogeneity	High	High	High
- Degree of involvement	Varying	Low	Varying
- Type of involvement	Funding & capacity	Limited capacity	Funding & capacity
- Degree of influence (on content)	Moderate-Low, small group High	High	Moderate-Low, small groups High
User involvement	Consumer research	Citizen focus groups	-
Higher order learning on the topic			
- Individual actors	Yes	Yes	Yes
- Group level	Yes	No	Yes

As a consequence, it is interesting to look in a more detailed way to these differences, in particular to stakeholder related aspects. Table 3 summarises the results of the three cases with respect to stakeholder participation and learning. To start with, the number of participating stakeholders and individuals was considerably higher in both the MSL case and the NPF case than in the SHN case. With regard to stakeholder participation, the degree of *heterogeneity* was high in all three cases. This means that in each backcasting experiment stakeholders from all four distinguished societal groups (research, business, government, and public interest groups and the wider public) were actively involved.

Table 3 also shows that the *degree of involvement* was low in the SHN case, while it varied across different groups in both the NPF case and the MSL case. In the latter two cases especially research parties, to which most research in the latter two backcasting experiments was commissioned, showed high degrees of involvement. As far as the *types of involvement* are concerned, stakeholders involved in the SHN case provided only the capacity to attend two stakeholder workshops. In the MSL case and the NPF case various stakeholders were willing to provide co-funding and substantial capacity for contributing to the activities (more than meetings, workshops, etc), including additional research capacity.

In all three backcasting experiments stakeholders had no or very limited influence on the process. In all three cases the process was designed and managed by the organisers of the backcasting experiment. With regard to the influence the stakeholders had on the content, there is again a difference between the MSL and the NPF case, on the one hand, and the SHN case on the other hand. In the latter case stakeholders had a high degree of influence.

To a large extent this influence was exerted through two stakeholder workshops in which content was generated for scenario construction, scenario assessments and backcasting analysis, as well as for defining and elaborating concrete follow-up proposals and a follow-up action agenda. A majority of participating stakeholders in the MSL case and the NPF case had only low to moderate degrees of influence on the content. In general, they had to work with what was decided and done before they came on board.

However, at particular moments in the NPF case and the MSL case a limited and carefully selected group of stakeholders could exert a high degree of influence. In the NPF backcasting experiment this was the case in six initial interviews and the related meeting that involved a small number of high level stakeholders including technological experts and R&D directors. After this there were no major changes with regard to the course and scope until the end of the backcasting experiment on NPFs. However, within this scope and focus, there was considerable influence from the multidisciplinary group of researchers from 9 research organisations and the project team appointed by the hosting STD programme.

In the MSL backcasting experiment four such key moments can be identified. The first one was during the workshops in the nutrition domain analysis, in which the MSL option emerged and received support from the attending stakeholders. The second moment was when a limited number of stakeholders was interviewed, after which it was decided at the STD office to select the Winterswijk region for a pilot. The third moment was when two rounds of interviews took place with selected stakeholders from the Winterswijk region, whose feedback was used to elaborate the future vision for the region. The fourth was when the stakeholders in the steering group of the MSL backcasting experiment decided to continue, which was the starting point of the MSL Winterswijk programme.

Higher order learning has been analysed with respect to three types of shifts (that are interrelated) following Brown et al 2003). These are (1) shifts in framing major problems and of perceived solutions by specific actors; (2) shifts in the principal approaches to solving these problems and in shifting priorities by specific actors; and (3) joint learning, shifts in congruence and joint opinions in any of the issues related to the previous shifts or shifts in the relationships among the participants. In this comparison I combine the first and second types of shifts, as they both concern higher order learning at the level of individual actors. By contrast, the third type of shift reflects higher order learning at the group level.

In all three cases higher order learning on the topic and higher order learning on the approach could be observed. Higher order learning on the topic has been more substantial in the MSL case and the NPF case than in the SHN case in terms of instances and the range of aspects. In addition, the SHN case showed no higher order learning at the group level, whereas both the MSL case and NPF case show instances of learning at the group level. Learning in the SHN case was also of a different nature; in the SHN case higher order learning was (partly) the result of comparing the three future visions. In the other two cases, the emphasis was on higher order learning with regard to the proposed solution (reflected in the envisaged sustainable system innovation), as well as reframing the sustainability problem underlying the proposed solution and the principal approach to the sustainability problem.

4.4 Case comparison

Our next interest is in identifying factors of backcasting experiments that may enable or constrain follow-up and spin-off. So, by comparing the differences between on the one hand the NPF case and the MSL case, and on the other hand the SHN case, factors may be found that affect the degree of follow-up and spin-off and can be seen as internal factors of the backcasting experiment.

Table 4 Differences between cases with and without significant follow-up

MSL case & NPF case	SHN case
High degrees of stakeholder involvement among some groups of stakeholders	Only a low degree of stakeholder involvement
Various types of stakeholder participation including co-funding and substantial capacity	Only one type of stakeholder participation, limited capacity for workshop attendance
Limited (selected) groups of stakeholders have high levels of influence	All participating stakeholders have high levels of influence
Single vision	Multiple visions
High degrees of guidance and orientation by the vision	Moderate degree of guidance and low degree of orientation by the visions
Considerable budgets (around € 2 millions)	Limited budget (around € 200,000)
Institutional protection	No institutional protection
Several vision champions	No vision champion
Strong focus on follow-up and implementation	Focus on academic methodology development; little focus on follow-up and implementation
More instances of higher order learning on the topic at the level of specific stakeholders	Moderate instances of higher order learning on the topic at the level of specific stakeholders
Joint and congruent learning among groups of stakeholders	No joint or congruent learning among groups of stakeholders

The differences that were identified are listed in Table 4. Please note that some of these differences and the underlying factors may be related and interdependent.

Table 5 Internal factors enabling and constraining the extent of follow-up

Enabling internal factors	Constraining internal factors
High degree of stakeholder involvement	-
Diversity in types of stakeholder involvement	-
Single vision backcasting experiment	Multiple visions backcasting experiment
High degrees of guidance and orientation of the future vision	-
Institutional protection	-
Presence of vision champions	-
Strong focus on follow-up and implementation	Strong focus on academic achievements
Joint and congruent learning	-

5. Conclusions

The ***first*** conclusion is that backcasting experiments involving various stakeholders from different societal domains can result in the development, exploration and analysis of desirable visions of the future that provide guidance (where to go) and orientation (what to do) to involved stakeholders; backcasting experiments can also lead to instances and processes of higher order learning among participating stakeholders and in the formulation of follow-up agendas.

The ***second*** conclusion is that this does not automatically lead to follow-up, spin-off and implementation in line with the vision and the follow-up agenda, but that this depends on various internal and external factors that can be both enabling and constraining.

Important enabling ***internal factors***, relating to the backcasting experiment (see Table 4), are institutional protection by top level of participating stakeholders, the emergence of vision champions, a high degree of stakeholder involvement, other types of participation in addition to the capacity to participate like co-funding or substantial 'free' capacity, a strong focus on follow-up and spin-off, a single vision backcasting experiment, and high degrees of influence to key stakeholders. Constraining internal factors related to the backcasting experiment include a multiple vision backcasting experiment and a strong focus on academic achievements.

Table 6 'Generalised' enabling and constraining external factors

Enabling external factors	Constraining external factors
> Entries of 'motivated' stakeholders, due to contingent or external factors	> Exit of stakeholders due to contingent or external factors
> Presence of and access to government funding programmes	> Competition by other visions or proposals
> Contingent factors due to initiatives in the context (e.g. policy change by NWO board)	> Constraining influence by supranational organisations like EU and WTO

External factors can have a big influence on the emergence of follow-up, spin-off and wider effects. Furthermore, they are highly context-dependent and can also be highly contingent. This considerably complicates identifying more generic enabling and constraining factors that may have a wider relevance. Nevertheless, based on the cases, some 'generalised' external factors are proposed in Table 6.

The ***third*** conclusion is that the vision of the desirable future is relevant to follow-up and spin-off activities and provides high degrees of guidance (where to go) and orientation (what to do). Follow-up and spin-off activities are constituted by networks of actors that have been successful in mobilising sufficient resources for establishing the activities. Visions of the future at play in follow-up and spin-off show both stability and flexibility; visions co-evolve with networks in the sense that networks and actors are influenced and inspired by the visions, while networks and actors involved in follow-up and spin-off influence and adjust the vision too.

The ***fourth*** conclusion is that when substantial follow-up and spin-off occur after five to ten years, they still take place at the level of niche activities, or concern a set of niches in the four distinguished domains of research, business, government, and of public interest groups and the general public. This follow-up and spin-off comes along with first instances of broader impacts and institutionalisation. The niches have 'grown out' of the backcasting experiments and can be seen as first steps or stepping stones towards system innovations towards sustainability.

6 Stakeholder involvement revisited

6.1 Stakeholder involvement and spin-off

What can we learn from the cases about stakeholder involvement in backcasting when aiming at spin-off and impact?

First of all, the results indicate that considerable follow-up and spin-off can be achieved when stakeholders have no or very limited influence on the process of the backcasting experiment. In addition, considerable follow-up and spin-off were also possible when most stakeholders have a moderate or low degree of influence on content and small groups of key stakeholders have a high degree of influence. This suggests that careful network management and theories of network management may be more relevant than theories of stakeholder participation in (public) decision-making and science. This also suggests that whereas most stakeholder theories argue that more influence and control by stakeholders on both content and process provide higher degrees of acceptance, legitimacy, accountability and commitment, and therefore a higher probability of follow-up and acceptance, this might be especially important for these key actors that potentially have most influence. For instance, Peek (2007) has argued that in urban planning stakeholders with resources should be involved in the early design stage, while the public and inhabitants can be involved at a later stage.

However, there is an ongoing debate on how to relate representative and deliberative democratic practices when they occur at the same time, as well as in what kind of arrangements they can be combined and how this relates to different types of governance (Driessen *et al.* 1995, Teisman and Edelenbos 2004). By contrast, it may also be that different purposes of participation must be distinguished in advance that require different types of participation, such as broad participation aiming at wide public acceptance, or a focus on stakeholders that see opportunities when aiming at follow-up. For instance, Peek (2007) has argued that in urban planning stakeholders with resources should be involved in the early design stage, while the public and inhabitants can be involved at a later stage. In technology assessment a similar dilemma has not yet been resolved. On the one hand there are pleas to involve the public in the early stages of decision-making on new technologies, for instance through citizen juries and lay panels, while on the other hand public concerns are only widely articulated when new technological artefacts diffuse into society.

Thirdly, as the degree of stakeholder involvement proved a relevant explaining factor in the cases, it also seems logical that a higher degree of involvement leads to better opportunities for learning, debate, exchange of views and opinions and diffusion of ideas, visions and concepts. However, no theoretical base for this has been found in stakeholder theory or in theories of higher order learning. This can be due to the roots of various stakeholder theories focusing on involving citizens and social actors in (public) decision-making and science or improving the external communication of companies, but deserves further theorising. It may be that relevant elaborations can be found in learning theories focusing on education or learning-by-doing in innovation studies. Interestingly, different types of involvement is acknowledged in economic or industrial network theory (Hakansson 1989), where it is referred to as different types of resources. By contrast, in various stakeholder theories no such concept has been found, while this might provide additional explanatory power.

Fourthly, this research indicates that participation not only may lead to joint vision development, but also to related network formation in the sense that the network supports the vision. Saying it differently, the vision and the network mutually influence each other and the vision is as much the outcome of the network (process) as that the vision provides guidance and orientation to the network.

6.2 User involvement versus stakeholder involvement.

User-centred innovation and user involvement is increasingly applied in design and product development. However, in sustainable innovation it has been largely neglected so far as the focus has been on improving the environmental performance of products by approaches like ecodesign, design for sustainability and sustainable product-service systems. However, the issue of user involvement in sustainable design is emerging (e.g. Sanders and Stappers

2008, Wever et al 2008) first pilots and cases are emerging, for instance by working with living labs (e.g. Bakker et al 2008, Scott 2008). Interestingly, in the field of sustainability studies, system innovations and transitions to sustainability, stakeholder participation is quite common through stakeholder dialogues and participatory generation of normative scenarios and desirable visions (e.g. Quist 2007, Loorbach 2007, Van de Kerkhof 2004, Cuppen 2008), though the level of stakeholder influence varies considerably.

The issue now is how these two practices might learn and benefit from each other, though we can only touch briefly on it. On the one hand, the practice of user involvement in design is strong in involving end-users and consulting them profoundly on usefulness and appreciation of the design as well as in getting feedback to improve the design, while there are also well structured and elaborated design and participation methods to facilitate this, as well as enhancing creativity and first attempts moving towards co-design. However, as most of this work takes place in a business setting, the emphasis is more on consultation. Co-design seems to refer to a higher level of influence and collaboration, but it is the eventually the company decision-maker that decides and bounds on what aspects influence is given and on what aspects not. Furthermore, little influence is in general given to other stakes and stakeholders, especially social aspects by which environmental performance and behavioural change options might become neglected.

On the other hand, practices of stakeholder involvement in sustainability issues provide nice examples of high levels of stakeholder influence (but not always). These also provide nice examples of working with heterogeneous groups of stakeholders having different views, stakes and values and facilitating their dialogue and putting up a broad range of issues and aspects in a structured way as well as development of long-term visions and perspectives.

So, co-design and user involvement practices may benefit from stakeholder-oriented practices by broadening scope and aspects including long-term effects and side-effects, as well as allowing higher levels of influence and involving more heterogeneous groups. Reversely, stakeholder oriented practices could benefit from co-design and user involvement practices by adopting creativity and more structured design methods as well as the involvement of citizens and end-users.

An early attempt to learn from co-design practices was the ‘Strategies towards the Sustainable Household (SusHouse) backcasting experiment that was one of the three backcasting cases reported on in Section 4 of this paper. Here, a design-oriented scenario methodology and creativity tools were combined with broad stakeholder involvement, high levels of stakeholder influence and consumer focus groups (Quist et al 2001, Green and Vergragt 2002, Young et al 2002, Klapwijk et al 2006, Quist 2002, Quist et al 2002).

7 Recommendations and reflections

7.1 Recommendations

It is recommended to **organisers** of backcasting experiments, as well as organisations that commission backcasting experiments, to use the developed methodological framework for participatory backcasting to design and conduct backcasting experiments. For more guidelines see Table 7. It is recommended to **developers** of backcasting to extend and elaborate the four groups of methods that can be distinguished in backcasting. This should be not only be done based on research, but also based on the experience of organisers and appliers of backcasting. This could for instance be done through establishing a Community of Practice on backcasting or include backcasting in a Community of Practice on foresighting and future studies for sustainability. Moreover, as argued in this paper this should include looking into other practices of stakeholder an user involvement.

To **initiators** and **commissioners** of backcasting experiments, especially the government, it is recommended not to limit support and facilitation to the backcasting experiment,

immediate follow-up and knowledge development, but to extend support and facilitation to follow-up and spin-off after more than ten years. The latter allows further facilitation of desirable system innovations towards sustainability. This could include support of market development, new regulation and adjustment of existing regulation.

Three major recommendations to **researchers** can be made: (i) extending the number of evaluations of backcasting experiments and their impact; (ii) further theorising and conceptualising on mechanisms and other theoretical aspects connected to the dynamics in backcasting experiments, their follow-up and how these relate to system innovation theories; (iii) further methodology development. There is also a need to compare more thoroughly with transition management as proposed by Rotmans et al (2001) and link it to reflexive governance (Voß et al 2006). This should also include utilising experences, skills and methods form user and stakeholder involvement practices, such as user involvement in design.

Table 7 Some guidelines for organisers of backcasting experiments

> Give influence to committed key stakeholders
> Stimulate other types of stakeholder involvement besides 'workshop attendance', such as co-funding, substantial capacity and expertise
> Focus on a single future vision with its 'own' group of stakeholders involved
> Stimulate institutional protection at top management levels of involved stakeholders
> Stimulate high degrees of stakeholder involvement
> Involve or stimulate the emergence of (potential) vision champions that can become 'brokers' in relevant networks
> Focus strongly on follow-up of the backcasting experiment, as well as implementation and usability of its outcomes
> Do not keep several visions within a single backcasting experiment

7.2 Reflections on (system) innovation theory & governance

Based on the cases it has been concluded that when substantial follow-up and spin-off occur after five to ten years, they still take place at the level of niche activities, or concern a set of niches in the four distinguished domains of research, business, government, and of public interest groups and the general public. This follow-up and spin-off comes along with first instances of broader impacts and institutionalisation. The niches have 'grown out' of the backcasting experiments and could be seen as first steps or stepping stones towards system innovations towards sustainability, or at least having the potential for this. Interestingly, clusters of activities as found in this research can be seen as niches, which can be found in all four societal domains distinguished. This finding contains various suggestions for refining the existing niche concept in innovation studies. Firstly, a niche is not necessarily a simple phenomenon like a market niche or a technological niche, but can comprise various types of niche activities in different societal domains that may have an implicit decentralised kind of coordination provided by a future vision. However, the mechanism 'from vision to niche' as shown in this paper may be an interesting contribution to the Multi-Level Perspective (e.g. Geels 2005), the growing niche literature (e.g. Raven 2005) as well as transition management (Rotmans et al 2001).

Clearly, more time is needed before it can be evaluated if the participatory backcasting experiments will have contributed to a system innovation towards sustainability. Finally, it may also be necessary to initiate additional facilitation in order to make a next step. But if and when that will happen, who will have to take the lead? This raises the issue of

governance for system innovations towards sustainability. Voß *et al.* (2006) have plead for reflexive governance that include both that includes reconsidering and adapting actors' and individuals' own actions and behaviour, as well as reconsidering and adjusting structures and institutions, which relates in a way to the ambitions of Beck's reflexive modernisation. Next to these fundamental aspects, there are also the issues of coordination or even control and what government should and can do.

Finally, it can be mentioned that the various theoretical concepts proved useful to build the framework, evaluate the impacts of backcasting and to connect these to the backcasting experiment. Clearly, stakeholder involvement, learning, vision development and network formation are important, but more theoretical and conceptual work is needed here, also on the process how spin-off activities are shaped and initiated.

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