Analytic and dynamic approach to collaboration

A transdisciplinary case study on sustainable landscape development in a swiss prealpine region

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ORIGINAL PAPER

Analytic and Dynamic Approach to Collaboration: A Transdisciplinary Case Study on Sustainable Landscape Development in a Swiss Prealpine Region

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Abstract The involvement of stakeholders and the public in societal decision processes has lately received increased attention. We suggest that appropriate and tailored techniques should be selected and integrated to provide the prerequisites for inclusive involvement depending on the issue, type, goals and phase of the decision process in question, i.e. an analytic, systematic and dynamic approach to collaboration. In a transdisciplinary case study design we integrate diverse analytical methods whereby a process of mutual learning between science and people from outside academia is strived for. Our framework for collaboration is illustrated by a case study on sustainable landscape development in the Swiss prealpine region of Appenzell Ausserrhoden.

Keywords Societal decision process · Involvement of stakeholders and the public · Collaboration · Transdisciplinary case study design · Sustainable development

Introduction: Dynamic and Analytic Framework for Collaboration

The need for more involvement of different stakeholders and the public[1] in societal decision processes is widely recognised. Different lines of reasoning are offered to *justify why collaboration* should be supported. Fiorino (1990) distinguished between three major arguments: (1) normative, (2) instrumental and (3) substantive. (1) The first refers to the democratic ideal that 'citizens are best to judge their interest' (Fiorino 1990, p. 227). It has

[1] We follow Chilvers (2007) in distinguishing between *stakeholders*, who represent interests of groups and *publics*, who represent primarily themselves but are potentially representative of different societal groups (see as well Pahl-Wostl 2002).

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long been recognised that concerned and affected people are the best experts for their problems and their needs. In line with that, Otway (1987) called "the people whose lives are affected … the true experts on questions of value regarding the risks of technology", p. 125. (2) According to the instrumental reasoning, involvement of the public should guarantee increased legitimacy of policy decisions countering the crisis of confidence and trust in decision-making processes (Fiorino 1990, p. 228, see as well Chambers 2003, p. 316). (3) On the substantive level, e.g. risk researchers stress that "lay judgments about risk are as sound as or more so than those of experts" (Fiorino 1990, p. 227; see as well, e.g. Renn 2005). Further, Beierle and Cayford (2002) distinguished as social goals between (1) incorporation of public values into decisions; (2) increasing the substantive quality of decisions; (3) resolving a conflict among competing interests; (4) building trust in institutions; and (5) educating and informing the public. The latter has lately received increased attention as the process character of collaboration is stressed and a learning process is aspired among all those participating (Hubacek and Prell, this issue; McDaniels and Gregory 2004; Stauffacher 2006; Stringer et al. 2006).

Despite these different functions, *'participation'* per se seems to be often an all-purpose vehicle. As yet, it is *not at all evident what 'participation' actually means*, esp. in complex and contentious issues (Krütli et al. 2006; Flüeler et al. 2007): Which groups should take part (scientific experts, stakeholder groups, public at large); by which information flow (one-way, two-way); to which degree of power should they be entitled (full power to public, equal power for all, none to public, as voices among others or with a final say); what is the goal of the process (integrating different sources of knowledge and values, acceptance and implementation of a preconceived project or, improved decision-making or learning during and by the process); and, consequently, what technique(s) should be applied?

To *decide which technique to use*, several typologies of involvement to discriminate different techniques have been proposed (e.g. Arnstein 1969; Bishop and Davis 2002; Pahl-Wostl 2002; Pretty 1995; Rowe and Frewer 2005; Van Asselt and Rijkens-Klomp 2002; Webler 1999). In her "ladder of citizen participation" Sherry Arnstein (1969) distinguished eight levels classified within three groups according to the degree of empowerment: non-participation (manipulation, therapy); degree of tokenism (informing, consultation, placation); degree of citizen power (partnership, delegated control, citizen control). The often expressed understanding of 'one technique is adequate for one problem' is in our view questionable (Krütli et al. 2006). From evaluation studies and our own experiences, we gather that there is not a one-fits-all technique but different techniques should be prudently combined and complement each other (Beierle 2002; Beierle and Cayford 2002; Fiorino 1990). For the selection of adequate techniques, we use an adapted distinction of involvement based on the general idea of increasing degree of empowerment by Arnstein (1969): information, consultation, cooperation, collaboration and empowerment. We consider information and consultation as rather weak forms. They have generally a non-committal character and use one-way communication. More up the ladder, we have more activating forms which require a commitment but give binding power to the input. The range varies from cooperation to collaboration both using two-way communication. In the former, still a hierarchical relation between those involving and those being involved exists. In the latter, all collaborators are responsible on equal footing for the progress of process and output. On the upper end, the public or the stakeholders will be empowered, giving them full power over content and process. Boundaries between the levels are of

course blurry and permeable, e.g. collaboration will eventually lead to empowerment. Yet, gradual differences are discernible and deserve attention.

The importance of a *dynamic understanding of involvement of stakeholders and the public* can be elucidated if we refer to two prototypical patterns (Krütli et al. 2006). The 'expert approach' is strictly limited to expert people. The problem is perceived as a technical one and therefore to be solved exclusively by technical experts. Involvement is generally limited to information and consultation. The counterpart is the 'grassroots approach' where stakeholders and the public are fully empowered during the entire process. In the context of many current environmental problems—with (1) complex scientific problems containing many uncertainties and at the same time (2) multiple stakeholder groups and the public affected—it is to be expected that both approaches fail. A dynamic and, thus, adapted approach is necessary. In our view, each type and phase of a project has its specific and adequate form of involvement (Flüeler et al. 2007). In fact, no process of a complex decision problem requires a single level of involvement only; it will rather span different levels at different points in time. The level of involvement should—and according to our experiences actually does—depend on the phase and goals of the process and its context.

Analytical approaches appear indispensable given the complexity of many present decision problems—with a set of different options for future development, a need to include knowledge and values from diverse stakeholders and the public as well as the need to gauge diverging goals and scrutinize possible trade-offs given high system uncertainties (Funtowicz and Ravetz 1993). Complex decisional issues require a framework that integrates multiple methods and allows for multicriteria decision making with multiple stakeholders (Petts 2004). Analytic methods to collaboration in sustainable development have only recently gained a more prominent role (see, e.g. Brown et al. 2001; McDaniels and Trousdale 2005; Loukopoulos and Scholz 2004; Sheppard and Meitner 2005). Most of them apply a generalized model of a decision-making process. Sheppard and Meitner (2005, p. 184) emphasise that this can "help [to] bridge the gap between general participatory processes and complex decision-support systems". Based on our research in large-scale transdisciplinary projects (for an overview, see Scholz et al. 2006) in domains such as transportation, urban and rural development, tourism, radioactive waste management and regional clustering, we propose a template for a decision-making process distinguishing several phases: goal formation, system analysis, scenario construction, multi-criteria assessment, generation of orientations (Scholz et al. 2006, p. 238). Along these phases, different analytical techniques and research methods are selected.

Thus, we propose an analytic and dynamic approach to societal decision processes in which appropriate and tailored techniques should be selected and integrated to provide the prerequisites for inclusive involvement depending on the goals and phase of the decision-making process in question. Essential seems that the approach is sufficiently diversified and adaptable to cope with an ever changing environment. That means a flexible repertoire of various techniques is necessary to cope with any contingencies (cf. "The Law of Requisite Variety" by William Ashby (1956)[2]; Jessop 2003). In the next section our approach is illustrated by a case study on sustainable landscape development in the Swiss prealpine region of Appenzell Ausserrhoden.

[2] We are thankful to an anonymous reviewer for this idea.

A Transdisciplinary Case Study on Sustainable Landscape Development

Overview

Appenzell Ausserrhoden is a canton of 20 communities with 53,500 inhabitants on a surface of 242 km^2. It has been historically shaped by traditional industries and lies in the vicinity of St. Gallen in the Greater Zurich Area (Scholz and Stauffacher 2007). Communities at a large distance from the national traffic infrastructure and the bigger cities suffer from decreasing population, decreasing labour opportunities, and thus decreasing wealth. Landscape is the main capital of the canton, for agriculture, tourism but also for housing (Scholz and Stauffacher 2002). To the regional government it was unknown, how the region can utilise its landscape without endangering its potential. Therefore, the president of the canton contacted ETH-NSSI (Chair "Environmental Sciences—Natural and Social Science Interface" at the ETH Zurich) to conduct a case study in the region.

For such an encompassing and complex subject, knowledge and experience of science and from people outside academia are to be combined. We denote such an approach as *transdisciplinary*. This refers to a new form of knowledge production with a change from research *for* society to research *with* society, whereby a mutual learning process between science and society is aimed at (Scholz 2000; Scholz et al. 2000; Hirsch et al. 2006). As such it is a competence building process for the society: "Transdiciplinarity is a way of increasing its [society's] unrealized intellectual potential, and, ultimately, its effectiveness. […] Transdiciplinarity is a new form of learning and problem solving involving cooperation among different parts of society and academia in order to meet challenges of society. Transdsiciplinarity starts from tangible, real-world problems." (Häberli et al. 2001, p. 4, 7). In this sense, a 'reciprocal participation' (Stauffacher 2006) takes place: researchers participate, e.g. in the decision process of a region; and planers, industry, politicians and administration participate in the research process but each still fulfilling their essential societal role and function.

The following core elements of the project were implemented in six steps (see Table 1): (1) Define a guiding question; (2) facet the case, perform (3) a system analysis and (4) a scenario development (see as well Gottschick this issue; Volkery et al. this issue); (5) conduct a Multi-Criteria Analysis (MCA) by referring both to science-based arguments (MCA I) and obtaining individual preferences from different stakeholder groups (MCA II); and, finally, (6) discuss the results and develop orientations (Scholz and Tietje 2002; Scholz et al. 2006).

Each phase of the case study in Appenzell Ausserrhoden had its specific form of involvement. We plot a graph with the project progress against the intensity of involvement and indicate a selection of the applied techniques (see Fig. 1). We indicate as well people involved (public or stakeholder) and the degree of formalisation (see Table 2).

The Procedure: Step by Step

Define a Guiding Question (February 2000 Until December 2000)

As said above, the initiative to this study came from the side of the canton. An initial agreement was established to conduct a case study in the region. The project was jointly led by the president of the canton and Prof. Scholz (*'co-leadership'*). As such it represents a specific form of 'participation' as we seek a real partnership where both parties (science and people from outside academia) join on equal footing with their own interests and goals.

Table 1 Six steps in the transdisciplinary case study on landscape development in Appenzell Ausserrhoden (for details see Scholz et al. 2002)

Step	Description
(1) Define a guiding question (Scholz and Tietje 2002, pp. 84–86, pp. 268–9)	We defined, jointly with stakeholders, the following guiding question: "How can the ecological quality of landscape in Appenzell Ausserrhoden be preserved or improved and, at the same time, the added value be sustained or even increased?"
(2) Facet the case (Scholz and Tietje 2002, pp. 55–56)	We determined, jointly with stakeholders, subsystems that allow for sufficient representation and extrapolation: 'nature and landscape', 'tourism and leisure', and 'rural settlement'
(3) Perform system analysis (Scholz and Tietje 2002, pp. 48–54, 87–88, 241–6)	We investigated history and dynamics of region using document analysis and analysis of relevant data from the national statistical office. We conducted interviews with different people from the region
	We selected a set of impact factors considered to be relevant and sufficient to describe the current state of the three subsystems. Impact matrixes, system grids, Mic-Mac-Analysis, system graphs deepened the understanding of the system and its dynamics (for details, see Scholz and Tietje 2002)
(4) Construct scenarios using Formative Scenario Analysis (FSA) (Scholz and Tietje 2002, pp. 105–116)	We defined two to three levels of development for each impact factor. A scenario, then, is defined as a complete combination of levels of all impact factors. Using consistency analysis (Scholz and Tietje, 2002 pp. 105) those scenarios exhibiting high inconsistency scores were discarded
(5) Perform Multi-Criteria Analysis (MCA) (Scholz and Tietje 2002, pp. 143–173, 197–224)	We used a small set of eight to nine evaluation criteria for each subsystem. We applied two different approaches of MCA: (i) calculations based on data, literature and expert interviews (data based evaluation, MCA I); (ii) assessments provided by different stakeholder groups for each sub-system (stakeholder-based evaluation, MCA II). MCA II evaluations were made in two steps: 1. overall, 2. detailled, using the criteria from the MCA I
(6) Develop orientations (Scholz and Tietje 2002, pp. 114–115, 268–269)	We discussed, again jointly with stakeholders, the results of the above steps. Based on this transdisciplinary discourse, we developed orientations for future action

Throughout this step, we primarily used informal workshop techniques (moderated group discussions, see Hornecker 2004). We defined the problem and the guiding question in a round of intense discussions in the *'steering group'*. This group was strongly involved during the entire project, defined the project framework and continuously evaluated the project quality (Scholz et al. 2006). It is here that *collaboration* in the project was established. The steering group was composed of the following stakeholders (*'key players'*, see Scholz and Tietje 2002): head of office for the promotion of the economy, two heads of administration (agriculture/forestry, environmental protection), the cantonal historian/archivist, one farmer/mayor of a community, another mayor of a community, one independent expert for tourism and landscape, three independent experts for regional planning/development. Furthermore, the project team of the ETH participated (four senior researchers). Some preliminary media analysis helped us define the problem in the region and how the issue 'landscape development' was framed by different stakeholders (Andsager 2000; Dahinden 2006). In-depth interviews with key people from the region (*consultation*) and first 'experiential case encounters' (Scholz and Tietje 2002, pp. 241–6) furthered our understanding of the case. Finally we informed the public about the case study with the help of newspaper articles (*information*).

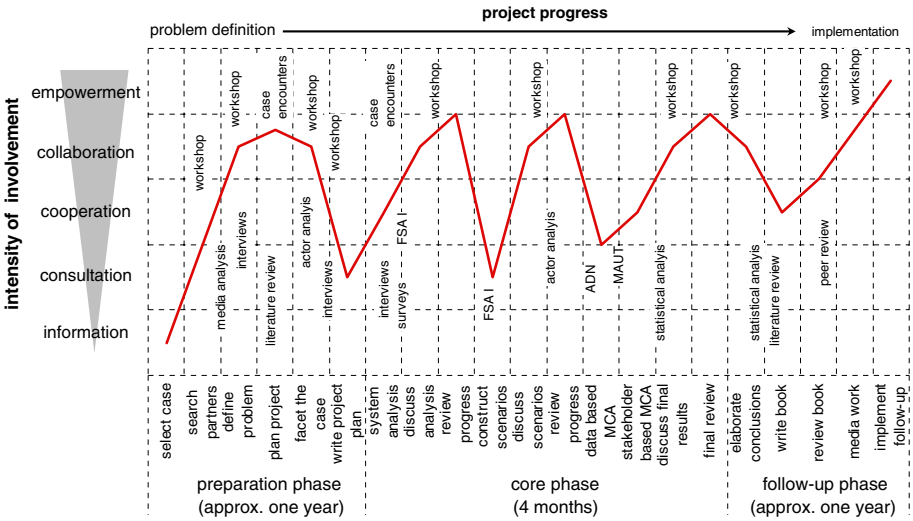

Fig. 1 Varying degrees of involvement and selection of applied techniques in the case study on landscape development in Appenzell Ausserrhoden

Facet the Case (January 2001 Until September 2001)

The discussion "which perspectives to choose" again required multiple workshops with the 'steering group'. In addition to the 'steering group', an *'advisory board'* was established, consisting of other stakeholders (e.g. CEO of industrial companies, farmers, community mayors, bank managers) from the region and scholars from ETH and other research institutes. In total 18 stakeholders were involved in this step—on the level of *consultation*. Again we applied mainly informal workshop techniques. Complemented was this step with a detailed literature review. We reviewed research literature to assess which disciplines are helpful to tackle the problem as in transdisciplinary projects not the scientific discipline is defining the problem but vice versa (Hirsch et al. 2006). Additionally, we investigated into available information and documents and executed a basic stakeholder analysis. With the help of a Formative Scenario Analysis (FSA, see Scholz and Tietje 2002; Wiek et al. 2002) we developed frame scenarios for the region. Here again, two regional experts were involved (*collaboration*).

Perform System Analysis (October 2001 Until November 2001)

In this step we used formalised methods (mainly FSA) but applied as well less formalised methods. In each of the subgroups, we established a '*reference group*' to regularly discuss the project work. In contrast to the 'steering group' and the 'advisory board', we wanted to involve broader segments of the public. To this end, an extended range of different people were involved, such as, e.g. farmers, teachers, a hotel-keeper, housewives, a medical practitioner, a bank manager, architects, planners, foresters, a pastor. In these groups, we used, e.g. focus group interview techniques to collect information systematically. In the *system analysis*, these 'reference groups' offered their detailed

Table 2 Level of involvement and degree of formalisation in the case study on landscape development in Appenzell Ausserrhoden

Step	People involved	Level of involvement	Degree of formalisation[3]
(1) Define a guiding question	'Steering group' (ten stakeholders from the region)	Collaboration	Low
(2) Facet the case	'Steering group'	Collaboration	Low
	'Case study advisory council' (eight stakeholders from the region)	Consultation	Low
(3) Perform system analysis	Personal interviews with approx. 30 people (from the public)	Consultation	Medium
	Discussion of the system analysis in three 'reference groups' with a total of 34 people (from the public)	Cooperation	Medium
	Progress review in the 'steering group'	Collaboration	Low
(4) Construct scenarios using FSA	Elicitation of intuitive scenarios in the 'reference groups'	Consultation	Medium
	Discussion and final selection of scenarios in the 'reference groups'	Cooperation	Medium
	Progress review in the 'steering group'	Collaboration	Low
(5) Perform MCA	Surveys (approx. 200 questionnaires with public) and approx. 20 expert interviews in MCA I	Consultation	Medium to high
	78 people in MCA II (stakeholders)	Consultation	High
	Discussion of results in the 'reference groups'	Cooperation	Low
	Progress review in the 'steering group'	Collaboration	Low
(6) Develop orientations	Discussion of results and elaboration of orientations with 'steering group' and 'case study advisory council'	Collaboration	Low

Further to the involvement depicted here, numerous media articles informed about the study and several presentations and poster sessions were organised with a total of approx. 150 participants (mostly information only)

qualitative insights into the components and functions of the system. Due to the technicalities of the method (FSA) requiring an abstracted system understanding, we carried out major parts of the analytical work at the ETH. The results, again, where fed back and discussed with the 'reference groups'. Hence, the groups were involved for *consultation* and to *cooperatively* develop a better problem understanding. Overall, the system analysis was used to synthesise results from a wide range of different sources (secondary data analyses, expert interviews, workshops with people from the region and media analyses) and to further our insights of the case. Formalised methods (FSA, social research methods) played a prominent role in this step but were supplemented with further "experiential case encounters" and qualitative in-depth interviews (*consultation*) to deepen our understanding.

[3] low: open response mode, unstructured aggregation of information; medium: either closed response mode or structured aggregation; high: closed response mode and structured aggregation (based on Newig et al. this issue).

Construct Scenarios (December 2001 Until January 2002)

This step was largely driven by formalised methods (FSA). In this technique, intuitive and analytical scenario construction is combined (Wiek et al. 2006). Especially for the intuitive scenarios, input from the region was essential. In moderated group discussions with the 'reference groups', we applied different techniques for creative thinking like, e.g. brainstorming and mind mapping to elicit various perspectives for the future development of the region (*consultation*). These intuitive scenarios were then contrasted, adapted and fine-tuned with the help of a formalised approach combining different levels of essential impact factors from the system analysis (FSA). The developed scenarios were finally discussed in the 'reference groups' supported by various visualisation techniques (e.g. maps, collage, photo compositions, etc.). Here it was also decided which scenarios were going to be evaluated in the subsequent step (*cooperation*).

Perform Multi-Criteria Analysis (January 2002 Until February 2002)

This step is, again, predominantly driven by formalised methods. Using a postal survey we assessed the views of the general public and guided expert interviews that provided input for a data based evaluation of the scenarios using multiple criteria (MCA I). Further, different stakeholder groups (*'key players'*, see Scholz and Tietje 2002) from the region provided detailed information in single person evaluation sessions (MCA II). These evaluation sessions lasted at least 1 h for each person and were conducted in line with the requirements applying to psychological experiments. Stakeholders had to provide detailed evaluations in two steps: 1. overall 'holistic', 2. using the criteria from the MCA I. In addition to detailed quantitative data, qualitative and in-depth information was collected, too. Overall, these elements were on the level of *consultation*. The results were then presented and discussed first in the respective 'reference groups' for the each subsystem independently, subsequently offering a comprehensive overall picture in the 'steering group' and finally for all involved people in a large presentation event (*information*).

Develop Orientations (February 2002 Until October 2002)

In this step we primarily used less formalised methods. A round of moderated workshops with the steering group and the advisory council helped us achieving a shared understanding of the results, the joint development of conclusions and joint elaboration of follow-up activities (*collaboration*). Essential in this step was the writing and reviewing of a publication (more than 300 pages, see Scholz et al. 2002).

Following the development of orientations, outcome presentation and discussion events for a diverse range of audiences enabled us to spread and discuss results and conclusions from the project. Many newspapers articles supported this information diffusion; hence, *information* was the level of involvement.

Discussion: The Use of Formalised and Less Formalised Methods

In discussing our experiences from the case study, we focus primarily on the use of different methods and techniques throughout the whole project progress. We place special emphasis on the question how strongly formalised a process element can be—e.g. standardisation of response mode, structuredness of aggregation (see Newig et al. this

issue)—but still be understood and accepted by people from outside academia. In correspondence with our dynamic approach, the answer to this question will be different over the process.

The initial step of a common construction of 'reality' by *jointly defining the problem and the guiding question* and thereby achieving a mutual understanding made it possible for participants to gain problem ownership (Rist et al. 2006; Stauffacher et al. 2006)—key for a real partnership and 'reciprocal participation'. In this first phase of the project, where, e.g. trust building takes place, formalised techniques would in our view, rather be counterproductive. We, therefore, mainly applied informal workshop techniques. In these initial steps, we did (luckily?) not encounter any serious problems. There is of course always a danger that one gets involved in ongoing "powerplays" in the region (Johnsen and Normann 2004). A thorough conflict analysis Sauer (this issue) or actor network analysis (Wiek et al. 2007) to prepare the ground would certainly be helpful in this respect. According to our experiences, having enough time is indispensable in this step. We started the preparation close to 2 years before the actual project started. This provided us with the trust basis essential for the subsequent steps.

By *analysing the current status and developing future scenarios* together with selected people and stakeholders from the region, we gained a comprehensive picture and shared understanding of possible future developments. These comprehensive yet understandable conceptions of the problem and potential options for solutions are, in fact, prerequisites of a rational decision-making process (Gregory et al. 2005). In this phase, well-structured and formalised methods are important to integrate as much knowledge as possible and still allowing transparency of the process.

The *evaluation steps* allowed for the detection and inspection of goal conflicts and necessary trade-offs between different scenarios. Yet, several challenges of the approach need to be acknowledged. The evaluation of scenarios from multiple perspectives is a real challenge, even more so when the criteria are used for preference ratings with people from outside academia and therefore need to be understandable for them. On the side of technical experts, usually some reservation, even resistance, emerges. They sometimes hesitate to provide data when they have to "'boil down' their research findings" to simple overall scores (Sheppard and Meitner 2005, p. 183) that do not cover the more complex interactions present between different criteria. Furthermore, in a stakeholder-based evaluation of the subsystems 'tourism and leisure' and 'rural settlement', we applied a direct measurement and did not use more subtle techniques such as pairwise comparison, outranking or mid-value splitting (e.g. Ananda and Herath 2003; Kangas and Kangas 2005). This choice was deliberate since other techniques are more time-consuming and complex—as we found in the pairwise comparison used in the subsystem 'nature and landscape'. They involve a greater risk of cognitive overload for respondents and, more importantly, are less transparent (Joubert et al. 1997). The evaluation process can become too complex and abstract for some stakeholders—a well-known dilemma in stakeholder-based MCA (Joubert et al. 1997; Sheppard and Meitner 2005). A trade-off is necessary between scientific depth and process appropriateness—yet always making use of established and trusted methods to allow auditability and traceability of results.

As to *the whole process*, an analytical approach was crucial. In contrast to less systematic approaches of collaborative planning (Forester 1999; Sager 1994), all input from the region is documented and can be traced in the process, and hence the transparency of the collaboration process is ensured (Joubert et al. 1997). At the same time, the systematic integration of multiple but mostly straightforward methods makes the input by scientists more traceable than when using, e.g. highly sophisticated computer models. Compared

with other analytical approaches such as stakeholder-based MCA (Brown et al. 2001; McDaniels and Trousdale 2005; Sheppard and Meitner 2005), our TdCS design offers at least four distinctive elements. First, joint problem definition at the outset is crucial as a first step towards real collaboration and joint ownership of the problem. In many other stakeholder-based MCA, this step is completed by the research team or the principal researcher alone. Second, the comprehensive, context-rich description of the actual situation and of future scenarios supported not only subsequent evaluation but also provided important insights into problem understanding and helped find scenarios where the evaluation outcome was not evident. Third, we would like to point out the equal footing of data-based and stakeholder-based evaluations in our approach. We deliberately refrain from referring to these two forms of evaluation as 'objective' and 'subjective', instead preferring the term 'constructive' as both are different ways of constructing reality (Belton and Pictet 1997; Stauffacher et al. 2006). Last but not least, the very process of assessing the actual situation and developing and evaluating future scenarios induces a learning process. It can empower and motivate people from the region to contribute more actively in the subsequent implementation or in other decision processes, an outcome documented elsewhere in similar studies (Brown et al. 2001; Sheppard and Meitner 2005).

Conclusions

If we review the "degree of formalisation" Newig et al. (this issue) of our methods applied throughout the case study, we notice an interesting pattern: *we started with rather little formalised methods, made use of much more formalised methods in the core phase and finalized with less formalised methods*. Again our dynamic approach becomes visible and illustrates how important it is to systematically decide how different groups of people are to be involved in such a project. Further fundamental is the institutionalised form of collaboration that we followed with the 'steering group', the 'advisory board', and four 'reference groups'. All these groups manifested an involvement at different levels. In the 'steering group' intensive collaboration between science and people from outside academia took place, in the 'reference groups' consultation and cooperation and in the 'advisory board' primarily consultation. Crucial was of course the decision who to involve. For the 'steering group' we concentrated on people with official mandates like, e.g. the president of the canton who served then as co-leader to the project. This stands in contrast to the 'reference groups', where we were interested in involving people from general public. All in all, this allowed for continuous interaction among science, stakeholders and the public and enabled as well subsequent steps towards implementation of results. The implementation was in fact primarily governed from within the region as we were slowly phasing out during this step. This goes in line with the idea of a "transdisciplinarity college" (Scholz and Marks 2001) where scientists and people from outside academia collaborate for a certain period of time—keeping their essential societal role and function and following after the end of the project their own activities.

The *impact of our case study* can be illustrated by individual feedback from involved stakeholders that we gathered over the last years. (1) A family holiday village in the poorest community of Urnäsch was opened in 2008. The concept and design has been strongly influenced by the case study as it has been expressed in a letter from the mayor of this community: "The buildings are made of wood; all wood comes from our forests. The construction complies with standards of minimized energy consumption. The holiday village will be heated using wood chips from our forests. You see, we have implemented

practically all what the study has proposed." (Our translation, shortened). (2) In the wood industry the results of the study were intensely discussed. The "Appenzell wood chain" received important, new inputs in the form of the case-study results as it has been expressed in their annual report in 2002: "We had serious and thorough debates about the future of the wood industry in Appenzell Ausserrhoden. The ETH case study was the trigger to these discussions" (our translation, shortened). Later in the annual report 2006, they added: "The year 2006 can be called the year of new beginnings. One has written and talked about our forests, wood as construction material, people who work with wood" (our translation, shortened). (3) Our project has led to the application of a similar approach in discussions dealing with the future of a milk collection point in the same community of Urnäsch. The approach was very well received by more than fifty dairy farmers and the implementation of a common milk collection is expected soon. Again here, individual feedback showed that our analytical and systematic approach was helpful in addressing diverging views and perspectives and thus enabled a process of analytical mediation. These stories provide a consistent pattern (see as well Scholz and Stauffacher 2007), which go hand in hand with other positive accounts from the more than ten transdisciplinary studies we have thus far conducted.

Societal impact could be confirmed by an *ex post* evaluation (Walter et al. 2007): Based on a postal survey of 84 people from the region who participated in the case study, building of networks between the participants, and the availability and use of transformation knowledge ("knowledge about how to make the transition from the current to the target situation") were most important mediating impacts. Furthermore, "trust in others" and "distribution of knowledge" was both affected positively by the intensity of involvement. More than 200 people participated in total in our case study on landscape development in Appenzell Ausserrhoden. 'Participatory network building' (Saether 2007) was achieved and a process of mutual learning among all those involved induced.

Some shortcomings and pitfalls of our case study are apparent. Invited by the president of the canton and addressing people with official mandate at the first place, we certainly *excluded some societal groups*. We tried to cover a broad range of people, yet apart from the surveys conducted, we did not apply random sampling procedures to select people. This becomes visible from the fact that about three quarters of the participants in the study were males. Furthermore, the study was addressing a future oriented strategic planning question and therefore existing interest conflicts and potential power games did probably not manifest. This might have been different when we would have investigated a more topical and disputed topic. We cannot yet say if our TdCS design can be transferred to such fields. We are at the very moment investigating site selection processes for a nuclear waste repository and are slowly learning how our approach has to (and can be) adapted in such a different context (Scholz et al. 2007; Flüeler 2006; Flüeler et al. 2007). As in other collaborative projects, "project ownership" is the key to success. This was, however, only noticeable for some of our partners. Those did take into account many of the jointly developed orientations in their future activities. It is worth mentioning that with these people we stayed in contact and were regularly contacted for further projects and presentations long after the case study was completed. In contrast, from other people we learned afterwards that they implemented actions not harmonised with the orientations. A local environmentalist commented this as follows: "The case study was like a good horoscope—you take only what you like" (our translation, shortened). This is of course no surprise as the orientations were not binding in this case study. The process and outcomes of the study might have been different if binding orientations would have been the aim—yet we argue that the general patterns would still hold.

In conclusion, crucial in our TdCS design is the *analytic and dynamic approach in addressing both the involvement of stakeholders or public and the societal decision process*. We are convinced that real and effective collaboration is only sensible if exercised in a systematic, analytic and dynamic way. TdCS design can be perceived as a collaborative approach in a decision-analytic framework: input is sought after, facilitated, documented and traceable in the course of the process, hence transparency, and proof, of the intensity of collaboration is guaranteed. It is important to recognize though that all participants put their autonomy at stake but expect to gain from the collaborative efforts—gaining additional insights for research on one side and better evidence for sound societal decisions on the other. Insisting on existing boundaries and the division of labour between science and practice makes boundary work essential, i.e. boundaries need to be actively discussed and reviewed throughout the project (Midgley 2003). TdCS design enables negotiation and deliberations among a large group of different stakeholders and the public. Consequently, the TdCS design offers a means for societal learning in sustainable development (Scholz et al. 2006; Stauffacher et al. 2006).

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