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Transition Management at the local scale

Supporting Sustainable Water Infrastructure Planning through Participatory Foresight

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Abstract

Water infrastructure in general and sanitation in particular are confronted increasingly with uncertain context conditions, a broadened spectrum of alternative system configurations and an increasing heterogeneity of value positions from which alternatives have to be assessed. All these uncertainties have to be taken into account to determine sustainable future configurations of these sectors. However, decision procedures and institutional structures which are currently predominant in many industrialized countries favor the perpetuation of the established regime and systematically neglect these uncertainties and new options. Therefore, more open and reflexive decision procedures and strategic planning methods have to be established, which help to identify and realize more sustainable system concepts.

The present paper elaborates the method of "Regional Infrastructure Foresight (RIF)", a localized approach to transition management, which starts from existing material and institutional infrastructures and aims at opening up the decision framework towards more future oriented and sustainable options. The paper elaborates the theoretical background of the method, presents its procedural outlay and will discuss results of a pilot application out of three case studies in different parts of Switzerland in order to show how this approach may contribute to the realization of more integrated and adaptive water management in the future.

Outline

1. Introduction

Sanitation infrastructure has been built up over the past 50 years in most industrialized countries by implementing a very narrow technological paradigm, which ultimately gave rise to a very distinctive socio-technical regime. The material basis of the infrastructure sector follows the logic of civil engineering consisting of concrete sewerages and centralized waste water treatment plants. This technology exhibits strong economies of size at the level of the individual plant, which leads to a centralizing logic from the technological point of view. Given the long life times of these technological systems, context conditions under which they will have to operate have to be estimated over 20 to 50 years. These conditions gave rise to an institutional infrastructure responsible for planning, constructing and operating these systems which is highly localized and community oriented in most industrialized countries. The resulting socio-technical regime has been implemented over the past 30 to 50 years from an initial connection rate of below 20% towards more than 95% (Maurer and Herlyn, 2006). When compared against the initially set goals of improved water quality of lakes and rivers and the non-discriminatory access to waste water cleaning services for all citizens this diffusion history has to be judged as a huge success in environmental policy implementation. This may be seen for instance in the fact that eutrophication of lakes and rivers has decreased tremendously since the early 1970ies (xxx).

Despite this very obvious success story, scholars have raised doubts about the long term sustainability of this dominant socio-technical regime (Wilderer 2004, Larsen and Gujer 2001). The main reasons are that the continuation of the established regime will be challenged by increasing uncertainties in the context conditions under which sanitation will have to operate in the future, which need more flexible and reflexive approaches. The present paper claims that the conditions for future development of sanitation infrastructure are actually changing fundamentally both with regard to the context conditions under which waste water organizations have to operate and with regard to the socio-technical options available. However, the established decision procedures and institutional structures are strongly biased towards the perpetuation of the established regime and they are therefore likely to miss important opportunities for more sustainable alternatives. As a consequence of this analysis, the method of “Regional infrastructures foresight (RIF)” is proposed for opening up strategic planning procedures that would take these changes in context conditions more explicitly into account. The RIF procedure addresses local decision

makers responsible for specific sanitation infrastructures as well as broader stakeholders to identify and assess future alternatives. In a highly structured elaboration and discourse process, these actors elaborate the spectrum of future context conditions, socio-technical configurations and value positions, which have to be taken into account in order to reach more sustainable solutions.

Why have uncertainties increased in importance over the past few years in water infrastructure? In general, these infrastructures are strongly vulnerable to changing framework conditions under which they have to operate. Investments need to be written off over 30 to 50 years and have to respond to newly emerging performance requests (changes in population and industrial activity, new pollutants, changes in local hydrology, etc.). These systems have shown some flexibility to adapt over quite impressive ranges of requirements as has been shown in some historical case studies (Dominguez and Gujer, 2006) but this flexibility comes at a considerably high cost. In the 1960ies and 1970ies when this socio-technical regime was developed and implemented from the centers to the peripheries in industrialized countries, constant growth rates were a rather secure estimate, the emerging technological paradigm remained largely unchallenged and goals on which the performance should be estimated were sufficiently clear (elimination of nutrients, un-discriminated access to sanitation service, relative unimportance of costs and tariffs and the provision of these services by public institutions).

Over the past decade however, many of these established certainties have been challenged: New regulatory frameworks (e.g., privatized ownership of utilities), reduced financial stability of communities, risks from new pollutants or contagious diseases, new technologies (e.g., household centered water treatment), regional population and industry dynamics and new hydrological conditions associated with a changing climate. All these conditions raise doubts about whether a simple continuation of the socio-technical regime may still be considered as optimal. Additionally, the sustainability of the established regime is all the more questioned when it shall be transposed into contexts of newly industrializing countries such as China and India. As a consequence the sustainability of the sanitation regime has been questioned by a wide range of commentators such as neo-liberal political movements (emphasizing the alleged inefficiency of highly localized organizational structures), by development studies (questioning the optimality of the prevalent regime in different institutional contexts) or by environmental movements (emphasizing the sustainability potential of more decentralized options for sanitation

and water provision). In particular the success of more integrated water resource management approaches will depend on how a more flexible and variegated sanitation structure may be taken into account.

New and better decision and planning procedures therefore need to address these uncertainties explicitly and open up the ranges for alternative socio-technical configurations. Additionally, they have to address diverging value positions of different stakeholder groups with regard to sustainable sanitation more explicitly, i.e. the former expertocratic decision mode with its narrow list of performance indicators has to be replaced by a more participative and pluralistic assessment. Starting from these procedural criteria, we have developed a participatory foresight method to support strategic decision making for infrastructures (in sanitation and elsewhere). It starts from local conditions and gradually opens up the framing in order to consider broader ranges of contexts, options and value positions. The “Regional Infrastructure Foresight” (RIF) approach aims at supporting strategic decision making in infrastructure development for a time horizon of about 25 years. The RIF procedure has been recently applied in three regions in Switzerland (the last process will end in October 2007). Based on the criteria which led to selection of the cases, we will generalize these results with respect to different design alternatives of the process, different positions in the maturing cycle of the infrastructure, and with regard to specific challenges (future availability of water, decreased ability of local communities to provide for public services, changing regional dynamics with regard to population and industry, etc.).

At a conceptual level, the RIF methodology and its application in Swiss sanitation planning may be interpreted as a localized transition management procedure towards sustainable sanitation futures. Given the strong entrenchment of current day decision structures and the considerable challenges ahead, transformation processes of the system have to start at the local level. By systematically opening up the black box of uncertainties, context conditions and emerging opportunities, however, synergies with neighboring communities, other infrastructure sectors (water supply or energy generation, for instance, and thus eventually also towards integrated water resource management) as well as more encompassing regional and national developments may be addressed. In this sense, RIF represents a localized procedure from which more encompassing regional and national transition management attempts could be addressed and thus pave the way for more sustainable futures in water governance.

The paper is structured as follows. In chapter 2 the theoretical background of transition management, foresight and infrastructure planning will be laid out on which the RIF method builds. Chapter 3 describes the basic methodology of the RIF approach in more detail. Chapter 4 gives an overview on the challenges of sanitation infrastructure reform in Switzerland and introduces three Swiss regions where the RIF methodology was first run and tested. Chapter 5 presents the major results of these case studies and discusses strengths and weaknesses of the method depending on the problem context of the specific cases. Chapter 6 concludes by giving an outlook on the potential application of the methodology for integrated and adaptive water management and for transition management in general.

2. Transition Management at the Local Scale - Theoretical Background

As illustrated above, the sanitation sector (in line with many other infrastructure sectors) exhibits strong path dependencies in its development. Strong material and institutional interdependencies have to be built up, in order to guarantee a proper working of the systems. As a consequence, incremental innovations are mostly preferred to radical system reconfigurations (Markard and Truffer, 2006). When analyzing transformation processes towards alternative system configuration, we may therefore not separately search for technological alternatives and later look for appropriate institutional frameworks, in which such a technology could operate. Rather infrastructure systems have to be conceived as socio-technical systems (Geels 2004) in which material and institutional aspects are tightly intertwined in order to establish "configurations that work" (Rip and Kemp 1998). In the recent literature of industrial transformation processes several concepts for analyzing the structure and dynamics of socio-technical systems have been developed (Markard and Truffer forthcoming, Geels 2004, Hughes 1987). In the following, we want to present some core tenets of these approaches and apply them to the question of how long term transformation of sanitation sectors could be conceived. Furthermore, we will present some recent proposals on how such systems may be transformed towards more sustainable future configurations. This allows us to set the conceptual framework in which strategic planning methods for sustainable infrastructures could be positioned.

2.1 Infrastructures as Socio-technical Systems

Infrastructure based sectors have since long received considerable attention from scholars of Technology Studies. One of the most earliest and prominent examples is Hughes (1987, 1993) with an analysis of the social and technological determinants of the growth and diffusion of electricity system in the US. He coined the concept of Large Technical Systems (LTS), which are characterized by specific conditions due to the tight interrelation between their material and institutional structures. Other scholars have emphasized the difficulty in transforming and regulating these sectors and their long term role in the provision of basic services for industrialized society (Coutard 1999, Hughes 1998, Joerges 1998, Summerton 1994).

More recently and related to research on the sustainable transformation of industrial sectors, the concept of socio-technical regimes has been applied to infrastructure sectors (Geels 2004, Rip and Kemp 1998). The emphasis is here on identifying coherent settings of material infrastructures and institutional settings, which may develop coherent configurations, so called socio-technical regimes, over specific periods of time. These configurations are characterized by strong path dependencies and a strong preference for incremental innovations against radical ones. Major changes in these configurations may nevertheless happen. They will either result out of an increasing mismatch between the regimes adaptive capacity relative to its context conditions (so called pressures resulting from landscape forces, see Geels and Schot 2007) or they will be challenged by rivaling regimes that develop their coherency within protected niches before they are able to supplant the established regime (Hoogma et al 2002). The dynamic analysis of regime transformations thus was epitomized as defining a multi-level approach focusing on the hierarchical interplay of factors giving rise to disruptive reconfigurations of specific regimes.

In parallel to the multi-level approach structural and dynamic analyses of industrial transformation processes have been formulated based on the systems of innovation approach. Starting from the National Systems of Innovation concept (Freeman 1988, Lundvall 1992) several variations have been spelled out such as regional, local, sectoral and technological systems of innovation (for an overview see Chan and Chen 2003). The core idea here is that new socio-technical configurations are produced by the interaction between different actor groups (producers, government, NGOs, research, users, etc.) which structure their interaction in specific networks and develop appropriate institutions supporting the introduction of novel socio-technical configurations. Infrastructure sectors have particularly been in the focus of the

tradition of technological systems of innovation (Carlson and Stankiewitz 1999, Jacobbson et al 2001). Conditions for more sustainable configurations were playing an important role in this context as well. Even though the multi-level approach and the systems of innovation approach started from different conceptual traditions, their approaches have been shown to be quite complementary (Markard and Truffer forthcoming).

As a consequence of these conceptual understandings of the emergence and transformation of socio-technical configurations, attempts to transform these sectors fundamentally have to be approached by explicitly taking into account the interrelated nature of the technical and institutional elements. A partial approach to introduce alternative technological concepts would thus most likely be prone to failure. Rather, processes of developing socio-technical configurations, the explicit and reflexive management of dealing with novel technologies in incumbent sectors as well as a reflexive observation of and adaptation to landscape forces is needed in order to support specific system transformations. One recent proposal on how such multifaceted transformation policies could be conceived runs under the heading of Transition Management (Rotmans et al 2003). Transition Management sees itself as an intermediary form of governance of socio-technical transformations, which neither wants a top-down steering approach nor a muddling through on a short term basis. Rather long term goal formulation shall be combined with shorter term experimentation (and niche development) for hopeful alternatives. The results of such experiments shall then be evaluated before the background of participatory visioning exercises (Wieck et al 2006) and thus generate the context for a long term reflexive management approach. Transition Management has been applied especially in Dutch sustainability policy and a wide range of transition processes have been initiated (Loorbach 2007, van den Bergh 2006). Infrastructure sectors have played a considerable role as empirical application fields and specific proposals on how infrastructure transitions could be tackled have been proposed in the literature (Truffer et al. forthcoming, Voss et al 2006).

2.2 Challenges in transforming water infrastructures

Water infrastructures in general and sanitation in particular have been the object of analysis in many of the above introduced approaches. Geels (2004, 2005) for instance has carried out a multi-level analysis of historical transformations of urban water management in the Netherlands. Transitions towards more decentralized alternatives have been analyzed by van Vliet (xxx). Hiessl et al (200x) have

elaborated different alternative socio-technical configurations for urban water management. Specific technological innovations have been analyzed following the systems of innovation approach, e.g. asking whether an appropriate sectoral system of innovation might be identified in specific national contexts (Wegelin 2006).

In the terminology of the above introduced concepts, the sanitation sector may be described as a specific socio-technical regime, which is characterized by sewerage and waste water treatment plants, a professional culture of civil engineering, organizational structures which are (often) highly localized and thus spatially fragmented, strong state regulation or even state run service organizations, and an almost invisibility for end-users (here actually waste water generators) which mostly are ignorant with regard to performance and price characteristics of the service consumed (a more elaborate analysis along these lines is given in Konrad et al 2003). High performance of the sanitation sector results in a high quality of a public good (absence of eutrophication of water bodies and water borne diseases) and attractiveness to explicitly deal with the service at the end-user level is rather low (the flush away and forget paradigm of current sanitation services). From this, we may derive that very strong path dependencies characterize the sector and there will be high resistance to change both technically, institutionally and from an end-user point of view. In particular, the long development process of the currently existing regime has led to deeply entrenched technical paradigms and accordingly strong professional cultures.

Accordingly, planning and decision procedures have mostly been attuned to these preconditions. Waste water treatment is locally planned, dominated by experts and evaluated considering a rather narrow range of alternatives and value considerations. Therefore, radically new alternatives have a hard standing in these contexts and barriers set up by incumbent actors to exclude potential rivals may be considered as relatively well developed.

In the past few years however, criticism has increased to challenge the long term reproduction of this established socio-technical regime. Challenges are seen in three domains. First, increasingly uncertain context conditions under which these systems have to operate call for more flexible system configurations: population dynamics, shrinking regions, industrial transformations, new contaminants and pollutants, risks of terrorism, reduced capacities of local communities to run the established institutional structures, aso. Second, new treatment alternatives based on membrane

and telecommunication technology combined with new sensor technology exhibit fundamentally different economies of scale characteristics and enable substantially different technological system configurations. Third, evaluation criteria for assessing system alternatives have become more diversified. For instance, economic and institutional performance characteristics have gained in importance alongside the liberalization debate in infrastructure sectors allover the world. An important driver for this development was the reduced financial capacity of many communities and states, which have to make increasingly tough choices, with regard to their expenditures. Furthermore, expertocratic decision making has come under criticism in different contexts and increasingly citizens demand participation in long term decision in their local and regional contexts.

Given these new challenges, strategic planning and decision processes should be developed, which more explicitly respond to the identified uncertainties and are responsive to the interrelated character of socio-technical systems. As a consequence, decision processes should be participative (respecting different perspectives and value positions), open for experimenting and learning (in order to enable novel approaches to be developed), flexible (relative to changing context conditions) and reflexive (towards the long term goals of a sustainable dealing with waste water and the associated resources). Given the strong localized nature of water infrastructures and the reliance on local natural resources such a procedure has to be *a fortiori* based at the local level. However, in order to reap synergies and identify opportunities it should be embedded in overarching regional or national concepts of transition management. Only by balancing these processes at different levels will it be possible to assess and ultimately realize more sustainable socio-technical infrastructures in the water sector. In this sense, developing strategic decision processes along the identified lines will also exemplify localized processes of transition management and thus be applicably to problem configurations relevant for integrated and adaptive water management.

3. RIF - Participatory Foresight for Infrastructure

Foresight methods have received considerable attention in many strategic decision making contexts since the late 60ies (Ringland 2002). In situations of high uncertainties of system interactions and long time scales, the discursive elaboration and specification of possible developments into coherent scenarios has claimed to

lead to better practical implications compared to a narrow prediction approach based on formalized models. Foresight in this sense has to be understood as analyzing coherent future possible system states which are determined by in discursive processes and synthesize the knowledge of participating actors. Often emphasis is given to a broad selection of perspectives and expectations and hence a participatory and strategic focus. Scenario planning has initially been used in business contexts and increasingly also as a tool for identifying shared courses of action in political contexts (Ringland 2002). With regard to environmental decision making scenario planning has been recently advocated by many scholars as a coordination dievice in interdisciplinary research contexts (xyz, Wieck et al 2006, Truffer et al forthcoming). In the context of future challenges related to sanitation infrastructure, several proposals have recently been made (Lienert et al 2006, Dominguez et al forthcoming). Given the lack of strategic competencies which has been identified for the sector in several countries, the application of foresight methods to the sanitation sector holds some promise.

Based on this analysis, we propose to develop a methodological framework which we name as Regional Infrastructure Foresight (RIF). It shall fulfill the following goals: (i) it shall consider possible context conditions in the time horizon of 25 to 50 years. In particular it shall address uncertainties explicitly and not enable decisions maker to not prematurely close down the range of possible developments. (ii) The range of options to be considered shall be broadened to include also radical alternatives and assess the advantages and risks of these alternatives, before the background of the broader range of context conditions. In particular also conventional system boundaries (or established regime delimitations) shall be questioned both with regard to their thematic boundaries (sanitation, versus integrated water services or even general utility or infrastructure service management) and their spatial delimitations (considering system configurations which transcend the given spatial boundaries for instance as in order to address catchment level processes). (iii) Decision making shall involve a broad range of perspectives and value positions and thus mobilize broader resources of knowledge stocks and value positions. Values shall therefore be analyzed systematically and compared to overarching sustainability concepts. As system transformations need to start from the current system configurations, current decision makers have to actively support considerable parts of the processes. Additionally, larger constituencies have to be addressed in order to take different value positions into account and arrive at less contested political decision making.

These goals lead to the derivation of specific structural and procedural characteristics which define the RIF methodology. Structural characteristics are the following:

(a) Three levels of intensity in participation: Core team of local decision makers (supplemented by members of the project team), stakeholder representatives collaborating in the identification and evaluation of core elements of the analysis and actual decision makers in the region (perhaps including public hearings) in order to represent and reflect the gathered results and deciding about the future planning process.

(b) Reflexivity with regard to the object of analysis and its potential extensions: Definition of time scale, and regional application area to which the planning process should be applied. Specification of relevant stakeholder groups in the respective area and position of the foresight process with regard to the conventional planning and decision processes in the regions concerned.

(c) Open and participatory approach to decision making: Decision maker have to accept to open several elements of their decisions to more public discourse and involve diverging inputs from different stakeholders. However, the foresight process will not act as a problem solving procedure or a conflict resolution exercise. Rather it will serve to open up possible courses of development and identify potential conflict lines. The result of the process shall serve as a starting point for more detailed planning and decision processes.

Based on these structural characteristics, a foresight process is initiated, which approximately runs over nine months. The process is characterized by the following phases:

(a) Preparatory phase: analysis of situation, delimitation of object of analysis, identification of key stakeholders, establishment of performance contract with research team.

(b) Analytical phase: Identification of relevant context conditions and options, elaboration of value tree and sustainability visions in the region. This step is worked out both in the core team and in the context of a two days stakeholder workshop.

(c) Evaluative phase: Assessing the strategic options before the background of the context scenarios and the values weighted by the preferences of different stakeholder groups. This leads to specific rankings of stakeholder groups and Identification of conflict lines.

(d) Implementation phase: presenting the results to the decision bodies, determining use context of the identified alternatives, determining an agenda for a more detailed planning process.

In the experimental application of the procedure in three regions in Switzerland, the actual process was organized as follows. A project team consisting of and interdisciplinary team of researchers (about 3 - 5) and 3-5 local decision makers was formed. Together they analyzed the relevant steps and prepared the stakeholder workshops. First they identified key drivers and assessed the uncertainties of their future development. Then they analyzed current technical and institutional characteristics of the local sanitation system. Finally, they specified different stakeholders in the region, which could have and interest or may be affected by strategic decisions. Based on this analysis, two workshops with about twenty stakeholders were carried out, in which possible future context conditions were combined into 3- 5 context scenarios. Furthermore, options were specified for a future sanitation technology and organization in the region. Finally, pros and cons of the different options when judged before the background of the different scenarios where assessed by the identified stakeholder groups in a second workshop. The resulting assessment was finally synthesized by the core team and presented to the official decision making bodies and the participants to the workshops.

This process has produced a number of specific outcomes. At a first level, a strategic plan was elaborated, which evaluates structural alternatives relative to the range of context conditions that had been worked out in the scenario processes. Pros and cons have in general been of a general form and rather indicated directions along which more concrete future solutions will have to be elaborated. Furthermore, the processes indicated possible conflict lines which might emerge if a specific alternative is pursued. Finally, the general evaluation of alternatives against context conditions helped to address more consciously flexibility, reflexivity and context sensibility. As the latter relates in particular to the system boundaries discussed in the beginnings, this prepares the decision makers and their associated interest groups for discussing overarching solution contexts such as integrated infrastructure management, regional development plans and/or catchment level water management approaches. So, overall, we expect that an increased effectiveness shall result in water infrastructure planning by adopting this kind of planning approach. In particular, it shall render the development of the water infrastructure more receptive to radical alternatives. In this sense, the implementation of the RIF

procedure might prove to be an important element of broader regional or national (or catchment level) initiatives to transition management.

4. Strategic Planning of Sanitation in Switzerland

The RIF concept has been applied to three case studies of local/regional sanitation systems in Switzerland in order to analyze and test its expected supportive function for improving strategic planning. Before we may present and discuss some core results of these case studies, we have to briefly present the current situation of the Swiss sanitation sector, as well as the future challenges, which may potentially act on the sector in the chose time frame. In a second step, we shortly present the selection rationale of three case studies carried out in Switzerland in order to argue in how far the results gained by these cases may be generalized to the Swiss sanitation sector in general or even beyond Switzerland.

4.1 Current situation in Swiss sanitation infrastructure

The exhaustive Swiss sanitation system has been built up over the last 40 years. In cities a sewer system has been built up much earlier for hygienic reasons. Today about 97 % of the resident population is connected to a central sanitation system. The alternative to the dominant system are decentralized water cleaning facilities which are less then 4'000 units in Switzerland. The centralized sanitation system consists of about 750 waste water treatment plants (WWTP) which are mainly owned by municipalities or associations of municipalities. This dominant socio-technical design of municipal central systems results from the combination of a technical drive for centralized "big" technological solutions and a political drive for a handy control of a low number of plants in the trustworthy hands of municipalities.

The sewer systems are in the hand of estimated 3'000 organizations, which are the municipalities, the WWTP-organizations, and third organizations. Additionally every house owner has its own connecting sewer. The cantons specify the national environmental and water protection law. They take care for the fulfillment of these regulations. They supervise and approve the municipal sanitation systems. In the phase of the first building up of the infrastructure the confederation (nation state) paid relevant shares of the investments as subsidies. Today for necessary replacements and reinvestments the sanitation system has to finance itself. This new challenge plus growing water protection requirements led to the need for higher professionalization of the organisation of the infrastructure. This led to some closures

of inefficient often small municipal plants, if a connection to a neighbor plant was possible and inexpensive. The number of WWTPs falls from about 900 to 750. This is a kind of second phase in centralization of the sanitation system after the erection phase of the centralized system with the closure of small plants and acquisition of the perimeter by a larger WWTP. While there is a slow change going on in the system element of the WWTP the situation in the sewer system is constant. Municipalities own and manage the network but often do not care much about the buried system. The network system needs more service as it gets. Firstly, because of damages in the network this makes it leaking. Secondly, because an integrated optimization of the sanitation system is not possible without a sound knowledge of the state of the sewers. In the case of the sewerage and especially of WWTP the knowledge and expertise for politicians and communal officers does not fulfill the requirements of the complex and specialized technologies. Usually a consulting engineer of confidence is accompanying the decision makers of the municipality. The external engineer carries high loads of the preparation of the decisions. This expertocratic black box decision preparation approach is mainly technology based. It includes the danger of unconsidered perpetuation of formerly successful solutions for today's problems. Uncertainties on future amounts of wastewater or new requirements from regulatory of societal side are often reduced to a singular definition of a trend or even neglected. Solutions for these uncertainties are often the quite expensive installation of overcapacities.

In the basic democratic system of Switzerland important municipal decisions on investments or changes in the sanitation system have to be accepted by the public through a voting. Regarding to different values and preferences of various groups in the community the result of these decisions can not be taken for granted. A strategic planning for flexibility in the infrastructure system is missing. Therefore, need for strategic planning with regard to future conditions and open value assessment is obvious.

4.2 Selection of three case studies

Before this background, three more or less representative cases were chosen to which the RIF procedure could be applied. The method was judged to be most appropriate for those regions and communities, which were smaller than the large cities and bigger than the small peripheral communities in the Alps. Sanitation in the former case is operated by relatively large organizational units, with a high degree of professionalization and more or less established strategic planning routines. The

latter are in general too small to engage in strategic planning. Therefore the core cases had to be chosen in the problem types b to d. These types are characterized either by association treating the waste water of about 3 to 5 communities (mostly by a single waste water treatment plant), a mixed and potentially volatile population and an average life span of their sanitation infrastructure of about 30 years. The cases were chosen in order to differentiate with regard to region type (peripheral, agglomeration, mix of population and industry), position in the life cycle of the sanitation infrastructure and different forms and sizes of organization. Additionally, the decision making bodies in the candidate regions had to show openness with regard to a discursive planning process and an explicitly stated need to open up the range of options to be considered in the planning of their sanitation infrastructure. In particular, they had to accept the methodological framework proposed by the project team and be prepared to invest the time needed to participate in the process (about 10 working days for each member of the core team, see below).

Selection of cases was based on a public announcement in the yearly national meeting of the professional association of sanitation experts in Switzerland (VSA), it was announced in the national professional magazine (GWA) and several engineering companies were informed about the ongoing project on a bilateral basis. Based on these activities, about ten waste water organizations expressed their interest to participate. Out of these candidates, three were finally chosen, based on interviews, local visits and discussions in the project team.

This procedure led to the selection of the three cases: Klettgau, Kiesental and Dübendorf. Together they represent a sufficiently broad range with regard to their problem constellation. All core teams showed a high degree of commitment to participate in the exercise. The following table gives an overview over the key characteristics of the three cases.

	Klettgau	Kiesental	Dübendorf
Characteristics of cases			
Location, regional context	North, rural region wine production), no major center, canton of Schaffhausen	Centre, rural (pastures, milk), proximity to Berne, Canton of Berne	Agglomeration of Zürich, near airport, service and production, Canton of Zürich
Size capacity	30'000 EWG, 10 communities served	2 x 10'000 EWG, 1x 1'000 EWG, 1x 20'000 EWG; 26 communities served in total	1x 50'000 EWG; 3 communities served
Sanitation System type	Rural with clearly delimited villages, some crafts, little industry	Rural with high number of decentralized dwellings (former farm houses), some industry	urban, agglomeration type densely built, high percentage of industry and services on load
Organizational structure	One association	Two associations, one community plant, one community focused regional organization	One association
Context for strategic planning			
Position in life cycle	Investments needed in 1-5 years	Investments needed in 15 years, synergy gains by joint organizational structure considered as high	Investment needed in 10 years time, little flexibility with regard to capacity growth
Interest in strategic planning	Proposal by conventionally consulted engineer was turned down because it was not transparent enough	Regional cooperation of communities identified waste water as an important topic. Working group was installed to conduct a strategy analysis.	Synergy gain between existing associations deemed to be high. Strategy process initiated and strongly supported by canton.
Pressure to engage in strategic planning	High	Medium	Low
Infrastructure Policy style	Community and association focused (local to regional)	Coordination among associations (regional)	Incentives for cooperation from canton (regional to cantonal)
Characteristics of RIF processes			
Core team	4, Planning commission and canton	8, planning group, canton	6, (3 from canton)
Worshop participants	18	20	15
Focus in workshops	Scenarios, evaluation of options	Sustainability goals, assessment by individual organizations	Challenges from scenarios on future investments

Table 1: Profile of the three RIF-cases

Each of the three RIF processes ran over nine months and followed a similar number and type of analytical steps. Due to the local situation and preferences of the core team, some steps were more or less explicitly worked out. Klettgau worked as a pilot case in which most of the steps were tested for the first time. Kiesental and Dübendorf were considered as cases in which the method could be consolidated and variants of the method could be developed.

From an overall process quality point of view, the three cases may be judged to have run successfully. Respondents' satisfaction with the procedure and the results were very high. Claims about the benefits of this approach were very explicit and positive and commitment to the process remained high throughout the process. This is

especially true for the three core teams. Also the workshop participants showed a high degree of process satisfaction. However, it was much more difficult to keep all stakeholders present at the full range of events. Several missed some came in somewhat late to the workshops or had to leave earlier. Nevertheless, we may judge the general processes as having run according to the planned procedural outline and that no negative consequences hampered the outcomes of the three trial cases. Therefore, comparison of the performance of the three cases should render valid results.

5. Results of the RIF process in the Klettgau region

For our argument it will be sufficient to look at one RIF procedure in more detail. The key questions of this chapter are: How did the results look like and in what sense did they differ from what could be expected from a conventional planning process. We will focus on the Klettgau study, as this was the pilot application and pressure to actually take decisions were highest in the set of the three case studies.

The Klettgau region is located in the canton Schaffhausen located in the northern most part of Switzerland. the Klettgau encompasses 18 communities from which 12 are organized in the association running a waste water treatment plant located in Hallau, a community located downstream of the river Halbbach and near to the German border. Sewerage is in the owned and maintained by the individual communities. Relative to the sanitation typology presented above, the Klettgau may be considered a peripheral region with a strong proportion of agriculture (mostly wine) and only little industry. It is somewhat distanced to the local urban centre Schaffhausen, which is also the capital of the canton. The waste water treatment plant in Hallau had been built in 1968 (?) and is in desperate need for renewal. The decision body of the organization commissioned a first study analyzing alternatives to renew the WWTP to the local planning engineer. Out of this analysis, two options emerged:: either refurbishing the existing WWTP at the location of the old one or build a new structure in the immediate vicinity of the existing plant. Local policy makers were strongly dissatisfied with these proposals. They claimed that this did not represent actual strategic alternatives and the assumptions under which one of these options (or even totally different ones) should be chosen were not spelled out. The high consciousness of the planning commission in the Klettgau together with its strong fit with problem type xy led the project team to chose it as a pilot case for the

RIF procedure. This illustrates very nicely how conventional planning may lead to a strongly reduced option set and how uncertainties in the context conditions were not addressed adequately.

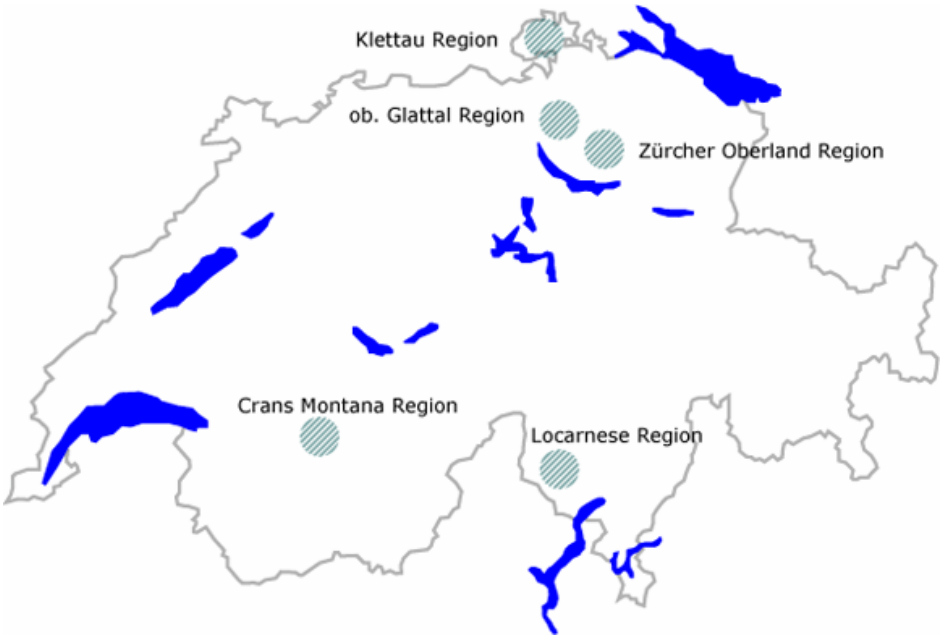

Figure 1: Location of the Klettgau region within Switzerland (source NFP 54)

Before this background the invitation to submit cases to the project team fell on highly fertile ground. The core team consisting of a member of the local decision body (and at the same time member of the board of one of the communities), the operator of the WWTP, a (newly commissioned) planning engineer and the official from the canton responsible for regulating sanitation in Schaffhausen formed a core team and worked out a contract between project team and planning commission to carry out the foresight process as described by the RIF concept (see chapter 3). The process ran from November 2006 to September 2007. Core and project team met for eight (?) meetings of three to four hours each. Two workshops were held with twenty (?) representatives from different stakeholder groups in March and June 2007. The strategic plan was presented to the commission and the participants of the workshop in September 2007. Since, the results of the RIF process have been used as a basis for further planning activities. Overall, the RIF process in the Klettgau region ran very smoothly, participants in the core team and in the workshops were highly committed. They expressed high levels of satisfaction with the process and the results. Due to its role as a pilot case however individual process steps took sometimes perhaps more time than what would have to be expected in a standard application of the method. (For an overview of the case see also table 1).

5.1 Scenarios, options and value trees

The conjoint core and project team defined the current regional organization as their object of analysis and a time frame for 25 to 30 years (i.e. about the life time of a newly built WWTP) as their time line. For these contexts major challenges were identified that could impact the Klettgau region and its sanitation infrastructure. Factors used in foresight processes that were conducted in similar contexts were analyzed. Furthermore, about ten interviews with experts in the region were carried out and analyzed. Out of this, about twenty drivers for change were identified. These were evaluated with regard to their importance and uncertainty and the nine most promising factors were worked out as inputs into the scenario process which was run in the first stakeholder workshop. Here, another two drivers were added and in a conjoint assessment of uncertainty and impact the five scenario factors were chosen. Table 2 gives an overview of the five scenario factors and their potential future states, which later on served to profile the different scenarios.

Nr.	**Faktor**	**Ausprägungen**		
		1	**2**	**3**
1	Industrie- und Gewerbeentwicklung (Einfluss von Verkehr)	*Industriesterben, nur einzelne Betriebe im OK*	*Industrieansiedlung im OK, wenig Entwicklung im UK, Konzentration bei Keltereien (gute Verkehrsanbindung)*	*Boom im gesamten Klettgau, mittlere Betriebe im UK, (Autobahn A98, Bahnstrecke elektrifiziert, bessere Anbindung an Zürich)*
3	Bevölkerungsentwicklung (Einfluss von Verkehr)	*Grosses Altersheim der Stadt, Armenhaus, Rückgang*	*Pendler, kaum junge Familien, grosser Schulkreis, stagnierende Bevölkerung*	*Positive Stadtflucht, Familien als Zuzüger (attraktives Bildungsangebot), Bevölkerungszuwachs*
4	Anforderungen an Organisation und Finanzierung	*Grosse Freiheit der Organisationsform (Trend zu Privatisierung)*	*Verursacherprinzip umgesetzt, Anforderungen an Rechnungslegung Gebührenerhöhung*	*Klare Richtlinien, hohe Anforderungen an Professionalität (Trend zu grossen Anlagen)*
5 (13)	Anforderungen an Gewässer- und Umweltschutz (Mikroverunreinigungen)		*Moderate Verschärfung von Anforderungen (Kosten vs. Gewässerschutz)*	*Höhere Vorschriften für neue Stoffe Zusätzliche Aufgaben für die Abwasserentsorgung, Schweiz mit Vorreiterrolle (Mikroverunreinigungen)*
12	Klimawandel		*Häufung von Extremereignissen (Spitzen: Trockenheit, Hochwasser)*	*Höhere Temperaturen, schlechtere Gewässerqualität, Geruchsbelastung (Fischsterben)*
16 15	Gemeindepolitik, Zusammenarbeit mit Deutschland		*Gesetzgebung EU-konform, gewisse Gemeinde-autonomie bleibt erhalten (weniger Aufgaben)*	*Grossregionen (von Bund bestimmt), weniger Gemeinden oder keine Gemeindeebene mehr, grenzüberschreitende Zusammenarbeit*

Table 2: Scenario factors and their projected future values (about here)

Five scenarios resulted from the analysis of the scenario factors. Three were developed in the workshop and one was added in the aftermath in order to complement the range of possible developments. As all four context scenarios represented major departures from the current situation, a fifth scenario for the continuation of the current trend was added. The five scenarios may be positioned in a two dimensional graph (see figure 2) were economic development and requirements for the sanitation system represent the axes. This gives rise to two growth scenarios and two reduction scenarios with either a strongly enhanced performance criteria for the sanitation infrastructure (increased environmental consciousness of population in the region, elimination of micropollutants becomes mandatory, climate change will have strongly negative effects, etc.) or more or rather reduced requirements.

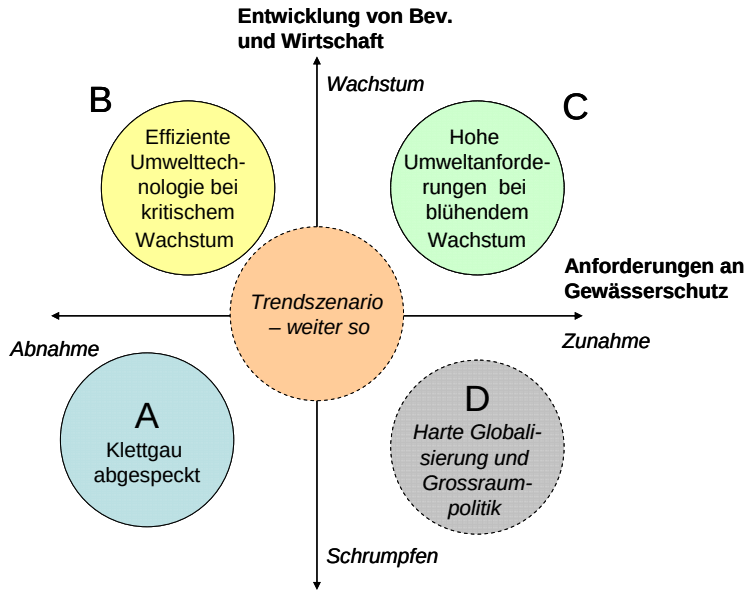

Figure 2: Context scenarios in the Klettgau

Strategic options were developed in the core team by analyzing the major technological and organizational elements that might form a future sanitation infrastructure. These were bundled into coherent sets of alternatives. They do not represent the only options available nor are they entirely exclusive. Rather they represent corner stones of a continuum of options and by this help to identify the basic trade offs more clearly. Finally, four options were developed (see figure 3). The first option aims at a thematic expansion of the current organizational competence range towards managing several infrastructures in the region. In a first step this

would include the management and maintenance of the sewerage in order to better run the waste water treatment plant. Later on also water provision or waste management could be added to the activity of the organization. A second option, foresees a radical reduction of the WWTPs. To this end, industry would be compelled to treat their waste water individually, and investments would be kept to an absolute minimum. In the long run, operation of the WWTP could be outsourced to some private company or one of the neighboring sanitation organizations. The third option would prepare for a radically decentralized structure of waste water treatment in the region. Building on household scale WWTPs would allow reducing investments in sewerage and, in the long run, render the existing plant obsolete. This option depends on the timely and cost effective availability of decentralized treatment technology as well as the guarantee that these plants could be operated and controled in a safe way. The fourth option describes the decommissioning of the current WWTP and delegation of the service to one of the larger neighboring organizations. One candidate is in the vicinity of the capital Schaffhausen and one in the neighboring city of Waldshut located beyond the national border on German territory.

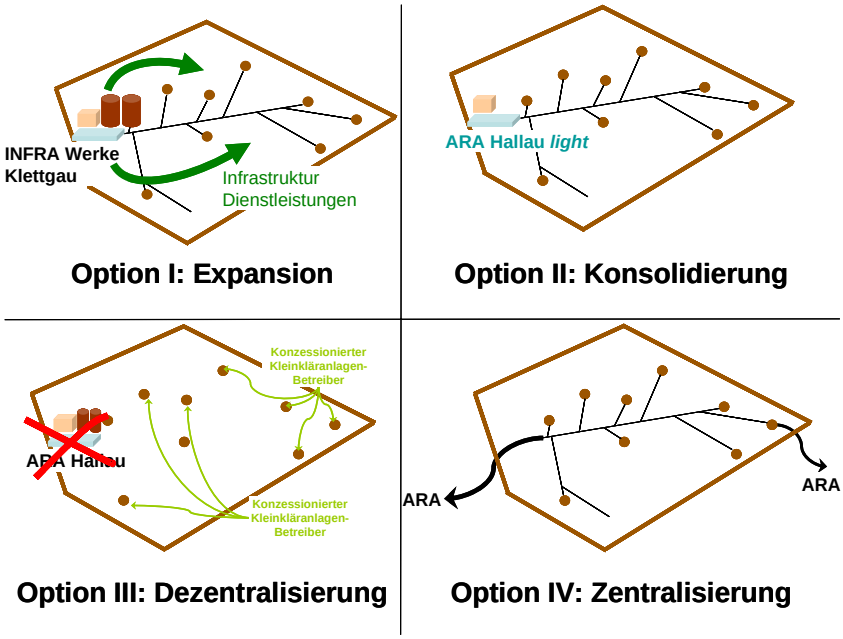

Figure 3: Strategic options to reorient the sanitation infrastructure

In a third step, the core team identified major stakeholder groups in the region and determined an encompassing value tree along which the options would have to be evaluated. Starting from the three core values of sustainable development (environmental, economic and social goals) and a fourth dimension relating to the

political autonomy of the community, more specific goals were identified and operationalized (see figure 4). Among the environmental goals, water protection and ressource efficiency were mentioned. Economic factors were chosen as xyz. Social goals were identfied as xyz and political autonomy was seen as consisting of xyz.

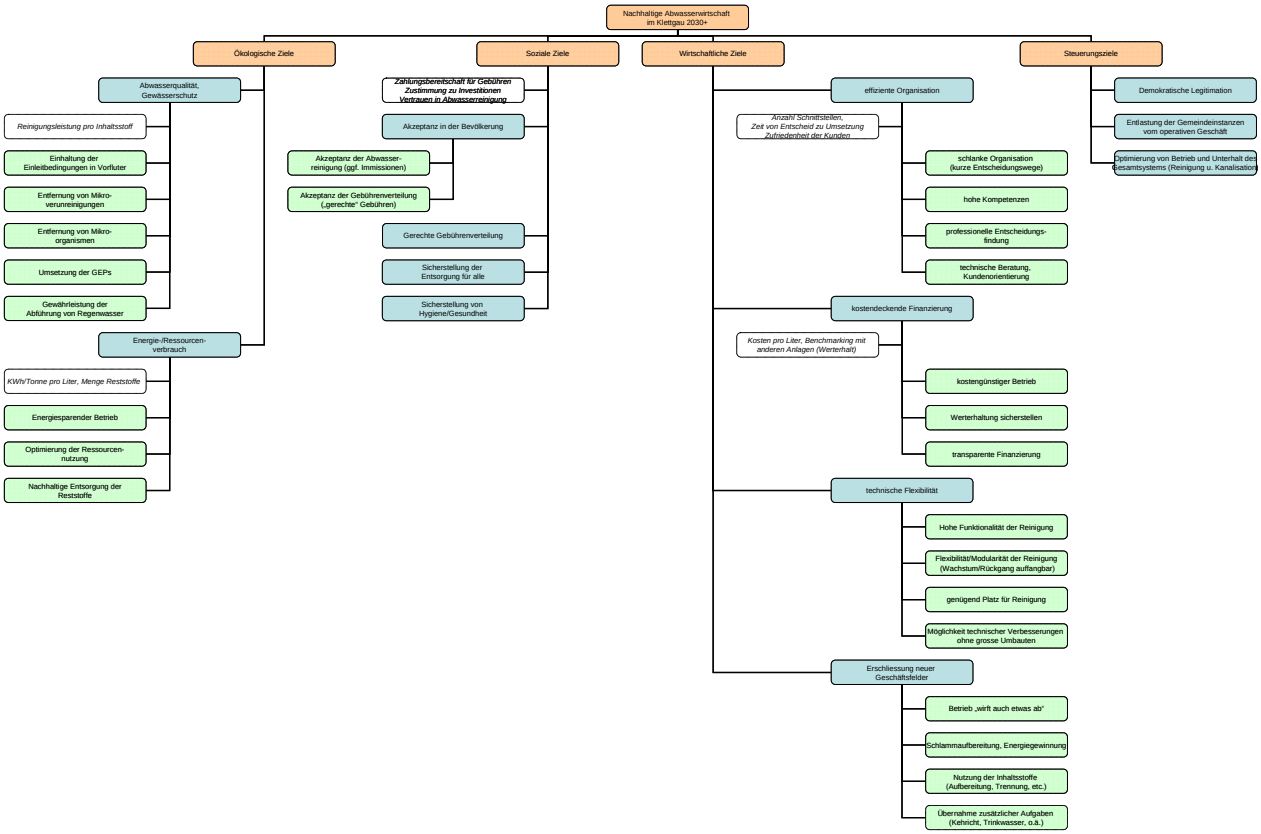

Figure 4: Goal hierarchy against which options had been evaluated

Context scenarios, strategic options and the value tree represented the inputs to the second workshop in which the assessment of the options in the different scenarios was carried out.

5.2 Evaluation of options and ranking of sustainable alternatives

In the second workshop, options were evaluated before the background of the different scenarios. In order to arrive at specific preference profiles, participants were divided into subgroups representing two future stakeholder positions: citizens and industry. Depending on the scenario chosen, the dominant population and industry structure would differ considerably. In the scenario representing negative growth and rising requirements (scenario w), for instance the scenario predicted that mostly elderly people with small incomes would populate the region. Their capability to pay would be reduced and openness towards innovations would be strongly reduced.

Industry in this scenario would be reduced to some small trades such as plumbers, carpenters or small service companies. Agriculture would be reduced to a small residue. Transport infrastructure would be more or less as today. In the growth scenarios instead, population was dominated by young urban families due to a new highway connection the Klettgau to the city of Zurich (in scenario y) or environmentally conscious middle to high income people (in scenario x). Industry would profit from highway construction as well and the location at the German border would be used as an asset.

Each of the supposed stakeholder groups first had to specify their exact future interest profile within their specific scenario and to determine accordingly how they would weigh the different values in the value tree. Then they had to rank the four options according to their supposed preferences and list the arguments in favor and against the options. Concluding, they had to determine in which respects their decisions were departing from sustainable reference points as determined by a balanced consideration of the value tree. For each scenario, “citizens” and “industry” were then put together in order to simulate a political decision in their selected scenario. Accordingly, potential dissent and conflict lines were identified and discussed. In a final discussion, results from these discussions in the different scenario teams were then put together in order to determine, which of the options would rank best under which context conditions, were the major uncertainties lay in these assessments and where the major conflict lines could emerge between citizens and industry. Figure 5 gives a rough overview of these assessments for the four options the four non-trend scenarios and the two stakeholder groups of citizens and industry.

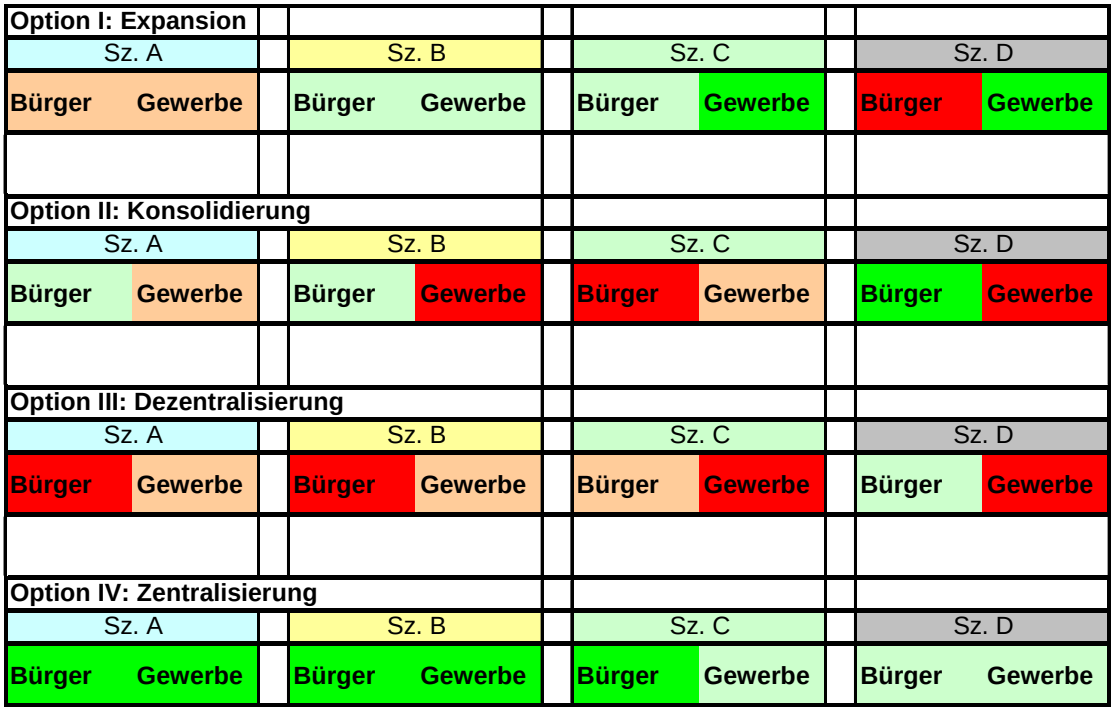

Figure 5: Ranking of the options relative to the four scenarios and the two perspectives of citizens and industry

These assessments were then analyzed in more detail in the core team and led to the formulation of a recommendation to the official planning commission of the Klettgau, which were presented to the commission and the stakeholders in a final meeting in September 2007. The recommendations foresee that option IV leading to a connection with other larger WWTPs should be elaborated and evaluated in more detail with regard to feasibility, costs, time structure, etc. In parallel the proactive option I should be spelled out as well. Option II of a resolute reduction of the WWTPs profile was considered as being associated with too many risks and would entail an open conflict between the communities and industry (especially if growth conditions in the region proved to be meager). Option III was at first totally dismissed as being utterly unrealistic. Upon discussion in the core team and the workshops however feasibility was increasingly accepted and positive aspects were listed in several scenarios. However, given the relatively high pressure for action in the region and the considerable uncertainties associated with the future development of decentralized technologies, this option was not considered as representing a full-fledged alternative. In the context of option I, however it was claimed that upon appearance of new opportunities, it would be possible to set up services for decentralized sanitation accordingly. As a consequence, it was decided to further observe this technological development and take options into account as they became more mature.

6. Towards Integrated and Adaptive Water Management

In how far can we now claim that the RIF procedure will be supportive for transitions towards more sustainable sanitation infrastructures? The above chapters have elaborated the theoretical background and the general arguments for a specific methodological approach. Based on the lessons learned in the context of the pilot case study of Klettgau, we may now tentatively draw some conclusions about the possible merits of this kind of approach.

First at the level of the concrete case, the results may be said to respond to the initially set goals. The conventional Klettgau decision making structure clearly produced an incremental approach to reinvestment in the sanitation infrastructure. The options proposed may be considered as minor variants of the existing socio-technical paradigm, leaving both the technological system as well as the organizational and governance structure around it largely unchanged. If we compare this to the recommendations that came out of the RIF process, we may easily see a broadening of the context conditions, a broadening of the option ranges and also a broadening of the value positions both with regard to the goals considered to evaluate the impacts of the different options was achieved. Furthermore, the ensuing planning process will most probably be more reflexive, with regard to context conditions, and it will take flexibility considerations more explicitly into account.

Most astonishingly, the option, which resulted from the RIF process as representing the one with the highest positive potential in most scenarios and by most stakeholder positions (option IV) was at the outset of the RIF process not even considered as a legitimate option. So the whole process produced a substantially different result as the conventional approach and more radical system configurations, at that. Nevertheless, one has to be critical with regard to the validity of this claim. As the options were judged on highly general grounds, many assessment criteria could not be assessed with a sufficient degree of precision. For instance, costs were not assessed in any detail for the options. Additionally, even though there were representatives of the neighboring German communities participating in the workshops, no feasibility of the option to send the waste water to Germany was carried out. Therefore, further analysis may change the preference orders still. However, as was mentioned by most of the participants of the core team and the

workshops, the broadening of the analysis brought a more reflexive consideration of the options and conditions to which a future sanitation infrastructure had to respond. The initial motivation to go beyond the classical approach of continuing the prevalent regime pathways was thus claimed to be fulfilled.

So apparently, the RIF procedure helped to broaden the spectrum taken into account for decision making and strategic planning in infrastructure. But in how far does it also correspond to a local approach to further transition management in this sector. As the example shows, the structured discursive process that was initiated in the region helped to open the spectrum towards different technologies (as in option III), different organizational set ups (option I) and different spatial boundaries (option IV). Furthermore, with the participation of the official from the canton, lessons from the one exercise could be transferred to other organizations in the same canton. It could become a core activity of the cantonal office to support this kind of strategic planning processes in the different regions and to support synergies between the different processes. If carried out in different cantons this may ultimately create a background for national organizations and federal offices to discuss and implement radically new technologies in sanitation. In the 1960ies to the 1990ies, the construction of sanitation infrastructure was organized and subsidized top down from the confederation to cantons and down to the local communities. In recent years, subsidies and support have decreased substantially in order to delegate responsibility to the producers of environmental pollution. A coordinated set of RIF procedures could now create momentum for reforming the whole sector without falling back into a centrally controlled logic of the past.

The results of the procedure have in particular shown that it is suited to included broader considerations both from a thematic point and a regional of view. These are important preconditions for arriving at more reflexive and open integrated water management approaches. In this sense, RIF contributes to these attempts as well.

Time will have to tell how the results and the enthusiasm of the first RIF case will survive in the every day planning practice of the commission and the hard political every day struggles in which it is embedded. However, when judged from the immediate reaction and feedback of the actors involved, it seems that such procedures are desperately needed and that they carry the potential to contribute to the reflexive and strategic, participatory and experimental way of governance which is advocated by transition management.

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