TOOLS AND PROCESSES TO FACILITATE COLLABORATION ACROSS POLICY AND SCIENCE

Applications in the field of water management

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The EU Water Framework Directive has transformed approaches to water management in Europe. It addresses the river basin scale, prompting new approaches that can deal with the water system as a whole. It also promotes the participation of a variety of stakeholders with different interests and types of knowledge. Information and knowledge from diverse sources are the basis for effective evidence based policy making. What information and knowledge is needed from different scientific disciplines to inform river basin management? How can we elicit knowledge from a variety of stakeholders and how can we share this knowledge for water policy and management?

- The PSI-connect FP7 project[1] – Policy Science Interactions: connecting science and policy through innovative knowledge brokering.
- Innovative knowledge brokering – addresses these questions by organizing and evaluating knowledge brokering activities within existing water policy and management processes on regional, national and EU-level.
- Knowledge brokering processes help to bridge the gap between water policy / management and science communities leading to both better evidenced interventions and better informed research agendas in water management / water policy. As an explicitly learning process, implementation of the Water Framework Directive can be facilitated through the use of knowledge brokering instruments.

This article elaborates the findings of the PSI-connect project and its conclusions. It gives recommendations how to develop a successful knowledge brokering process which supports policy-science interactions in the field of water management and climate change.

PSI-connect: project context and objectives

Although large quantities of high quality knowledge on the issue of the impact of climate change on water management have been generated through recent EC RTD Framework Programme projects, this understanding remains poorly exploited by policy makers and water managers. Exploitation should be improved, or as it was concluded in a publication in the journal Science: "Future international scientific climate change assessments should be faster, more integrated and more directly linked to policy questions". [2]

EU policies such as the Water Framework Directive (WFD, Directive 2000/60/EC), the Daughter Directive on Groundwater and the Habitat Directive, provided improvements in our ability to reverse unsustainable trends in natural resources management. In particular, the WFD has radically altered approaches towards ma-

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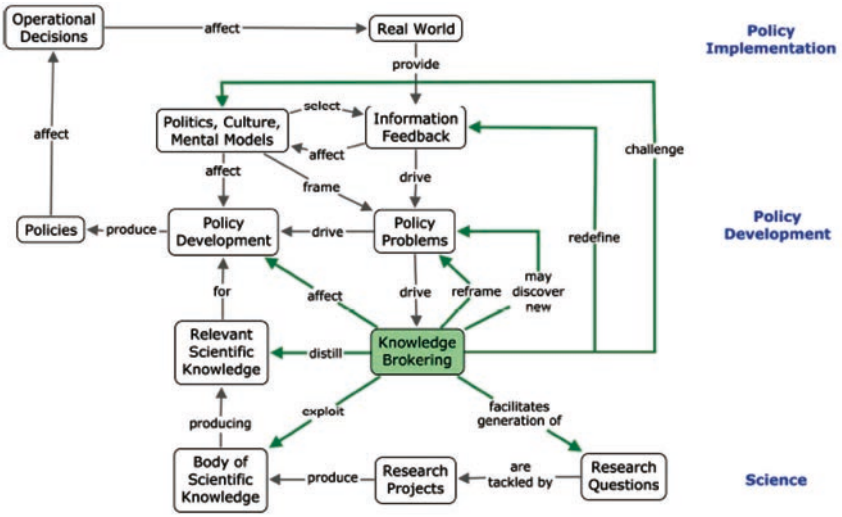

Figure @ :

Conceptual framework for policy science interactions enhanced by knowledge brokering[4]

nagement as it promotes the integrated management of water (and water related) resources based on the natural hydrological unit of the river basin rather than administrative boundaries.
PSI-connect – through experimentation with and development of innovative knowledge brokering instruments – aims to improve the quality and value of interactions between the science base and river basin managers and policy makers in the field of impacts of climate change on river systems (including surface water, sediment, soil and groundwater). The project developed 'knowledge brokering instruments' specific for this purpose and the usefulness and effects of these instruments for science and policy making in relation to the typology and specific context of the management of the impacts of climate change on river ecosystem services were evaluated. The instruments that were tested within the PSI-connect project are: group model building, scenario planning, role playing games and communities of practice.

What is knowledge brokering?

Knowledge brokering in the PSI-connect project is conceptualized as an entangled process of research and policy development and can be understood as an intermediary activity that takes place between the spheres of science and policy. Knowledge brokering is also understood as a social construction process in which production, sharing and use of knowledge is simultaneously taking place and can hardly be separated. Knowledge brokering can directly challenge politics, culture or mental models. It can reveal new ways of thinking or can deliver information that change the way a problem is perceived, and in this way helps to reframe the policy problem. It can also facilitate the generation of (better) research questions and in this way supports to exploit the knowledge base in a better way. In order to be successful Participatory Knowledge Brokering needs to be effective at the basic level of the group process. We assume here that an effective group process helps to transform (at least to some extent) diverse individual mental models into a shared mental model in the group.[3]
The group process is especially important when individual mental models come from very different backgrounds as it is in case of scientists and policy makers. They are embedded in politics, culture and organisational contexts – both intra-organisational and inter-organisational. Shared mental models enable to achieve policy-related outcomes as well as influence the background in which individuals are embedded.
The developed framework in the project helps to identify important policy outcomes resulting from knowledge brokering processes such as better information feedback, improved policy development process, redefined and/or new policy problems and finally initiation of a new policy relevant research.

Knowledge brokering is a participatory process in which scientists from different disciplines and backgrounds work together with policy makers from relevant sectors and domains to create knowledge and information for evidence based policy. Knowledge brokering processes are geared towards joint exploration of problems and research questions, sharing knowledge, and the design and monitoring of interventions intended to address problems. Knowledge brokering processes are typically organised in the very early phase of a policy making or policy implementation process. Knowledge brokering processes can form part of a participatory process but differ from the later as they are not aimed at joint ownership of measures, policies or decisions.

In order to be successful knowledge brokering has to go far beyond a simple transmission of knowledge from scientists to policy makers. The interaction between involved scientists, policy makers, and stakeholders should be shaped as a learning process that allows to develop the understanding of the system and to fine tune the measures that should be undertaken. Monitoring of effects of these measures is needed to better understand the impacts of human interventions in the system. Such a learning process influences the policy process in many different stages. It is generally assu-

med that knowledge brokering contributes to improvement of policies by exploiting the body of scientific knowledge to distil aspects relevant for the analyzed problem. However the scope of knowledge brokering should also be expanded to problem framing: how are problems defined and whose problems are they? This may lead to reframing of these problems and to preventing exclusion of certain groups. Such a process may also discover new problems hidden previously. Knowledge brokering processes may discover gaps in information feedbacks that in turn drive what policy problems come to the political agenda. In this process there is space for development of a common language by different groups of stakeholders especially policy-makers and scientists. It may also lead to challenging stereotypes, understanding alternative perspectives, innovative ideas and commitment to change. Similarly as scientists need to engage in many stages of the policy process, policy-makers need to become involved in different stages of research – not only asking for specific knowledge but also helping to formulate research questions and critically evaluating research outcomes having in mind the need for application in the real world.

In order to achieve the potential outlined above knowledge brokering should be shaped as a group learning process. All stakeholders – actors that have an influence on the problem – should be selected to participate in this process. The presence of diverse individual mental models provides opportunity for many innovative solutions. The process has to be facilitated professionally such that it transforms individual mental models into shared mental model of the group thereby avoiding the danger of so called "groupthink". To this end it is also very important to employ appropriate knowledge brokering instruments (KBIs). The developed conceptual framework is used for a better adjustment of particular KBIs to the case studies in the PSI-Connect project and delivers variables that are important for the evaluation of the case studies. It directs attention on particular stages of the process as well as associated barriers that should be broken down.

The dynamics of the policy process and its context make it difficult to achieve a connection between science and policy that creates an impact of science on the policy process. To wait for the window of opportunity to open in such a context – the moment that politics, policy and science coincide – asks for much flexibility, patience and perseverance from these parties to connect. Timing of the process is in such a situation of decisive importance. If the knowledge brokering activity is organised at the same moment as the window of opportunity is open, the activity can be successful. This moment is however hard to control or to predict, and scientists and policy makers will have to deal with the capriciousness of the political and social contexts. Sometimes this leads to the situation that promising initiatives to connect science and policy are suddenly stalled or even abandoned for instance due to elections, bureaucratic discontinuities, or certain social events. Conditions for a successful knowledge brokering can be created, but the success is dependent on factors that cannot be controlled fully by the parties who organise the knowledge brokering process.

The case studies in 'real life policy situations'

Country	Title case study	Knowledge Brokering Instrument applied
Regional Case studies		
Germany	Future challenges in Buxtehude	Group Model Building
Poland	Flood protection in the Upper Vistula	Group Model Building
The Netherlands	Water defence system polder area Alblasserwaard	Role Playing game
The Netherlands	Water Framework Directive and the preparation of 2nd River Basin Management Plan within the Regional Water Authority Rivierenland	Scenario Planning
National case studies		
Germany	'Water and Climate Network' hosted by the German Ministry for the Environment, Nature Conservation and Nuclear Safety	Group Model Building and Scenario Planning
The Netherlands	'Towards the 2nd River Basin Management Plan' hosted by the Ministry of Infrastructure and Environment	Group discussion and information exchange
European case study		
CIS-SPI group	The Common Implementation Strategy on Science and Policy Interface group is an ad hoc activity on the water science – policy interface in the frame of the common implementation strategy groups for the Water Framework Directive	Role playing game

In the case studies PSI-connect worked closely with policy makers, scientists and stakeholders to identify and characterize the knowledge needs in the addressed policy area. Knowledge brokering instruments have been developed and pretested in the cases in an early stage. Those early applications helped to design sound knowledge brokering experiments.

Seven case studies (knowledge brokering experiments) have been performed: four at the regional level (in Poland, in the Netherlands (2) and in Germany), two at the national level (in Germany and the Netherlands) and one at the EU-level (with the WFD Common Implementation Strategy, Science-Policy Interface group). The table below gives an overview.[5]

In each case study, PSI-connect has:

- worked closely with policy makers and stakeholders to identify and characterise the knowledge needs in the addressed policy area;
- tailored the candidate Knowledge Brokering Instrument to and tested it in specific policy situations in the case study sites; and
- evaluated the functioning and performance of the KBIs in order to determine their effectiveness for supporting policy-science interactions as well as to identify conditions for their successful application.

Each case study event was intensively evaluated and generated a set of three reports and surveys:

- **Case Study Report** prepared by the team delivering the event. Aimed to collect general information about each case study and to describe the overall evolution of the case study process. It focuses on understanding the case study context (i.e. socio-political setting, key stakeholders, decision-making challenge and processes), key steps for initiating, designing and implementing the case study as well as the main barriers and enablers encountered during this process.
- **Designers' Questionnaire Report** containing information about the design of the deployed KBI. It collected detailed information about the experience of the project team which implemented each Knowledge Brokering event in a case study. Questions focused on the objectives of and rationale for the design of the specific event as well as the quality of the interaction process, learning outcomes and policy-relevant outputs. It captured the project team's experiences, including the logic of their research design as well as their perceptions of the factors influencing the successful design and implementation of the various KBIs and activities.
- **Participants' Questionnaire** which was administered to those attending the event following the day's activities. It provided policymakers and stakeholders taking part in the knowledge brokering exercises with an opportunity to reflect on their experiences. Mirroring the Designer Questionnaire, questions focused on participants' experience of the process, learning outcomes and overall benefits of the methods used.

Both the Designer and Participant Questionnaires were completed after each knowledge brokering event. By eliciting both the project team's and the participants' views, we were able to compare the benefits attributed to different KBIs (theory) with our practical experiences (practice), thus exposing any discrepancies between theory and practice and allowing us to identify and further explore relevant barriers, challenges and opportunities for designing and implementing KBIs and related processes.

Conclusions: how knowledge brokering can facilitate policy science interactions

Based on the overall project the following general conclusions were drawn.

Making the connection between science and policy

Making the connection between science and policy starts with building mutual trust and commitment, which takes quite some time (months).

The connection between science and policy is quite sensitive for timing. Therefore, the connection should be made if a certain policy issue is "urgent", if incidents occur, or if a next step in policy development is forth coming.

Flexibility on the side of the researchers and facilitative leadership on the policy side are prerequisites for the connection between the two. The facilitative leadership on the policy side is performed by a person who has a good overview of the policy issues involved, the 'sense of urgency' of these issues, is well respected in the organization and has easy access to the decision makers in the organization.

Different governance levels require different science policy interfacing processes

The processes differ per governance level and require a different approach and/or timing for the connection between science and policy. The EU level, for instance, requires abstract scientific information or scientific evidence on a "framework level". On the regional level, there is a need for more detailed scientific information, "water system information" and monitoring as at this level the regulations are being implemented.

The flow of scientific information between the involved levels of governance requires attention, as we have seen that these flows are not established "automatically". For instance we have seen in the

project that in the context of the Water Framework Directive, information exchange about science-policy practices was not shared between the involved levels, while they could have benefited from that.

Keeping the connection

An established connection between science and policy can be lost when policy urgency for a certain topic changes, when organizational structures are shifting and when people move to new positions. In the project we experienced these different types of disruptions. Only the shifting of political priorities turned out to be a real loss of connection. In the other cases it meant serious delay and extra time investment to make the connection to new people.

Involving stakeholders in the research process

Involvement of stakeholders in the research process is needed to acknowledge different perspectives on the problem and solutions. To enhance both problem focus and relevance of research, stakeholders should be asked to articulate their questions relevant for the problem and should be continuously involved during the research process.

The knowledge broker

A knowledge broker is a professional with good communication skills, a broad background, who can operate between domains, and knows the languages of the domains.
Various people in a group can act as knowledge brokers representing their domain. However, we found that often there is no 'one person' that overlooks the whole system or process. This is an extra argument for a broker who is specifically responsible for the complete process and can make the connections between the parts.

Knowledge brokering instruments

The knowledge brokering instruments we applied in the various policy trajectories or events work well. The evaluation of the case studies shows that knowledge brokering instruments foster:

- the sharing of experiences and knowledge,
- the integration of different types of knowledge,
- and the generation of new views and knowledge

They open a wider scope of problem perceptions and interests of different actors. Not the instruments, but the process that is unrolled by the instruments leads to these impacts.
The process needs a facilitator to apply the knowledge brokering instruments properly.
The processes help to create knowledge and generate new insights in how to change water management and related policy and research processes. Especially this "change character" of the processes requires extra attention.

Lasting results

The knowledge brokering processes that were developed in PSI-connect lead to changed insights and new ideas of organizing the knowledge. If these new insights are not firmly embedded in the institutions, they will not last. If we look at it from a change management perspective, we need to look for a "sponsor of change" on a high level in the organization.
Organizations who have organized specific strategic units that deal with the strategic role of knowledge for their organization are most likely better equipped for the knowledge brokering tasks.

Recommendations for future knowledge brokering processes

Based on the conclusions from the PSI-connect project, recommendations were developed how to develop a knowledge brokering process in future, what roles within this knowledge brokering process need to be taken up and how to organize such a process.

Requirements for a knowledge brokering process

A knowledge brokering process that connects science and water policy will involve the relevant research and policy communities and can be relatively straightforward depending on the problem situation. Contrastingly, a knowledge brokering process that connects different types of knowledge to river basin management requires the involvement of scientists, policy makers and stakeholders from the area. This process will generally be rather more complicated and will require a higher budget than that needed for activities at the science – policy interface.

Following specification of the type of knowledge brokering process to be undertaken, a decision can be taken about the communities to involve as well as the available budget and time frame. The next step is to secure support for the process, not only internally but also externally. Conversations with key individuals in the policy making organisation should be initiated and – if the activity is focused on river basin management – with opinion leaders in the basin region. These conversations should include discussion of both the benefits of a knowledge brokering process and the potential pitfalls.

Important roles in a knowledge brokering process

Based on the project there are three important roles that can be distinguished: the facilitative leader, the knowledge broker and the facilitator. These roles will be described below.

The facilitative leader – The facilitative leader is a high level contact person in the policy organisation who helps pave the way for the knowledge brokering process. He/she has a good overview of the policy issues involved and a well-developed 'sense of urgency' for these and is well respected in the organisation having access to decision makers.
The facilitative leader helps to identify and engage appropriate contacts in the organisation, arranges meetings and is the supporter for knowledge brokering in the policy counterpart. He or she should have decision making power, for instance, on how to organise the process and whom to involve.

The knowledge broker – If the connection between science and policy is important for an organisation, it is advised that a specific individual is appointed in the role of 'knowledge broker'. The knowledge broker is a professional with good communication skills and a broad professional background who can operate between scientific and problem domains and is proficient in the terminology and professional languages of those domains. This person would ideally have worked in both the policy and scientific communities. The knowledge broker mediates between science and policy, organises specification of the organisation's scientific information requirements, connects different policy domains and knows where to find the appropriate scientific information. He/she must overlook the process and have an eye for 'the whole'. Knowledge brokers act as the "lubricant" for the knowledge brokering process. However, as their value is difficult to "measure" their position and budget are likely to be challenged regularly.
When looking at the capabilities of the knowledge broker, he/she should be positioned at quite a strategic ("high") level in the organisation. In fact, knowledge brokering is an important strategic function for the organisation.

The facilitator – The facilitator is the independent person who designs and organises the knowledge brokering activities, facilitates meetings and keeps an eye on all process aspects. He or she should be a skilled facilitator in knowledge brokering processes, for instance, from consultancies specialised in mediation. It is highly important that this person is accepted and trusted by the involved participants and has no stake in the problem or interest in the cooperating organisations.

How to organize a knowledge brokering process

Once support is secured for a knowledge brokering process, the question is how to design the next steps of the process, and plan the use of the most suitable knowledge brokering instrument. The project has given insight in how to take up action in different phases: initiation, design and execution. They will be described hereafter.

Initiation

1. Find the policy maker contact
   Identify who is responsible for the policy problem and explore his/her interest in conducting a knowledge brokering process via an interview. If there is interest, make an appointment to conduct further interviews.

2. Explore the policy problem and select the stakeholders
   Conduct interviews to explore who can act as the facilitative leader, diagnose the policy problem, understand the most urgent policy issues and identify the most influential actors.
   Plan the interview with the policy maker contact, for instance, preparing a list of topics for discussion and of interviewees, considering both internal and external stakeholders.
   Investigate the laws and regulations that are applicable to the specific policy problem and which procedural steps have to be followed.
   Look for the opportunities to link the knowledge brokering process to these steps.

3 Start the knowledge brokering process
Start the process with the contact person when:
- knowledge is available and
- knowledge is not shared between the actors or actors have distinct problem perceptions or different visions on the problem and
- they are willing to spend time for knowledge brokering.

These questions should be answered from the interviews. If a positive decision is made, the design phase follows.

Design

1 Identify the facilitative leader
The facilitative leader will act as the contact person for the knowledge brokering process and will guarantee commitment and ownership from the organisation. He/she can be the person initially contacted or someone identified during the interviews.

2 Appoint the facilitator
Select the facilitator who should design the process in consultation with the facilitative leader and/or the stakeholders.

3 Allow for time
If the interviews show that the perception of the problem is divergent, and/or the involved communities are disconnected, the process should take more time (at least six months) allowing for a common sharing of problem perceptions, development of a common language and a "community feeling". Such a process should contain several steps to develop the connection between the knowledge and policy. If a community has already been established, the process is less time consuming.

4 Define a plan
Make a clear plan that forms the 'process agreement' involving all participants as early as possible, ideally starting when problems and goals are identified. Record the 'rules of the game including timing, steps, goal(s) of each step, results of the process and time and commitment required from participants. Before starting the process, participants should approve the plan with their signature.

5 Choose the Knowledge Brokering Instrument
Knowledge Brokering Instruments (KBIs) are tools to facilitate the knowledge brokering processes which level of effectiveness depends on the typology of the knowledge problem and the time that participants want to invest in the process. Four types of KBIs are presented in the table hereafter: Group Model Building (GMB), Scenario Planning (SP), Role Playing Games (RPG) and Communities of Practice (CoP). In order to decide which KBI, or combination of KBIs, will be used, the interviews should provide answers to the problems identified in the table below:

Execution
Workshops are the suitable format to conduct KBIs as they provide face-to-face opportunities to exchange and discuss knowledge. It is important to:

1 Keep the knowledge brokering process flexible and transparent so that it can be adjusted to unexpected changes, and that this is discussed with the participants that are part of the process.

2 Create an open atmosphere for participants to feel comfortable to share their views and opinions, which in turn permits co-creating knowledge.

Problem?	GMB	SP	RPG	CoP
Knowledge is not shared	X	X	X	X
Experience is not shared			X	X
Divergent perceptions of problem and solutions	X	X	X	
No common vision on the problem		X		X
System and its boundaries are not clear	X			
Obstacles in the system not clear	X	X	X	X
Uncertainty about the future situation		X		
Roles are not clear		X	X	X
Time consumption	Low to High*	High	Low	Medium

Table @

Connecting the KBIs to the problems addressed in the process including time consumption[6]

* GMB can be done in relatively short time (one or two sessions) but is more effective when more time is dedicated conducting a series of sessions.

3 Promote lasting results through for instance the development of an action plan or make sure that the knowledge and insights resulting from the knowledge brokering processes are firmly embedded in the institutions and organisations.

Outcomes of a knowledge brokering process

In the end of course it is about what the outcomes can be of use in practice! These arguments are important to promote connecting science and policy. The PSI-connect project has delivered insight in why the outcomes are of added value. It is key that knowledge brokering leads to better cooperation on "fragmented problems" and makes sharing and co-creating knowledge possible. The recommendations show how the lessons learnt are translated into a practical hands-on approach.

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3 Buchel B. & Moos I. (2007), "Facilitating groups to drive change". Palgrave Macmillan.
4 Magnuszewski P. (CRS), Sodomkova K.(CRAN), Slob A. (TNO), Muro M. (CRAN), Sendzimir J. (CRS) and Pahl-Wostl C. (UOS), 2010. Report on conceptual framework for science-policy barriers and bridges. Final version 22.12.2010 of deliverable No. 1.1 of the EC FP7 project PSI-connect. EC contract No. 226915. July 2010, Delft, the Netherlands.
5 Henriques, C. (Cranfield); Slob, A. (TNO); Jeffrey, P. (Cranfield). Recommendations and guidance generated through cross-level workshop and knowledge brokerage collectives. Final version of deliverable No 5.2 of the EC FP7 project PSI-connect. EC contract No. 226915. April 2012, Cranfield, UK.
6 Slob, A. (2012), Collaborative tools and processes for connecting policy and science – Hands on approach, booklet PSI-connect.

COOPERATION ON "FRAGMENTED" PROBLEMS

Knowledge brokering processes lead to better cooperation between policy makers, researchers and stakeholders. The process by which collaboration happens does not follow standard institutionalised paths allowing for a diversity of stakeholders to be involved. Planning and decision making is usually a sector specific, top-down activity which typically involves stakeholders only at a later stage in the process. KBIs bring together policy makers and/or stakeholders from highly fragmented policy processes at a very early phase of decision making (problem exploration). Participants from different backgrounds that do not usually work together will be able to share different types of knowledge and insights. Moreover, participants also get to know each other and may maintain such contact in the future.

SHARING AND CO-CREATING KNOWLEDGE

PSI-connect case studies have been very successful at:

- Sharing knowledge;
- Integrating different types of knowledge;
- Generating and co-producing knowledge.

The evaluation of the Role Playing Game has shown that playing a different role forces discussion and negotiation from different perspectives. Effective learning experiences were reported by participants that played someone else's role during the game. Some participants combined their existing knowledge with newly acquired insights about other roles in order to suggest next steps or even to create new solutions for a problem. In another case study, Group Model Building was used in a setting in which initially one cause of the problem was of concern. During the workshop a wide range of causes was explored, false assumptions were clarified and discussions brought common understanding.