The SLIM (Social learning for the integrated management and sustainable use of water at catchment scale) Final Report

Other

Final Report

European Commission – DG Research

Final Report **August 2004**

Social Learning for the Integrated Management and Sustainable Use of Water at Catchment Scale **Contract No. EVKI-CT-2000-00064 SLIM**

A research project supported by the European Commission under the 5th Framework Programme and contributing to the implementation of the Key Action 'Sustainable Management and Quality of Water' within the Energy, Environment and Sustainable Development Programme.

Social Learning for the Integrated Management and Sustainable Use of Water at Catchment Scale

(EVK1-2000-00695SLIM)

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About SLIM

SLIM stands for *S*ocial *L*earning for the *I*ntegrated *M*anagement and Sustainable Use of Water at Catchment Scale. It is a multi-country research project funded by the European Commission (DG RESEARCH – 5th Framework Programme for research and technological development, 1998–2002). Its main theme is the investigation of the socio-economic aspects of the sustainable use of water. Within this theme, its main focus of interest lies in understanding the application of social learning as a conceptual framework, an operational principle, a policy instrument and a process of systemic change.

Social learning in recent years has attracted interest as another way of conducting public business, alongside regulation, compensation, stimulation and the operations of the (free) market. It has also been promoted as essential for the management of complex natural resource dilemmas and a key process in adaptive management. The SLIM project investigates these claims and expectations. A premise of SLIM is that it is very useful to view sustainability as an emergent property of stakeholder interaction, and not a technical property of the ecosystem. The introduction into national law of the Water Framework Directive, and the requirement for public participation in its implementation, adds relevance to the research.

The research partners are:

The Open University, UK
Landwise Scotland, UK
Wageningen University Research, The Netherlands
Swedish University of Agricultural Sciences, Sweden
INRA–SAD, France
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The research teams are working with case study partners at various sites in England, Scotland, The Netherlands, the Atlantic coast of France and the Marche region of Italy. The research has been conducted in part as a process of co-learning and action researching. The contribution of all the project partners to the material presented in this paper is gratefully acknowledged. Contact can be made with researchers as follows.

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Further information about SLIM is available at http://slim.open.ac.uk

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1. Preamble and overview

SLIM is a multi-country research project funded by the European Commission (DG RESEARCH – 5th Framework Programme for research and technological development, 1998–2002). Its main theme is the investigation of the socio-economic aspects of the sustainable use of water. Within this theme, its main focus of interest lies in understanding the application of social learning as a conceptual framework, an operational principle, a policy instrument and a process of systemic change. A premise of SLIM is that it is very useful to view sustainability as an emergent property of stakeholder interaction, and not the technical property of the ecosystem.

The SLIM project was approved in 2000 and began in February 2001. The project addressed Key Action 1.1 within the Fifth Framework which focused on the "Integrated management and sustainable use of water resources at catchment scale." SLIM also addressed RTD thematic priorities 1.1.1 (Strategic planning and integrated management methodologies and tools at catchment scale), 1.1.2 (Socio-economic aspects of sustainable use of water) and 1.1.3 (Operational management schemes and decision-support systems). The funding of the SLIM project owed much to the commitment and conviction that research in this area was needed and to initiatives led by Niels Röling (see Röling and Wagemakers, 1998; Röling, and Maarleveld 1999; Leeuwis and Pyburn 2002). SLIM is an adaptation and evolution of four previous bids over a ten year period. There is a strong sense in which SLIM researchers were, and perhaps remain, ahead of their time. This was, for example, the perception within parts of DG Research following the successful running of SLIM's final work package (WP10) held in Brussels from 23-26th May 2004. The design of this event was based on SLIM's research findings about process management and experiential learning (see SLIM 2004a,b). We suggest there are lessons in SLIM's experience for DG Research's commissioning and managing of research. We address this point in the report in sections 4.1 and 4.4.[1]

1.1 The 'headlines'

- SLIM case studies provide evidence for achieving the transformation of individual and institutional behaviour, at large social scale, with significant technical results, through deliberate investment in multi-stakeholder learning processes (social learning). We propose that these processes be seen as a complementary governance mechanism as portrayed in Figure 1.
- SLIM research has produced a framework for organising analysis and action in situations of complexity, connectedness, controversy, multiple perspectives and uncertainty, such as water catchments. Included is operational guidance for dealing with complex resource management situations. A full account is given in the publication SLIM Framework (SLIM 2004b). At the core of this Framework is a heuristic device[2] (Figure 2).

[1] SLIM researchers do not adopt an objectivist stance to their research. As researchers they are located within, not outside the research even if the research is based on case study or participant observation. For this reason personal pronouns are used. 'We' refers to a group position within SLIM.

[2] This could also be described as a 'meta-tool' or a tool to use tools (where a tool could be a model, a decision support system etc).

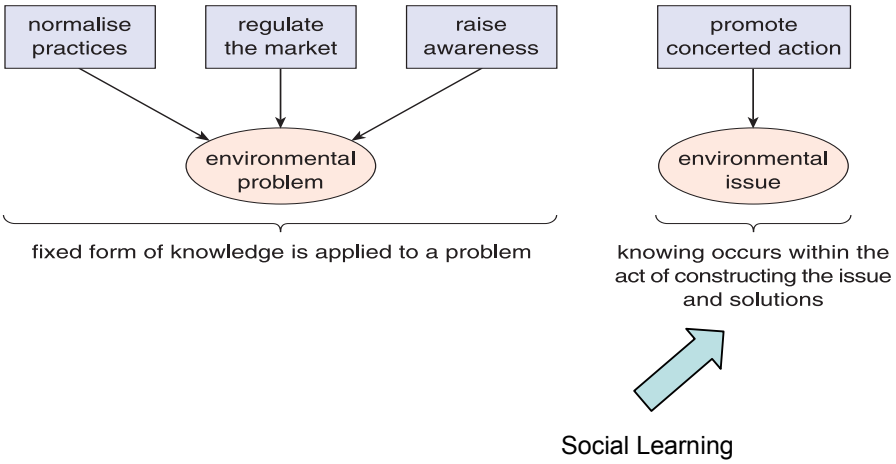

Figure 1. Traditional policy responses to objectified environmental problems (left) and a policy response which has an alternative epistemological basis from which social learning can be developed as a purposeful policy choice.

- The SLIM Framework (Figure 2) which has been built based on our case study research and tested in a number of fora, including with Brussels-based policy makers, is the outcome to meet SLIM's first research objective: to formulate an effective operational interactive approach which policy makers at different levels can foster and apply. Further background is provided in Section 4.2.1.
- We identify a range of situations where current traditional policy initiatives are not doing well (see 4.2.1) and suggest purposeful investment in Social Learning could do better. In particular we draw attention to situations of complexity, connectivity, uncertainty, multiple perspectives and conflict. These situations exist in the social domain including interactions humans have, or do not, have with the biophysical domain such as water catchments. We provide empirical evidence for both.
- We identify a number of constraints to enacting a Social Learning Approach as well as factors which are facilitative. Of particular importance is the need for capacity building if social learning is to be used purposefully in the water or other sectors. Our second research objective, to develop guidelines and methods for human resource development for using this interactive approach, is primarily addressed in two places – in the SLIM Framework document and in SLIM PB7 (SLIM 2004a; 2004i). Both draw on our case study research. The main implications of our findings are summarised in Section 4.3.
- Our results show that a knowledge-based society requires people who are recognised for what they do and not just for what they are (that is, their recognised 'status' should be that of subjects rather than objects). The added value of such an approach is the emergence of relational capital resulting from the presence and interactions of different elements of the other forms of capital (K) – artificial, natural, social and human. The involvement of citizens, formal groups, enterprises and institutions sharing the same concerns facilitates the integration of sector-specific policies. But the shared concerns can only become explicit when these are derived from collaborative knowing (social learning).

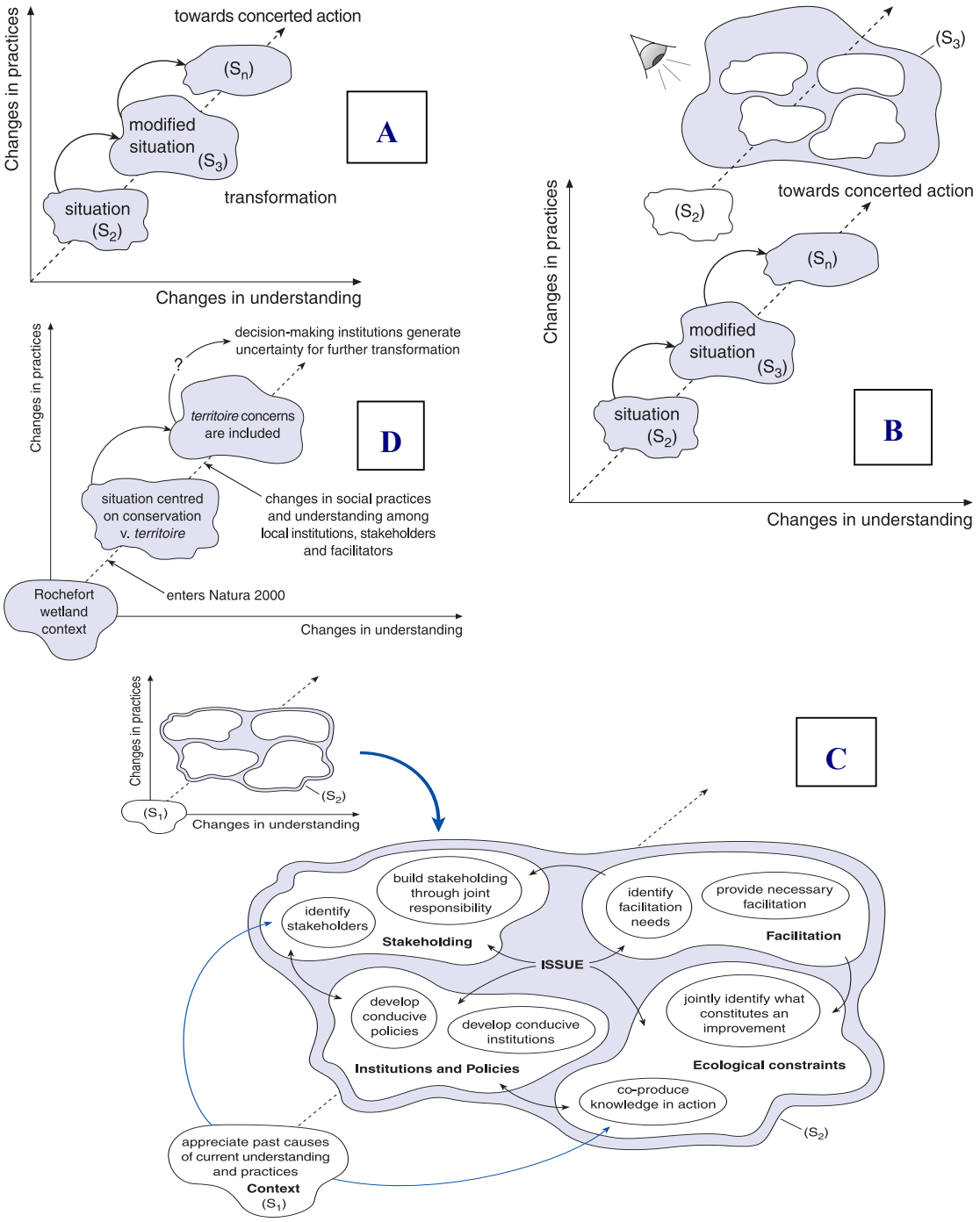

Figure 2. The central heuristic device at the core of the SLIM Framework: (A) the transformation of situations over time through changes in understanding and practices towards concerted action; (B) the SLIM perspective on the variables in the situation, elaborated in more detail in C and exemplified in one of SLIM's case studies (D) (see SLIM Framework for more detail)

- The SLIM research heuristic (Figure 2) supported by our case study findings can be used to frame guidance on how decentralised units such as micro-catchments can be integrated into larger 'wholes' to aid the development of river basin management plans on a national or international level (SLIM's third initial research objective). We do not offer a guidance blueprint as case study research has shown how this needs to be context specific (for example the effective management of salmon in the River Tweed requires interactions at all biophysical and social levels if it is to be adequately conserved – see CSM 93). We develop two key concepts to assist in the development of such guidance: networking and appreciating the role of intermediary objects for designing (IOD) or intermediary concepts for designing (ICD; see section 4.2).
- Case study research has shown that the notion of networking offers opportunities for facilitating social learning and for moving across scales with consequent positive effects on water management. Networking is required to understand the consequences of multiplication and diversification of social scenes, as well as that of cross-scaling issues (between decision levels and social and bio-physical scales). Networking is a way of coordinating shared activity and is an effective way to cross boundaries, of disciplines, organisations, hierarchies and scales. The potential for networking to support social learning highlights the essential role of the management process and that of its coordinator or facilitator. In one case study (see CSM 2), a considerable number of social scenes were created and managed to allow social learning to occur. A consequent effort was made to transform individual learning into concerted effort at societal scale. The activities under this heading have been grouped by the coordinator into the 'spaces for learning' that addressed stakeholders in society (citizens and users participation), and those that addressed project stakeholders (decision-makers).
- Our fourth research objective was to help the development of strategic planning methodologies and social tools at catchment scale and identify socio-economic pressures and barriers hampering the sustainable use of water resources as specified in RTD priorities 1.1.1, 1.1.2 and 1.1.3 (see above). The SLIM heuristic device, supported by policy briefings as well as a case study dedicated to the use and further development of 'dialogical tools' to facilitate concerted action (see CSM 5) are the main contributions to this research objective. Other methods and tools have also been used effectively in the case study research and in the conduct of SLIM's own social learning process.

This final report starts by reviewing the context in which the SLIM research was commissioned and conducted (Section 2). This includes the theoretical context (2.1). The scientific/technological and socio-economic objectives that were set when SLIM commenced are then outlined by considering the structure of the research (3.1) and research methods (3.2). In section 4 the applied methodology, scientific achievements and main deliverables are presented. This is the core of the report. The applied methodology details what was actually done and how the planned methods were adapted as the research progressed. The main conclusions including socio-economic relevance, strategic aspects and policy implications are summarised in Section 5. As required, sections 6 and 7 deal respectively with dissemination and exploitation of the results and the main literature produced.

[3] see 6.7.1.2 for full citations; CSM 9 is an abbreviation for SLIM Case Study Monograph number 9.

2. Background

2.1 The research context

Historically water catchments have been regarded as biophysical entities governed by hydrological characteristics. Some water managers have begun to regard them as "bundles" of natural resources and ecological services whose sustainable management requires continuous balancing and integration of social, economic and ecological factors in a complex process through statutory and non-coercive measures. Within both of these framings 'catchments' are seen as pre-existing entities that require managing. Another view, which will be elaborated upon, is that water and its physical and social characteristics creates interdependencies that must be taken into account by humans who then conceptualise particular ways of understanding water – it is through this process that some societies or professional groups come to speak of 'catchments' or 'watersheds' or 'wetlands'[4]. Each of these terms has different meanings in particular social and professional settings and each seeks to bound the dynamics of water in a particular way. An evolution in understanding of catchments from biophysical to socially constructed entities has implications for policy makers, water managers and researchers.

Water catchments, however bounded, are focal points for adaptive management. They generate many 'surprises'. They are vulnerable to misuse and the feedback to that misuse directly affects the well being of major segments of the European population. Soil erosion leads to land degradation and to silting of reservoirs, lakes and estuaries (or in some cases the lack of silting, where this brings environmental benefits such as habitats for flora and fauna). Run-off and reduced infiltration and retention lead to extreme events and overall reduction in the quality of life (flooding, desiccation, scarcity of drinking water and droughts). Pollution and water extraction have important downstream multiplier effects and leads to conflict. Catchments provide an important arena for managing biodiversity (wetlands, fisheries), as well as agriculture (irrigation, nutrients, chemicals, deforestation, etc.). Such considerations make water catchments important 'bundles' of natural resources and ecological services which need to be singled out for special attention, even though their scale boundaries are not always easy to agree upon (ranging from micro catchments to major watersheds straddling different countries). Water catchments must be understood and managed as 'systems' which incorporate both the social and biophysical.

Each year we are becoming more aware of alterations of the natural world that are large-scale, long-term, and anthropogenic in nature. This issue raises the question of the management of common goods, which have to be accessible to everybody (such as drinkable water or landscapes) but are altered by private actions from individual stakeholders. In such situations, public policies have to take into account how private activities can be managed (through taxes, incentives, contracts, regulations, bans, etc.) to preserve the quality – and, most of the time, also the quantity - of a resource, which is a public good devoted to common uses. So, it is not only the nature of the good which makes the distinction between private, collective or free access goods, but also the ways and the institutions by which their uses or alterations are controlled by public actions.

Although requiring urgent attention, these problems are typically associated with uncertain facts, disputed values, and high stakes that make their management difficult. They emerge in

[4] The terms watershed and catchment are used differently even within the English speaking world; our research results suggest a very low public awareness of the concept of 'water catchment'.

situations where multiple stakeholders with differing interests make claims on the same common pool resources. The problem is that one user's use of such a resource will subtract benefits from another user's enjoyment of it; and excluding individuals or groups from sharing the resource involves high transaction costs.

Box 1. Defining institutions

There are multiple uses and interpretations of the term 'institution'. In English, it is often used interchangeably with 'organisation'. In SLIM, we use the term institution to describe an 'established law, custom, usage, practice, organization, or other element in the political or social life of a people'; 'a regulative principle or convention subservient to the needs of an organised community' (*The Oxford English Dictionary*). An organisation is understood as a hierarchical network of behaviour and roles to elicit desired individual behaviour and coordinated actions obeying a system of rules and procedures.

Institutions can be policies and objectives, laws, rules, regulations, organisations, policy mechanisms; norms, traditions, practices and customs. They influence how we think and what we do.

SLIM's concern—in the context of 'catchments'—is with concerted action among users seeking to manage common pool resources in a sustainable manner. Some studies have shown that pre-industrial peoples have been able to establish institutions (see Box 1) among defined user groups who agree to regulate the use of, access to, and surveillance of a common pool resource, as well as sanctions against its misuse. These examples, whilst not universally successful, raise the question of whether collective rational choice can override individual rational choice in the use of hydrological systems in post-industrial Europe? And how do policies promoting Integrated Catchment Management (ICM) and Sustainable Use of Water (SUW) contribute to this trajectory? Before answering this question, there is a need to look at ***how an issue*** is built (socially constructed) around resource use. SLIM researchers find that it is moulded by a wide diversity of elements acting at different scales and decision levels.

The main features of an issue are[5]:

(i) Interdependencies

The use of natural resources through one type of human activity affects ecological processes in ways that interact with other people's uses of natural resources across geographic and ecosystem boundaries and time scales. ICM and SUW, for example, address interdependencies:

- between human activities, relative to their qualitative and quantitative effect on water and their water-related needs
- between linked geographic areas such as upstream areas, lowland wetlands and estuaries or aquatic and terrestrial ecosystems.

(ii) Complexity

Natural resources are under the influence of a complex mix of enmeshed natural, technical, and social processes including changes in public policy, organizations, and a diversity of stakeholders each with their own perceptions. When considering water as a resource for human uses as well as a part of nature, we are compelled to make the link

[5] Taken from SLIM Framework (SLIM 2004b)

between ecology and societal processes such as technological development, the market, public policies, and interpersonal relations. ICM and SUW operates within a set of interlinked and assorted elements that create a high level of complexity.

(iii) Uncertainty

The complexity of such circumstances make them inherently impossible to explain comprehensively and accurately, and the effects of proposed solutions cannot be forecast with confidence. The realms of uncertainties are also diverse:

- Technical and ecological, regarding the relationship between human activities and ecological processes, and fragmented and sector-specific technical and scientific knowledge
- Socio-economic, relative to market and consumer trends, changes in social demands, the emergence of new sorts of crises such as BSE and the proliferation of institutional arrangements
- Political, with respect to the increasing diversity and number of public policies generating contradictions, and decision-making levels and organizations implementing these policies.

(iv) Multiple perspectives

No one stakeholder can know everything about a particular situation. Just what constitutes a situation improving action is often contested as people perceive different 'systems of interest'. In addition there are always people who are affected but not involved ('le tiers absent') – whether because of logistical and practical reasons or because future generations cannot be present to speak for themselves.

(v) Controversy

Uncertainty and interdependencies result in differing perceptions and lasting disagreements on the issue. The controversies may question the existence of the problem, its origin, how cause-and-effect relations are understood, and how it should be managed and by whom.

Water catchments have been conventionally understood as bio-physical 'hard' systems and not as situations of complexity, uncertainty, interdependence, multiple perspectives and controversy. In the traditional paradigm problems are addressed through instrumental interventions, typically through engineering works or the measurement of biophysical or ecological indicators in isolation from their social context. To the extent that the sustainable management or regeneration of water catchments requires changes of behaviour of stakeholders in the catchment, use is made of strategic reasoning. Intervention typically is attempted through fiscal policies, regulatory measures and education (Figure 1). Consider, for example, the following quote: "The 6th Environment Action Programme promotes environmental development using all instruments available: legislation and penalties, grants for improvements and innovations, research and information." (Wallström, 2003).

In recent years, a fourth approach has emerged in response to the frequent failure of instrumental and strategic reasoning. This 'social learning' (SL) approach is based on the idea that sustainable and regenerated water catchments are the emergent property of social processes. That is, desirable water catchment properties arise out of interaction (sharing problem definitions and monitoring, negotiation, conflict resolution, learning, agreement, creating and maintaining public goods, concertation of action) among multiple, inter-dependent, stakeholders in the water catchment. Where such an interactive approach applies, centralised and objectified policy does not become irrelevant but can be encompassed within a

broader understanding of how knowledge, and thus issues, are constructed and employed in policy processes. A 'social learning approach' provides a context for a dynamic local decentralised process, and, in the case of large watersheds, for concerted parallel local processes.

'Social learning' also rests on a different set of epistemological assumptions – that knowing occurs with the act, the process, of constructing an issue and seeking improvements. The traditional policy instruments are built on an epistemological foundation of fixed forms of knowledge (Figure 1). These two different foundations do not preclude their complementary use but to do so requires awareness of the differences and of the implications for practice, whether in policy development or water management. For example the practices characterised by assumptions about fixed forms of knowledge can be described as 'supply push' or technology transfer whereas those associated with knowing as a process can be seen as leading to 'demand pull'.

"Social learning" is an emerging policy option for the management of natural resources. It is central to non-coercion and important, we argue, in the fulfilment of the EU Water Framework Directive (WFD) but its successful conduct needed to be much better understood. In the framing of 'social learning' as an interactive approach we postulated three important implications in the design of SLIM (see Description of Work on http://slim.open.ac.uk) which have been further tested (and revised) during our research:

1. In the first place, it emphasises social learning. Stakeholders are considered intelligent, responsible agents who are willing to act in the collective interest, given that they are enabled to learn through building their stakeholding in an issue and given that they are assisted to create the institutional conditions in which they can rely on reciprocal arrangements. Collective interests are not merely the sum of individual interests or preferences. Typically, such social learning is facilitated by helping stakeholders see the water catchment (in its social and biophysical dimensions) as one system or common pool resource in which they are interdependent with others.
2. In the second place, research had suggested that stakeholder platforms for decision making and action were required for social learning (see Röling, 1994). It was argued that a capacity for communication, social learning and concerted action among the stakeholders must be created at the level(s) of the water catchment perceived to be under threat and a 'soft side' of the water catchment deliberately developed, within an already complex social context of existing organisations, vested interests and institutional arrangements. At the commencement of SLIM little was known about how to do this in the European context.
3. In the third place, for policy, it was known from theory and practice that the interactive approach had important consequences because it is based on communicative, as opposed to instrumental reasoning. This implied a different policy theory from the customary bio-physical and economic models and a requirement for totally different instruments[6].

[6] Bilson (2004) argues that theories of action based on Habermas effectively lead to a rational approach in which the aim is to use theory construction to first enlighten and then emancipate groups of people (through rational argumentation approaching an ideal speech situation but which may require militancy or struggle). Maturana's constitutive approach suggests that ethical behaviour stems not from rationality but from emotions and that 'abuse' stems from relationships which are not based on mutual acceptance (p.29).

These three framings rest on a solid and emerging body of research but one that has been slow to be appreciated and incorporated into praxis in the European context. A brief review follows.

2.2 Theoretical roots

SLIM's research built on pioneering work by Peter Checkland (1981), Bawden (1994; 1995) and Wilson and Morren, (1990), Röling and Wagemakers (1998), Jiggins and Röling (1999), Ison and Russell, (2000), Hubert, Ison and Röling (2000) and others who have begun to develop radical alternatives for natural resources management. For example the methodology (SSM) developed by Checkland and Scholes (1990) was adapted to natural resource management in RAAKS (Engel and Salomon, 1997). Participatory approaches, developed for work with small holders in highly diverse, risk prone environments where the Green Revolution did not reach (e.g., Morss 1976; Chambers and Jiggins, 1987), were adopted for use in major infra-structural work planning in industrial Europe but are not yet mainstream in policy circles nor supported by the education and training of professionals. The failure to implement centrally conceived plans (e.g. Nitrates Directive), and the increased public resistance they meet, has led to interest in interactive policy development at the local level in many European countries (e.g., van Woerkum, 1997). In some, but not all, circles constructivism has undermined the positivist arrogance which made science the source of innovation and gave the expert a prominent place in our society (e.g. Berger and Luckman, 1967; Kuhn, 1970; Funtowicz and Ravetz, 1993). Farming Systems Research is developing to include multi-disciplinary systems approaches that are complex in terms of levels of space and time (Hubert, Ison and Röling 2000; Jiggins and Röling 2000a).

In economics, Hardin's (1968) 'Tragedy of the Commons' motivated a search for reasons why his logic might not apply, notably by Ostrom and her colleagues (1992; 1998). That work has led to identification of institutional conditions for overcoming social dilemmas, a major problem in water management (Steins, 1999; Maarleveld, 2000). For example, Knox and Dick (1999) cite the case of artisanal fishermen in Kerala who through organisation and advocacy were able to restore common property rights, state financial assistance and eventually a season ban on trawling by commercial fishermen.

Ecologist Holling and his colleagues (Gunderson et al, 1995) have coined 'adaptive management' as a normative model for human behaviour that is suggested by the dynamic, cyclical nature of eco-systems and the resulting 'surprises'. These behavioural implications are specified in 'social learning', i.e., development of a collective understanding, ability to monitor, experiment, etc. This work has led to a great interest but as yet limited application in the European context. The ideas about adaptive management fit very well with the work of Maturana and Varela (1987) on cognition as a basic process of life and its implications for ecological rationality (Jiggins and Röling, 2000ab; Röling and Jiggins, 2000; Open University 1998; 2000ab; Ison and Russell 2000; Russell and Ison 2004).

Despite these achievements useful policy theories, metaphors, case studies, diagnostic tools, and curricula for training that can effectively inform (interactive) policy processes for sustainable and regenerative water catchment management are still required. Much of the work has occurred outside Europe or in contexts not normally associated with water management. Few findings and associated practices have been effectively institutionalised. This is typified by the quote from Wallström (2003). In addition 'integrated catchment management' (ICM), now widely articulated as an ideal to be aimed for, is a contested notion. As Cameron *et al* (1996) point out its practice has elements of rational planning as well as signs of the dynamic of a new social movement. Both involve a struggle over what share of resources for practical activities will be supplied by government and what by local

communities (p.ii). These authors, based on Australian experience, conclude that 'ICM should be viewed as an activity in collective learning, rather than a dispute between parties that are already in possession of all the necessary knowledge' (p.iv).

Margerum and Whitall (2004) argue from a North American perspective that collaboration has rapidly become the dominant paradigm in natural resource management. Whilst this may be true in their context it is still not the case in Europe. They note that there are many dilemmas about how collaborative management is applied effectively, highlighting (i) tensions between technical complexity and open participation; (ii) difficulties with information exchange for joint project management; (iii) the relationships between technical issues and policy issues; (iv) the role of regional policy in supporting collaborative efforts, and (v) the importance of institutional arrangements. These factors require further elucidation in the European context.

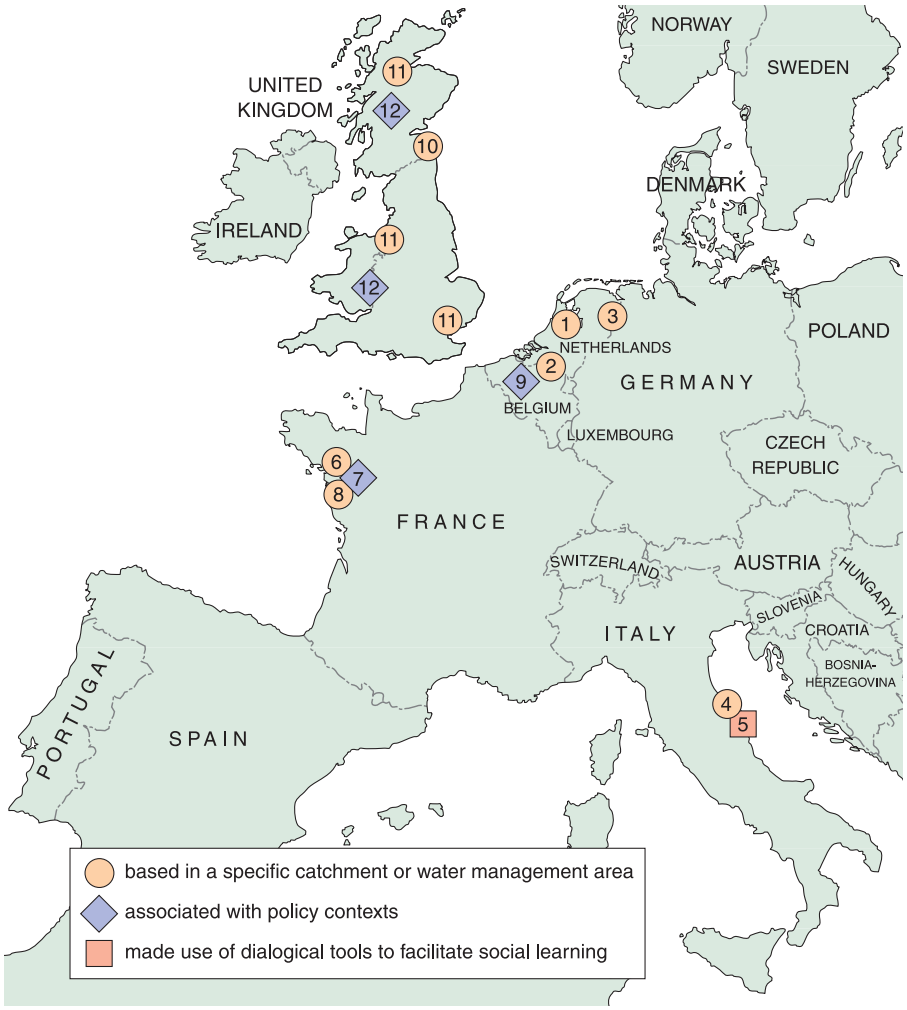

Figure 3. Location of the SLIM case studies listed in Table 2. Case studies were based in a specific catchment or water management area (O) or associated with policy contexts (◇) or the use of dialogical tools to facilitate social learning (□) drawing on more than one particular area.

For this purpose the SLIM project assembled a multidisciplinary group of researchers with backgrounds that included agronomy, environmental science, sociology, rural development, systems and geography. The group undertook to work in an interdisciplinary (as opposed to multidisciplinary) manner and to work with stakeholders in one of three modes (observers, facilitators or co-researchers). SLIM researchers studied social learning, or elicited the

factors constraining or enhancing social learning as a purposeful policy and praxis option, through fora of stakeholders in catchments of different type, scale, and socio-economic situation (Figure 3). They developed and tested the usefulness of social tools and methods developed from their research and in other spheres. It is against this background that the specific research objectives for the SLIM project were set. They are described in the next section.

3. Scientific/technological and socio-economic objectives

The primary need to which SLIM research contributes is to elucidate how a shared capacity at all levels of policy making in EU countries can be developed so as to create conducive contexts for local interactive processes for sustainable management and regeneration of nested watersheds in Europe. To fulfil this research objective required SLIM to:

(i) provide evidence of the need for an alternative policy approach;

(ii) exemplify the circumstances when it is needed and likely to be advantageous, and

(iii) provide policy makers and water managers with the conceptual and practical tools to use social learning as a deliberate (purposeful) policy instrument.

Factors which constrain or enhance the use of a social learning approach, including human resource capacity in enacting these approaches are also illuminated by the research.

The particular research objectives set by SLIM were to:-

(1) formulate an effective operational interactive approach which policy makers at different levels can foster and apply;

(2) develop guidelines and methods for human resource development for using this interactive approach, and

(3) develop guidance on how decentralised units such as micro-catchments can be integrated into larger 'wholes' to aid the development of river basin management plans on a national or international level.

(4) help the development of strategic planning methodologies and social tools at catchment scale and identify socio-economic pressures and barriers hampering the sustainable use of water resources as specified in RTD priorities 1.1.1, 1.1.2 and 1.1.3[7].

3.1 Structure of the research

The SLIM proposal was based on a simple logic developed by Röling and Wagemakers (1998) on the basis of case studies of ecological agriculture in various countries:

(a) Designated Stakeholders

engage in

(b) Desirable Practice

which requires

(c) Learning

[7] The relevance of SLIM's research to these priorities are described in detail in the initial Description of Work as are the more detailed research objectives – see http:// slim.open.ac.uk for a copy

based on

(d) Facilitation

made possible by

(e) Institutional Support

embedded in a

(f) Conducive Policy Context.[8]

This structure was useful in that it provided entry points for the research and suggested a search for systemic coherence in complex situations. The comparative case studies sought to follow this logic in terms of (i) case study choice and (ii) research approach but did not follow *ex ante* blueprints. This original heuristic informed our research design and has evolved based on our research findings. For example the case study contexts described in Table 1 had a particular focus (e.g. river basin, policy context) but were chosen because of their potential to illuminate systemic connections between the above 'variables'. A further elaboration of this structure was subsequently developed for cross-case comparisons (see section 4.1).

The heuristic device originally proposed by Röling and Wagemakers (1998) was also used as a focus for the outputs from the interactive workshops (workpackages) which were central to SLIM's design. State-of-the art thematic papers (TPs) were developed by cross-country authoring groups on (i) desirable practices and ecological constraints to the sustainable use of water; (ii) stakeholders and stakeholding; (iii) conducive institutions; (iv) facilitation (v) conducive policies and (vi) learning processes. These in turn have been transformed into a full set of Policy Briefings for use by policy makers and water managers (see section 7.1.1).

3.1.1 Case study choice

SLIM case studies were also chosen on the basis of an appreciation of the notion of research and researcher-in-context. This means that historical factors as well as relational factors were often key considerations[9]. For example case studies in France and Italy grew out of extant relationships associated with the historical location of the research organizations and researchers.

In the UK and the Netherlands case studies were originated *de novo* (except for Case Study 3 – see Table 1). In all 15 case studies were completed which have been written up in 12 Case Study Monographs (CSMs – see section 7.1.1 for a full set of citations).

Other factors were also taken into consideration in case study choice[10]. A preliminary choice was made in the original proposal, but it left open the possibility to further specify case studies within each partner country, and for collective choice by the partners from among them on the basis of agreed-upon criteria. Each choice was originally attempted so as to deliberately (purposefully) facilitate social learning among stakeholders who perceive or are perceived to need to take concerted action to improve water resources management. In the end this proved too ambitious and only some of the case studies involved facilitation or genuine co-researching (see Table 1).

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[8] Mark 1 version as articulated in the SLIM proposal.

[9] Relational capital is defined in Box 3.

[10] These are detailed in the SLIM WP2 and SLIM WP3 reports (see 6.7.1.6).

Table 1. Case studies undertaken by the SLIM project and prepared as case study monographs (CSM) by researchers acting as 'observer' (O), 'facilitator' (F) or 'co-researcher' (CoR).

SLIM Code and Number	Position of the Researcher	Case Study focus	Case Study Citation
CSM1	O	River Basin	van Bommel, S. and Röling, N. (2004) The Drentshe Aa in The Netherlands, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) Case Study Monograph 1 (available at http://slim.open.ac.uk).
CSM2	O, F	Regional groundwater management	**a**. Jiggins, J. (2004) Key informant studies I: InterReg project water management in the Central Benelux area (1st Generation project), SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) Case Study Monograph 2 (available at http://slim.open.ac.uk). **b**. Jiggins, J. and Röling, N. (2004) Key informant studies II: water conservation project in North Brabant and Limburg (2nd Generation project), SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) Case Study Monograph 2 (available at http://slim.open.ac.uk).
CSM3	O, F and CoR	River Basin	van Slobbe, E. (2004) The Overijsselse Vecht in the Netherlands, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) Case Study Monograph 3 (available at http://slim.open.ac.uk).
CSM4	O, F	River Basin (micro catchment)	Arzeni, A., Lupini, L., Roggero, P.P., Ruvutuso, S., Seddaiu, G., Sotte, F. and Toderi, M. (2004) The nitrate problem in Serra de Conti and Montecarotto (Marche, Italy), SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) Case Study Monograph 4 (available at http://slim.open.ac.uk).
CSM5	CoR	Use of dialogical tools	Toderi, M., Powell, N. et al. (2004) Dialogical tools: a methodological platform for facilitating and monitoring social learning processes, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) Case Study Monograph 5 (available at http://slim.open.ac.uk).
CSM6	O	Wetlands (institutional perspective)	Badache, L. (2004) The Atlantic Wetlands Forum: an intermediary body wavering between expertise and facilitation in its search for legitimacy, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) Case Study Monograph 6 (available at http://slim.open.ac.uk).
CSM7	O, F	Wetlands (policy perspective)	Steyaert, P. (2004) Natura 2000: from consultation to concerted action for natural resource management in the Atlantic coastal wetlands, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) Case Study Monograph 7 (available at http://slim.open.ac.uk).
CSM 8	O, F, CoR	Wetlands (local actor perspectives)	Brives, H. (2004) Changing practices and understandings for natural resource management: the example of the local cattle breed in the Atlantic coastal wetlands, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) Case Study Monograph 8 (available at http://slim.open.ac.uk).
CSM9	O	Policy Context	Ollivier, G. (2004) An analytical understanding of the Water Framework Directive questioning its potential to enable sustainable management of water, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) Case Study Monograph 9 (available at http://slim.open.ac.uk).
CSM10	O, CoR	River Basin	Collins, K. (2004) The Tweed Forum and Tweed catchment management plan: a SLIM-UK case study, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) Case Study Monograph 10 (available at http://slim.open.ac.uk).
CSM11	O, F	River Basins	Watson, D., Morris D., Collins K., Stoate. C, Blackmore, C., Reynolds, M. and Gibbon, D. (2004) SLIM-UK catchment cases: the Ythan, Eyebrook and Ribble, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) Case Study Monograph 11 (available at http://slim.open.ac.uk).
CSM12	O	Policy Context	**a.** Blackmore, C., Collins, K., Furniss, P., Morris D. and Reynolds, M. (2004) The UK policy context for water management. I The English and Welsh policy context, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) Case Study Monograph 12 (available at http://slim.open.ac.uk). **b.** Ison, R. and Watson, D. (2004) The UK policy context for water management. II The Scottish policy context, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) Case Study Monograph 12 (available at http://slim.open.ac.uk).

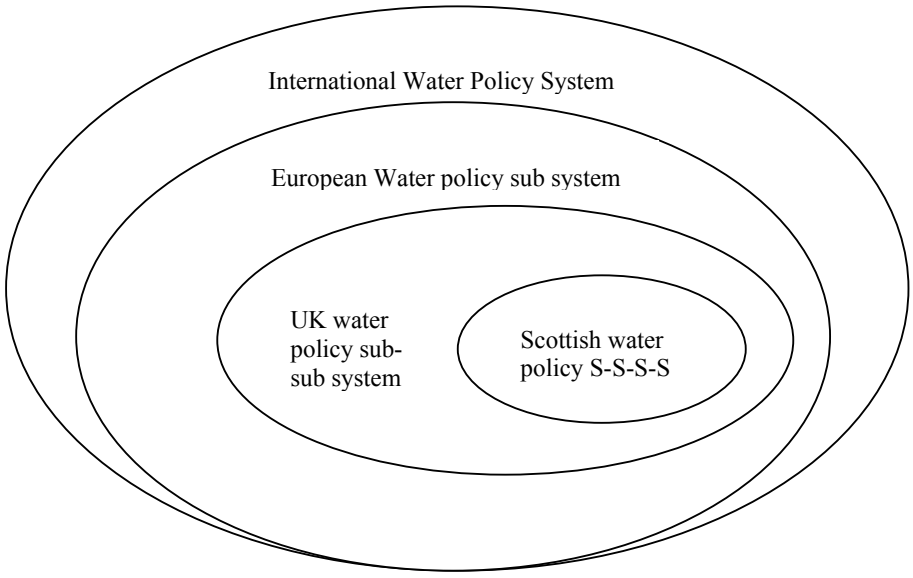

Figure 4. A systems map of the layered structure of water management policy (N.B. other levels such as 'basin' or sub-catchment' or 'regional' could be added to the model as could an 'England and Wales policy sub-sub-sub-system', S-S-S-S).

As our research progressed it became apparent that case studies which specifically illuminated the policy, and associated institutional, context of water management were likely to be needed if we were to fully understand the way in which social learning might be developed as an alternative policy instrument. This led to the conduct of four case studies focused on specific policy and institutional settings rather than catchments *per se* (CSMs 7, 9 and 12a and b – see Table 1 and Figure 3). The systemic logic of this choice is depicted in Figure 4 in relation to the UK.

3.1.2 SLIM workpackages

The sequence of SLIM workpackages was organized around the following logic:

1. Inventory (WP3). The study unit is identified and its boundaries are described as well as the method by which these boundaries were constructed and by whom.
2. *Platform Analysis (WP4).* During this phase, the focus was on the institutional and policy context in which the (micro) water catchment is embedded, as well as on the intended intervention in the (micro) catchment itself. Who are the agencies that are taking the initiatives? What platforms for negotiation, decision making and implementation have been created at the (micro) water catchment or other levels? How do these platforms fit into the existing institutional framework? What resources are available? What policies are implemented (objectives, process)? What implementation strategy is being followed?
3. *Stakeholder Analysis (WP5).* During this phase, the case study focused on the different stakeholder categories in the (micro) catchment (including outside interests that impinge on the area). The key stakeholders or their representatives were interviewed. This provided understanding of the multiple perspectives on both, the bio-physical and socio-economic aspects of the (micro) catchment. This analysis aimed to allow for a revised problem analysis.

1. *Learning Process Analysis (WP6)*. During this phase, the study focused on what stakeholders have learned about both the bio-physical and the socio-economic aspects of the (micro) water catchment. The aim was to examine the way stakeholders construct the water resources management issues, their knowledge sources, the monitoring they use and their insights in the functioning of the (micro) water catchment as a system. We also proposed to examine the expectations about other stakeholders and the social capital available (i.e., trust in existing agreements and institutions for overcoming social dilemmas). To the extent that active stakeholder involvement is going on in the (micro) catchment (and we assumed it would be, since the case studies were to be selected accordingly), this process was to be recorded and analysed.
2. *Facilitation, Institutional Support, and Conducive Policy (WP7)*. We speculated that this phase of the case would bring a pay-off in terms of understanding what facilitative activities, support institutions and conducive policies can help explain the learning towards collective action (dependent variable). It was recognised that it would be impossible to draw hard 'if then' conclusions as the research does not deal with a mechanical process and contextual and historical factors play a crucial role. We hypothesised that responsive learning process management, and conditions for such management, could be identified and described and used as a basis for future process design.

In practice we found the need to revise and iterate between these steps because of a range of pragmatic, logistical and methodological issues. These are addressed in Section 4.1.

The final set of workpackages and contract deliverables are summarised in Table 2. They included a coordination work package (WP1); a preparatory and team building workshop (WP2); in-country workshops (WP8) designed around preliminary findings and as a key strategy in our overall technological implementation plan (TIP); a synthesis workshop (WP9) and an elaboration of WP8 designed specifically for Brussels-based policy makers and built on our final results(WP10).

3.2 Research methods

A range of qualitative research approaches were used. The research consisted of (i) desk study; (ii) semi-structured interviews; (iii) participant observation (iv) informal discussions with key informants; (v) facilitation of action and (vi) co-research. Specific details are provided in each case study monograph (Table 1). Overall, researchers adopted a constructivist approach. Case study methodology as developed by Yin (1984) was loosely followed. In character with its constructivist perspective, the studies relied heavily on the methodological approach advocated by Guba and Lincoln (1994) in their 'Fourth Generation Evaluation'. We primarily focused on understanding actors' reasons or explanations instead of identifying causes for their behaviour (see also Ison and Russell 2000).

It was intended that case studies would mainly employ a grounded theory approach (Glaser and Strauss, 1967; Strauss and Corbin, 1990 and 1994). This entails attention to categorisation and linking of the research data. The basic technique of grounded theory research are working through the data systematically, categorising, developing core categories and abstracting definitions, following through on particular themes which relate to the core categories and noting possible theoretical ideas as the data are sifted, read and re-read describes the main method of analysis. However, not all categories arose 'from the ground-up' in the case studies. Earlier research by Röling and Wagemakers (1998) had established a set of key variables that appeared to be present when social learning emerged in situations of

natural resource management – these are encapsulated in what became know to the researchers as the SLIM matrix containing our main variables of concern (Box 2).

Table 2 Summary of final set of SLIM contract deliverables

Workpackage (WP)	Technical Deliverable	Contract Deliverable
Preparatory Workshop (WP2) Month = 3	i. Background Paper ii. Analytical Framework iii. Inventory and Groundwork Research Protocol	Workshop Proceedings
Inventory Workshop (WP3) Month = 8	iv. .6 country/partner reports v. .State-of-the-Art-paper vi. .Project Process Protocol vii. Ecological constraints to watershed function review	Workshop Proceedings
Platform Analysis Workshop (WP4) Month = 10		6 country/partner reports Workshop Report (finalised chapters from all partners plus SLU synthesis)
Stakeholder Analysis Workshop (WP5) Month = 12 - 24		6 country/partner reports Action Documents Evaluation Report Workshop report
Learning and Process Analysis Workshop (WP6) Month = 26	viii. Methods for Facilitation; social learning processes in action ix. Assessment of role of tools -e.g. GIS	6 country/partner Reports
Facilitation, Institutional Support and Conducive Policy Contexts Workshop (WP7) Month = 29	x. Methods of intervention/facilitation xi. Recommended Institutional Support xii. 'Policies that work'	Workshop Report
In-Country Workshops for national integrated sustainable water resources management (WP8) Month = 33-34	xiii. Methods for Facilitation of Social Learning xiv. Practical Guidelines for Facilitation of Social Learning by Stakeholders in integrated sustainable water resources management xv. Learning about ecological constraints	6 Country/Partner Workshop Reports Evaluation methodology report
Synthesis Workshop (WP9) Month = 36	xvi. Synthesis Papers xvii. web resources and CD-rom (Dutch team) for training policy makers, facilitators as well as self-appointed activist stakeholders and volunteers; xviii. Practical Policy Guidelines xix. .Process design guidelines for enacting social learning	Workshop Proceedings Final Report[11]
Process design for Brussels policy makers – experiencing social learning. (WP10)	xx. Techniques for engaging policy makers with SL tools	Report on outcomes

[11] Renegotiated for submission by end of August 2004.

One of the outcomes of the research was the evolution of our analytical framework as well as the development of an evaluative framework for the conduct of our own, and similar research.

Box 2. The modified SLIM analytical framework (Mark 2)

The **context** is explored

To identify and invite

Designated **stakeholders**

Who engage in

Desirable Practices (for Integrated catchment management)

Through processes of

Social **learning**

With the aid of

Facilitation

And the formation of appropriate

Institutional Support (or platforms)

In the context of

Conducive policies (for sustainable water management)

This framework continued to evolve during SLIM based on our research findings and our engagement with it as a device for cross-case comparisons (see Section 4.1.3). For example a later variation was: *The stakeholders explore the context in an interactive dynamic process in which*

- *new stakeholders may emerge/be involved*
- *new knowledge is created*
- *the boundary of the system of interest changes dynamically*

From this refinement it followed that the objective was not to operationalise social learning (SL) because SL is a process! What SLIM aimed to do was to operationalise concepts (e.g. facilitation, stakeholding learning… the SLIM variables) to foster (understanding how) SL could lead to change in ICM and SUW practices. This is discussed in more detail in Section 4.2.2 and in the SLIM Framework publication).

3.2.1 Analytical framework

Our espoused ambition was for the analytical framework outlined in Table 3 to be used in relation to the case studies. Although the emphasis was on discrete phases, as if the various activities would be strictly sequenced in time, it was recognised from the start that this would not to be the case in practice. Many of the concerns mentioned under the various phases were to be pursued simultaneously if required recognising some need for iteration for the overall research program'[12].

As implemented, this framework (Table 3) was not used systematically. However all variables of concern have been taken into account in some form or other in the case studies. The way in which these variables were adapted to choice of case study by the French (INRA) partner is given in Table 4 as an example.

[12] From Description of Work.

Table 3. Variables of concern in our proposed analytical framework (Source: SLIM DoW).

CLUSTER OF VARIABLES	EXAMPLES
I. THE SITUATION	
1. hard system boundary (as perceived by different actors)	Micro-water Catchment, including lake fisheries, ground water aquifer, wetland habitat, nature reserve, estuary.
2. the actors involved	Stakeholder analysis
3. the context	The role of politics, policy context, important economic and infra-structural supra-systems. Larger water catchment of which case study forms part
II. THE PERCEPTION OF THE PROBLEM	
4. the concrete immediate problem (as perceived by different actors)	Present unsustainable water resources management, too few fish to go around or too little water, desired outcomes which other actors make impossible (resource conflicts), the collective impact of individual actions
5. metaphor of the problem	common dilemma, public good dilemma, mixed problems, nature of interdependence among actors
6. description of the problematic past (as perceived by different actors)	historical description and its implications for the trust or lack of confidence in a potential solution
7. the desirable soft future (as perceived by different actors)	the nature of the soft collective cognitive system on which actors agree, concrete agreements, individual actions with positive collective effect, effective collective action, desired platforms for decision making, collaboration; risk sharing, labour sharing, insurance, exchange of benefits, trade-offs and compromises, break impasse. Positions and interests of stakeholders
8. the desirable hard future (as perceived by different stakeholders)	Sustainable water resources management, accumulation of bio-mass, biodiversity
III. THE LEARNING PROCESS	
9. learning about the hard system	Mapping, developing indicators, agreeing on concepts, adopting tools to make visible the state of the resource; using methods for analysis and monitoring
10. learning about the soft system	conflict resolution, negotiation; network management, conversion towards shared perspectives, accommodating perspectives, learning to share metaphors, reflexive learning, learning about other stakeholders and shared learning processes, legitimation, signification and domination (mobilisation of resources)
11. structural change	Representation, constituencies, change in interactive process, leadership, power, interest coalitions, platform development, impact of existing institutions. Co-ordination of parallel decentralised platforms
IV. FACILITATION	
12. actors and institutions involved	Perceived objectives and policies, praxeology used, resources available, organisational and policy context, staff, facilities
13. incentive structure	means available for stimulating collective action, rules and regulations for access, sustainability
14. communicative interventions	non-formal education methods, participatory methods used, meetings, procedures, training, clients selected, praxeology used, conflict resolution, etc.
15. support institutions	Nature of facilitating institutions, network activities, meetings, science access, decentralisation, structural constraints to communities of practice etc.
16. policy context	'policies that work', regulations, statutory powers
V. DEPENDENT VARIABLE	
17. Learning path: extent to which collective cognitive agency is being achieved at the (micro) water catchment level	Extent to which there is a shared appreciation of the problem, agreement on causes (soft and hard), a shared vision on way forward, agreement on concrete action, agreement on ways of monitoring effect; agreement on institutionalisation

Table 4. An example of criteria used for case study choice and analysis by the French INRA partners. The outcomes are found in case study monographs 6-8 as described in Table 1.

Case studies	Natura 2000 site	Atlantic wetland forum	Maraîchine conservation
Framework origin	European habitat directive	National wetland action plan	Local actors initiative
Related frameworks	Agri-environmental measures (LAEO) Territorial farmer contracts (CTE)		LAEO, CTE
Main stakeholders	Land users (farmers, reserve managers,...) Land owners Water managers Institutional actors (administration, development) Territorial collectivities Scientists	All actors involved in wetland development (5 colleges)	Livestock farmers Members of breed conservation association Scientists
Action scale	Undefined : maybe ecological entity, hydraulic management unit or administrative territory	All wetlands near Atlantic coast	Farm territory of breed users
Main objective	Biodiversity conservation and restoration	Conservation of all wetland productive and environmental functions	Local breed and grassland conservation
Type of platform	« Pilotage comity » for problem finding and decision making	Consultative assemblies Planning office	Farmers assembly
Natural objects	Wildlife species Natural habitats Water levels	Surface water	Cattle breed Wet grasslands
Technical objects	Farm practices Water management practices	Water management practices	Farm practices
Expertise	Ecologists Scientists (animal science, hydrology,...)	Hydrology	Animal science
Scientist involvement	Observer Maybe action research	Observer	Action research
Knowledge production methods	Co-ordination Monitoring Nature process studies	Expertise (maps, methodological frameworks,...)	Co-ordination Experimentation Inquiries
Stake of learning process	Contract between society and land users Construction of rules to manage water and grasslands	Common tools for decision making	Desirable common practices code
Facilitation tools	GIS Knowledge linking natural and technical facts	GIS Maps	Community activities method

3.2.2 Role of the researcher

We have found that developing action-oriented 'social' research, which complements science-based research, for policy development, brings into question the relationship between research and concerted action. It is therefore important to understand the role of researchers (and the

knowledge claims they make) in the transformation process towards concerted action. That is why we distinguish the three researcher positions R1, R2 and R3 in Figure 5 and Table 1). The first, R1, concerns observing (O), for the researcher to reflect and understand (i.e. learn). The second (R2) concerns facilitating (F), through the use of tools, skills and data, the learning of others. The third (R3) involves co-constructing knowledge-in-action with stakeholders in a joint process with shared responsibility (CoR). R4 is what emerges when stakeholders engage in concerted action as active citizens. Citizenship is an expression of stakeholding through action and can be a consequence of social learning. It is therefore embodied and active (in contrast to the passive, disaffected nature of current democratic procedures). These are all roles we ourselves have adopted, and have done so in the design of our work packages, rather than the traditional allocation of work packages to discrete groups. To some extent we have monitored our own learning throughout the SLIM project, and thus have additional experience and some data on our own evolution as a community of practice (see Section 7.1.4 – Gibbon and Jiggins 2003).

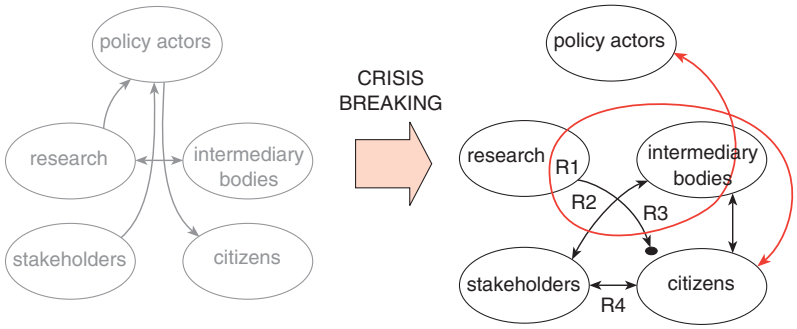

Figure 5. Traditional relationships (on the left) and innovative relationships (on the right) in which SLIM researchers are engaging.

Research as observers (O)

When adopting this role research included various methods, such as use of secondary sources, using informants, and observation techniques which stress the role of the researcher as an outsider who makes sense of it all. Further details are provided in the relevant CSMs (Table 1).

Research as facilitators (F)

SLIM's focus on social construction, negotiation, etc., calls for a symbolic interaction approach (e.g., Wagemans, 1987; Ison & Russell 2000), which seeks to understand the way in which the stakeholders make sense of it all. This implies using various participatory methodologies such as retrospective resource mapping, semi-structured interviews, narrative interviews, resource walks, semi-structured focused discussion groups, and purposeful inquiry processes such as Soft Systems Methodology (Checkland 1999). In this way, conventional social science methods move beyond description and analysis to include management application.

Particular emphasis was given to using GIS (Geographic Information Systems) and intermediary technical objects (as a platform or 'dispositif') to meaningfully represent perspectives at both watershed and project workshop levels. The technical support associated with the use of GIS was principally supported by SLU and restricted to the SLIMAN (Italian) case study. A specific CSM has been prepared based on this experience (CSM5 - Table 1). Specific biophysical and ecological parameters as constraints to social process were investigated by the SLIMAN (Italian) and to a lesser extent, INRA (French) research partners.

The roles of researcher as observer and facilitator are not mutually exclusive particularly in terms of what constitutes relevant research data. In most cases research data and drafts were returned to respondents for comment prior to release of the CSMs.

Research as co-research (CoR)

In addition to being passive observers of the action, and collectors of information through secondary data, interviews with key informants and stakeholders, and other normal data gathering devices, some of the researchers engaged in co-research (or participatory action research) with stakeholders within the context of the cases selected and especially with respect to clusters of variables related to 'process' and 'facilitation'. This involved the negotiation of acceptable roles and protocols with the 'owners' of the case studies. It also involved making the study's objectives and comparative analytical framework transparent to the actors involved.

3.2.3 Evaluative framework and the mid-term review

When the SLIM proposal was approved it was mandatory for projects such as SLIM to have mid-term evaluative reviews. The capacity to do this was built into the original project proposal though by mid-term of SLIM this requirement was no longer being enforced. Because SLIM was interested in, and had a felt need to, monitor and evaluate our own learning, a proposal for an innovative mid-term review (MTR), based on the underpinning theoretical framing of SLIM, was proposed and accepted. The design and outcomes are described in section 4.1.2.

4. Applied methodology, scientific achievements and main deliverables

4.1. Applied methodology

The SLIM project has addressed the challenge of generating an alternative policy instrument for the management of complex natural resource situations such as water catchments with an interdisciplinary (natural and social science), interactive design-oriented research approach. The project is interdisciplinary both locally (at partner level) and internationally (between partners) because: (i) all disciplines participated in the interactive design of the actual research methodology and the conduct and interpretation of the case studies from their own perspectives; (ii) disciplinary experts learned from stakeholders as the research proceeded and did not make *a priori* assessments; (iii) the coordination involved a sophisticated set of workshops (workpackages or WPs) in which attempts were made to translate local learning into meta-learning through an interactive process (i.e. the outcomes are more than the sum of the individual contributions).

Research of this type within Europe in general, and EU projects in particular, is at the cutting edge of research practice and is state of the art.

4.1.1 Revising project measures of performance within an evaluative framework

Interactive social science research as conducted by SLIM raises particular challenges for the management of R&D. Traditionally projects are set up as blueprints with outcomes specified in advance (contract deliverables). This has some advantages in some types of research and as an accountability mechanism but does not guarantee the best research outcomes or that the research addresses the espoused issues of concern. At the heart of this conundrum are

epistemological issues (see Figure 1; SLIM WP10 Report). In practice the scope for negotiation and renegotiation depends on relational capital that is built up between the research project and the scientific officer (Box 2). This is no bad thing as long as there is no collusion because the research questions and design can be modified as the research progresses. In the case of SLIM the intended outcomes were further defined (and revised) during our project to:

- Social Learning is considered important for Integrated Catchment Management (ICM) and the implementation of policy;
- Theory has been put into practice (and practice has informed theory);
- Guidelines are developed (tools, lessons, etc);
- Capacity is built (of stakeholders, policy makers, etc);
- Increasing citizen participation, particularly, though not only, in relation to the Water Framework Directive is achieved;
- Better development & implementation of EU policies; and
- Social, economic and environmental outcomes are achieved.

A commitment to these outcomes was made – they are schematised in Figure 6 and Table 5. These elements became know as the '**whys**' of SLIM research (see below) and were consolidated through a process of team building. In articulating our commitment to these outcomes it was recognised that not all were achievable within the lifetime of the SLIM project (*sensu stricto*) but that we would be looking for evidence that our research had initiated or contributed to an emerging trajectory of action. SLIM researchers nominated additional outcomes as a basis for evaluating our project (see Figure 6 and Table 5; also McClintock 2003a[13]).

Those nominated included:[14]

- Other applications of our research are identified;
- Other researchers incorporate SLIM or social learning outputs;
- Publications are produced and cited;
- Invitations to speak are received;
- Other practitioners use the 'guidelines' (as presented in the SLIM Framework publication);
- The SLIM project platform is seen as an example of an effective approach for co-researching;
- Further funding is obtained;
- Courses and training materials are developed;
- Students find SLIM material interesting; and
- Work packages are completed, an interdisciplinary research community is built, contributions to theory are made, links between scientific and practitioner communities developed, ideas are tested and new knowledge is produced.

[13] This rearticulation of purpose and outcomes was undertaken as part of a modified mid-term review of SLIM in conjunction with our WP5 and 6 event in the Netherlands

[14] Not all of these are outcomes *per se*

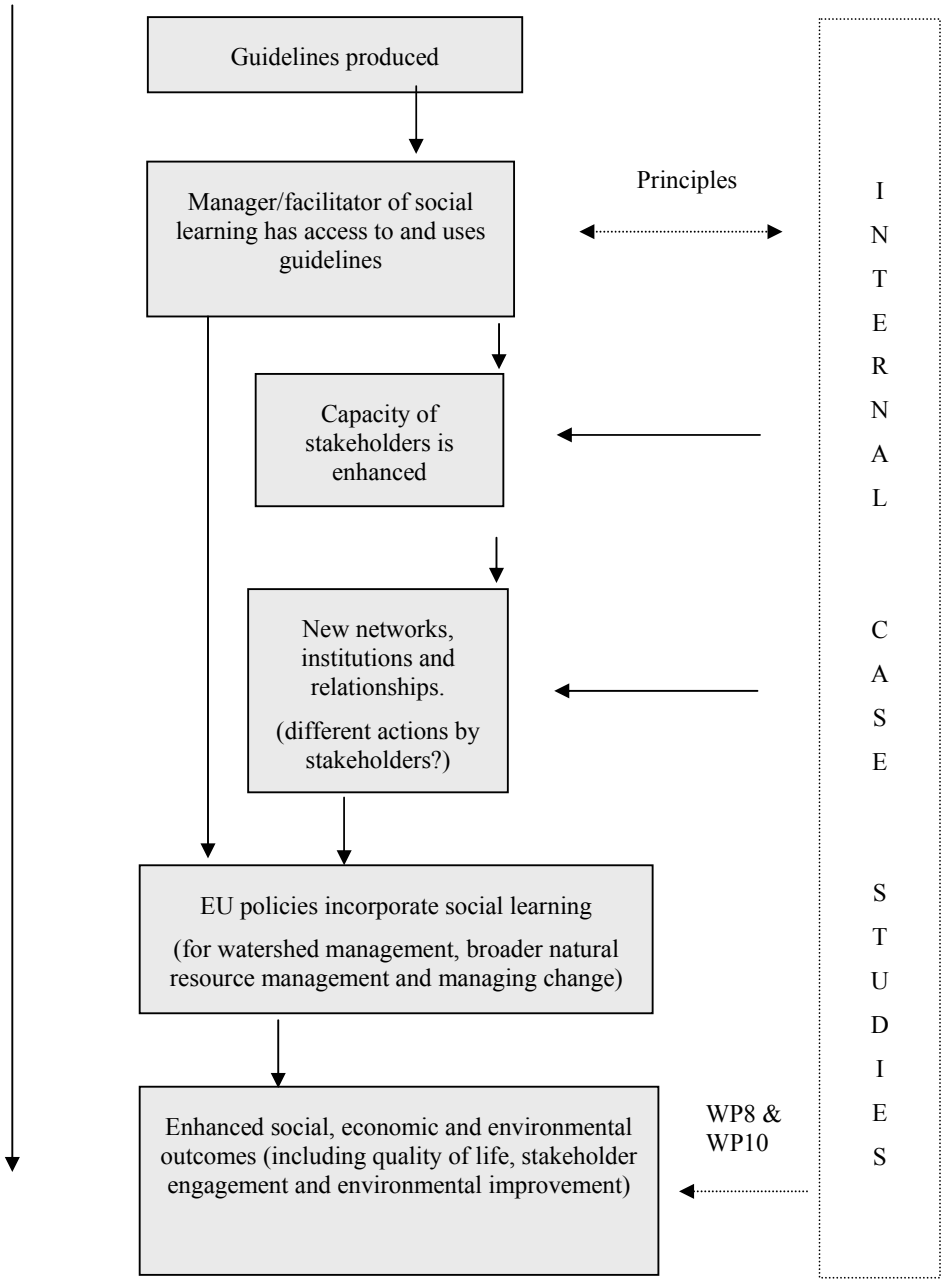

Figure 6: Suggested map of intended outcomes for the SLIM project

Table 5: Description of intended outcomes

Outcome & description	*Attributes of success*	*Performance indicators*	*Data sources & collection*	*Assumptions*	*What was achieved by SLIM*
Guidelines available: "what would a manager/ facilitator of SL do". Primary audience is EU. Secondary audiences are practitioners, researchers, stakeholders, etc	Lessons from cases captured and generalised Social learning defined Consistency between theory and practice	Guidelines produced (contractual) -'users' are aware of guidelines	EU and other audience opinions (collected through case studies and WP8?)	A need for social learning is identified Social learning can be managed Can demonstrate relevance (better than top-down approach –regulation and/or purely fiscal measures) Different audiences are catered for in the guidelines production Language used is acceptable	A need was identified mainly through extensive and compelling 'negative evidence' i.e. Our case studies consistently identified situations where current policy instruments and practices were not working well (see 2.2.2). Social learning, where it was found could be managed (CSM2 & CSM12b) and facilitated (CSM 3, 8, 10, 11 and 12a); Different audiences have been catered for by the range of SLIM publications and professional editing has been used to help with design and language;
Capacity building: ***"how to support/develop learning of stakeholders in catchment management"***					
a. policy makers	Engaged in process & interested -learning occurs because of SLIM processes	Interest and extent of engagement -Policy makers' opinions of changes in capacity	As above	SLIM contributes to empowerment and capacity building -policy makers have a better understanding of the context /catchment	Successful in-country activities, on-going and new collaborations associated with WP8 Successful event in Brussels with policy makers (see WP10 report)
b. other stakeholders	Dialogue promoted between/with different stakeholders	Stakeholder opinions of changes in capacity	Through cases	SLIM contributes to empowerment and capacity building Stakeholders have a better understanding of the context / catchment	Evidence in CSMs (Table 1) New funded projects have emerged from stakeholders in the SLIM research process; Creation of role in SLIM called 'counterpart' for key stakeholders in case study situations
New relationships and institutions ***"social learning results in intermediate changes"***	Emergent relationships, networks & institutions that capture learning Capacity to achieve higher level outcomes	New relationships	Observed in conjunction with co-researchers?	Factors outside of SLIM can constrain outcome. These factors need to be identified. New actions or expressions of learning need to be defined – each will be particular to a context/case	New projects funded based on perceived need for SL; new discourses emerging in water management circles but limited evidence of moves to build capacity; significance of building networks as opposed to platforms (see CSM2);
Better EU policies developed and implemented ***"creating conditions in which social learning can occur"*** ***(for water, natural resource and change management processes)***	Guidelines are used and refined through use Policies support new relationships & institutions	Awareness of guidelines and intentions to consider. Changes in policy 'rhetoric'	EU policy maker opinions	Within time of SLIM or following? -Water Framework Directive (also Natura & others) is implemented in an acceptable manner – policy might evolve through experience of SLIM and associated projects.	Limited evidence to date with exception of the Netherlands (CSM2); Evidence that perspectives amongst Brussels-based policy makers differ radically w.r.t social learning as a purposeful policy instrument (also evidence of considerable epistemological confusion amongst practitioners and within policies – see CSM9 and WP10 Report.).
Social, economic and environmental changes ***"If social learning occurs, then what does this mean for quality of life, engagement & environmental change"***	Identified through cases and subsequent use of guidelines	Agreed indicators. -capacity to address different policies/issues (e.g. flooding)	To be defined.	Within time of SLIM or following?	Requires more longitudinal investigation; preliminary findings are suggested in CSM 2, CSM 7 and CSM 12b (see section 2.2.2).

4.1.2 Design of an innovative mid-term review process

Within one year of commencement SLIM researchers considered that a process to engage with our more deeply held theoretical perspectives was needed because: '*Despite our attention to our own social learning processes we have yet to arrive at satisfactory process mechanisms to explain our deeply held theoretical positions. We suggest this is an important issue to continue to address because it is vital to any forms of social learning that involve collaborative action'*.[15] With the agreement of the SLIM Scientific Officer we designed and conducted an 'alternative' mid-term review designed to be consistent with our research approach. We anticipated that the overall design of the review would be of interest to the EU in considering future review/evaluation processes.

The design of the SLIM alternative 'mid-term review' (MTR) process took into account our own commitment to enacting social learning in our own researching. SLIM's research approach – organised around interactive workshops (workpackages) and with an important initial team-building workshop (WP2) was designed to model and develop those processes and concepts we were seeking to understand. Our research design sought coherence between espoused theory and theory-in-use. An important focus in the early phases of SLIM, in recognition of our differing cultural, disciplinary and experiential backgrounds was to gain: (i) conceptual clarity; (ii) methodological clarity; (iii) theoretical clarity; (iv) epistemological clarity and (v) procedural clarity. We started from the perspective of examining what we as researchers do when we research. Against this we recognised the need to illuminate the contexts of our researching - the specific case studies and sites where we were concerned with social learning and our particular claims about it that may inform the integrated management and sustainable use of water at catchment scale.

The SLIM review process was thus designed to surface and value multiple theoretical perspectives that became apparent as our research progressed (see SLIM Mid-term Review Report in 7.1.4). We suggest that such a step is rare in projects as project structures (e.g. discrete work packages) often hide such differences. When doing interactive social science research failure to surface and value difference is, we suggest, a trap because it can mask the relationship between theorising and practising (Figure 7). In our daily life the flux of theorising and practising goes on whether we are aware of it or not. Good research makes it apparent but need not privilege a single theoretical framing (see Section 4.1.3).

The focus of the review was a one-day workshop which took place immediately before the WP5/6 meeting between the country teams. To prepare for this workshop, each team wrote a paper detailing their theoretical position with respect to social learning. The Dutch team then took responsibility for organising an editorial/drafting committee, which visited each team in order to discuss their draft position paper prior to revision. These were then circulated to a panel of external reviewers, alongside a synthesis paper written by the Dutch team (see Jiggins 2002). The review panel was asked to provide written comments on the position papers for the SLIM teams against overall project objectives and some of the criteria that have informed formal EU mandated mid-term reviews in the past. Five reviewers were invited and commissioned on the basis of their professional expertise and geographical experience. Three reviewers were also invited to take place in the review workshop on 9th September 2002, where they were able to take part in discussions with team members.

[15] From year 1 management report

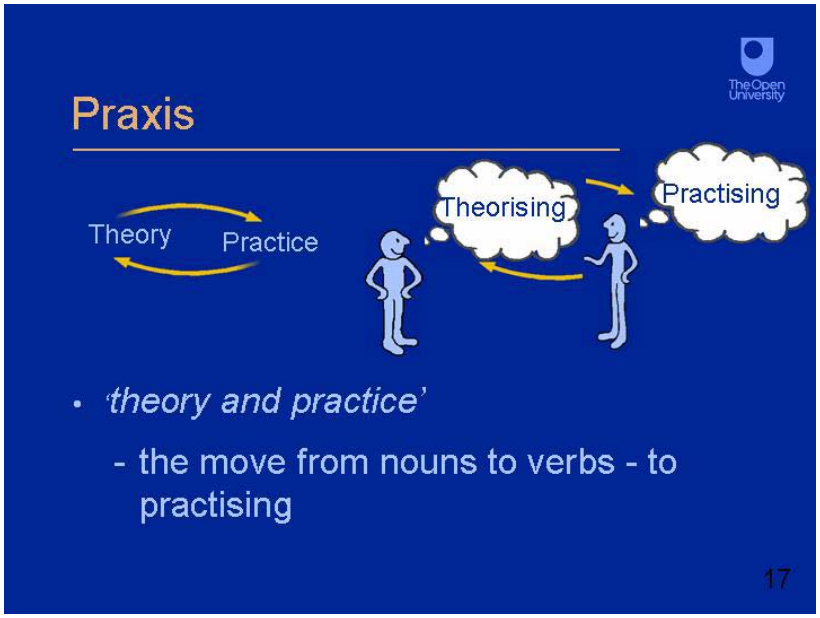

Figure 7. One way of breaking out of the trap of thinking about theory as distinct from practice is to depict them in recursive relationship. It is always someone who theorises and practices, so it is helpful to turn away from nouns (a particular constraint in the English language) to the verbs associated with what is being done.

The overall review was positive and aided the further development of SLIM. The outcomes of the review per se have been reported elsewhere so are not repeated here (see 7.1.4). In this section the point is made that ***the process design and conduct of the mid-term review is an additional research output from SLIM***. We suggest it can be adapted to other contexts by both researchers and research funders concerned with developing interactive social science research, with breaking down cultural and disciplinary boundaries between researchers and with achieving novel, interdisciplinary insights. The following three points are highlighted as significant questions that need to be posed of any research but which only arose from the review process:

- Diversity: The diverse theoretical positions available to the SLIM project was valued because of the range of influences this brings to bear on the common concerns of the teams, and because of the recognition that each context would bring its own challenges and require its own response.
- Convergence: Questions were raised about the degree of convergence between the theoretical positions across the project that might be considered possible or desirable. Different ways of presenting information in a common style and format were discussed, and it was also suggested that the different team's theoretical frameworks could usefully be applied to the other teams' contexts.
- Conceptual gaps: The reviewers picked up three issues to which, in their view, more attention should be paid by all the teams – power, gender and the way that ideas are communicated and presented.[16]

[16] Two of these recommendations were addressed but deliberately chose not to address gender.

4.1.3 Development of a shared grounded framework

Following SLIM's self-initiated MTR a common implementation and analysis matrix was developed for the SLIM research. This followed Frank Aggeri's questioning in the MTR, viz:

What ought to be standardised in the project? He goes on to observe that: *'Standardization is not an objective per se. .. But a certain degree of standarization is indispensible for cross [case study] comparisons.'* He suggested standardization was needed in (i) theoretical framework, (ii) case study design [and analysis] and (iii) evaluation framework.

The SLIM Project teams were successful in agreeing upon a framework for future project work. A pentagon (Figure 8) was chosen as an apt illustration of how SLIM teamwork has elements specific to the intellectual traditions of each team and the context of the case studies, whilst sharing elements common to the SLIM Project as a whole.

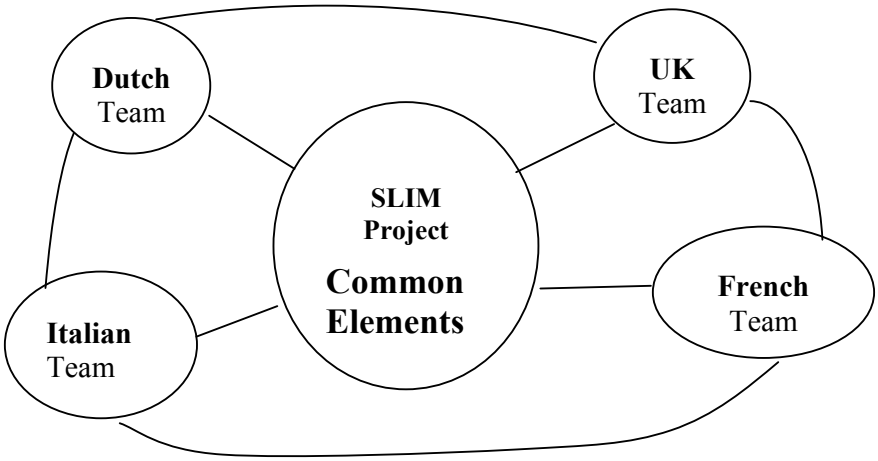

Figure 8: SLIM grounded theory pentagon

In moving from multiple conceptualisations, research methods and questions to a collective understanding, the need was identified to commit to shared methodologies (*what is researched* and *how*) and objectives *(*why this needs to be researched). A matrix was developed (Table 6) to capture the mutual commitment towards shared research actions at SLIM Project level. A full elaboration of this matrix can be found in the SLIM year 2 management report and on http:/slim.open.ac.uk.

The 'why' cells were completed for all variables by re-visiting the original aims and intentions of the SLIM project. These are listed at the beginning of this section.

Case Study Research Strategy: Common *Whats* and *Hows*

The SLIM Project teams agreed to use the matrix and pentagon for the next rounds of research and analysis, signaling the move from a collection of separate country team projects allied to a common purpose, to a unified SLIM Project evolving within a strong overall framework. The framework allows investigation of research issues particular to a case study, as well as the common research questions and methods that allow rigorous comparison of findings across cases and contexts.

It also became clear that specification of 'how' could not be done mechanistically as 'how' was a product of both context and researcher experience. So in the elaboration of these matrices there was no explicit linkage of 'whats' with 'hows'. The focus of this activity became one of learning our way to greater clarity about 'whats'. An example relating to the 'facilitation variable' is shown in Appendix 1.

The matrix has primarily been used in two ways:

(i) In conducting and analysing our case studies;

(ii) In formulating synthesis briefing papers about each of the key SLIM variables.

Other issues emerged through use of the common matrix. Figure 9 depicts one of these.

Table 6. A grounded research matrix developed by SLIM for cross-case comparisons.

SLIM Project Variables	what	how	why
Context			
Stakeholders			
Practices in ICM & sustainable water use			
Learning Processes			
Facilitation			
Institutions			
Policies			
Meta-questions			

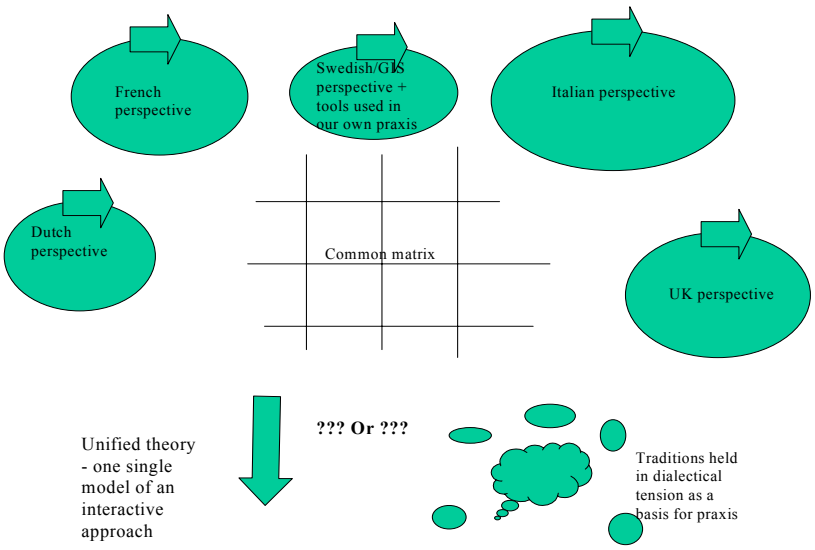

Figure 9. A conceptual model of tensions in using the common SLIM matrix - are we attempting to derive common theory or to hold the differences in a dialectical tension as a basis for praxis?

The SLIM researching approach was designed to surface and value multiple perspectives (both amongst researchers and stakeholders); this has been achieved to a significant extent but a tension remained within SLIM as to the degree of standardisation that was required across case studies and the extent that a rigorous cross-case comparison was likely to be capable of

producing new 'fixed forms of knowledge' that were insightful outside the contexts of their generation. Figure 9 depicts the alternative positions: an alignment of theory to produce a coherent synthesis of new theory (and one model for an interactive approach) or a methodological approach in which the synthesis arises out of a comparison of differences in which these differences are held in a dialectical tension between case study and particular traditions of understanding belonging to each research group. In the latter new ways of knowing arise in the doing of the research or when working with stakeholders.

We did not resolve this tension; there is no right answer just different answers dependent on purpose. One strategy contributes to the evolution of fixed forms of knowledge whereas the other, if appreciated, contributes to a form of praxis consistent with the SLIM Framework (see Figure 1 and 2).

4.2. Scientific achievements

4.2.1 SLIM's perspective on social learning

1. Do the usual environmental policy approaches achieve their purposes?

As noted above (sections 1 and 2), social learning can be seen as a complementary policy approach to the usual policy instruments dealing with environmental problems: fiscal means or grants for improvements and innovations, market regulation, training and information. These instruments, implemented for more than twenty years, have produced some effects but remain insufficient to change human activities and understandings in a sustainable way. Sustainable development can only be achieved if societies learn how to deal with highly complex issues (Banthien *et al.,* 2003). The "Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters" (Aarhus Convention, 1998) is the main European initiative stating the need to involve civil society in this changing process.

As indicated, many of our case studies were not originated by the researchers and their partners but were existing collective action situations initiated by the need to provide concrete responses to policy implementation (WFD, Nitrates Directive, Habitats and Birds Directive) or by the willingness of local actors to deal with problems they have to face (institutional arrangements, farming viability, etc.). In that way, the social learning approach proposed by SLIM was not taken *per se* but was analysed as a complementary approach taking place in a mix of policy approaches used at local levels. As a consequence, our case studies provide insights into some failures of the classical ways of policy framing and implementation based on the transfer of knowledge model (Figure 1).

a) Top-down policy implementation

The WFD policy, which makes claims for inclusion of participatory approaches, reveals the tensions between the transfer of knowledge model and that of creating space for citizens' participation. The strong eco-centric perspective on water adopted in the WFD and its translation into monitoring work will lead to the high involvement of experts and the increasing use of data-based tools to build management plans at River Basin levels. Participation, as it is conceived, is hesitating between convincing people of what has to be done to protect water and involving these people in building the issues together and in changing their own practices (see Figure 2 and SLIM CSM 9).

The implementation of the Habitats and Birds Directives in France provides a good example of the weakness of this policy approach to deal with change. The use of natural science knowledge to identify nature protection areas led to strong conflicts and social resistance at

local levels. People did not recognize themselves and their own stakes in these goals, and wanted to have access to the decision-making process. The environmental problem, first defined by naturalists, evolved through these interactions into a more complex issue mixing environmental goals and socio-economic aspects. Recognition by a policy of the outcomes of this type of process becomes key to the process itself (see SLIM CSM 7). The narrow translation of the nature conservation policy in the Netherlands led to a very different way of implementation. People were not invited into platforms to build the issues but negotiations were engaged in between naturalists and landowners to dedicate some pieces of land to nature. Funds were used to buy the land and farming activities were forbidden in these natural reserves. This model (partitioning land between nature conservation and agricultural production areas) is now questioned by new interdependencies: the hydrological status of natural reserves is highly dependent on what happens in productive areas. As a consequence, the dualistic management of nature and agriculture becomes inappropriate to deal with this new stake (see SLIM CSM 1).

b) Reification of problems in policies

Policies are the result of a building process between different kinds of interests, stating at one time what is needed to improve environmental issues. In that way, they reify the perceived reality of the world at that moment in time, using established concepts and knowledge: e.g., the WFD defines water as water bodies, determines a set of indicators to qualify these water bodies, defines quantitative and qualitative levels to achieve, etc. As a consequence, the policy focuses more on results to be achieved (e.g. better ecological status of water). Being defined at one time such policies cannot take account of new knowledge and the dynamics of the social and economic systems. The way to overcome this is to introduce in the policy some aspects related to the decision-making process itself, rather than to focus on the results to be achieved. The WFD again provides a good example of these tensions (see SLIM CSM9 and 12a and b).

c) Sector-related approach to policy design and implementation

It is usual for scientists and water experts to consider spatial and temporal scales of ecological processes to deal with environmental problems. But a cross-scaling issue often remains unexplored: that between various interconnected decision levels, and between various institutional organisations involved in policy building and implementation. The sector related approach is influencing policies at two main levels: during policy conception and during their implementation.

The Habitats and Birds Directives, for example, were conceived by the world of nature conservation specialists. When it came into the field, it was implemented by environmental administrative services or NGOs, with weak connections with other organisations. The goals and related concepts used to conceive the policy may appear antagonistic with other policies like the CAP, and people have to deal with these contradictions. The ways organisations support the policy, between a narrow or broader conception of its implementation, influence social acceptance of the policy and opens more or less space for civil society participation (see SLIM CSM 7 and 12).

d) Conventional use of knowledge and tools

Knowledge and concepts are used to conceive environmental policies such as the WFD through some reification of perceived ecological reality. They are also used during implementation by experts to provide concrete responses to what has to be achieved: e.g. maps and GIS tools have developed considerably with the emergence of environmental

problems. They are most of the time very complex to build and to use. In some way, this complexity leads to the imposition of experts' solutions on people involved in dialogue around environmental issues. Many examples exist where knowledge related to environmental problems is available but does not lead to any change of practice or understanding by people (in terms, depicted in Figure 1). In the Marche region of Italy, a lot of data, models and knowledge was available and communicated to farmers in a very conventional way. It raised some awareness of the water problem but remained outside of social and technical preoccupations of these farmers. Even grants to change practices did not change the way these farmers understood the cause-effect relationship between their practices and water quality at various spatial scales. However, their involvement in the construction of the GIS system, used as a dialogical tool, allowed these farmers to change their understanding, creating more lasting conditions for technical change (see SLIM CSM 4 and 5).

2. A social learning approach can probably do better…

The main failings of the usual policy approaches provide various arguments for the use of a complementary ***social learning*** approach, particularly during policy conception and implementation. Some key arguments resulting from SLIM's research findings are listed below:

- Considering the five main features of natural resource management problems (interdependencies, complexity, uncertainty, multiple perspectives and controversy; see section 2), expected technical and social changes can not only be defined *a priori* but are also emergent properties of social processes;
- Science and expert knowledge can't reduce complexity of problems. In complex situations, increasing scientific data reveals more uncertainties and new problems and makes visible new interdependencies. Mastering the situation cannot be supported only by scientific data. Social Learning helps to make decisions when and because everything isn't known. More traditional research may not be the need to foster concerted action;
- Environmental problems involve cross border and cross scale groups of interests, organisation and decision levels, spatial and temporal scales, etc. Each individual or group of stakeholders builds their own perception of reality through experience, social relationships and actions. Social Learning is needed to bring these perceptions together to be confronted and to build some shared vision of problems and improvements;
- In the same way, actions taken by an individual or a group are based on their understanding of the world. Required changes in practices and reallocation of responsibilities can better be obtained and are more sustainable through changes in understandings, which require social learning processes, than through legal means;
- Citizens' involvement in collective action is needed, related to the main features of environmental problems. Social Learning is a means to involve the wider public and to bring people to a wider ownership of these problems (citizen eco-literacy; catchment consciousness; learning catchments). It is more than just information or communication. It helps citizens to feel responsible for the issues and to be involved in improvement-making actions.

3. The SLIM perspective on social learning

a) A framework for observing, reflecting and enabling

The initial analytical framework of our project (see 3.2, Box 2) was discussed during our workshops and evolved during our work in analysing our case-studies. All variables identified were explored using three key questions:

- Why is it important to consider this variable?
- What does that variable mean?
- How can it be explored?

The linear way chosen to analyse complex situations of interaction among multiple stakeholders was confronted by the dynamic of the process itself: all chosen variables are relevant but have to be considered regarding the changes taking place in these situations. Therefore, we have developed an evaluative framework focusing more on the processes involved (see Figure 2 and SLIM 2004b). What we term the 'situation' is where interactions among diverse stakeholders, institutions, ecological constraints, issues, perceptions, practices and policies leading to 'concerted action' take place. SLIM researchers have found that stakeholders operating within a conducive situation change their understanding and their social and technical practices. They collectively construct the issue and its solutions through this process of building concerted action. This contrasts with a process where problems and solutions are defined through fixed forms of knowledge: expert knowledge constitutes but one source of pertinent input into the process of defining the issue and building successful outcomes; local and changing forms of knowledge, concerns and constraints also feed into the equation.

Through concerted action in situations where many interacting things are at issue, stakeholders co-construct the issue or opportunity. The process entails changes in practices and behaviours as well as changes in perceptions and understandings. We refer to these changes as a 'transformation' of the situation. In Figure 2, S2 refers to the situation, S3 to its modified state and Sn to the result of further iteration of modifying situations (S1, which does not appear in this Figure, refers to the history of the situation).

SLIM researchers have split the 'situation' into a set of five interacting pieces corresponding to the variables of our analytical framework (Figure 2c). The 'history of the situation' provides an understanding of the situation's origin and the state of understanding and practices in the initial interactions among stakeholders. The situation involves the four others. These four are transformed by social interactions; they are variables explaining the situation and the issue they have constructed.

b) How can the model be used and by whom?

This systemic model does not provide ready-made answers to the natural resource problems people are facing. First of all, it is a heuristic device that can be used by people involved in natural resource management to better understand their own role in these kinds of processes. For example:

- policy makers who are interested in creating conducive conditions for participation in the policy-making process;
- facilitators or experts who are interested in involving stakeholders in decision-making processes;
- researchers who want to adopt new research practices that provide support for stakeholders involved in an environmental issue.

The ways the model was used by SLIM's researchers, and how it could be used by others, are diverse:

- the observer's position is analogous to that of a traditional researcher using a model to gain a better understanding of the object of their research. The observer may share with the stakeholders the insights gained through the use of the model and encourage stakeholders to reflect on their own understanding and practices in the situation;
- the enabler (a policy-maker, a facilitator or an expert) can use the model to identify the effects on the process and related changes of the situation of his own interventions: use of tools and knowledge, investments, training, etc;
- the 'insider' can use the model to jointly reflect with stakeholders and explore how the components of the various variables are identified, defined or perceived by these stakeholders. The insider is part of the process and has to be aware of ethical issues of his own position (see section 3.2.2).

c) Temporal and spatial dimensions of trajectories towards concerted action

The empirical evidence from SLIM case studies and our three modes of doing research provide novel insights into the temporal and spatial dynamics of moving towards concerted action (Figure 2a). The trajectory is very sensitive to initial starting conditions; project design can structure in constraints whereas open-ended, inquiry-based approaches are facilitative (see CSM11 for examples of constraining and enhancing factors). Changing boundaries to systems of interest can undermine promising local configurations and processes (CSM 3) as can local networks of power (see CSM 10) particularly if they are embedded in rigid institutional arrangements. In another instances changing boundaries of systems of interest enhanced the number of stakeholder perspectives as well as the stakeholding in the Scottish Water Bill with all stakeholders agreeing that better outcomes were achieved (see CSM 12b). Our results suggest that moving between different levels (scale, or systems hierarchies) can bring both unintended or surprising (positive) outcomes.

Good project design and strong facilitative leadership can enhance both the temporal and spatial shift towards concerted action (i.e. scaling-up) as exemplified in the Benelux Water Conservation Project (see CSM 2) but it too was sensitive to initial starting conditions – in this case the cultural and political history of the two Provinces from which different sets of practices emerged.

Considerable evidence is given for the need for adaptation in context of both policies and practices, especially at local levels and in attempts to scale-up. This can be undermined by blueprint planning, homogeneous 'roll-out' of policies, belief that 'best practice' can be transferred rather than constructed and re-constructed in context (Snowden 2003) and rigid institutional arrangements.

d) How does the model relate to social learning theories?

Learning is often considered a process of transferring established knowledge by means of training, teaching and information. SLIM researchers propose to consider learning as a process of 'knowing' based on experience and practice. This perspective relates to Gibbons *et al*. (1994) distinction between two 'Modes' of knowledge production:

> "In mode 1, the problems are set and solved in a context governed by the largely academic interests of a specific community. By contrast, Mode 2 is carried out in a context of application. Mode 1 is disciplinary, while Mode 2 is transdisciplinary. (…) In comparison with Mode 1, Mode 2 is more socially accountable and reflexive. It

includes a wider, more temporary and heterogeneous set of practitioners, collaborating on a problem defined in a specific and localized context".

From this perspective, knowing is inseparable from a subject capable of speech and action in a particular context: our ways of knowing are guided by the rationalities within which individuals, groups, organisations or societies operate. These in turn link to specific intellectual traditions offering explanations that are sometimes contradictory, sometimes synergistic. The recognition and creation of the conditions in which Mode 2 can operate is a crucial challenge. Second order systems traditions (Ison & Russell 2000) and third generation knowledge management theory (Snowden, 2002) have come to similar conclusions. SLIM's research is all about creating these conditions and understanding the social learning processes involved.

The 'social' in social learning (SL) refers to the collective process that can take place through interactions among multiple interdependent stakeholders who are given proper facilitation, institutional support and a conducive policy environment. Three different definitions of this concept were used by SLIM researchers, depending on their focus:

- SL seen as the convergence of goals, criteria and knowledge which leads to more accurate mutual expectations and the building of relational capital (Box 3). If SL is at work, then convergence and relational capital may lead to agreement on concerted action for integrated catchment (ICM) and sustainable use of water (SUW). SL may thus result in sustainable resource use;
- SL seen as a process of co-creation of knowledge, which provides insight into the causes of, and the means required to, transform the situation. SL is thus an integral part of or constitutive of concerted action;
- SL seen as the change in behaviours and actions resulting from understanding something through action ('knowing in action') and leading to concerted action. SL is thus an emergent property of the process to transform the situation.

Box 3. Relational capital

In a knowledge-based society, people should be recognised for what they do and not just for what they are: that is, their recognised 'status' should be that of subjects rather than objects. The added value of such an approach is the emergence of ***relational capital*** resulting from the presence and interactions of different elements of the other forms of capital (K) – artificial, natural, social and human. The involvement of citizens, formal groups, enterprises and institutions sharing the same concerns facilitates the integration of sector-specific policies. But the shared concerns can only become explicit when these are derived from collaborative knowing.

The emergence of relational capital results from the presence and interactions of different elements of the other forms of capital:

- Artificial K is composed of infrastructure, equipment, means of transport, technologies, structures and levels of income, etc. This relates to economic development of areas promoted by sectoral policies (industry, agriculture, commerce) and assessed by conventional economic indicators.
- Natural K refers to area-based natural resources such as water, biodiversity, landscapes, soils, and so on. Environmental public policies aim to promote

restoration or conservation of these resources, by implementing means such as regulations or fiscal policies framing artificial K.

- Social K includes formal and informal institutions, rules and uses, relations of property, social networks.
- Human K consists in skilled populations, people's experience, culture, education, health, ethics, and so on.

These three definitions are very close and are based on a shared theoretical background taking account of concepts coming from constructivism (Berger & Luckman, 1967), the biology of cognition (Maturana and Varela, 1992), Soft Systems Methodologies (Checkland, 1981; Checkland and Scholes, 1990; 1999), Actor Network Theory (Callon 1986); Communities of Practice (Wenger, 1998), Common Property Resource Management (Ostrom, 1992) and participatory learning and adaptive management (Röling and Wagemakers, 1998; Leeuwis and Pyburn 2002).

But they have various theoretical and methodological consequences:

- the first one refers to cognitivist approaches, considering cognition as the factor that makes living organisms different from other matter. The process of cognition, based on four capabilities (perception, emotion, theory and action), leads an individual to build an internal coherence between these four capabilities, in relation with a better correspondence with their environment (Röling 2002). The methodological issue is to apply this concept and test its validity for groups of individuals, and for multiple stakeholder fora;
- the second one considers knowledge produced through social interactions as a key element of learning processes. Knowledge and concepts are related to technical and social 'objects' revealing how reality is socially constructed (Berger and Luckman, *op.cit.*). This construction operates in a complex bunch of platforms, fora and socio-technical networks. The methodological stand here is to follow these objects, to observe and understand how they are transformed through interactions. These objects are key to identifying social controversies and agreements and their dynamic;
- the third one considers Social Learning as effective when changes in understandings are translated into changes of behaviours and practices. In other words, SL operates if a subject, having learned something in one place, is able to reproduce related actions and behaviours in another place. The methodological stand here is to facilitate and identify these changes of behaviour and practices and to encourage reflection in action.

More information on these different perspectives and related theoretical backgrounds used by SLIM researchers can be found in the papers listed in section 7.1.4.

SLIM case study research quickly revealed that within the European context of our research there appeared to be very little: (i) strategic thinking of the sort that might facilitate the further development of an interactive approach; (ii) awareness amongst policy makers and 'catchment managers' of the opportunities afforded by an interactive approach nor the growing experience of these approaches in contexts outside Europe; and (iii) capacity to engage with and enact interactive approaches. There was however, in localised situations, as exemplified in our case studies a desire to engage with processes with which SLIM was concerned. We have built on these localised situations (see SLIM WP8 and WP10 reports). Our research also revealed the extent to which new policies can conserve, create or destroy relational capital.

In the following sections we have made the choice to develop some theoretical issues based on our research findings focusing on four important aspects related to social learning and the transformation of complex situations towards concerted action: the role of the researcher, platforms and networks, intermediary objects and institutional frameworks.

4.2.2 Role of the researcher for integrated catchment management and sustainable use of water - a 'new' interactive social science

1. The context for the researcher's role

The starting point of this analysis is that state of the art science is essential but not sufficient to effectively approach complex resource dilemmas concerning the integrated management and sustainable use of water at catchment scale. However, even if it is impossible to measure or model the entire set of variables associated with a particular situation, there will be particular aspects of the ecological state of a catchment that are critical to different stakeholders.

In *theory*, having chosen an appropriate system boundary for a natural resource system, there is a total set of variables that could be used to characterise the relevant biophysical system. In *practice*, at any one time, only a subset of these will be known, through scientific investigation or in lay knowledge (*connaissances profanes ou vernaculaires)*. The known subsets will themselves be limited by technical factors and by the cognitive capacity of those involved, and can only ever represent a very partial understanding even of the chosen biophysical systems of interest. Within that known subset, there will be a further subset that is regarded as constraints that are important or critical to different stakeholders, which may be termed the "ecological constraints" (Figure 10). This distinction between the set of known variables and those that are regarded as constraints at any particular time closely parallels Checkland and Holwell's (1998) distinction between "data" and "capta". So the "snapshot" that a stakeholder gets from his/her particular perspective is made up of several elements, each of which limits his/her grasp of the totality of the situation. These are the limits of perceptiveness inherent in a stakeholder's culture and other internal features such as knowledge base, the point of view induced by the scope of their interest, and the limit to what is practically knowable about the system.

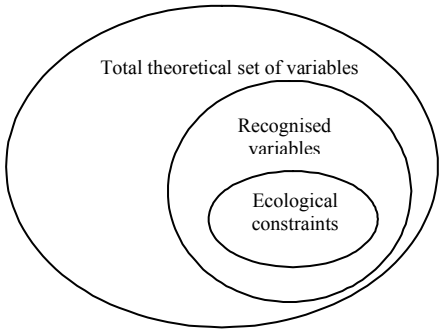

Figure 10. Venn diagram illustrating the "ecological constraints" as a set of known variables associated with a particular situation, regarded as constraints at any particular time

The learning processes involved in managing catchments thus include those whereby the different sets of variables are identified and studied. This involves interactions between stakeholders, the biophysical catchment and influences from the wider environment within which the stakeholders and the catchment operate, conceptualising the catchment as a human activity system (Checkland, 1981). Figure 11 highlights the relevant features of two major

stakeholder groups (scientific researchers and those directly involved with the catchment) and of a notional biophysical and social catchment system with which they are concerned.

Science is here seen as one of the possible sources of knowledge that can feed (but also be fed by) learning fluxes that can influence practices and policies. One reason for separating out scientists in this context is the existence of a particular, formalised scientific process for generating knowledge (Latour, 1987).

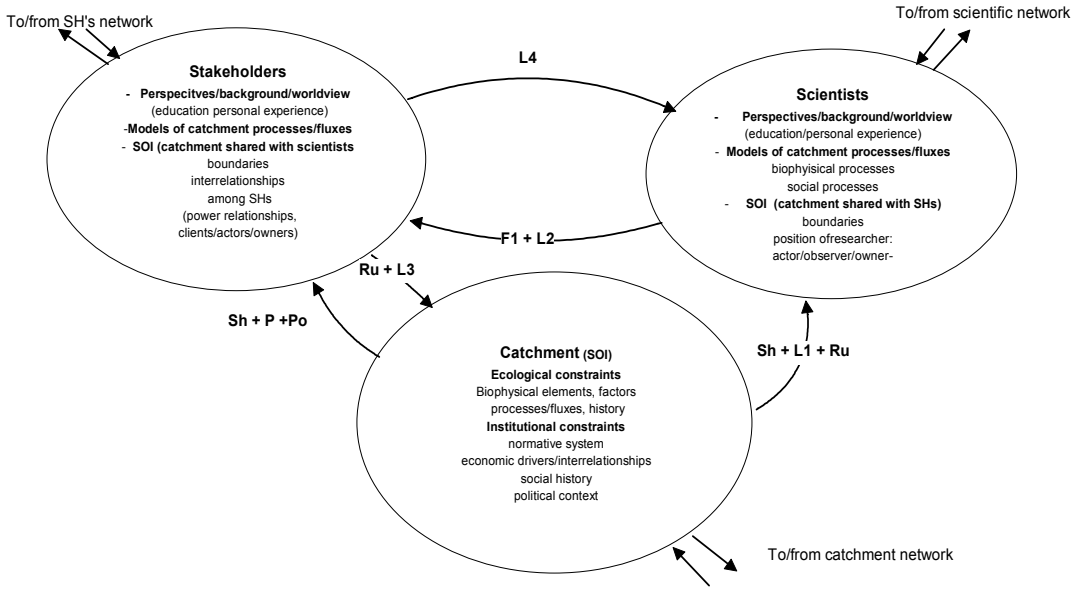

Figure 11. A model of the relationships between, stakeholders, learning and catchment management

Learning processes (L)

L1: *Scientists observe and learn from the catchment*, from scientific systematic observation/analysis of the system of interest (SoI) as defined by scientists themselves (most frequently) and/or shared with stakeholders (SHs; if scientists interact with/or observe them) and from personal experiences/emotions if directly involved "in the field".

L2: *Stakeholders learn from scientists*, through dissemination of knowledge, which requires some sort of facilitation/interface or participation in common experience.

L3: *Stakeholders observe/experiment and learn from catchment*, from direct (e.g. local actors) or indirect experiences related to catchment processes (both biophysical and human).

L4: *Scientists observe (and/or interact with) and learn from Stakeholders***,** if they consider other stakeholders as part of their SOI and interact with them

Resource use (Ru)

Ru: Stakeholders use catchment resources through practices which affect catchment processes/fluxes

Stake-holding (Sh)

Sh1: Stakeholders who hold a stake in resources use and control of biophysical and social catchment processes

Sh2: Researchers hold a stake in studying catchment dynamics and processes

Facilitation (F)

F1: Facilitation (of learning processes) may occur as a consequence of deliberate action by someone (eg researchers facilitating SH dialogue/learning). However, learning can occur without facilitation, as a consequence of observed, often "negative", events such as flooding or fish kills.

Policies (Po)

Po development and implementation of policies in catchments are the consequence of complex processes operated by several stakeholders

Practices (P)

P are developed by actors (practitioners) and have complex (i.e. unpredictable) effects on catchment process dynamics and hence products (both desirable and undesirable). Conflicts among SHs often arise as the consequence of undesirable effects of actions by a group of SH (e.g. nitrate pollution from farming systems).

Such knowledge is generally respected in European culture although, as the SLIM case studies show, the extent of this varies. Scientists are shown here as stakeholders in the identified **system of interest**, which in turn reflects their own (i.e. peculiar and hence limited) scientific background and worldview. Scientists' stakeholding is often limited to observation and learning, whose outcomes are often addressed more to the scientific community than to local stakeholders. Therefore, they may not influence directly the processes and factors driving the catchment system's functioning.

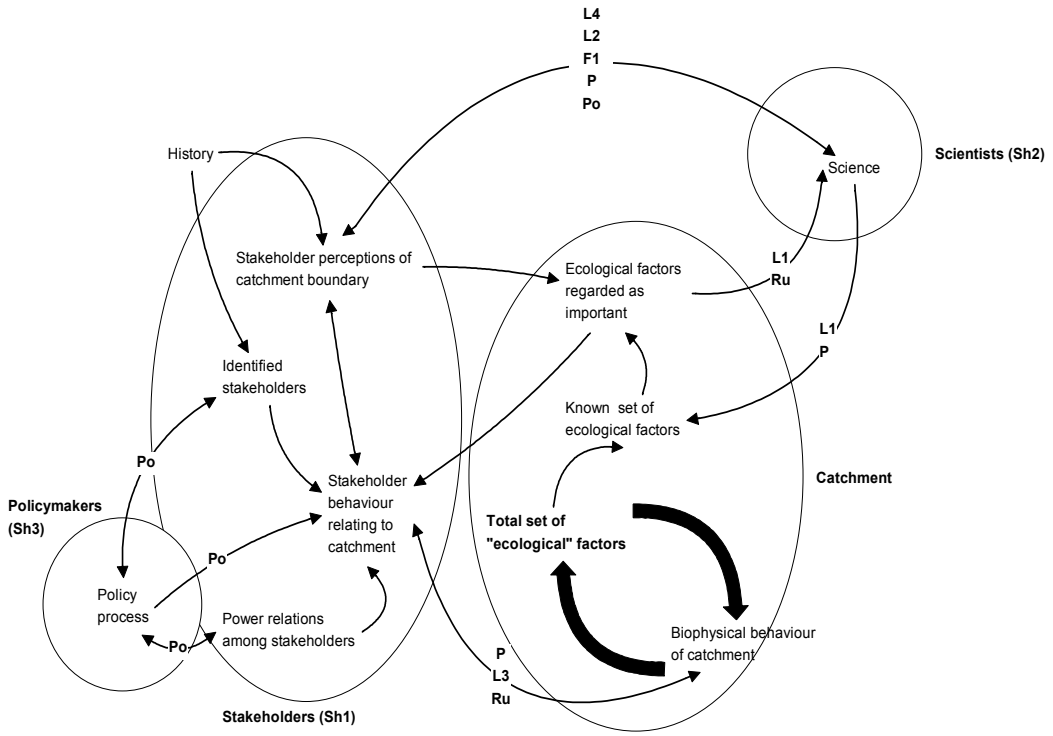

Figure 12 Causal loop diagram of the "system of ecological relationships" associated with catchment management

Figure 12 uses a causal loop/multiple cause format (Open University 1999) to represent the processes whereby the different sets of factors associated with the catchment system of interest change and interact with the stakeholders. Three of the superimposed circular/oval boundaries correspond to the subsystems identified in Figure 11, and the figure uses the same labels for the processes linking them. The behaviour of the biophysical catchment system of interest is shown as arising from the internal dynamics and relationships of the whole (theoretical) set of biophysical factors, influenced also by stakeholders in practice using the catchment as a resource. Learning occurs, often informally, through the interactions of these stakeholders with the catchment, (L3). This learning feeds the continuous change in the identification of the system of interest, and in the set of variables regarded as critical by those stakeholders.

The distinction of first order and second order change proposed by Ison and Russell (2000) provides an interpretative frame to critically reflect on the role of the researcher in relation to the nature of the change they foster. Ison and Russell (2000)[17] write, "am I apart from the universe? That is whenever I look, I am looking through a peephole upon an unfolding universe (first order tradition). Or am I part of the universe? That is whenever I act; I am changing the universe and myself as well (second order tradition).

a) Multiple roles of researchers dealing with resource dilemmas

First order tradition scientists (Russell and Ison, 2000), particularly those with natural science background, try to play the role and position of "pure" observers, thus interpreting the production of scientific knowledge as mainly to identify, describe and classify processes of a bio-physical or socio-economic nature, also to support decisions in a prescriptive way. In the second order tradition, scientific observation is not considered an "objective" view of the reality, at least as it implies a choice of what, why and how to observe, which is closely related to the skills, scientific and personal background of the researcher.

In this context, a distinction should be made between the scientific observation of just biological, chemical or physical processes (e.g. water levels, nitrate concentration, organic matter mineralization and so on), ignoring the human behaviours that influenced them, and the scientific, systematic observation of social processes, e.g. of the relationships between people's behaviour and the outputs (both qualitative and quantitative) of the bio-physical processes controlling the ecosystem[18]. As social processes are constituents of water resource dilemmas at catchment scale, the pure observation of just bio-physical processes, even if essential to interpret them in a scientific and systematic way, is not generally sufficient to drive change towards sustainable management of resources. For example, the prescriptions developed for the agro-environmental measures, that were claimed to be an operative implementation of state of the art agronomic knowledge, proved to be ineffective in Italy to remove excess nitrates from the groundwater, while most farmers did not recognise them either as effective or transferable to practice (see SLIM CSM4).

In some SLIM case studies, the integration of social science expertise with other scientists such as agronomists or agricultural economists (e.g. the SLIMAN team) was a significant push for moving the natural scientist role from just pure observers of bio-physical variables (e.g. monitoring plants, water and soil) to facilitation and co-researching. This was fundamental for the development of a more reflexive and constructive behaviour of researchers in relation to the declared objectives (towards sustainable management of water at catchment scale) and to start the bi-directional learning fluxes between scientists and stakeholders described in Figure 12. In the Nitrates case study (CSM4), this resulted in e.g. farmers learning about the consequences of their practices on water quality at catchment scale and scientists learning that much of the farmers practice impact on water quality was not mainly driven by the income from CAP subsidies, as previously assumed, because many other factors played a fundamental role (e.g. pride about their product quality and healthiness, search for new niche markets that would value their work and role in the society, willingness to continue the story of their rural family etc.). Based on this new understanding, researchers were able to use the data from the bio-physical monitoring as a heuristic device for social

[17] Following Wittgenstein and Heinz von Foerster

[18] The term 'ecosystem' is now often used colloquially for any area, or grouping of organisms, that can be regarded as functionally independent, such as an isolated clump of vegetation on a rock or the whole biosphere in which life occurs.

learning, through a set of activities which helped to make farmers and researchers roles for the sustainable use of water more visible to other stakeholders (e.g. theatre event – see SLIM CSM5), which also resulted in increased reciprocal trust between researchers and local stakeholders.

2. Language and disciplinary barriers, dialogical tools and requirements for new skills sets or for new types of researchers

It is a widely recognised experience that specialised scientific language is not accessible to a public which is not trained on that specific subject (see for example CSM 11). This is also an obstacle to cooperation even among scientists of different disciplines and in the case of research studies dealing with resource dilemmas at catchment scale, it can be the main impediment to the involvement of stakeholders in the learning process. The "vulgarisation" of scientific language often results in misinterpretation or ineffectiveness, particularly if it is delegated to intermediaries. Furthermore, the linear model of transfer of knowledge science→intermediary bodies→ agents is in fact an obstacle to the integration of local knowledge into the learning process, which is crucial for the development of sustainable practices.

In the dialogical tools case study (CSM5) the heuristic value of scientific data in multiple stakeholder platforms was demonstrated but only on the condition that scientists are ready to play a role as learning facilitators and co-researchers. In this case, scientific data were not just "presented" to audiences as "the" knowledge about a given system of interest: scientists facilitated with different tools (e.g. aerial photos, GIS, landscape photos, ranking of available scientific data, depiction of possible future scenarios, theatre scenes on water issues) the negotiation of the system of interest (e.g. map of relevant stakeholders) and the emergent issues, inviting the audience to explore the relevant sets of variables and processes that may help the interpretation of the relationships between human practices and natural processes related to the water cycle and drawing conclusions about possible concerted actions.

In these cases, the ingredients for successful facilitation and co-researching were:

- a skilled facilitator, who was able to use the tools and play with scientific data in a constructive rather that descriptive or prescriptive way. Skills emerged from personal talent fed by the outcomes of a multiple perspective reflection and design process that preceded each event;
- the exploitation of the heuristic value of scientific data collected at the local scale, which helped to focus on intermediary objects, (maps, images, charts, geo-referenced data on nitrates and crop production and so on) which were made accessible to everyone and, most important, able to raise the interest and participation of the whole audience (e.g. land use data about participants own catchment);
- the participation of members in the role of observers, to ensure monitoring and feedback on the process to all participants;
- a multiple perspective research team to design the process, integrating different skills, scientific backgrounds and personal experiences, ensuring a reflexive behaviour about the monitored processes;
- an informal atmosphere and language, a "neutral" place to discuss with stakeholders (e.g. a restaurant or a bar, not an academic or institutional room), ensuring that the role of any researcher is clearly declared before the meeting;

- an audience of people with multiple perspectives, interested to actively learn about their own territory, open to listening and critical reflection and to contribute with their own knowledge;
- the design of a process which ends with concrete results which are made visible to all participants and others, which is a fundamental ingredient for the development of concerted actions.

The SLIM research experiences suggest that effective approaches to resource dilemmas require the integration of new skills into the conventional process of scientific research. We assume that the complexity of the resource dilemmas implies that issues, system's boundaries, variables and processes considered by researchers are not exhaustive of the total theoretical set, thus requiring the integration of different types of knowledge (i.e. scientific and not scientific), skills and researchers' background and experiences.

Depending on the context in which the issues are constructed, and the structure of the relationships among stakeholders, researchers can provide elements for reflections to others just from systematic observation of social and/or bio-physical processes. This happened initially in the Natura 2000 French case study (CSM7), where researchers held up a mirror to reflect to stakeholders how the process works. Sometimes the role of observer is the only one researchers can take, in a context in which current platforms do not want to involve them in the process, as happened in the Drentsche Aa case study in the Netherlands (CSM1).

However, starting from a role of pure observers, researchers may find that their position is not effective both in terms of creating the conditions for concerted action or for learning about the different stakeholders positions. From simple observers, research position can easily evolve towards a role of facilitators and co-researchers, as happened in many other SLIM case studies (e.g. CSMs 3, 4, 8 and 10). If this is the case, the process design requires the integration of a research team with specific skills in facilitation, use of dialogical tools, effective interpersonal and communication skills; the role researchers are adopting must always be declared particularly to public audiences. In this context, a crucial point is a dynamic and iterative process design, which should emerge from the dialogue among researchers and between researchers and stakeholders.

One main difficulty arising in this type of process is the disciplinary barriers that often exist between social and natural scientists. They use different languages, tools, approaches, which often discourage scientists from joining each other in a real process of integration. The SLIM researchers' experience reveals that despite the difficulties, as resource dilemmas concerning water issues at catchment scale deal with human and "natural" processes, an effective approach cannot do without the integration of social and natural sciences. Some SLIM participants preferred to take on a position of "a-disciplinary" researcher, emerging from a long experience of hard-science skills background which had to integrate social sciences and communication skills to be able to study complex resource dilemmas. These experiences reveal the need for investing more in interdisciplinary research teams sharing an issue of common interest from multiple perspectives and designing a concerted research strategy, which can help researchers to experience the relevance of theories and methods of other disciplines "in the field" and thus to feed with their own experience an on-going learning process within the different scientific communities. Current reward and promotion criteria often devalue this.

4.2.3 Moving between scales – platforms and networks

1. Platforms are needed to generate common understandings

The SLIM starting point was to consider platforms as key places were social learning could occur: it is a site where collaborative and concerted action around some jointly perceived issue or problem is enacted (see CSM 12b for the description and interviewees' perceptions of some of these sites in the Scottish context). In these platforms, a person or group is not a stakeholder simply by asserting a claim but becomes a stakeholder through processes that construct the nature of the stakes and the relationship among stakeholders. A platform can thus be defined as a purposeful social scene, bringing various people to interact in order to identify stakes involved and to share some common vision on the issue and the solutions to be found. The platform can be seen as a tool to 'cross-scale' people's perceptions and to bring various kinds of people, acting at diverse and interconnected scales, to deal with social and bio-physical interdependencies. SLIM researchers were interested to understand (i) how these platforms are working, (ii) under what conditions social learning could occur, and (iii) how the changes of understandings occurring in these platforms are 'diffusing' to other places and social scenes.

These questions are strongly related to the WFD implementation process: it states that it is necessary to build a management plan for water at River Basin scale through agreements between institutional organisations (this refers to platforms), and it requires active involvement of citizens at different steps of plan elaboration for better social acceptability and application of the proposals (see CSM 9). This requirement rests on the theoretical assumptions built into the diffusion of innovations model (although in implementation it does not have to).

2. Platforms are constrained by their institutional environment

Platforms are usually created within existing institutional frameworks. The people and organisations that derive power from these frameworks are not interested in losing it. Instead, they can see platforms as a way to protect or enhance their power. Platforms are usually instituted without independent statutory powers. They derive their power from those represented on platforms and their willingness to act through the platform. As a consequence, questions of representativeness of people in the platforms and legitimacy of what the platform will produce are key to participants.

In the Ythan case study for example (see CSM 11), a feedback meeting on the functioning of the Steering Group (SG) brought participants to the following conclusions:

- establish clear Terms of Reference for the SG
- develop strategies for the conduct of meetings
- address issues of
  - delegation of project delivery to project staff
  - degree of autonomy of project staff
- investigate reasons for non-attendance of SG members at SG meetings
- improve communication both internally and outside the local area
- review monitoring and evaluation procedures – a systemic approach is needed
- review SG membership – examine skills and interests
- consider time scales

These SG members of the Ythan Project express very clearly the difficulties they have to face in conducting a well-functioning platform. These were all identified in our other case studies (see particularly CSM 1, 2, 7 and 10). The lessons are that:

- A platform cannot be looked at in isolation. The institutional and policy context is essential in determining the progress that can be made on the platform;
- A platform usually is made up of representatives. This leads to problematic relationships between the representative and their constituents. The representative begins to share a way of looking at the world that is not shared by their constituents; Ways have to be found that involve constituents also in shared action and shared learning;
- Platforms require facilitation based on historical analysis and stakeholder analysis (see SLIM PB2);
- Platforms require space for additional local experimentation and other interaction; Platforms need to be fed by bottom-up activities that explore the resource dilemma at the level of practice.

As a consequence, 'a' platform to interact is not sufficient to make progress towards concerted action. Platforms bring forth questions of power relations between interconnected decision levels and between sector related organisations: social learning between participants is thus very weak. More, the institutional composition of these platforms and the distance people involved have with the 'field' introduces a break between those who take decisions and those who have to apply these decisions, leading to local social resistance and conflict.

In many of our case studies, partners involved in facilitating the management process felt the need to create new social scenes to deal with these potential conflicts and emerging problems. For example, in the N2000 case (see CSM 7), the initial design of the process (steering committee and thematic working groups) was complemented by municipality-level meetings, farmers groups, expert groups and field meetings. In the Benelux Middengebied, the process involved various participants at various interconnected levels, from the ground to higher decision levels (see CSM 2). But in some cases, the creation of a new social scene was not allowed by our partners, because it endangered their powerful position in existing places (see CSM1 and CSM 3).

In all cases, this extension of the management process to a 'bunch' of interacting social scenes brings to the fore three main questions:

- Who is legitimate to take part in what kind of social scene and how could they be invited or designated?
- What kind of coordination is needed between various social scenes (networking)?
- What skills and activities are needed to help these platforms and the coordination function perform well?

3. Legitimacy of stakeholders in platforms

It is usual, when environmental policies are implemented, to invite institutional organisations to take part in platforms to build management plans and the technical prescriptions people will have to apply. But, as previously described, the WFD insists on public involvement through information and consultation throughout the process of building plans; but social asymmetries and strong power relationships reduce the ability of these platforms to produce innovative proposals. Citizens' participation brings into the process people who don't have an "institutional" legitimacy and creates new "informal" social scenes interacting with more "formal" ones.

Lessons drawn from our case studies can be summarised in two ways:

- When stakeholders are designated to take part in the process, they act as representatives of a group of interests and as spokespersons of that group. Even if their understandings evolve under the effects of social interactions, they have to hold that position, or to negotiate its evolution with their constituencies;
- Stakeholders' legitimacy can be gained through the process if it leads them to feel responsible themselves for the collective story. Following Checkland's distinctions (1981), legitimacy is gained when a stakeholder moves from a position that relates to his own interests (*customer* or *owner*) to one that relates to the community involved in collective action (*actors'* position).

To achieve these changes in social positions, a stakeholder analysis (SA) can be carried out in a participatory fashion, with sets of stakeholders jointly conducting the analysis (see CSM 10 and 11). It is more typically carried out by researchers, managers or project initiators as a 'desk-top' exercise, as part of their own preliminary inventory of the situation and context. In both cases, the basic steps in SA are usually:

- drawing up a table or 'map' of those stakeholders considered to be primary, intermediate and key (customers, actors, owners), on the basis of information presently available;
- assessing stakeholders' importance with regard to the situation, problem or activity that the analysis addresses, and their relative importance or influence;
- identifying assumptions about how stakeholders might affect relationships, outcomes or the viability of collective action.

4. Networking is needed to cross-scale boundaries and decision-levels

The notion of networking is required to understand the consequences of multiplication and diversification of social scenes, as well as that of cross-scaling issues (between decision levels and social and bio-physical scales). Networking is commonly seen as a way of coordinating shared activity. Networking is also seen as an effective way to cross boundaries of disciplines, organisations, hierarchies and scales (Lipnack and Stamps, 1993). It is a form of 'social intelligence' (Gigerenzer et al., 1999), that is, of using shared frameworks for decision-making, in conditions of uncertainty, time constraints, and partial information, which improve the fit of interaction with the environment.

The networking issue highlights the essential role of the management process and that of its coordinator or facilitator. In the Middengebied case study (see CSM 2), a considerable number of social scenes were created and managed to allow social learning to occur. A consequent effort was made to transform individual learning into concerted effort at societal scale. The activities under this heading have been grouped by the coordinator into the 'spaces for learning' that addressed stakeholders in society (citizens and users participation), and those that addressed project stakeholders (decision-makers).

The 'social fora' employed familiar dialogic and communication tools, and are remarkable mainly for the number of instances and the variety of combinations that were implemented. They served the important purpose of providing spaces, or public platforms, in which meanings, values and purpose could be presented, shared, and negotiated. The 'project fora' are noteworthy, however, for the care that was taken to structure the membership, frequency of meetings, meeting locations, and terms of reference for how the groups would work together, in a consistent manner, that supported the cross-scale and cross-discipline learning goals of the project. The design of project fora processes can be interpreted as structuring inter-agency platforms, which allowed experiences gained at different levels and scales of

interaction to be discussed face to face (rather than, for example, by the slow movement of written reports up a bureaucratic hierarchy). They also allowed expert understanding, research data, and socio-economic reports, to be interpreted jointly, rather than by any one particular interest or power holder.

Managing the process well is not enough. Care must be given to how knowledge produced in one place can be used and serve learning issues in other places (see section 4.2.4 'Intermediary objects and novel concepts'). The role of researchers is also questioned in that process, as the classical model of transfer of knowledge can constrain learning processes through social scales and spaces (see section 4.2.2 'Role of the researcher')

5. Facilitation is needed inside and between platforms

Facilitation work consists in "putting in interaction people who are interested in situations of interdependencies" (cross-scaling). The nature of facilitation work will depend on whether interaction starts with a public political statement – as it is the case with the WFD or Habitats Directive – or emerges from attention to a socio-technical object – as it is in the case with the French Maraîchine project (CSM 8) or the water weirs in the Dutch Middengebied case (CSM2). Facilitation is bound to the activity of one or several specific actors. It can also be bound to specific organisations, playing a role of intermediary body between policies and stakeholders, like in the case of the French Atlantic Forum and the Tweed Forum (see CSM 6 and 10). It assumes specific actions (around invitations, enlivened conversations, feedback from meetings for example) and gathers competency and know-how relating to strategic analysis and the art of communication.

Facilitation can be described as a political activity in the sense that it is often organized by public policy, and that one of the facilitation purposes is to bring collective action to the public space. In using convenors' tools (from basic records, synthesis, etc., to sophisticated GIS), it contributes to organise the collective production of knowledge. In translating meanings which emerge from the localised interactions, it ensures articulation between the various social scenes involved. Facilitation acts at five different levels:

- *Norms* constitute the world visions or world-view and values associated with different types of action. Work at this level will allow actors involved in the facilitation process to gain a sense of ownership and change their social legitimacy;
- *Evidence* is the work related to knowledge claims and co-production. It is necessary in situations of uncertainty and controversy to make an inventory of what is known and what is not, and to provide regular feedback on knowledge produced;
- *Persuasion* constitutes the skills of winning acceptance of the project and of the policy. Evidence can participate in persuasion (make problems 'explicit'), but it is also about exploring and appreciating values. It draws on what actors think is acceptable, related to the different systems of beliefs in interaction. It is strategic and risky work: trust is at stake between actors and particularly between the facilitator and others;
- *Education-training* builds on the three previous levels in opening up new dimensions of meaning, calling for adjustments and the questioning of routines, but also offers the prospect of new situations which can be potentially innovative.
- *Process design and management* in which someone takes, or is given, responsibility for designing, managing or mediating the dynamics and architectures of interaction in particular social spaces.

These various levels show that within a Social Learning situation, facilitation plays a role that is both undetermined and specific: undetermined because the whole process of SL across boundaries is a collective self-generating process aimed at improving interactions. Specific since it requires the development of skills, pro-activity, and the use of tools, knowledge and concepts for an explicit final result. These issues are taken up in SLIM (2004f).

4.2.4 Intermediary objects and novel concepts

To understand and facilitate platform and network dynamics, SLIM's research has involved generating a theoretical framework and producing methods and tools. The management of such group dynamics is akin to a project on a new manufacturing process based on a three-pronged logic: (i) acceptance by the concerned partners, (ii) identified objectives, phases, and committed participants, considering that a "future" is at stake, (iii) research—exploration, experiments, prototypes, etc. This process is finite in time and relevant to the changing circumstances that are posing problems. It involves new agreements leading to solutions that are found satisfying to most participants. It should not result in new power balances preventing future evolution.

New agreements are obtained based on socio-technical objects termed "intermediary-objects" (Vinck, 1999), or, more appropriately, "intermediary concepts for collective design" (Teulier and Hubert, 2004). These are the links between heterogeneous entities and represent milestones in a group initiative that participants have chosen to build. In this progression, the challenges faced reveal the participants' positions as well as the knowledge that is at play and emerging. Here, knowledge is understood from the point of view of a participant, it is built through action on committed foundations and entities: it pertains to—as Berger and Luckman (1986) remind us—the relationship between a participant and these entities. In this sense, the role of the material world in the relationships between people becomes apparent. Metaphors, models and symbols that reveal this role enable the generation of new understandings. In a group process, those in possession of particular knowledge occupy asymmetrical positions, especially researchers (see section 4.2.2). It is thus the "action, or more aptly, the interaction in which they are engaged that […] gives strength, meaning and effective reality" to the entire set of objects and stakeholders in the interaction process itself (Jeantet, 1998).

1. Characterising heterogeneous stakeholder collective action situations

The situations studied in the SLIM case studies are particularly appropriate to the observation of these characteristics. Because they involve a heterogeneous set of stakeholders, the conflicts are expressed more openly and reveal processes that are often so interconnected as to make them invisible. The lessons we learn from these situations regarding the process of collective development are applicable to a wide variety of situations, particularly those involving partnerships between large organisations or even within a single organisation. We shall illustrate this purpose using two SLIM case studies, Water conservation in the Benelux Middle area (CSM 2) and the Maraîchine breed in the Western Marshes of France (CSM 8), which are the most relevant regarding this issue.

These situations often generate conflicts because of stakeholder involvement in the management of increasingly scarce and sought-after resources. Stakeholders interact in a new context in an arena "owned" by a variety of participants who find meaning in the situation as well as giving it meaning. Within a rich historical context, complex group dynamics often bring stakeholders to a crisis stage prompting them to collectively design a brand new situation. The design process brings stakeholders closer to a resolution of the crisis and to a modification of activities around a negotiated collective interest that can satisfy individual interests and practices.

Heterogeneous situations between independent stakeholders can thus be characterised by the following:

- Individual interests appear in conflict with collective interests until a worsened stage is reached where all individual interests are affected or threatened.
- The solution is obviously concurrent: all stakeholders are affected or threatened concurrently. A "sign" that is interpreted as an immediate or expected threat to all makes its appearance.
- Design processes are collective and spread-out over time; there is no ready-made solution.
- Stakeholders from various worlds of interest are very independent. Their links prior to the situation's initiation, when the problem had not yet clearly emerged, were nearly invisible because they share in their daily life a common territory.
- The independence between stakeholders means that they are free to exit the collective design process at any point in time.
- But they are also very interdependent due to their local interactions around numerous other stakes.
- Their social positions are usually very unequal and associated with the knowledge they hold or apply. Those holding institutional knowledge are not the ones most committed to the knowing process.

As mentioned earlier, these situations are representative of situations within organisations or inter-organisations, inter-projects, or network-like organisations.

2. Design process is a major characteristic of collective action situations.

In collective action situations among heterogeneous stakeholders, design processes are key. The goal is to emerge from a new situation where all are concerned for a variety of reasons and often according to differing interests, with one or more pre-set solutions apparent to no-one at the outset. The situation is brand new and no satisfying solution is at first glance obvious. Stakeholders are designing a collective solution involving a set of very different activities, of diverse professional behaviours that affect the parameters of a bio-physical or socio-physical situation in a manner that is not a one-to-one relation relative to the introduced changes in activities or behaviours. It is not the nature of the artefact or of the idea, focus of intellectual production, or of the reasoning that determines the nature of the design activity (Simon, 1973).

But a design process within this type of situation is key. That's because the new solution must be entirely thought up and even the problem needs to be set. What will subsequently turn out to be recognised as a "solution", its development, the negotiation that will lead to a form and definition agreed to by all, and lastly its implementation cannot be imagined with any accuracy by a participant in the initial stage of the collective situation. Clearly, the design of a new solution is involved. Here, 'solution' is understood in its broad meaning, such as that of the solution in problem resolution (Simon, 1973), i.e., including both the final state of the problem, but also all the operators used to arrive at this state. This is indeed a cognitive type of design activity matching the definition given by Simon: the problem is poorly posed, and it is not a matter of selecting a solution among a set of previously known solutions. The "solution" must be of a systemic nature since all involved stakeholders use the same space. Over-simplified statements generated by a stakeholder may even become a source of conflict and result in a stalemate, as

noted by Raulet (1993). Additionally, a process adding complexity (Callon, 1986) and providing a framework are needed (Raulet and Crozet 1999).

One significant and original aspect of these situations is that design is tightly meshed with its implementation. It is also associated with the high degree of independence of stakeholders, and even more so with the way the process takes place: it is a social process entirely interwoven with a wide variety of activities. Numerous meetings between heterogeneous stakeholders take place, and in between these meetings, participants return to the routine practice of their profession, each community of practice once again confronted by the physical world of its practice, and forced to act in the situation that is itself the focus of collective design. The design gradually "matures" as people practice their activities, go through various confrontations, and experience the intrusion into their individual universes of the situation whose collective process design they are involved in.

However, since implementations are somewhat separate, neither the coordination problems (Malone, 1990) nor the negotiation process taking place around the design of the new object appear fundamental in this type of situation, even though they are naturally ubiquitous. That is why we consider design processes as key elements in this type of situation and why we have focused our attention on them here.

3. In these situations, intermediary concepts function as collective design aids.

As in classical industrial design situations (Jeantet 1998), certain concepts used by stakeholders play a significant role as intermediary objects in collective action situations among heterogeneous stakeholders. One of the characteristics of design situations is to resort to using intermediary objects in communication and negotiation among co-designers.

Using intermediary concepts, which play the same role as Jeantet's intermediary objects, can serve as a framework and as a guide for participant-observers taking part in collective actions. Jeantet's definition of Intermediary Objects for Design (IOD) is: "These include objects produced or used during the design process, evidence and design action aids in relation to tools, procedures and stakeholders" (Jeantet, 1998). Such a definition places these objects at the heart of the design process. These objects are abstract entities emerging from action and have no substantial status outside of, and prior to the action.

Teulier and Hubert (2004) suggest a transition from IOD to Intermediary **Concept** for Design (ICD). This is not to remove the object's materiality, but rather to acknowledge that it can be shaped, find "resonance", and appear relevant in the various worlds of action. From this point of view, the ICD holds the same creation of meaning function as Pierce's "sign". The ICD plays the role of "sign" analogous to the meaning assigned to it by Pierce in the context of worlds when it is used in management situations. The sign is therefore a transition between several worlds, and is interpreted in different ways in each world according to who is doing the interpretation.

Integration and collective design do not take place around a computer-assisted diagram but rather, around one or more key concepts allowing stakeholders to assess, relative to their own constraints, the node embodied by this concept representing a collective goal: (i) it results from the set of different knowledge sources without however resulting from any one source in particular and (ii) its use by a stakeholder does not require understanding the entire system.

ICDs result from negotiations between the various stakeholder points of view and carry with them these various points of view. These objects are ideal for focusing the points of view of various stakeholders. In the Benelux case, for example, a set-up of micro-weirs for individual farmers but managed by the water boards is identified after many discussions and conflicts leading to a genuine effort of characterisation of the future situation of water supply and use

in the whole area. In the Maraîchine case, it is a standard for the breed taking into account its economic value as well as its ability to graze wet areas, but within the scientific discourse of what is possible; a discourse that does not acknowledge numerous other stakeholder points of view, a condition required for successful process outcome (Jeantet p 18). ICDs must be easy for stakeholders to identify and observe. They have meaning in each partner's world of action, without resulting from a direct operational translation from any one partner.

Certain phases common to the various case studies can be described. Nevertheless, caution is required when conducting this relatively arbitrary breakdown of very diverse and context-specific situations:

- 1st phase: differences are expressed in terms based on other concepts that end up not being useful ICDs.
- 2nd phase: appearance of the intermediary concept relevant to collective design, but in competition with other concepts.
- 3rd phase: stabilisation, this concept becomes the key concept
- 4th phase: How groups restructure themselves and redefine the positions of their worlds. A diversity of knowledge and knowing is able to feed into the intermediary concept and contribute to a resolution of the problem taking shape around it.

As reported by Raulet-Crozet (*ibid*), an approach confined to simplified problem-setting involving the main participants is not conducive to finding solutions. On the contrary, it is by complexifying the problem and by including all stakeholders that solutions can be found. Jeantet proposes an analysis of the translation process through the transition of one state to another. Looking at these states for the two cases is instructive.

Table 7. The issues translation process during a collective action. Examples from two SLIM case studies (CSM 2 and CSM 8).

Expressed need ➔	**calculated solution** ➔	**product drawn**
Goals expressed	Calculated Goals	Negotiated Goals (implementation constraints weigh heavier here)
Protect groundwater supply (Provincial Government)	Banning sprinkler irrigation	Ban temporarily lifted for participants in the project
Improve irrigation efficiency (Farmers)	"measured irrigation"	Micro-weirs to capture winter rainfall and reduce pumping
Mastering all water issues (Water boards)	To allocate water rights to each stakeholder according to the law	Design a simplified enterprise water management plan with the farmers
A rare breed conservation programme (livestock farmers)	To implement a genetic selection scheme	To take into account wetland grazing capacities in the breed standards
To protect the marshes as a local Natural Heritage (Natural Regional Park)	To prevent agricultural holding over wet areas (maize and drainage programme)	To ally with the Maraîchine farmers into the recognition of the breed towards a grazing programme

4 Characteristics of objects / intermediary concepts for collective design

The construction of ICDs requires time and is not explicit: it is only after going through a number of discussions and confrontations that the intermediary concept stabilises itself and takes on a key position. Once the ICD is identified and stabilised, it allows an integration of the points of view. The intermediary concept is continuously reviewed and updated. It also enjoys a high

level of stability and resilience since, once it is agreed upon among stakeholders, it remains a steady point through which their exchanges transit and serves as a building block for the various design proposals. In that way, intermediary concepts have the power to cross-scale boundaries and decision-levels.

The ICD as much as the IOD plays a pivotal role in collective design: they constitute a common proposal and solution-testing link, around which the constraints of farmers, Natural Parks, Local Government, all the water users, etc. are acknowledged and around which negotiations needed for the design of a collective solution are at play. The goals of design enable the development of a solution to take place within a permanent confrontation between those participating in its definition: they are in agreement with the idea of integration or cooperative design. ICDs are produced, circulate, guide, channel or are tested, criticised, corrected, completed. In other words, they provide support to the efforts of stakeholders.

When speaking of intermediary concepts, we are not referring to the concept in isolation, or as a static and simple indicator, but rather we are referring to the concept as a site around which various scenarios and coordinated action systems transit. They form the building block for common scenarios and serve as a basis for the various specific scenarios growing out of the common scenarios. The specific scenarios that stakeholders build themselves within their own worlds serve to test points of view. ICDs can be considered as outcomes of social learning processes, as well as tools around which social learning occurs. They are core elements in analysing and facilitating learning processes.

Intermediary concepts for design play a role in situating stakeholders relative to the group. In collective process design, the idea or constraint escapes from its author - that is the price of its becoming an object. And other stakeholders are confronted to this sub-set of requirements. The stewardship of the groundwater level requires strong framework policies and learning-based transformation for farmers, other extractors, water boards, etc in the Netherlands as well as in Belgium. ICDs just as IODs only convey the author's intention by transforming it.

In the Benelux Middle area, after establishing a water management plan with a set-up of micro-weirs as an intermediary concept and after participants have related it to their own systems of action, it shifts from being a goal to attain and an object of negotiation to that of an object of reference and of regulation. With stakeholder attention captured by the implementation of their sub-systems, the ICD is consulted only intermittently. One challenge posed by the ICD for heterogeneous collective design relates the need of its being *actionable:* its ability to be concretely implemented within each of the concerned stakeholders' activity. Beyond simply enabling communication, it must also become an instrument: stakeholders must have "a grip" on this object. Because of this, ICDs enable interactions with the physical world and represent the concrete action context for each stakeholder. When used by participants, they represent action contexts, physical objects to which stakeholders are confronted, with their own action rationale. This link between the intermediary concept and a bio-physical object is significant: it constitutes its anchoring point.

Nevertheless, the concept cannot be reduced to a bio-physical object because it is viewed in multiple ways according to each of the multiple visions of stakeholders. It is as if the intermediary concept "contained" several visions, several objectives around a single bio-physical object. The physical object is "perceived" in a particular manner according to the world of action. For example, crop farmers all perceive water supply as a condition for sustainable productivity, livestock farmers all perceive the format of their cows as key for production and hardiness in rough grazing conditions: this constitutes a "professional" point of view that they agree on concerning the situation and the intermediary object. Relative to the entire group, the relationship to the physical object is more complex and relates to the

heart of the justification of the use of the intermediary concept. Everyone must refer to the same physical object: available water supply, a cow. Nevertheless, as already mentioned, this tangible and irrefutable materiality does not have an "objective" existence, i.e. stakeholders perceive it from their own world of action. The ICD is therefore polysemic[19] and that is what confers its power as a communication medium. Nevertheless, Prudhomme (2004) notes that design is an artefact production activity, and that designers constantly refer to known physical configurations. The relationship to the object's materiality is constant and strong.

In the situations we refer to, the goal is to modify activities and behaviours and to act from the outset on the bio-physical world to change it. Design is not, therefore, a separate step within the action: there is a continuous to-and-from movement between collective design and individual activity (itself undergoing re-design under new conditions), and between collective design and collective activity. The concept corresponds to a general concrete object (water supply, cattle) which corresponds to other concrete objects that are key within each world: maintain crop productivity in summer by irrigation, control groundwater extraction; design a cattle development project, protect a Natural Heritage.

Not only do ICDs provide each stakeholder an entry point to commit to a design process in their own world, but because it has meaning to others, it conveys new associations of concepts and knowledge creation: "*The conversation can evoke novel associations, connections, and hunches – it can generate new insight and new meaning."* (Cook and Brown 1999, p 393). This exchange between points of view and between genres is a form of collective knowing, as noted by Cook and Brown: "*Knowing entails the use of knowledge as a tool in the interaction of the world*". The simplified enterprise water management plan was built after a period of recrimination and reflection by all the involved partners, individual farmers, the Farmers Unions, the water boards, nature managers and provincial officials. Prior to designing it and placing 2,500 weirs many discussions occurred, experiments have been carried out (on flexible micro-drainage, measured irrigation), facilitators have been employed by water boards, peer-based networks among field-level water managers have been set, etc. This process took about 10 years and in order to consolidate the transformation process more than 70 participants, including individuals from each stakeholder category, met in April 2004 in a public debate on the results of the 2nd Generation Project (see CSM2b). The Farmers Union summarised the lessons learned in a short booklet entitled "Social Learning for enduring change in behaviour".

ICD provide a cognitive entry point for all to rebuild their individual point of view. It also confers legitimacy to re-design a new situation via a renewal of roles. This social aspect of the ICD offers an exit from the conflict: participants are no longer tied to a stereotyped position and are no longer set on a position they must "defend". They are thrown into a new collective "definition" of the situation in which they can re-think their point of view and in which they have the legitimacy to offer this new point of view to the group. The ICD therefore brings about a renewal of the situation in terms of social legitimacy as well as on the cognitive level so as to better understand transforming situations and changes of understanding and practices that occur in these situations (see Figure 2).

5. ICDs as scientific topics

It is important to qualify IODs or ICDs and to scientifically study the way they are built, their content and the roles given to them in the group action process. These objects can be embodied in bylaws, action plans, good practices definitions, various implementation forms

[19] Literally poly semantic – having many meanings.

and dates relating to actions taken. We have also shown (Hubert and Bonnemaire, 2000) that these objects can be studied through an inter-disciplinary scientific approach generating particularly fruitful insights for the various disciplines involved.

To study the design and implementation of the management of these processes, researchers must participate in building group action systems that take into account the diversity of stakeholders and the history of circumstances and the institutional make-up. Several studies illustrate these approaches based on empirical procedures and theoretical frameworks (Röling and Wagemakers, 1998; LEARN, 2000). ICDs modify the cognitive status of the set of stakeholders, thus fostering the emergence of new professions and roles to take on this management. These involve facilitation and mediation activities that emerge from complex field situations (see section 4.2.3). They question also the role of researchers and the ways they are practising research (see section 4.2.2). They also give rise to organisational as well as cognitive training between stakeholders. They lead to original approaches addressing knowledge, practices and co-ordination (mediation tools, sequencing of actions, *in itinere* evaluation, etc.) that allow genuine and lasting management of such innovative processes.

The collective identification of performance indicators used in evaluating progress or lack thereof, and developed in the course of the actions, is an essential component of such processes. This explains why **further research is needed to study the requirements for the collective identification of indicators (of development, of status, of sustainability of an action, etc.) rather than designing indicator systems from the outside and subsequently imposing them on stakeholders. Apart from the technocratic nature of such an approach, stakeholders may reject such top-down indicator systems due to their lack of relevance to local concerns.**

The outputs relate to the conditions for opening spaces to change the context, the configuration, the situation for activity: how to help people and groups to be involved in changing their situation (Figure 2a). However ICDs can become removed from the understandings and practices from which they arose — they can be said to become institutionalised in ways that 'blackbox' them i.e. they move into a background and become part of the traditions of understanding out of which we think and act (Russell and Ison 2000). This is the subject of the next section.

4.2.5 Institutional framing for 'social learning'

There are few resource-management issues which are not affected by institutions. Institutions, as defined in Box 1, shape all aspects of how resources are managed. For this reason the conduciveness of institutions is a key variable in the SLIM Framework (Figure 2). Yet the increasing number and overlap of institutions give rise to complexity and uncertainty in policy and management issues, as a result of which no individual or organisation is able to progress these in isolation. Institutional frameworks span (or can exist at) different scales, from the micro, local and regional to international conventions. However, institutions are not permanent. They are created and recreated through altered management practices, policies or changing social values or norms. We use the verb 'to institutionalise' to describe the process(es) by which these patterns of behaviour, values and norms emerge, become represented, embedded, replicated and changed in that context. At the moment, for example, all over the European Union (EU) a set of ideas and practices relating to the characterisation of water bodies as part of implementing the European Water Framework Directive (WFD) is being institutionalised. For SLIM, the emphasis on process is an important part of identifying the dynamic relationship between institutional frameworks and concerted action.

For example in CSM 9 evidence is provided for how particular understandings of water and its ecology have become (or are in danger of becoming) institutionalised in the WFD. Examples of some of the dangers are highlighted in particular in CSM 11 and 12. One in particular is that the holistic intent of the WFD will be undermined by implementation which is either sectorally based or, within organisations, constrained by relations, or lack of relations, between departmental or professional 'silos'.

Our case study research also reveals an existing 'planjam'. For example the transposition of the WFD in the UK makes large demands on a wide range of local and institutional stakeholders (e.g. a range of different statutory and non-statutory agencies). The former suffer from consultation fatigue and the latter already have responsibilities under various legislation and regulations. The WFD and planning represent a particularly complex set of 'intersections' (or lack of intersections). The coming 'planjam' can be gauged from the diversity of plans (and the planning) such as Local Plans, Natura 2000 Management Plans, RBMPs, LBAPs, Community Plans and others all of which require integration. New legislation, including the Scottish Planning Bill and changes to Strategic Environmental Assessment (SEA) were also on the horizon (CSM12b). Research in the River Ribble catchment in England has shown up to 100 external and 38 local plans which affect the management of the water environment.

These situations are not conducive to social learning. New ways of developing more conducive institutions, which enable concerted action to occur between multiple stakeholders, are thus required. Institutions still have a significant role to play in progressing more sustainable forms of resource management; some conducive institutional forms are identified (e.g. CSM 12a, b). However, this hinges on the extent to which institutions enable or constrain learning and concerted action among stakeholders.

4.3. Summary of implications and recommendations for policy

The material presented in this section is derived from the full set of SLIM Policy Briefings (see Section 7.1.1 for full citations) which in turn are a synthesis derived from our state-of-the art 'thematic papers' and the empirical work presented in our case studies (see Table 1). A significant outcome of SLIM is the production of a set of seven Policy Briefings as well as an Introductory Overview Briefing for use by policy makers and managers (see also http://slim.open.ac.uk). SLIM's main policy implications and recommendations are now summarized.

4.3.1 Investing in heuristic values of scientific knowledge and engagement of stakeholders

- The Water Framework Directive assumes that detailed, quantitative targets for good ecological status can be derived from scientific knowledge. However, the necessary state of the art of scientific knowledge is never exhaustive, as the underlying models are under continuous evolution in relation to the progress of science, and in most cases the systems of interest in any situation chosen for study by scientists, or recognised by other stakeholders, are personal constructs, and hence not objective descriptions of an agreed reality.
- While state of the art scientific knowledge is essential for effective catchment management, it needs to be complemented by the views of other stakeholders on the nature of the system of interest and understandings of ecosystem function. This step is necessary to start a process of co-construction of knowledge among scientists and

stakeholders, which would enable stakeholders to respond to changes in an adaptive way consistent with the shared views.

- In this context, *practical action* is an effective means of increasing and sharing understanding and there is a range of tools that can be used to create conducive contexts for learning to occur starting from scientific data (see CSM 5). This includes the exploitation of the heuristic value of experimental results and mathematical models, using them not only as technocratic decision support systems, but as tools to think and reflect upon shared issues and in a way that it is accessible to a wide range of stakeholders.
- There are a number of guidelines on this matter, to avoid the risk of using scientific data just as a prescription of the best solutions or as a tool to reinforce the researcher position in a platform (see 4.2.2).

4.3.2 Stakeholders and stakeholding analysis

- Formal stakeholder analysis should be incorporated in public decision-making processes, as a necessary process to help to generate learning about water management problems and their resolution. To be effective, stakeholder analysis needs to be conducted in the early stages of a process and updated throughout as learning progresses. Participatory stakeholder analysis is to be preferred but is not always possible. Figure 12 illustrates an example of the basic structure of a network or platform of stakeholders dealing with integrated catchment management and sustainable use of water.
- Stakeholder analysis can be distorted by powerful interests or by limited perspectives. Preferably it should be applied as a participatory tool, but this is not appropriate when individuals or groups are not open to the notion that stakeholders have a right to be engaged.
- Technocratic application of stakeholder analysis can still be useful. However, it carries the danger of locking catchment management into a rigid process that excludes those who subsequently turn out to hold the key to integrated management.

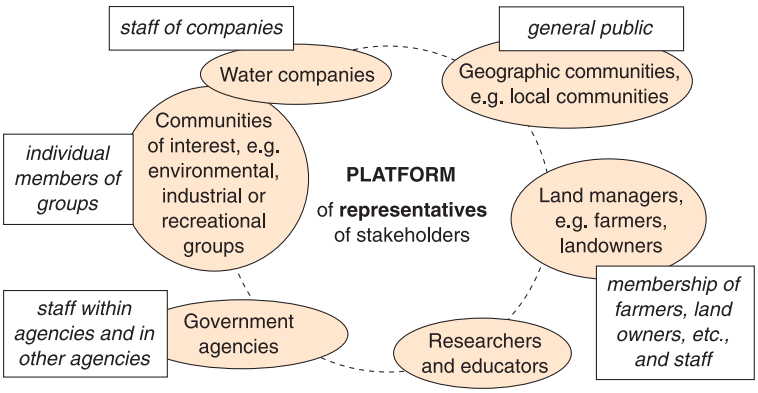

Figure 12. The basic structure of a network or platform of stakeholders dealing with integrated catchment management and sustainable use of water.

- Recognition of the validity and diversity of stakeholders can both complement and challenge existing processes and outcomes. Policy makers need to be more aware of governance dilemmas raised by stakeholder involvement and should seek to promote

engagement in ways which complement rather than replace existing democratic structures. However, policy makers must also be prepared to accept that involving stakeholders may bring to the surface new challenges to policy processes.

4.3.3 Investing in facilitation skills

- Interaction among stakeholders creates the relationships that are needed to make integrated management possible. Often stakeholders feel inhibited to interact because of a lack of confidence. Facilitation strategies to help stakeholders to participate and develop their own experience and data have proved an invaluable trigger for generating meaningful and sustained interaction. For example, joint diagramming activities among stakeholders (e.g. CSM 10 and 11), sometimes centred on exploring different metaphors, and use of media technology (e.g. participatory GIS described in CSM 5) have been particularly effective for engaging interest and confidence among stakeholders and for developing awareness of interdependence. The tools are most effective when linked to shared experimental actions.
- Objects of mutual interest (e.g. Maraîchine cattle in France, data on nitrates and landscape in Italy and on-farm weirs in Holland) can be effectively used as focal points of reference in identifying stakeholders and co-deliberating on stakeholdings. These "intermediary" or "mediating" objects have more value if they lend themselves to hands-on manipulation or allow routine observation and measurement by stakeholders, enabling better appreciation and development of stakeholding (see 4.2.4).
- The engagement of stakeholders in concerted action can also be built around their involvement in the organisation of public events (e.g. the theatre event organised in Italy), which can create conducive situations for dialogue and critical reflections around water issues both within the audience, the local community and the actors involved, and hence may result in significant change of practices.
- The use of tools should be consistent with a particular context, stakeholder group and situation and they are not to be considered as technical fixes to a given problem that can be applied (or rolled-out) in many contexts.
- Targeted funding, facilitation of interaction and process management are needed to invest in facilitation. Three kinds of enabling support appear to be essential:
    1. The costs of interaction must be supported by explicit funding;
    2. Facilitators with appropriate skills are needed to create the social spaces in which meaningful dialogue and interaction can take place.
    3. The process of interaction must be managed so that one-off events develop into ongoing relationships that continue to deepen the dialogue and build 'systems for shared learning'.
- The experience gained from SLIM case studies revealed that it is more relevant to pay attention to the accurate design of the *process* of facilitation of two-way interactions between stakeholders, more than to the *mediating object per se*. In fact, one risk from the scientist side would be to divert resources and energies to systematically describe the "object" more than to invest on the learning processes driving the change towards sustainable resource use in the system of interest. From the perspective of another stakeholder, a threat may occur of appreciating the mediating object as *the* problem requiring a technical fix e.g. through increased regulation. In other cases, media

technology or diagramming, which may appeal to some stakeholders, may have an alienating effect on others. These mediating objects serve to engage stakeholders in experimentation, discussion and action researching in ways that help them to redefine their stakes.

- Skilled facilitation and process management are essential to the fully effective functioning of platforms and networks. Facilitators should sustain the effective functioning of the platform and act as mentor to (i) improve stakeholders' capacity to sustain the platform and move towards ICM and sustainable use of water, (ii) to learn how they have learned through structured group reflection and ensure "spaces" for this activity are created in the timetable, thereby improving stakeholders' practice for learning and (iii) to help identify and capture new areas of learning that need to be mastered.
- Practitioners facilitating the learning process should therefore be able to choose appropriate tools and conducive situations for learning to occur, to enable the process by which stakeholders experience being heard by each other and to enable stakeholders to explore, make sense of and act upon their interdependencies in a more concerted fashion.
- One basic principle of such activities is to avoid situations in which stakeholders meet just for "dividing up a pie" instead of "baking the pie together" (see CSM 1). This metaphor emphasises the difference between engaging in negotiation to maintain separate stakes in contrast to sharing learning in order to engage in concerted actions. A motivation for engaging in sharing strategies is the recognition of the *potential* of concerted effort. Examples of positive application of such principles are reported in CSM 5 and 10, where participants shifted from an initial joint exercise in *mapping* reality, towards a more purposeful joint enterprise in *shaping* reality. Another example is the Benelux Water Conservation case study (CSM 2), where weirs were identified as a "mediating object" for farmers to move from a passive '*waiting for more government regulations to be formulated'* to a proactive role in responding to the WFD.
- The political challenge is then to invest in supporting the development of facilitation skills as a professional activity, allowing facilitators to learn from practical experiences as well as building an existing repertoire of facilitation tools and associated techniques.
- This implies long-term investment and trust in the process more than insisting on instrumental control associated with a belief in one single "correct" outcome. In fact, pay-offs may not be immediately visible, but policy makers already show some appreciation of the fact that costs incurred through regulation and enforcing compliance can be very high in the long run. Supporting facilitation moves the costs to the front end and removes the risk of unanticipated costs later.

4.3.4 Investing in training and experiential, interactive learning processes

- Regulatory approaches, markets and information campaigns have proven not to deliver sustainable resolution of resource dilemmas. An interactive learning approach requires an understanding of the principles and creative applications that fit the context.
- Interactive learning is not restricted to any stakeholder group. SLIM cases show that executives of farmers' unions, chairpersons of water boards, directors of drinking water companies, administrators and elected officials at the local, regional and

national levels, and indeed scientists, all can become engaged in transformative learning.

- Interactive learning requires explicit investment of time, in the organisation of interactions, and in the design of experiments around material-mediating objects from which all can learn.
- The incentive to participate is based on mutual realisation that 'going it alone' no longer delivers desired outcomes; the realisation is often triggered by crisis (including admission that '*we do not know what to do'*) and politically unacceptable conflict.
- For the process to work, those who have the power to create framework conditions must be willing to accept the outcomes from area-based stakeholder interaction. The process builds civil society by creating a distributed capacity to act in concert, based on an informed understanding; interactive learning processes include learning about each partner. It generates respect and begins to create what can be called a 'community of practice' (Wenger, 1998) across sectoral, professional and organisational boundaries.
- Several SLIM case studies have shown that there are widely shared weaknesses within catchment groups in the areas of generic skills in process management, facilitation, conflict resolution, capacity to think about whole systems, interdisciplinary communication, and the communication of the contribution of science to the public. Few people have mastered this full range of skills and knowledge. Different group members will have command of different parts of the "jigsaw." Hence the training and educational needs of individuals will differ greatly.
- Competence to facilitate interactive processes needs to be institutionalised within resource organisations. Technical experts also need to be helped to reflect more on the actions and processes that might lead to concerted action. The skilled use of dialogic tools proved to effectively assist these processes of interactive learning in different European contexts.
- Specific training support can be designed for technical experts requiring facilitation skills, which have different needs from a professional facilitator, to enable them to effectively communicate with other specialists across professionals and other divides.
- The praxis of ICM and SUW is still at an early stage and future courses should not only train participants but lead to the furtherance of the development of that praxis through engaging the knowledge and experience of participants. Creating this praxis is not only a matter of learning about ICM and SUW but of learning how to learn to do it. These factors have important implications for the content and approach within courses. They lead to some guidelines around which courses need to be structured (see SLIM PB7):

The totality of the impact of the guidelines outlined in SLIM PB7 helps to develop the capacity of ***learning how to learn***. The generic skills element of such a course is applicable across a wide range of human endeavour and in particular, by adapting the "field skills" element in Figure 13 can be contextualised within any sphere of natural resource management to aid the delivery of policy on the ground.

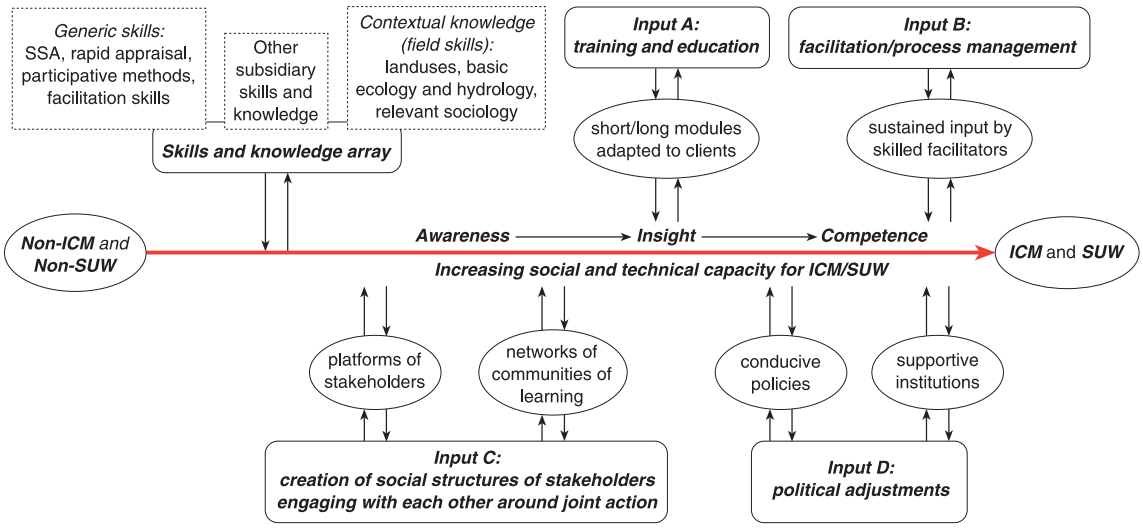

Figure 13. The transformation of non-integrated catchment management (ICM) and non-sustainable use of water (SUW) into ICM and SUW through a programme of developing the capacity of learning how to learn. (Source SLIM PB7).

4.3.5 Required political and institutional adjustments

1. Platforms and networks to develop interactions among stakeholders

- A key point is the creation of new spaces for interaction and dialogue through platforms and networks. This can be as simple as arranging a regular 'open' meeting between stakeholders, or more formalised platforms. Neutral ground is preferable, or rotation of meetings between the stakeholders' normal place of work.
- Platforms and networks of stakeholders focused on the integrated management of a catchment often arise "spontaneously" in the social space created by the need for ICM in the face of apparent environmental and physical degradation of the biophysical system. However, their initiation may require an intervention by one or more stakeholders, particularly when degradation is not apparent to all.
- Successful functioning and development of platforms and networks of stakeholders require effective support from key stakeholders and significant resourcing. SLIM results suggest that the capacity of such groups to promote ICM and sustainable use of water depends not so much in their functioning as just "talking shops" but in the way this function interacts with stakeholders engagement with each other around joint action for ICM and SUW.
- Informal platforms of stakeholders can often help to build bridges between different organisations across different sector interests and organisational boundaries. They can also be a means to promote partnership building and developing collective responsibility.

2. Conducive institutions and policies

- Awareness of what institutions are and how they can mediate practices is essential to avoid natural resource managers become the victims of theories and practices that have been institutionalised but which are no longer valid to the circumstances.
- There are two aspects to consider here. One is regarding the impact of policy and institutional arrangements on ICM and SUW and groups aiming to deliver this. The

other is the functions and approaches of organisations, especially government agencies, aiming to deliver same.

- There are different ways policies can impede progress towards ICM and SUW.
- Policies can often conflict with one another, and with ICM and SUW. A major current example is the environmental degradation, including effects on water quality and ecology, through the impacts of the Common Agricultural Policy of the European Union. Policies may also concentrate power in the hands of agencies, leaving little social or political space for broader, meaningful, stakeholder engagement, although this may greatly hamper the delivery of water management policies. The recognition that political goals related to resource dilemmas, such as sustainable water management at catchment scale, are realised through people, implies a revision of existing mandates and responsibilities of technical agencies associated with policy design and implementation, and hence the necessity to appreciate professional facilitation skills.
- There are a variety of ways in which **agencies** may aid or impede the process of SL in aiding progress towards ICM/SUW. For example, they may have views that policy should be delivered solely by regulation and its strict enforcement with no role accorded to social learning, regard themselves as having the exclusive function, or feel themselves to be so driven by the timeframe and political pressures to deliver that there is no scope for more interactive engagement with stakeholders. More often, agencies "adopt" participative approaches and public involvement but do not realise that this has significant implications for how the organisation functions at all levels.
- Feedback from public involvement needs to be fully incorporated into bureaucracies' top-down decisions making processes to ensure alignment between their local and national agendas and work practices. Within agencies with largely technical and scientifically trained staff, social-based skills such as facilitation skills and social outputs such as group learning inherent in participative approaches are often undervalued, thus hampering also the integration of different technical and scientific skills among experts and practitioners.

3. Access to funding

- Collaborative action is time consuming and needs proper resourcing but, properly done, can lead to more cost effective and more ecologically and economically sound solutions (e.g. Margerum and Whitall 2004). Hence, agencies that commit resources to effective participation can ultimately save by reducing conflict, accessing knowledge and skills among participants, and producing more effective and integrated policies.
- Institutions are rarely created overnight. The same is true for concerted action. Negotiation, development of trust, understanding and changes in practices all require an investment in time. Institutional practices need to give room to enable this to occur. Conducive institutions give 'permission' or promote freedom to stakeholders to realise their interdependencies and to act in new ways, rather than re-enact old patterns of behaviour when faced with new situations.
- SLIM policy recommendations on this matter need to be considered differently by (i) policy makers involved in the conception of policies; (ii) those responsible for implementing policies; and (iii) those managing the interface between collective action and policies.

- Trusting an open-ended learning process to deliver policy implementation is not a leap into the unknown: in practice, a history of conflict, crisis and negotiation around conditionalities usually precedes the reluctant acceptance among stakeholders that co-construction of knowledge is the only way forward.
- The process of policy conception is a key factor to reflect upon, in order to avoid internal contradictions and ambiguities of policies, as is revealed for sector-related policies when they are implemented. Adopting a policy mix, including participatory approaches, questions policy makers' willingness and responsibility to take account fully of the outcomes from learning processes. Evaluating policy implementation through a set of environmental and economic indicators, based mostly on 'pressure-state-response' models, does not allow space and time for co-creation of knowledge through participation.
- Funding is often a major constraint to concerted action. Official funds at present do not provide room for funding social processes, learning and participation. Such funding asks for 'creative' budgeting. Social-learning approaches require investment in interaction at the beginning of the process. The pay-off comes towards the end when wide-scale participation achieved from small beginnings, starts to achieve macro effects, and when the accumulation of relational capital begins to simplify policy implementation. Social interactions have a high cost in terms of salaried time, meetings and travel. The means are generally not available to create the human conditions for participatory approaches. Relatively simple changes to funding protocols and budget management can release considerable creativity and experimentation to address resource issues. The investment costs are highest at the beginning of the process, while the benefits come later.
- Training people to move from a top-down bureaucratic approach focusing on results, to an ability to enhance useful interactions with a focus on process management, requires considerable investment in capacity building.

4.4. Implications for research design and management

We have stressed at the outset that SL is a complementary policy option to those traditional policy instruments outlined in Figure 1. What is novel however is that we have explicitly drawn attention to the different epistemological assumptions that underpin these policy choices. These differences are profound as they affect both policy as praxis and, ultimately the practices of managers and others in the field of water (or other natural resource management). What is more, SLIM research has revealed the extent to which there is epistemological confusion amongst policy makers and water managers (see SLIM WP10 Report). This confusion will continue to negatively affect R&D while ever it remains a subject that cannot be spoken about. We are not advocating one or other epistemological position but pointing to the implications of not being aware of one's own epistemological stance and the implications of that choice. Figure 14 is one means – another heuristic device – around which an epistemological conversation can be held.

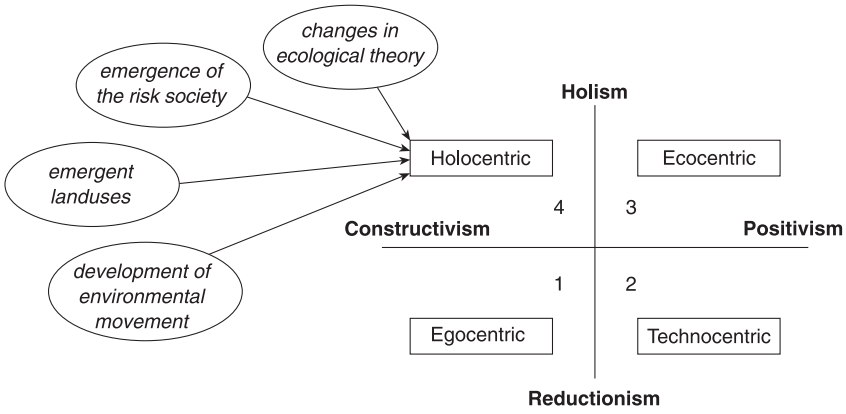

Figure 14. Situation of complex natural resource management 'problems' and associated epistemological and praxis distinctions. Any individual committed to a lower number quadrant has fewer choices than someone operating in a higher number quadrant with awareness (Source: see SLIM PB7).

Unfortunately the capacity to be epistemologically aware and to work with different epistemological assumptions is not easy nor is it easily taught (Ison, Armson and Stowell 2001). This is because it is known (Perry 1970, 1981; Salner 1986) that personal change in epistemic assumptions is absolutely essential to any major breakthroughs in decision making based on understanding and applying systems theories to practical problems (quadrant 4 in Figure 14). If, as Salner has found, many people are not able to fully grasp relatively simple systemic concepts (such as non-linear processes, or self-reflexive structures), they will not be able to rethink organizational dynamics in terms of "managing" complexity without substantial alteration in the worldviews (their "applied epistemology). This has major implications for how SL is both understood and facilitated in praxis and policy terms. It is clearly an area for further research and for attention in the practices of R&D funders such as DG Research because of the implications for R&D design, management, effectiveness and evaluation.

4.5. Emerging theoretical and methodological issues

We have already highlighted some important emerging theoretical and methodological issues including: 'relational capital'; the tension between theoretical convergence and maintaining a dialectic in case study research, the place that IODs and ICDs might play in facilitating SL; the importance of the role of the researcher and awareness of this; 'institutional framing' and the idea that what we accept as SL is observer dependent i.e. it depends on your perspective – and we offered three. In this section we highlight two further issues for further research: (i) how the SLIM heuristic framework might further evolve so as to elucidate SL as a purposeful policy instrument and as a domain of praxis and (ii) the ongoing utility of the 'platform' concept.

4.5.1 Further understanding the transformation processes leading to concerted action

To accept any claim about learning then a theory of learning is required which makes sense of our actions in the world. Our experience is learning is under-theorised in the framing and evaluation of practices associated with water policy and water R&D. One can hardly pursue SL as a policy instrument if 'learning' and 'learning processes' have not been understood in theoretical and practical terms (see SLIM PB6). The use and utility of the SLIM heuristic device cannot be divorced from the choices that can be made about what is accepted, or not, as learning. The more one is aware of assumptions about learning and epistemology then the

more creative the use of the heuristic becomes. For example as awareness grows it can be recognised that:

- there is not one trajectory towards concerted action but many potential pathways that are a product of the history of the situation and the local dynamics at play (Figure 15);
- a trajectory towards concerted action can be understood in terms of structural drift – there is further research to be done on linking this notion with Giddens' structuration theory and with Maturana's theories of structural coupling;
- institutions are pervasive – if conceptualised as a three dimensional space Figure 15 may describe a cube in which institutions share understanding, practices and structures;

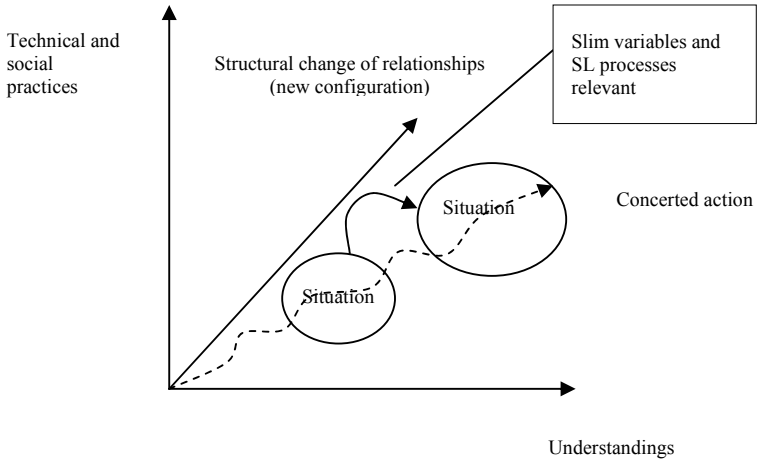

Figure 15. 'Playing' with the SLIM framework to facilitate changes in understanding and practices (there is no one trajectory towards concerted action).

- whilst the history of the 'capitals' concept comes out of an attempt by some social scientists to use economist's language, reflecting perhaps an ideological struggle, the term *relational capital* builds on this language by expressing quite a simple idea - as new social configurations emerge and new understanding and trust begins to be built among members of a given configuration then it is possible to begin to speak about relationships to build more ambitious collaborations. There is more research to be done to connect this idea with other intellectual traditions especially communities of practice and third order knowledge management.
- The trajectory (Figure 15) is sensitive to the implicit and explicit boundary judgments that are made by stakeholders and the assumptions that are made about those affected, but not involved. Research which illuminates this issue from a critical systems perspective is needed.
- When linked with theories of learning the SLIM framework can become a device to understand and orchestrate practices associated with 'organisational learning' (Figure 16). This is clearly an area for further research.

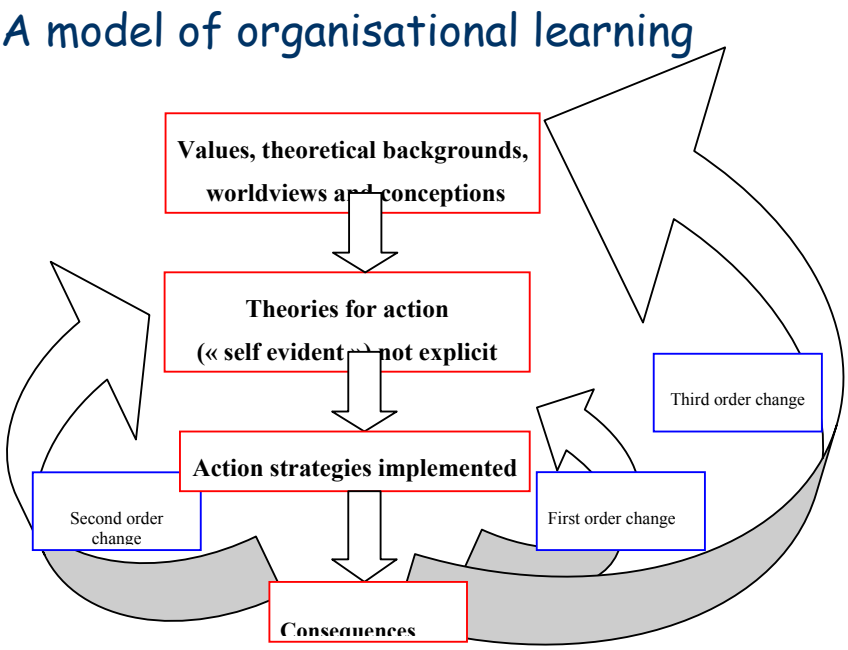

Figure 16. A heuristic device for organisational learning: triple loop learning which can be used in conjunction with the SLIM Framework.

4.5.2 Platforms and scaling (different biophysical or social levels)

Margerum and Born (1995) reached two major conclusions about environmental decision making: that 'the alteration of the institutional environment (culture, politics, tradition, history)' and changes 'in the attitudes of managers and the organizational structure of the public sector' are critical (p. 386). As noted in Open University (1998b) the 'platform approach' envisaged supporting institutions actively facilitating stakeholders working together at both the scaled-up resource level and the platform level (Figure 12 depicts this in part). The policy context of platforms includes legislation and regulatory frameworks, incentives, deployment of policy instruments for inspection and control and resolution of conflicts between electoral politics and local autonomy.

Appreciating the notion that institutional platforms are needed for environmental decision making is one thing but how are such institutions created and what action could you take in facilitating these changes? SLIM research has led to an evolution in thinking about the nature of 'platforms' and the utility of platforms as both descriptor and metaphor in terms of what it reveals and conceals. In the Netherlands the concept 'platform' has become associated with the 'polder model' - which at the operational level means committees whose membership is made up of 'interested parties' - who spend their time representing and defending their institutional interests - typically leading to stalemate, inertia, or factional in-fighting (see CSM 1). We have also observed that platforms often end up as being officially constituted and made up of representatives of representative organisations - thereby raising all kinds of questions of legitimacy, transparency, accountability and so on.

The notion of nested platforms remains a key issue but we have come to prefer the formulation of '*multiple social spaces for learning at multiple scales'* (see CSM 2). In the Netherlands the comparison of the Drentsche Aa and the Water Conservation Project has shown that one huge official platform with representatives is likely to fail to bring about

movement towards concerted action (CSM 1), while the multiple meetings, field days, discussions groups, shared experiments etc. that were observed in Brabant (CSM 2) have much more chance of success. This is clearly an area that needs further research.

In the water conservation cases, for example, what was significant was the attention to communication and concerted action among stakeholders at a variety of levels, in many different kinds of fora, representing different but cross-cutting scales of interaction. Interaction at the project level, through the structure and terms of reference of the working groups were also important in bringing about this direct cross-cutting confrontation of experience, valuation, and interest. It is the 'cross-cutting' nature of the interaction, communication, and concerted actions, that 'delivers' - and the quality of the connectivity (relational capital). It is not a question of finding the right 'levels' for the platform but of helping to make the connections that matter. 'Platforms' that manage to bring together cross-cutting scales and interests (etc), might be located at various spots in a complex institutional array but they are in themselves useless unless tied to experimental actions that allow the members to learn - and to learn, moreover, about possible ways forward with issues that have got stuck, are creating conflict, or which appear intractable (see CSM 2 and CSM 1 as well as CSM 12b). From this perspective SL is the outcome of interaction rather than a 'thing' in itself (an emergent property that is constituted in transformation).

5. Conclusions including socio-economic relevance, strategic aspects and policy implications

The EU Environment Commissioner at the time this research was conducted frames her understanding of managing EU environmental policy in terms of three Is: integration, implementation and information, each of which is referred to as a tool (Walström 2003). For her, 'integration means shared responsibility. Care for the environment cannot be separated from other areas of activity, nor is it something which can be added as an afterthought. It must be directly integrated into all relevant areas of activity, such as energy, transport, agriculture and tourism. It must also be integrated into commercial business plans'.

Implementation refers to the implementation of laws and regulations: 'a law is only as effective as the way it is applied'. She says 'I am determined to deal with those who do not observe the rules and I will continue to take Member States to the European Court if necessary'. A number of "name, fame and shame" seminars have been held.

Information is linked to increased transparency and to the improved 'distribution of information to consumers, parents, company managers and employees about how their behaviour and decisions can help improve the environment'. She goes on to say that: 'everyone must help, and we have to spread our knowledge and set a good example …. Ideally, everyone should have their own "toolbox" to help them improve their local environment'.

This account of Commissioner Walstrom's perspective is offered here, not to criticise, but to point out some of the main differences between SLIM research findings and explanations and current articulation of key policy drivers – the three Is. Each is different in underlying epistemological and theoretical assumptions which have profound implications for praxis – the transformation of stakeholder interests towards ICM and SUW. The disabling nature of the 'toolbox' metaphor is a case in point which has been highlighted in SLIM's WP10 report.

Engaging with the SLIM results, especially through the use of the SLIM framework offers an opportunity to widen the repertoire of policies and practices that are available for the sustainable management of natural resources.

SLIM is also a case study in how an alternative, interactive social science R&D can be conceptualised and enacted. Given the historical reservations about funding social science in some parts of DG research we commend the SLIM model for further attention.

6. Dissemination and exploitation of the results

SLIM has taken an innovative approach to dissemination commencing with the project design. Two specific work packages (WP8 and WP10) were conceived to specifically use our emerging research results as a basis for design of one or more learning processes with a range of in-country (national) stakeholders (WP8) and Brussels-based policy makers (WP10). Our aspiration was to both trigger and facilitate emergent collaboration around common issues of concern though these processes. In other words, we used our research results about our growing understanding of social learning to design activities that might trigger new cycles of social learning about water management issues. In this regard SLIM WP8 and WP10 activities have been remarkably successful (see WP8 and WP10 Reports) and represent a significant point of departure from processes traditionally associated with the linear model of knowledge, or technology, transfer (ToT) viz: research → knowledge → transfer → adoption → diffusion. This ToT model clearly informs the thinking behind DG Research's TIP (Technological Implementation Plan) documentation and strategy.

6.1 Avoiding the linear 'transfer of technology' trap

At the outset we indicated that some of the SLIM deliverables would be in the traditional form of books and reports for use by others as well as the posting of all resource materials on a purpose designed web page. Our aspiration to develop interactive internet-based resources that focuses on 'the soft side' of integrated sustainable management of water resources was over ambitious given the resources at our disposal (though moves are afoot to develop these in the near future so as to become a focal point for a community of practice (Wenger 1998) in the sustainable management of water at catchment scale).

One of our prime objectives has been to avoid the trap exemplified by the linear model of technology transfer (see Röling and Wagemakers 1998; Ison and Russell 2000 for an overview). The ToT paradigm has been found wanting in domains such as integrated water management.

In developing our thinking on the dissemination strategy the following points were noted as important in determining our approach:

- The range of deliverables specified in the SLIM proposal was ambitious and resource demanding, particularly if translated into other languages.
- Careful targeting and design is important if SLIM's products are to be effective in that they will be used by those they are aimed at.
- The arena into which we wish to disseminate is complex, with a great diversity of interested parties and a wealth of existing material, much of which is not easy to handle.
- A major part of that complexity lies in the differences in national culture, eco-physical context and legal systems of the different countries within the EU.
- It follows that, perhaps even more than usual, the design of products and the context in which they are set will be important in ensuring their use.

- This suggested that each country team needed to gauge the nature of its "target audiences" prior to designing dissemination materials. This drew upon our involvement and experiences with stakeholders in case studies.
- The Water Framework Directive, which supplies much of the context within which the material will be set, is process based and hence the SLIM input could be very important. Our dissemination material would have to focus on process quite strongly.
- Another difficulty we face in dissemination is that much of what we have to say about the whole business of water management are lessons that need to be learned experientially – that is a statement in words does not necessarily convey the real significance of the points made to the reader, the lesson needs to be learned by persons living through certain experiences.
- As a result, our dissemination might have to focus not so much on the "right way" to do water management, but on how to learn your way through situations and processes. We will be testing this during WP8 and WP10.
- We also note that there may be an ethical aspect to the production of this material in that it has to be equally accessible to all parties for their use and to honour the interdisciplinary, collaborative nature of SLIM's research processes.[20]

6.2 Measures of success

Several performance measures relating to a successful TIP were developed during SLIM's mid-term review (see Table 5). We have evidence of success on all of these measures. For example, SLIM researchers are increasingly being invited to present at National and International events (see the Management section of the SLIM Final Report which includes a final version of our Technological Implementation Plan). What is most significant is that SLIM's research has led to new in-country research and dissemination activities which will continue beyond the life of SLIM. This situation exists in all partner countries; the following examples from Italy exemplify the situation:

- Collaborative work between some members of SlimAN and the Marche Regional Administration within the WP2 of the SIMOCA (Setting up and implementation of sustainable and multifunctional rural development model based on organic and competitive agriculture) Interreg III B CADSES project;
- Some members of SlimAN (PP Roggero, Marco Toderi and Giovanna Seddaiu) have been formally involved by the Agricultural Department of Region Marche in this project to supervise some of the pilot activities developed in the inland hills of the province of Pesaro-Urbino, finalised to promote rural development through organic and low input farming. The research activities, designed by the project leader, have been implemented by SlimAN members in the role of facilitators and co-researchers with stakeholders and regional officers, interpreting the submission of a questionnaire as a collective learning experience.
- Initiated a collaborative project with Unilever (SAGIT S.p.A.) on sustainable agriculture in a frozen Spinach growing area, involving some SlimAN members using PPGIS and other dialogical tools with farmers and Unilever officers to facilitate the

[20] SLIM is used as the citations in all publications generated collaboratively and which draw on all CSMs.

shift of current farming practice taking into account of the biodiversity at the ecosystem scale.

- Involvement of the lead researcher of SlimAN (PP Roggero) in the scientific committee of a National project on the coordination of activities among the Regional Agricultural Development Agencies, coordinated by the National Institute of Agricultural Economics (INEA). Contacts between the scientists involved in this committee followed the circulation of SLIM documents and publications within the Italian scientific community, including the WP8 and WP10 initiatives.
- Involvement of some members of SlimAN in the design of a new collaborative project with the Department of Agriculture of the Regional Government, about the evaluation of the Rural Development Plan in the Region. The project is being co-designed with a team of regional officers that had been already involved in SLIM activities (focus groups, seminars, interactive workshops and so on) in order to create an open team of scientists, regional officers, farmer unions, farmers and other stakeholders that during the incoming 3 years will co-research and interact under a process that will be facilitated according to the outcomes of SLIM.

If anyone has read this far we invite feedback and comment on what you have read.

The next section details the main SLIM publications to date. Of note are the SLIM Policy Briefings have been specifically designed to aid dissemination of our research and to inform policy makers and water managers. Other publications are in the pipeline or planned (a SLIM Book, several special editions of journals and a SLIM Training Pack).

7. Main literature produced

7.1 SLIM collaborative publications and research 'products'

7.1.1 SLIM Introduction, SLIM Framework and SLIM Policy Briefings

SLIM (2004a) Introduction to SLIM Publications for Policy Makers and Practitioners. (available at http://slim.open.ac.uk). 4p.

SLIM (2004b) SLIM Framework: Social Learning as a Policy Approach for Sustainable Use of Water, (available at http://slim.open.ac.uk). 41p.

SLIM (2004c) Ecological Constraints in Sustainable Management of Natural Resources. SLIM PB1 (available at http://slim.open.ac.uk). 4p.

SLIM (2004d) Stakeholders and Stakeholding in Integrated Catchment Management and Sustainable Use of Water. SLIM PB2 (available at http://slim.open.ac.uk). 4p.

SLIM (2004e) Developing Conducive and Enabling Institutions for Concerted Action. SLIM PB3 (available at http://slim.open.ac.uk). 4p.

SLIM (2004f) Facilitation in Policy Processes: Developing New Professional Skills. SLIM PB4 (available at http://slim.open.ac.uk). 4p.

SLIM (2004g) The Role of Conducive Policies in Fostering Social Learning for Integrated Management of Water. SLIM PB5 (available at http://slim.open.ac.uk). 4p.

SLIM (2004h) The Role of Learning Processes in Integrated Catchment Management and the Sustainable Use of Water. SLIM PB6 (available at http://slim.open.ac.uk). 4p.

SLIM (2004i) Guidelines for Capacity Building for Social Learning in Integrated Catchment Management and the Sustainable Use of Water. SLIM PB7 (available at http://slim.open.ac.uk). 4p.

7.1.2 Case Study Monographs (CSMs)

van Bommel, S. and Röling, N. (2004) The Drentshe Aa in The Netherlands, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) *Case Study Monograph 1* (available at http://slim.open.ac.uk).

Jiggins, J. (2004) Key informant studies I: InterReg project water management in the Central Benelux area (1st Generation project), SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) *Case Study Monograph 2a* (available at http://slim.open.ac.uk).

Jiggins, J. and Röling, N. (2004) Key informant studies II: water conservation project in North Brabant and Limburg (2nd Generation project), SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) *Case Study Monograph 2b* (available at http://slim.open.ac.uk).

van Slobbe, E. (2004) The Overijsselse Vecht in the Netherlands, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) *Case Study Monograph 3* (available at http://slim.open.ac.uk).

Arzeni, A., Lupini, L., Roggero, P.P., Ruvutuso, S., Seddaiu, G., Sotte, F. and Toderi, M. (2004) The nitrate problem in Serra de Conti and Montecarotto (Marche, Italy), SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) *Case Study Monograph 4* (available at http://slim.open.ac.uk).

Toderi, M., Powell, N. et al. (2004) Dialogical tools: a methodological platform for facilitating and monitoring social learning processes, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) *Case Study Monograph 5* (available at http://slim.open.ac.uk).

Badache, L. (2004) The Atlantic Wetlands Forum: an intermediary body wavering between expertise and facilitation in its search for legitimacy, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) *Case Study Monograph 6* (available at http://slim.open.ac.uk).

Steyaert, P. (2004) Natura 2000: from consultation to concerted action for natural resource management in the Atlantic coastal wetlands, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) *Case Study Monograph 7* (available at http://slim.open.ac.uk).

Brives, H. (2004) Changing practices and understandings for natural resource management: the example of the local cattle breed in the Atlantic coastal wetlands, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) *Case Study Monograph 8* (available at http://slim.open.ac.uk).

Ollivier, G. (2004) An analytical understanding of the Water Framework Directive questioning its potential to enable sustainable management of water, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) *Case Study Monograph 9* (available at http://slim.open.ac.uk).

Collins, K. (2004) The Tweed Forum and Tweed catchment management plan: a SLIM-UK case study, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) *Case Study Monograph 10* (available at http://slim.open.ac.uk).

Watson, D., Morris D., Collins K., Stoate. C, Blackmore, C., Reynolds, M. and Gibbon, D. (2004) SLIM-UK catchment cases: the Ythan and Eyebrook, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) *Case Study Monograph 11* (available at http://slim.open.ac.uk).

Blackmore, C., Collins, K., Furniss, P., Morris D. and Reynolds, M. (2004) The UK policy context for water management. I The English and Welsh policy context, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) *Case Study Monograph 12a* (available at http://slim.open.ac.uk).

Ison, R. and Watson, D. (2004) The UK policy context for water management. II The Scottish policy context, SLIM (Social Learning for Integrated Management and Sustainable Use of Water at Catchment Scale) *Case Study Monograph 12b* (available at http://slim.open.ac.uk).

7.1.3 SLIM Thematic Papers[21]

Morris, R.M., Roggero, P.P. Steyaert, P., van Slobbe, E. and Watson, D. (2004) **Ecological constraints and management practices in social learning for integrated catchment management and sustainable use of water**. SLIM Thematic Paper 1, (available at http://slim.open.ac.uk).

Billaud, J-P., Brives, H., Jiggins, J., Reynolds, M., Röling, N. and Todderi, M. (2004) **Facilitation of social learning processes for integrated catchment management and sustainable use of water.** SLIM Thematic Paper 2, (available at http://slim.open.ac.uk).

Jiggins, J. and Collins, K. (Editors and Lead Authors) Brives, H., Roche, B., Billaud, J-P., Powell, N., Blackmore, C. and van Slobbe, E. (Contributing Authors) **Stakeholders and stakeholding in social learning for integrated catchment management and sustainable use of water.** SLIM Thematic Paper 3, (available at http://slim.open.ac.uk).

Collins, K. and Brives, H. (Editors and Lead Authors) (2004) **Institutional frameworks and social learning.** SLIM Thematic Paper 4, (available at http://slim.open.ac.uk).

Röling, N. and Jiggins, J. (Editors and Lead Authors) Gibbon, D. Roggero, P.P., Steyaert, P. and Watson, D. (Contributing Authors) (2004) **Social learning process analysis**. SLIM Thematic Paper 5 (available at http://slim.open.ac.uk).

Lupini, L., Arzeni, A., and Sotte, F. (2002) **Policies brief on social learning processes for integrated catchment management and sustainable use of water**. SLIM Thematic Paper 6 (available at http://slim.open.ac.uk).

[21] These papers (except No.1) appear only in the members area of the SLIM website. All are being refined for further publication.

7.1.4 SLIM Working Papers: review and theory papers on social learning

van Dijk, N. (2001) **Social environmental learning for collective action in catchment management.** SLIM Working Paper No.1.

Jiggins, J. (Editor) (2002**) Interim state of the art paper on social learning and a benchmark statement of SLIM partners' own learning about social learning**. SLIM Working Paper No.2.

Brives, H., Steyaert, P., Billaud, J.-P., Hubert, B., Tichit, M., Roche, B. (2002) **Environmental public policies and collective action: How is social learning able to contribute to the sustainable use and management of water?** The French Team's Social Learning Theory Position Paper. SLIM Working Paper No.3.

Jiggins, J., Röling, N. and van Slobbe, E. (2002) **Social learning theory in relation to integrated water management at catchment scale.** The Netherlands Team's Social Learning Theory Position Paper. SLIM Working Paper No 4.

SLIMAN (2002) **Social learning theory in relation to the Water Framework Directive**. The Italian Team's Theory Position Paper. SLIM Working Paper No. 5.

Blackmore, C.P., K.B. Collins, P. Furniss, D. Gibbon, R.L. Ison, R.M. Morris, M.D. Reynolds and D. Watson (2002) **Social learning, systems thinking and practice for the integrated management and sustainable use of water at catchment scale – the UK team**. The UK Team's Theory Position Paper. SLIM Working Paper No. 6.

Gibbon, D. and Jiggins, J. (Editors and Lead Authors) (2003) **SLIM's own learning processes**. SLIM Working Paper No. 7.

McClintock, D. (2002) **SLIM evaluation report**. Final report. Prepared for the SLIM Project Coordinator and Land and Water Australia. Prepared by Dr. David McClintock Hassall & Associates Pty Ltd GPO Box 4625 Sydney 2001 Australia. SLIM Working Paper No. 8.

McClintock, D. (2002) Report on R&D implications for Australia arising from SLIM. Report. Prepared for the SLIM Project Coordinator and Land and Water Australia. Prepared by Dr. David McClintock Hassall & Associates Pty Ltd GPO Box 4625 Sydney 2001 Australia. SLIM Working Paper No. 9.

7.1.5 DVDs

Roggero P.P., Maurizi S. (eds.), 2004. *Il Teatro dell'Acqua*. DVD video including a selection of performances and the press releases of the theatre event organised on 27-28-29 November 2003 as part of SLIM WP8 (in press).

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7.1.6 Workpackage Reports

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9. Appendix 1. The 'what how and why' of the facilitation variable from the SLIM matrix.

	WHAT	HOW	WHY
FACILITATION	• What do we mean by facilitation? • What's the difference between facilitation and intervention? • What's the difference between methods for facilitation and tools to facilitate? • What are the conditions to be or to become a facilitator? • Who are the facilitators?; What are their responsibilities (managing personal and ethical boundaries)?; What kind of skills are needed? (Is s/he a SH or external to the S.O.I.?) • What's the role of knowledges and knowledge communication in a facilitation process? • What are social positions asymmetries and how does facilitation change those relationships? (What changes in power relations occur as a result of facilitation). • which groups of SH should be involved in the facilitation process? • how should the local administrations support facilitation of learning? • which barriers of communication between SHs require which type of facilitation? • identify key scientific knowledge required to facilitate a learning process to develop ICM and SUW • Presence/absence of professional facilitators • What processes are facilitated? • Presence/absence of a facilitation strategy • At what level(s) facilitation occurs • Role of facilitation in the mix of SL, regulation, compensation, and market-led policies? • How is facilitation valued? • How is facilitation experienced in different cultures of decision-making? • What are the links (and how do we understand them) between facilitation and learning? • What are the key measures of success of facilitation? • What knowledge is being 'facilitated' through engagement and by negotiations with intermediary technical objects? • What group or learning processes are being facilitated? E..g airing perspectives, checking understanding; evaluation • What catchment management processes are subject to facilitation?	• Monitoring of facilitation "success" through pre-post interviews • Analysing the facilitators stakes and roles in the SOI through the help of skilled external observers. • Developing tools for facilitation: • Participatory methods (PP-GIS) and visual techniques to improve communication (mapping, ranking exercise) about landscape issues such as ICM and SUW • Remove communication barriers through "interfaces" which have a strong influence on emotions, values and intentions (e.g.: interactive theatre performance) • Engagement of key SHs (to be defined with SA) • *Fora* and meetings among SHs • Provide local scientific data to trigger dialogue and hence learning processes through concrete objects • Monitor processes & context; Researcher participation as facilitators • training of skilled **facilitators** • Observation & archives (Minutes etc.) • Semi structured interviews (SSIs) • Focus group interviews • Key informant interviews • Key informant interviews • Key informant interviews • Participatory evaluation • Identify what or who acts as a facilitator in a dialogue process • Identify prevailing social asymetries and how they move • Analyse emergence of "intermediary objects" • Participative observation • Reflective meetings with facilitators focusing on methods and tools used • Reflective meetings with researchers involved in intervention research	• Considering social learning is one of the key conditions to increase capacity building in NRM and to involve actors in adaptive management • Facilitation is one of the key conditions to increase social learning processes • to meet ethical rules on the possible influence of facilitators on SH behaviour. • to improve communication among SHs • to trigger stake holding processes and build self-awareness of SHs role in the SOI • to develop an iterative and collective process of learning finalised to ICM and SUW • to prevent the risk of reinforcing existing power relations • to ensure that boundaries are kept open • to develop a space for interaction between SHs