CIRCLE-2

Productive Science-practice Interactions in Climate Change Adaptation

Lessons from practice

A CIRCLE-2 research policy brief

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Lessons from practice

The ERA-Net CIRCLE-2

Box 1

From 2004-2009, and from 2009-2014, partners of CIRCLE (Climate Impact Research & Response Coordination for a Larger Europe) and CIRCLE-2, respectively, have collaborated to fund research and share knowledge on climate change impacts, vulnerability and adaptation and the promotion of long-term cooperation among national and regional climate change programmes in Europe. The partners have funded or are funding projects or programmes of varying size at the national level (see CIRCLE-2 Infobase http://www.circle-era.eu/np4/10) and have, through competitive joint calls, supported a number of transnational projects for the Nordic, Mountainous and Mediterranean areas, the latter including partners from Northern Africa (see http://www.circle-era.eu/np4/Joint_Initiatives).

The objective is to develop and strengthen the coordination of national and regional research programmes and help reduce fragmentation across the European Research Area (ERA). Under the ERA-NET scheme, programme 'owners' (typically ministries or regional authorities) and 'managers' (typically research councils or other research agencies) can identify research programmes they wish to coordinate or open up and develop joint activities including the support of joint calls for transnational projects. Having evolved from a focus on climate impacts to climate adaptation, CIRCLE-2 comprises 34 institutions from 23 countries (http://www.circle-era.eu/np4/home.html) that work together to:

- support a common research agenda and joint programming foresight activities helping to structure a common language and framework for policy relevant adaptation research;
- fund adaptation research though transnational joint calls and other joint activities contributing to a durable cooperation between European climate research programmes and their funders;
- make available existing knowledge on adaptation and foster the production of research along identified needs contributing to the development of a European knowledge base on Climate Change. ■

1. Introduction

The purpose of this policy brief
As with many complex societal challenges, climate change adaptation calls for productive, direct science-practice interactions. Science-practice interactions are the different ways in which scientists, policy makers, practitioners and other stakeholders communicate, exchange ideas, and jointly develop new knowledge to inform policy and decision-making processes as well as to enrich climate change adaptation research. For pragmatic reasons, in this research policy brief the term science-practice interactions is used to capture both interactions between science and policy (developing adaptation policy), and between science and practice (implementing adaptation).

There is a growing body of scientific and practical knowledge on climate change adaptation. However, learning from it and applying it in different adaptation situations is still in its infancy. Not all knowledge is equally relevant for use in practice and in different adaptation situations. One reason is that the specific knowledge needs and processes of knowledge production are often not well aligned (Kirchhoff et al. 2013). A way to address this problem is a better interaction between research, policy and practice.

The aim of this research policy brief is to present recommendations for productive interactions between researchers, policy makers, practitioners and other relevant stakeholders, based on lessons from practice. To learn more about what is actually required for productive science–practice collaborations in climate change adaptation, leading experts of pioneering climate change adaptation programmes and other initiatives were interviewed. Selected quotes from these interviews are included. In addition, this policy brief is based on a scientific literature review as well as on the results of more than 30 science-practice sessions during the 1st European Climate Change Adaptation conference (ECCA) in Hamburg in March 2013[1]. Although selected references are provided for further reading, this brief is not a scientific publication, but aims to provide practical information to design and implement collaborative science-practice projects in the area of climate change adaptation.

More or better scientific research results on climate change will not automatically result in the development of more effective adaptation policy, better adaptation decisions by decision makers, or better implementation of adaptation actions by practitioners. In many cases, scientists and practitioners 'co-produce' new knowledge by jointly defining questions and maintaining frequent interactions (Moss et al., 2013). National research programmes such as the Dutch Knowledge for Climate and the German KLIMZUG programmes are pertinent examples of this in Europe. Many projects however, still struggle to take into account the culture, knowledge needs, vocabularies, constraints, roles and perspectives of policy makers and practitioners, in particular in the design and planning of the research. The institutional separation of adaptation research, policy and practice makes the alignment of these processes challenging. Researchers, policy-makers, and practitioners work in different, but interacting and dynamically evolving environments. This difference is compounded by significant differences in the timescales according to which they work, ▸

[1] *http://eccaconf.eu/index.php/page/ECCA*

the language they use to describe phenomena, issues and needs, the reward systems in place and their different perspectives on how and what knowledge and information to use (e.g., Caplan, 1979).

> **'Climate change and climate adaptation have some features that make productive science–practice interactions challenging. These features include the presence of misinformation and skepticism about climate change, people's typical reactions to uncertainty, and variations in the capacity for long-term planning, as well as other issues.' (Gardner, 2009).**

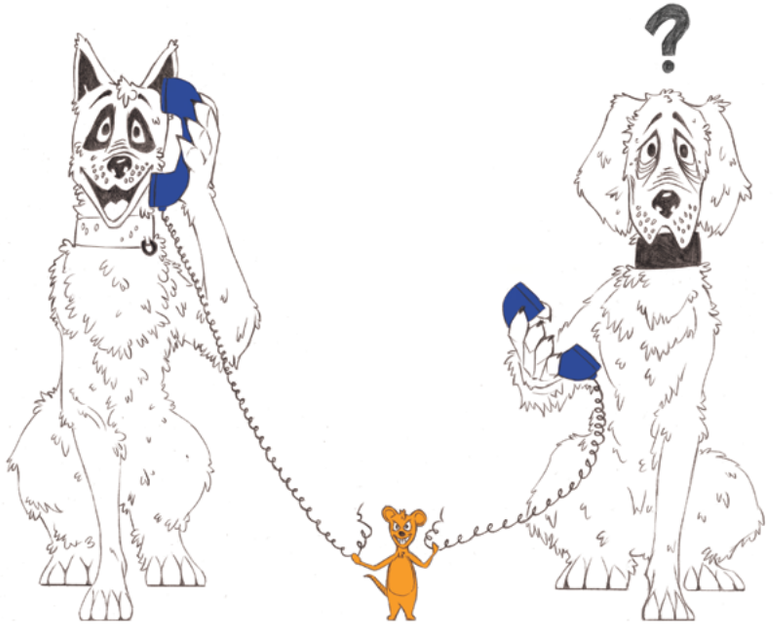
For scientific information to become useful and applicable, mechanisms need to be established that facilitate communication, translation and mediation between researchers, policy makers and practitioners (Box 2 on page 6 provides definitions of relevant actor groups as used in this policy brief). This includes not only ensuring that scientific information is relevant to policy demands and is formulated in a way that is accessible to policy makers and practitioners, but also making sure that they take this information into account and, vice versa, formulate their demands or questions in a way that is understandable for scientists. This task is anything but simple.

What are productive science-practice interactions?

Productive interactions are defined here as exchanges between researchers and stakeholders in which knowledge is produced and valued as being scientifically robust and socially relevant. These exchanges are mediated through various communication channels, for instance, a research publication, an exhibition, a design of an adaptation process, involvement of particular people or financial support. The interaction is productive if it leads to efforts by stakeholders to use or apply research results in decision making or action and if it enriches scientific research. Societal impacts of scientific knowledge could be behavioral or policy changes that would not have happened without this knowledge. These changes may involve human well-being (quality of life) and/or the social relations between people or organizations (Spaapen and van Drooge, 2011). Climate change adaptation knowledge has to pass a double test: that of scientific reliability and that of societal relevance. More particularly, productive science-practice interactions should (Young et al, 2013; ODI, 2006):

- facilitate timely and coherent translation of research into policy options or advice;
- facilitate rapid uptake of research results by policy makers and/or practitioners;
- alert policy makers and/or practitioners about emerging issues;
- contribute to the scientific quality control process by allowing critical assessment of scientific outputs in light of users' needs and of other types of knowledge;
- enhance strategic orientation of research in support of policies and societal issues;
- allow for exchange and co-evolution of scientific, policy and practical knowledge, in a dynamic fashion;
- fit within the political and institutional limits and pressures of policymakers, and resonate with their assumptions, exerting sufficient pressure to challenge them.

Close collaboration between researchers, policy makers and practitioners is the way forward to improve all these elements. It can take various forms and degrees of interaction, ranging from consultations to joint fact finding or joint implementation.



Sustain continuous two-way interaction.

Who is this policy brief for?

A potential reader is anybody who is professionally engaged in adaptation to climate change, and who would like to learn more about productive science-practice interactions. The initiative to consciously work towards better science-practice interaction can come from many different sources. However, none of the relevant actor groups can achieve adaptation alone. Science-practice interactions by definition require scientists, policy makers and practitioners to interact in productive ways. In order for science-practice interactions to be productive, all actors engaged must be open to recognize and understand the roles, perspectives and knowledge of the other actors, and be willing to provide all relevant information required - and change views, if needed.

Thus, this policy brief targets researchers, policy makers, stakeholders from business and non-governmental organisations, programme developers, research funders and boundary workers who are involved in climate adaptation (research) programmes and projects. The recommendations presented in this policy brief are also intended to feed into the future programming of climate change adaptation research funding, e.g., by partners of CIRCLE-2 (see Box 1 on page 2), the Joint Programming Initiative (JPI) Climate, the EU Horizon2020 programme and other national, European or international research funding networks and organisations.

This policy brief is organized around core areas of productive science-practice interactions. Recommendations are formulated for (1) the starting up phase of problem-oriented adaptation research projects, (2) their implementation, (3) communication, (4) dealing with uncertainties, and (5) a next generation of adaptation research. The policy brief finishes with (6) conclusions and a future outlook. ■

Box 2

Most important actor groups involved in problem-oriented adaptation research

Recognizing that different definitions of various actor groups exist in the domain of climate change adaptation, in this policy brief the following groups are distinguished (Capela Lourenço et al. (in press); Pohl and Hirsch Hadorn, 2007)

Researchers: Scientists involved in research projects with the aim to advance knowledge, usually in universities or public or private research institutes.

Funders: People, or agencies, planning research programmes and funding research projects.

Policy makers: People developing policies in governmental institutions or people developing business plans in private firms. Rather than making decisions, this group prepares and supports decisions to be taken by decision makers.

Decision makers: People making actual decisions, such as politicians (parliamentarians, city council members, ministers), company managers. While they may not have time and interest themselves to personally engage deeply in science-policy interactions, they can enable policy makers to do so. Recognizing that their role can vary according to the adaptation situation, in this policy brief, societal interest groups such as environmental NGOs are also assumed to be part of this group, as they can be regarded as mainly influencing other actors.

Practitioners: People involved in the implementation of adaptation, for examples engineers, local authorities, water managers, urban planners, farmers, architects and consultants.

Boundary workers: People with the role of improving interactions between scientists, policy makers and practitioners. Working on the interface between research and policy, they act as intermediaries assisting stakeholders in specifying information requirements, eliciting and sharing knowledge and can help to jointly generate new knowledge. Boundary workers are sometimes also referred to as knowledge purveyors, knowledge brokers, interface workers or process facilitators. They can have a background in research, policy or practice.

This policy brief, where relevant, distinguishes between recommendations for the group of researchers and boundary workers together on the one hand, and for policy makers and practitioners on the other. Both sets of recommendations would be relevant for the programming and funding of research, e.g., in the form of terms of reference for proposals or criteria for reviewing project proposals. ■

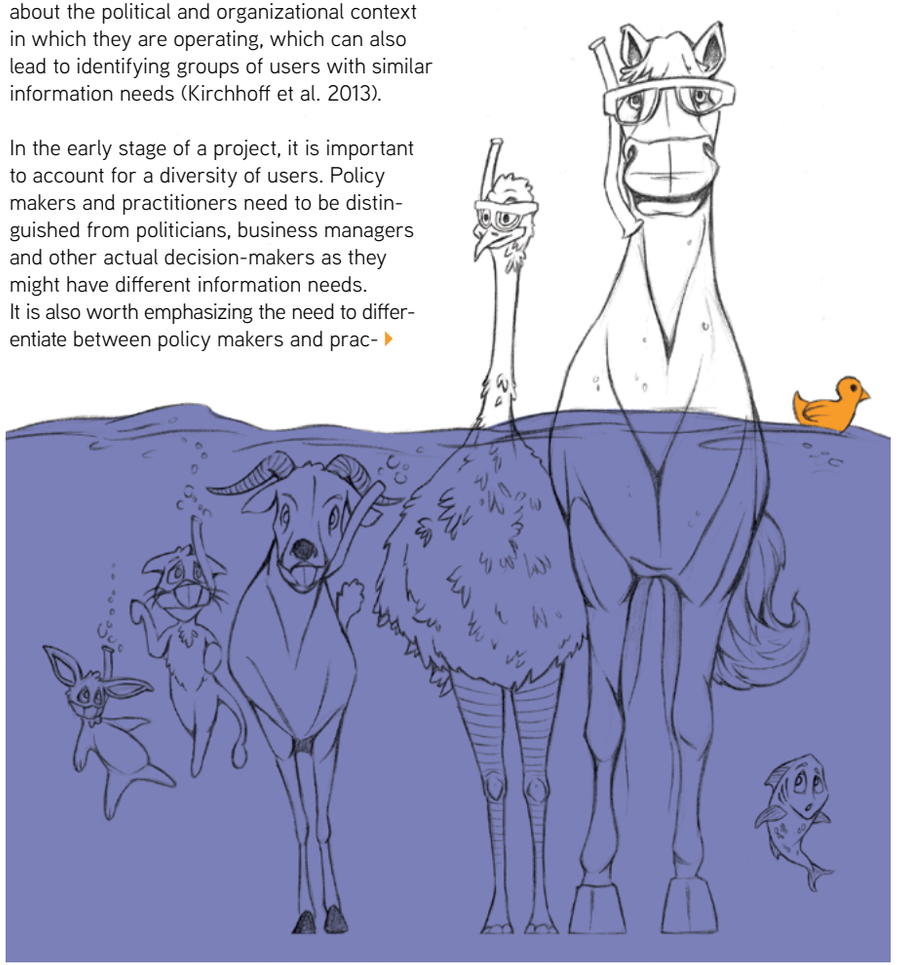
2. Starting up

Identify the users of the research and develop understanding about the context in which they are working and the decisions to be made

Researchers and boundary workers setting up a problem-oriented adaptation project need to identify all relevant users of the project output and to develop understanding about the political and organizational context in which they are operating, which can also lead to identifying groups of users with similar information needs (Kirchhoff et al. 2013).

In the early stage of a project, it is important to account for a diversity of users. Policy makers and practitioners need to be distinguished from politicians, business managers and other actual decision-makers as they might have different information needs. It is also worth emphasizing the need to differentiate between policy makers and prac- ▸

'Activities such as workshops, lunch meetings, conferences where policy makers meet adaptation researchers, are all important to create and maintain an effective science – practice community.' (boundary worker)



Develop a strategy to address different needs.

titioners at various governance levels as policy makers or practitioners at the municipality level might require different climate information than those operating at the national level. In the beginning of a project, researchers need to map the potential users, get to know them, their agendas, constraints and the decisions to be made. Before starting to build a relationship with the users it is useful to think about different ways in which the interactions can be designed. Box 3 on the next page presents experiences from the ECCA.

To deepen the understanding about the political context in which the users are operating, researchers and boundary workers need to map relevant policies, plans, laws, regulations and procedures. Climate change adaptation is usually but one item on the decision makers' agenda, competing for priority and resources (staffing and budget) with issues that are often considered to be more urgent. Adaptation will, at least in part, be addressed by pre-existing policy sectors such as water management, agriculture, nature conservation, public health and spatial planning. Researchers or boundary workers therefore also need to understand the organizational context and how climate change adaptation is integrated in the policy agenda of the different sectors. This will help researchers and boundary workers to identify possibilities of mainstreaming climate change adaptation into other policy domains and plans. By carefully listening to the policy makers and practitioners, researchers learn about relevant information on the decision-making context for which research results are being produced.

Researchers often have a naive or little understanding of the complexities of policy-making and decision-making processes. Some assume that informing policy is a unidirectional and direct process. They consider science and politics as clearly distinguishable and independently evolving worlds, where the former deals with facts and the latter with values (Leroy et al., 2010). Recently, however researchers, policy makers and practitioners increasingly tend to view the relationship between science, policy and practice to be more dynamic and intertwined, especially in areas related to societal challenges such as climate change. Scientific research can affect decision making and, in reverse, decision making influences the production of scientific knowledge in which none of both is superior to the other (Dewulf et al., 2011). In order to effectively support policy and decision making, researchers need to develop knowledge on the opportunities and timing for providing research input into the decision-making process.
In turn, policy makers and practitioners also have to take their responsibility when they want problem-oriented research to produce knowledge that is useful for them. Experience shows that researchers often have to start from scratch with identifying relevant stakeholders, their policy priority areas and their information needs. Usually little or no information is available on stakeholder websites to quickly find out about their user requirements – as a consequence the potential users of adaptation research projects are typically identified only in the later stages of a project (Neßhöver et al., 2013), e.g. well after research grants have been committed. Consequently, it can be too late to build the necessary relationships, establish trust and specify user needs adequately. Similar challenges are described by Bento et al. (2013) in their analysis of a number of projects from the CIRCLE-MED network, the regional network of CIRCLE focusing on the Mediterranean area. In order to effectively support decision making, policy makers and practitioners need to (Neßhöver et al., 2013):

- develop better information sources for researchers to quickly obtain a good overview of the policy context (e.g. websites);
- be more often involved in the formulation of research tenders;
- organise events for (groups of) research projects to inform them about the policy context;
- plan and commit to regular exchange with other users and the researchers.

Box 3

Experiences with science-practice Interactions from the ECCA

Experiences with science-practice interactions reported during the 1st European Climate Change Adaptation Conference (ECCA, Hamburg, March 2013) show a range of formats:

A) Informing partners - one party (i.e., scientists) determines problem-oriented research questions and, based on research, proposes a strategy to address the problem. The proposal is then discussed with other parties (i.e. practitioners, stakeholders) to reach acceptance for the proposed strategy.

B) Active exchange with partners – while the problem-oriented research questions are still mainly determined by the scientific community, regular exchanges with other parties (i.e. practitioners) are organized from the start in order to develop a meaningful response strategy that will get support from the stakeholders (user consultation).

C) Joint development of research needs – from the very beginning, all relevant parties are engaged actively in a process to jointly determine problem-oriented research questions and subsequently develop a strategy to address the problem ('co-production' of knowledge, sometimes from a scientific perspective referred to as transdisciplinary research).

Group discussions during the conference focused on the importance of a stepwise exchange (i.e., each 'interest group' needs to go through an iterative process to clearly articulate their adaptation questions and then – as soon as possible – start the exchange with the other).
The attendees especially recommended workshops as an efficient way to start an active exchange between scientists and practitioners. If many stakeholders are involved, or if sensitivities are expected, it seems sometimes justified to work with a 'Memorandum of Understanding' at the beginning of the process, in order to clearly define roles and responsibilities and avoid confusion and conflicts later on. These findings are consistent with other publications on science-practice interactions in the literature. ■

Source:
http://eccaconf.eu/index.php/page/ECCA

Organise needs assessment
In a needs assessment, researchers and boundary workers closely interact with the potential users to find out which data and information they require for supporting adaptation decision making. To align knowledge supply and demand, it is essential for researchers and boundary workers to start projects with an open discussion with all relevant users on the climate data and information needs and how to accommodate these. To avoid generation of information and data which are finally not being used, it is important to ask the 'why question' behind the 'what question'. Such probing questions will help to understand how the climate data or information will be used in practice, or in the policy or decision-making process. The type, form, time-frame and scale of information required have to be specified. This articulation of knowledge needs is stepwise and might start with a somewhat unclear picture of what information is actually needed by the users and what knowledge can actually be provided by the researchers to answer a question.

For researchers and boundary workers it is important to acknowledge different types of stakeholders when assessing their data and information requirements. For example, a distinction between policy makers operating at the national level and at municipality level should be made, as their needs might differ. Policy makers usually prefer to have more detailed information than politicians or other decision makers, but also need aggregated data, e.g., in the form of risk maps to communicate with politicians. Water board engineers are familiar with the use of complex outcomes of hydrological model to support decision making, but professionals working for a NGO might prefer simpler drought risk maps.

> **'See the planning of the research project and its design also from a different angle. To what extent does it help in developing ownership and long term collaboration with practitioners?'**
> **(boundary worker)**

Box 4

Identifying user needs: requiring recurrent interaction between providers of information and users
In the beginning of the Dutch Climate Atlas project, the user needs were not very clear (Goosen, 2013). The local policy makers asked for information on drought and drought risks. Initially, the researchers had developed maps showing the water scarcity in the soil for two climate scenarios. Feedback on the research results made clear that the policy makers required information about how ground water flows would change over time. They also needed information on the location of drought sensitive crops and ecosystems. In the end, the researchers developed a vulnerability map in which three indicators were combined (drought tolerance of crops, water scarcity under two climate scenarios and ground water flows). However, as the effects of drought on agriculture and nature are different, there was a need to further investigate if both domains were to be considered. Moreover, the concept of drought is complex and involves ground water flows, water storage capacity of soils and water uptake by plants. Also there was a need for clarifying the specific requirements in relation to the decisions for which the new information is to be used. ■

Source: personal communication Hasse Goosen, project leader Dutch Climate Atlas project; Goosen (2013).

A user needs assessment is a time consuming activity and requires intensive interaction between researchers and the users. As policy makers or practitioners operate in a dynamic world, their information needs might change during the project. They usually can only be articulated in a stepwise manner (see also Box 4). Therefore, discussions on information requirements need to be considered a recurrent activity within the project. Consequently, the research design should be sufficiently flexible to accommodate new needs in the course of the project. Moreover, it should be monitored if policy objectives have changed during the research project. This does not necessarily mean one should change the research focus radically, but if needed one could address revised objectives or priorities in the project's final discussions and summary.

When information and data needs have been clarified, it is useful to map the data and information that is already available. This type of existing knowledge, which is sometimes referred to as 'first generation-knowledge', is useful for many general and tentative decisions. Then when it comes to e.g. implementation, new, 'second or third generation knowledge', i.e., on managing information flows, contextualizing, and embedding know-ledge into organizational decision making and processes, might be needed. For policy makers and practitioners it is important to discuss and agree with the researchers or boundary workers the conditions under which they can participate actively in the project, what level of commitment can be guaranteed and what type of interaction is preferred. Is a long-term involvement worthwhile or is participation for a short term sufficient? How to ensure rele-vance of the project's outcomes? Are there intermediate outcomes which are interesting and how and when are these outcomes communicated? How does the project design build in essential feedback loops in which policy makers and practitioners can give input and feedback to intermediate findings?

Be clear about different roles – manage expectations
Policy makers and practitioners should be realistic in their expectations about which questions scientists can answer. This can be because current scientific understanding is insufficient or because the questions may be policy rather than research questions. A question such as 'when will climate change adaptation be sufficiently dealt with in the city?' requires a political response and cannot be answered by researchers. 'What will be the future impact of climate change on the recreation sector?' cannot be answered in a meaningful way as the future of this sector is influenced by a range of factors of which climate change is but one. When asking scientists for an answer, there might not always be a simple solution or a number, the question may not be solvable within the timeframes and budgets available, or the answer may not match the priorities or views of the policy maker or practitioner. It is nevertheless important that such questions are posed, and that scientists learn to interpret these questions – not necessarily to provide an answer, but to have a starting point for dialogue on what is possible to provide.

In addition, at an early stage of their interactions, researchers, policy makers and funders should clarify towards each other their respective different expectations, perspectives and ambitions with respect to the aims of a project, how these aims can be mutually supportive or interrelated, and how possibly conflicting aims can be dealt with. The different roles in an adaptation process of scientists and boundary workers on the one hand and policy makers, practitioners and decision makers on the other hand should be acknowledged and reconciled. In the end, the scientists' role is to provide credible knowledge on the range of decisions one could make and on the various effects of these decisions. ■

> **'Successful science-practice interactions include learning about each other, developing mutual understanding.'**
> **(researcher)**

3. Implementation

Facilitate knowledge co-creation
Science-practice relationships do not follow a simple linear model, policy makers and practitioners also possess relevant knowledge for climate change adaptation. However, this process needs to be actively organized and professionally facilitated because representatives of different domains need to interact productively. Some of these actors may not have much experience in knowledge co-creation and do not exchange on a regular basis outside of their own profession. As a result, when designing a knowledge co-creation process, a number of considerations should be taken into account by researchers, boundary workers and other actors involved. It is not enough to merely have researchers, policy makers and practitioners sit at one table. The process of their interaction needs to be actively organized, supported and structured by using suitable methods (for examples see Table 1 on the next page). As the actors have different organizational backgrounds, languages and working styles and above all, only limited resources and time, the use of professional facilitation in the knowledge exchange process is key to productive outcomes.

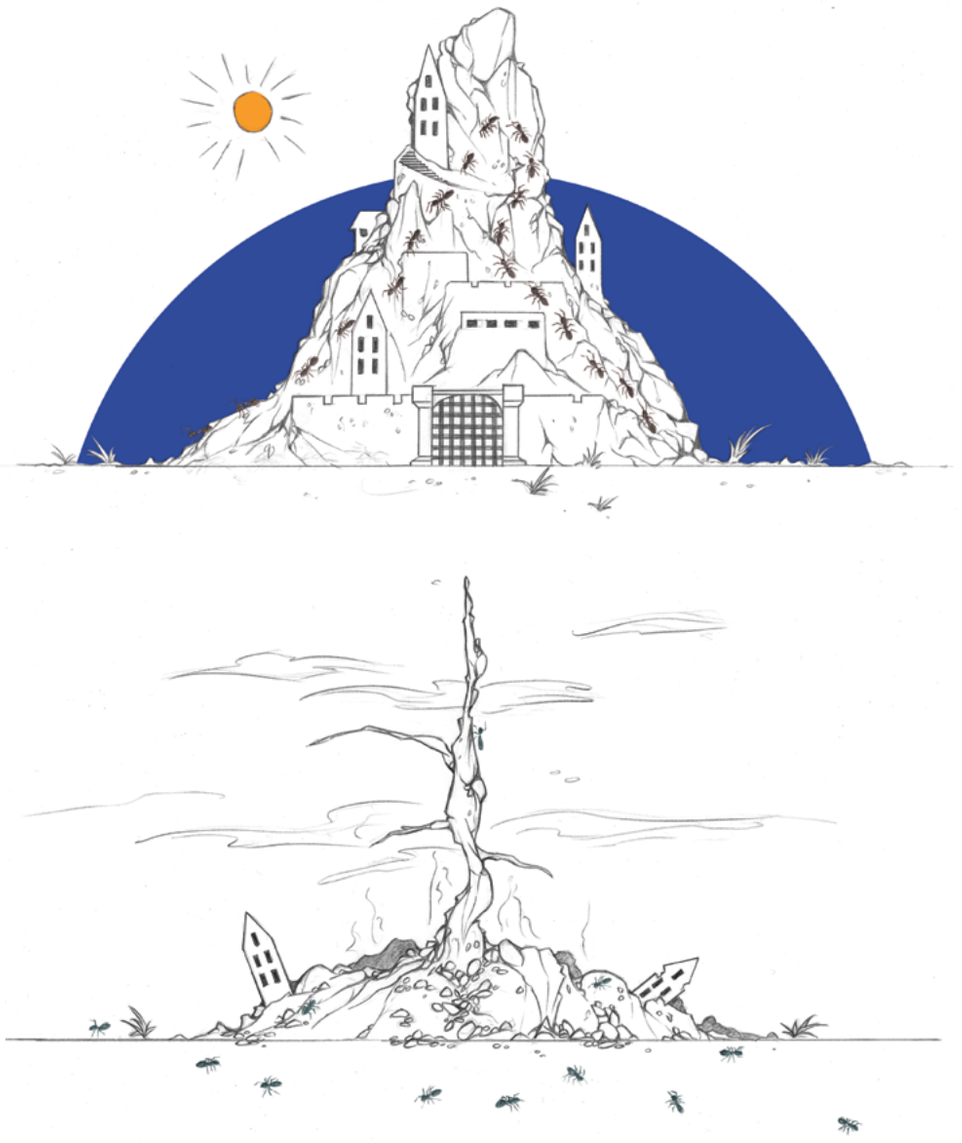
Apply suitable methods to support productive exchanges and mutual learning
It is not so much the choice of a single best method (Reed, 2008) alone that determines if exchanges are fruitful, but any method chosen should provide for repeated exchanges or feedback loops before agreeing on a final result. In this context it is important to emphasize that participation is a process and to ensure the quality of this process by focusing on creating trust, equality and opportunities for mutual learning. Mutual learning can be supported by repeated two-way interactions, for instance encompassing formats such as training sessions, joint scoping studies or project deve-lopment sessions, a joint criteria catalogue or participative modeling (e.g. examining the consequences of decision-making in a computational simulation model). There are numerous methods facilitating knowledge co-creation that can be explored. Table 1 on the next page gives some exampes. For a rich source of empirically tested examples on integration methods and strategies, also see the primer for practice from Bergmann et al. (2012).

Making the project focus on concrete or tangible outputs and solutions
Making the project focus on concrete or tangible outputs and solutions (which can be observed or even touched) can help facilitate the process of knowledge co-creation. An example is a concrete adaptation measure that helps to link long-term challenges with here-and-now solutions. Multi-functional embankments combining water safety with landscape development provide a long-term solution to sea level rise but could increase business opportunities for recreation entrepreneurs. Artefacts, services and products can be regarded as such 'boundary objects' (for inspiring examples on implemented adaptation measures consult the CIRCLE-2 Adaptation Inspiration Book (2013a)).

> **'Even when starting from a big idea, it is relevant to have outcomes that are practical and tangible. Projects should diversify their goals and which products they aim to deliver, to cover both the big picture and small actions that take place during project lifetime.' (boundary worker)**

Table 1: Examples of methods that can be used for knowledge co-creation involving researchers, policy makers and practitioners

Category of methods	Method-tool	Suitable for	Advantage	Pitfalls	References
Raising awareness	Serious gaming, e.g. Sustainable Delta game	raising awareness about water management under uncertainty learning about adaptive policy making and adaptation pathways starting a discussion about scenarios and sustainable water management discussing and developing innova-tive solutions	helps to communicate uncertainties related to climate change (adaptation)	complex and time consuming, requires good facilitation skills and knowledge of the game	Haasnoot, M. 2012 https://publicwiki.deltares.nl/display/CAW/Game+-+simulation+tool
Fact finding	Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis	identifying strengths, weaknesses, opportuni-ties, and threats of e.g. a region or organisation (due to climate change)	makes local knowledge about the area or organisation explicit, building a shared understanding about the area or organisation	it is a rather explorative method and does not give due importance to urgent issues that the area is facing	Koponen, H. and H. Pesonen (2012). Climate SWOT for Decision-Making in the Business Sector. Baltic Climate project. Helsinki
Integrated assessment tools	Multi Criteria Analysis	prioritising alterna-tive policy options or adaptation strategies on the basis of a set of alternatives and an explicit set of criteria	considers monetised and non-monetised costs, allows for a wide range of criteria, generates stake-holders' acceptance	scoring and ranking is subjective, not always easy to reach an agreement on weighting	Zhu, X and E. van Ierland (2010). Report on review of available methods for cost assessment. Deliverable 3.1 of the Mediation project.
Systems thinking methods	Group model building	developing a shared conceptual model, in which the participants' views on the problem and their knowledge are incorporated, revealing where knowledge is missing	it helps in the formation of consensus on the solution to a climate change related problem and can increase commitment to the strategy to be followed	the outcome i.e. the conceptual model is less accessible for people who did not take part in developing it	Vennix, J.A.M. (1996), Group Model Building. Chichester: John Wiley & Sons.
Visioning	Scenario building workshops	exploring possible futures, identifying robust adaption measures, strategies or policies	the written form guaran-tees that due attention is given to everyone, especially suitable for stakeholders with specialist knowledge and 'out of the box thinkers', stimulates creativity	when participants are not diverse enough, biased pictures can be developed, partici-pants might consider the possible futures as 'real'	Elliott, J. S. et al. (2005), Participatory Methods Toolkits. A Practitioner's Manual.
Visualisation tools	Touch table	awareness raising on climate change, participatory planning of climate change adaptation	the interactive surface computing platform, in combination with specific software allows for the visualization of different climate and policy maps, tier 1,2 and 3 indicators showing primary, secondary and tertiary effects of climate change can be visualised	requires software and good facilitation skills and knowledge about the technique, sometimes people be-come distracted by the techniques involved	Goosen, H. et al. http://www.climate-adaptationservices.com/gfx_content/documents/Bangladesh%20methodiek.pdf



For successful co-production, take an iterative approach and ensure equitable contributions over time.

Strike a good balance between practical relevance, legitimacy and scientific reliability of knowledge

In contrast to a conventional research project where quality criteria of the results are usually academic, disciplinary criteria and agreed upon and valid (only) in a specific academic community, in science-practice collaborations a different and broader set of criteria is required that captures practical relevance, legitimacy and scientific reliability of knowledge. All participants should agree on the legitimacy of the process in which the knowledge is produced as an important quality criterion in itself; they should accept the way in which the results are or were achieved (e.g. Hegger et al., 2013).

Take an iterative approach

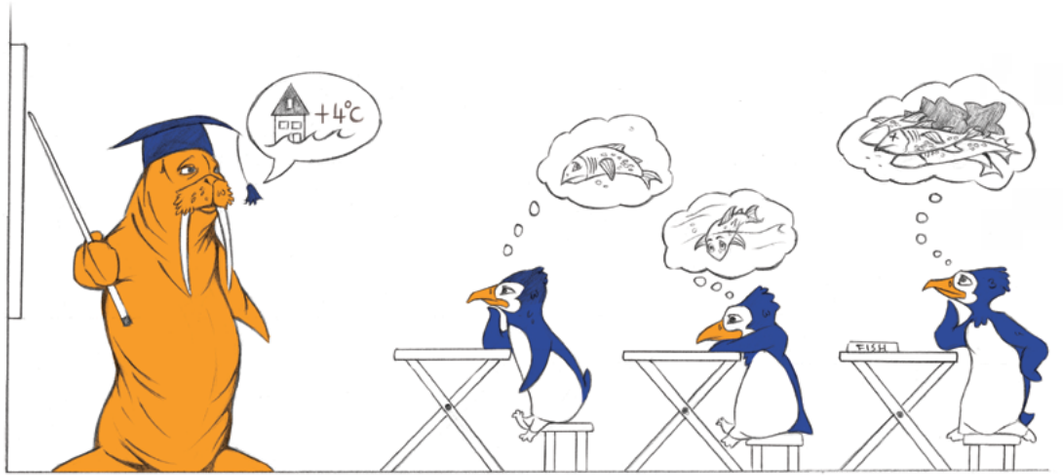
Projects should be developed and implemented stepwise, re-visiting the problem description and if needed re-adjusting the problem formulation, since participants can be expected to depart from different knowledge bases, backgrounds, normative values and cognitive perspectives on the issue. Not only can it be a gradual process in which these differences are revealed but perspectives may also change and new ones emerge.

It is very likely that participants differ in their perceptions of what actually the problem to be examined is, how it is understood better or it might be solved, and in which priority order issues need to be addressed. A common understanding of these questions cannot be assumed. As a result, there is no certainty on what is the common ground at the start. The common ground needs to be established and confirmed during interaction. Knowledge co-creation processes are interactive and recursive (Merkx, 2012) and should include feedback-loops and flexibility.

Sustain stakeholders' equitable participation over time

The effort it takes to sustain participation over time is often underestimated. Knowledge co-creation often happens during the phases of agenda-setting and utilisation of scientific knowledge in practice (beginning and end of a project). There tends to be less interaction and user involvement during the knowledge production phase itself. It is useful to plan a number of checkpoints in between – to help the different participants to keep in touch with the developments and help keeping the topic on the policy and practice agenda. Often, not all elements of a project can be handled in a way that they are genuinely co-produced by the whole team of researchers, practitioners and policy makers, due to time and resource constraints. In that case it is worthwhile to identify a number of concrete products (such as a roadmap, a scenario analysis, a development plan, a pilot case study or a modelling exercise) which can be jointly worked at and co-produced. These elements can serve to demonstrate in an exemplary fashion the added value of co-production for the project and help enhance mutual understanding on the subject and on potential implementation constraints, even if the entire project cannot afford to be run in a co-productive manner. This helps to create ownership, by being involved in the development of ideas and initiatives and increases the intrinsic motivation and sense of personal responsibility. ■

4. Communication



Connect to stakeholders' objectives and agree on common goal.

Understand each other`s language and develop a common one
Researchers and boundary workers should be aware that to develop a common language and mutual understanding there is need for investing in regular face-to-face contact and in exchanges on what is actually meant by terms or stipulated project goals, consciously organizing it (e.g., in the absence of a 'joint coffee corner'). Trying to understand each other`s language and developing a common language are first steps in overcoming communication difficulties. The issue is more complex than using joint vocabulary since even using the same words can mask the fact that participants attach different meanings to it. Communication does not simply happen and does not by itself lead to mutual understanding. Thus management of communication should be acknowledged as a separate task. Experience has demonstrated the usefulness of scientists and/or boundary workers working in the same building as policy makers or decision makers. It might be easier not to have too formalized procedures for e.g. staff exchange and regular visits.

> **'We have to learn to speak the same language and respect different ways how to work, to implement and how to find solutions. Listen carefully, consider and respect differences.' (practitioner)**

Arrange for active professional facilitation support
Since differences in perspectives can be large or not revealed, communication is often difficult. Participants can feel they have nothing to offer to each other, resulting in disagreement and misunderstanding (Merkx, 2012). To support communication effectively, process facilitation is important which needs to be impartial, open to multiple perspectives, approachable; support positive group dynamics; handle dominating or offensive ▸

Box 5

Selected examples of do's and don'ts in research communication

Selected examples of do's and don'ts for researchers and boundary workers in communicating research results to decision makers mentioned during the interviews held in support of this policy brief:

- *do not provide too much information* (but don't omit essential information just to reduce complexity). It is not useful for policy makers to receive lengthy research reports when all they might need is a very short executive summary. The language used in such a summary report has to be brief and to the point; avoid the use of scientific jargon; ask for feedback on draft executive summaries.
- *develop a common language.* In order to communicate effectively between policy and science it is necessary to find a common language. Professional knowledge brokers can help to overcome boundaries and understand different 'languages'.
- *use plausible scenarios of the future* relevant for policy-formulation over a range of spatial scales from local to regional and global.
- *use visualizations,* but test them beforehand, and employ user panels to assess proposed visualisations or other interactive communication methods.
- *communicate in terms of information packages* linked to current and future policy challenges and be careful not to communicate isolated research results. ■

Don't overfeed stakeholders; focus and tailor the information.

individuals; encourage participants to question assumptions; and re-evaluate entrenched positions (Reed, 2008).

Take a deliberative approach and learn from different perspectives

A deliberative approach focuses on communication as argumentation and expression of a diversity of positions and assumptions. Since the way a problem is conceptualized (for instance what causes are regarded to lead to a problem) may already point to perceived solution pathways, it can be productive to gradually develop towards consensus. This implies that one should first stimulate a diversity of opinions and values and not settle for a premature consensus, even if for groups, consensus is often desirable from a social perspective and contributes to a 'feel good factor'. From a cognitive perspective it can be productive to confront different opinions and viewpoints (Bergmann et al., 2012). Also, it is possible to start with identifying those points about which there is a disagreement or where more information is needed to enable stakeholders to develop their positions.

Taking a deliberative approach, participants define the problems and establish the purpose of their dialogue reflectively (Reed, 2008).

> **'To arrive at solutions, research needs to go beyond presenting research results and researchers need to take a different approach and redefine their role, such as that of 'designing research' so research activities are embedded in a frame of developing ideas for solutions.' (boundary worker)**

Interactive methods can help to organize such a process by offering a structure for a 'controlled confrontation' where positions are not so much identified as conflicts of persons but have the function of mutually enriching contributions. To explore, include and integrate divergent perspectives can greatly support learning processes – if adequately supported and embedded. This requires that those engaged can accept that their knowledge is not a priori better than that of other participants. It is crucial that the participants in a project are open to one another, which means, among other things, asking oneself as a project participant what the other perspective might have to offer and being prepared to relativize one's one point of view (Pohl and Hirsch Hadorn, 2007). Cuppen (2009) shows how constructive conflict methodology can be used for dealing with unstructured policy issues in stakeholder dialogues.

Choose carefully how information is presented, using visualization techniques

As adaptation often has a spatial character, visualisations (visual materials) are very useful. Researchers and boundary workers do generally not yet sufficiently acknowledge the importance of visualisations in climate change adaptation communication. In the development of visualisations it is again important to first find out for what purpose the picture (e.g. a map) will be used. Afterwards, regular feedback of the intended users on draft visualisations needs to invited. Presenting research results needs to be taken a step beyond just presenting the results like in a scientific paper. The map below provides a good examples of presenting vulnerability information.

Organize interaction mechanisms

Researchers and boundary workers need to realise that only few policy makers and practitioners invest in becoming informed about the state of the art of scientific knowledge on climate change in general or adaptation in particular. There is a need for mechanisms to create awareness about the importance of and maintain interest in (the generation of) policy relevant knowledge, e.g. regular meetings or Communities of Practices on science–practice linkages. Such semi-formal mechanisms can also help to generate funds for policy-relevant research. Those managing science-practice interactions as project or

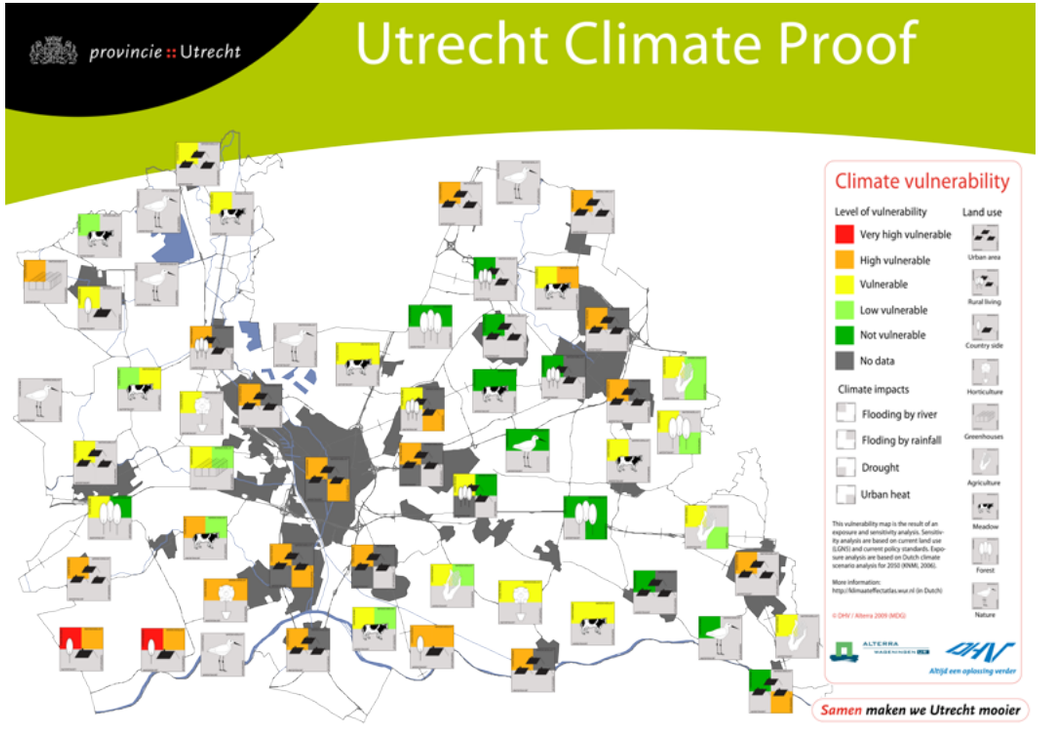
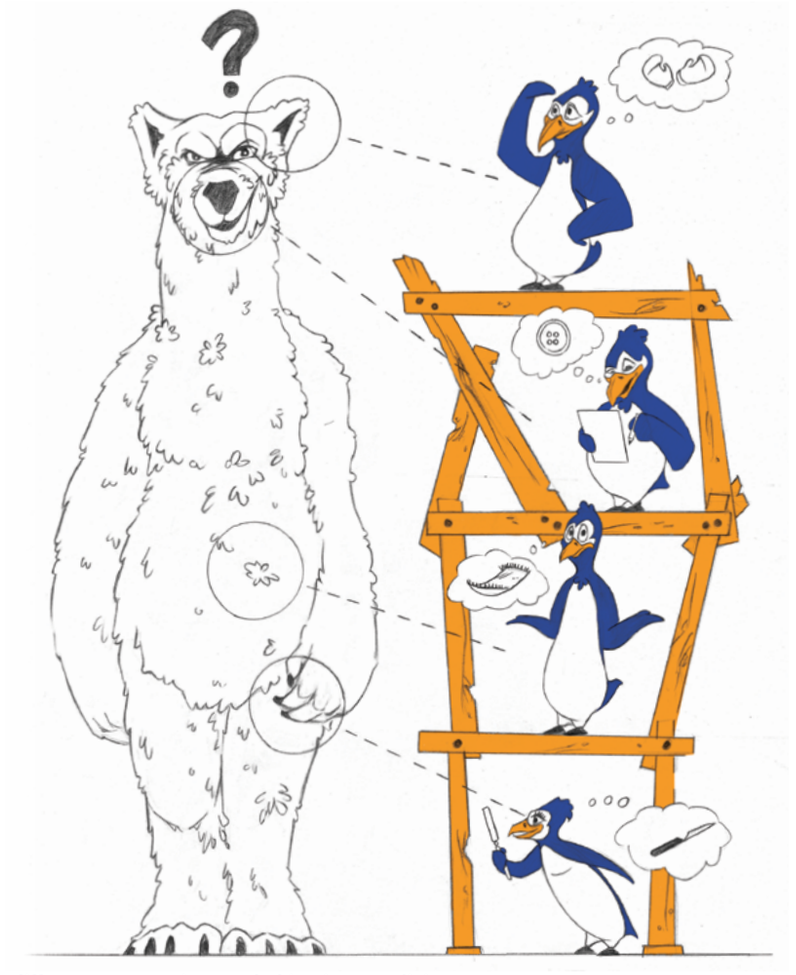


Figure 1: Example of a map with combined information of several impact indicators. The map has been developed for the government of the Province of Utrecht to summarise and visualise the climate robustness of the area and to discuss policy challenges (Goosen et al, 2013).



Make different perspectives and objectives explicit.

consortium leaders need to be able to mediate between different positions,take an open approach to resolving conflicts as well as show strong proactive organizational abilities.

> **'The project must be anchored in the municipal organization. From the political lead – to the managers of the departments. This must be done a long time ahead in order to get funding and personnel to secure funding or key persons.' (practitioner)**

Research projects with different parties from different spheres need an active management approach. Whereas projects within one organization profit from numerous informal exchange opportunities, projects which bring together researchers, policy makers and practitioners normally span different institutions and different working cultures. The flow of information and exchange between partners thus needs to be actively attended to. ■

5. Dealing with uncertainty

Discuss uncertainty with policy makers and practitioners and provide them with recommendations for dealing with it

Dealing with uncertainty is a key element for decision-makers, policy makers, practitioners and researchers in adaptation decisions making. Uncertainty can be looked upon from three different points of view (Capela Lourenço et al., in press):

- it is possible to deal with uncertainties and act in spite of their existence;
- it is necessary to reduce uncertainties before making a decision on how to proceed;
- uncertainties are considered too large and act either as a barrier to decisions or as a motive to postpone them.

Misunderstandings about the phenomenon of uncertainty in climate change adaptation decision making hinder effective communication and appreciation between researchers and boundary workers, policy makers and practitioners. Disputes are often rooted in confusions and different interpretations about uncertainty in climate change science and impact projections. Lack of systematic attention for unquantifiable uncertainties makes the scientific basis for climate policies prone to controversies. It can also undermine public support for climate policies (Dessai and Van der Sluijs, 2007).

Agree on how to characterize climate change uncertainties

How significant is the difference between researchers, policy makers and practitioners in how much certainty about a particular projected climate change impact they regard sufficient to take action? Scientists often use statistical information, e.g., a 95% confidence level, as a benchmark to describe scientific results. Policy makers usually use different standards (Scarlett, 2013). For policy makers or practitioners, how much uncertainty would be acceptable is related to the urgency of the issue at stake or the policy goals that might require action. The amount of acceptable uncertainty might also depend on the available resources or the legal context that might dictate action regardless of uncertainties involved.

> **'In contrast to socio-economic development in which uncertainty is hardly questioned, in climate change adaptation uncertainty is widely acknowledged and subject to serious debates.' (boundary worker)**

Communicate uncertainty adequately

Experience shows that scientists tend to communicate in a very scientific manner which is difficult for policy makers to understand. Or, even worse, uncertainty issues are left out to avoid too much complexity. Uncertainties are usually communicated linguistically, numerically, or graphically. Linguistically, different methods to communicate uncertainties can be used. The IPCC (Intergovernmental Panel on Climate Change) has developed guidance for the authors of its assessments that depend on the source of uncertainty and disciplinary context. The proposed methods are primarily used for the Summaries for Policy Makers, but can also be used elsewhere (Mastrandrea et al., 2010). Researchers and boundary workers can make use of an uncertainty typology to make uncertainty 'visible'. Such a typology helps to identify where the most relevant uncertainties can be expected (e.g. in data, models, expert judgement) and discuss how they can be characterised (uncertainty in knowledge, uncertainty in stakeholders' values and goals, statistical uncertainties, scenario uncertainties, surprises). Additionally, such an uncertainty typology can serve as the first step of a more elaborate uncertainty assessment, where the magnitude of uncertainties and

their impact on the policy-relevant conclusions are explicitly assessed and discussed with policy makers and practitioners (Petersen et al., 2012).

The use of visualisations to communicate uncertainties is also recommended (see Table 2). The use of 'interactive maps' (such as the map presented on page 19) is experienced as an effective method to present climate change scenario information. Interactive forms of visualising scenario outcomes allow stakeholders to handle the data themselves and so to better understand the impact. It also helps to avoid that policy makers are confronted with a huge number of maps.

For researchers and boundary workers it is important to tailor the information about uncertainty to the target audience. Providing policy makers with a lengthy report listing all the possible uncertainties will not necessarily lead to better informed policy-making. In a press release or a project summary, for example, the uncertainties that are most relevant to the policy decisions need to be described, without too many technical details. This way, a policy-maker, using the results of for example a climate assessment, will not be directly confronted with a typology of all uncertainties, but will be provided with the information needed to properly interpret and use the results.

Support decision making by acknowledging uncertainties rather than trying to reduce them

Policy makers, practitioners and researchers should jointly discuss the level of certainty that can be provided and what is really needed to inform particular decisions. Policy makers and practitioners can learn about academic standards and requirements for sound science. Generally, researchers have a stronger tendency to focus on uncertainties and new research questions (indeed, uncertainties drive science), whilst policy makers, practitioners and decision makers often demand certainty. However, with the inherent uncertainties about climate change, impacts, and costs and benefits of responses, there are ways to handle this tension. One way is for instance by acknowledging the reality of uncertainty and exploring responses which take uncertainties into account, such as no regrets measures, resilience and flexibility. The focus in science-practice can be more on risk management rather than getting drawn into a fruitless discussion about absolute proof of climate change (Gardner et al., 2009).

EPAL Future Vulnerabilities to Climate Change	Water quality			Water quantity			Total climatic vulnerability
	Floods	Drought	Forest fires	Floods	Drought	saltwater intrusion	
Castelo de Bode Dam	Low	Low	Low	Medium	High	N/A	High
Valada river	Medium	High	Low	Low	High	Low	High
Valadas groundwater	Low	Low	Low	Low	Medium	N/A	Medium
Lezírias groundwater	Low	Low	Low	Low	Medium	N/A	Medium
Ota-Alenquer groundwater	High	Low	Low	Low	Medium	N/A	High
Olhos de água spring	High	High	Low	High	High	N/A	High

Table 2: Example of uncertainty communication in support of adaptation decision-making. The table presents a summary of potential climate change vulnerabilities for water quality and quantity in EPAL - Empresa Portuguesa das Águas Livres - a Portuguese state-owned water utility company. The column on the left refers to the companies' studied water sources. For each source, the potential level of vulnerability (Low, Medium or High, coloured) was communicated to decision-makers and practitioners along with the degree of confidence in the results (Limited, Medium or Robust, represented by the 'mobile charge symbol' analogy) (Capela Lourenço et al (2013) (Courtesy of EPAL).

Advise policy makers and practitioners on how they may deal with uncertainty

Researchers and boundary workers can help policy makers and practitioners to take decisions under uncertainty. They should take into account that the suggested approaches to decision-making are numerous and should be adjusted to each decision context (Capela Lourenço et al, in press). However it is recommended to:

- search for approaches that are robust under a wide range of possible futures, have multiple-benefits and that are low- or no-regret;
- look for options that contribute to enhance resilience and adaptive capacity;
- opt for strategies that consider a wide range and variety of options and are able to support adaptive management or learning-by-doing approaches;
- favour options and measures that allow for flexibility.

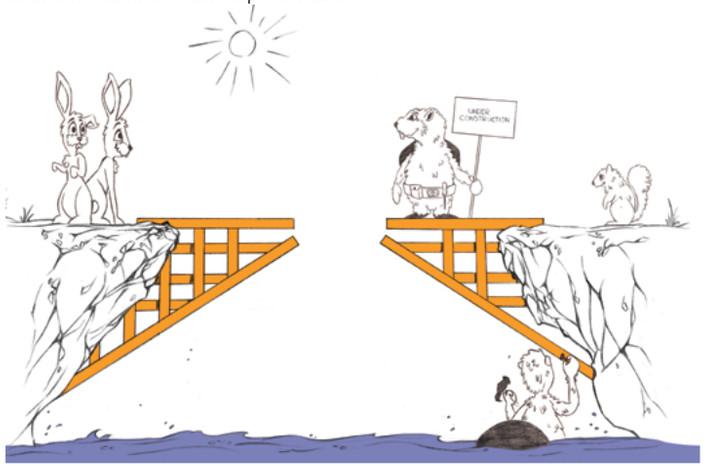
Researchers can help them to identify options that are robust given the uncertainties involved. The challenge for researchers is not to use, e.g., twenty different model runs or socio-economic scenarios but a number that a policy maker or practitioner can handle and which is relevant for the decision at stake. However, at the same time it should be made clear that behind a small number of models or scenarios that may be selected for a project for pragmatic reasons (limited time and resources, but also limited human ability to understand complexity), there may be 20 or more behind, while the selected models and scenarios have various underlying assumptions which are not always made explicit. An additional possibility to help policy makers and practitioners to better deal with uncertainties is to help them in developing and implementing an adaptive management approach allowing for learning by doing and making adjustments when needed. ■

Take uncertainties seriously, but don't allow them to block progress.

6. Next generation adaptation research: challenges and recommendations

Distinguish between problem-oriented and fundamental research
Funding agencies are advised to be aware of the tensions caused when a programme combines practically relevant adaptation research and fundamental, or purely academic, research. Many national and European climate change adaptation research initiatives aim to develop both fundamental, generic knowledge on the one hand and applied, specific knowledge required for climate-proofing in the same project or programme on the other. Experience however shows many difficulties in applying new theoretical frameworks and tools in policy and practice. One of the constraints is related to timing. Academic researchers, often PhD students, first need considerable time to acquire new knowledge of the underlying foundation of the problems at hand and on the available theoretical frameworks (also from other fields) before being able to (further) develop new theoretical frameworks and tools. Policy makers and practitioners require inputs relevant for their work at an early stage of the project, before new knowledge may have been developed. Other constraints are related to the lack of competence amongst researchers to conduct demand-driven research, poor integration between stand-alone fundamental research activities, and the difficulties boundary workers have in translating new theoretical knowledge into information relevant for policy makers and practitioners. Some interviewees who provided insights for this research policy brief recommended not combining fundamental research with societal relevant research in the same research project. Their advice to funding agencies is to clearly distinguish between fundamental research projects involving (PhD) researchers and societally relevant or applied research. Both types of research are essential and enrich each other's outcomes, and should be linked to be mutually supportive.

Develop a translational approach for climate change adaptation
Researchers and boundary workers in practice-oriented projects have to find out what knowledge already exists, translate this knowledge into information relevant for policy makers or practitioners and identify the knowledge gaps to be addressed by future research. Some refer to this type of activity as 'translational research' i.e. scientific research that helps to make



Involve skilled facilitators.

Participation: practice what you preach.

findings from fundamental science useful for practical applications that enhance human health and well-being. Utilizing the capabilities of professional boundary workers can play a central role in developing a translational approach for climate change adaptation. More professional exchange on this is desirable.

Consider funding project scoping phase
Funding agencies could consider providing funds for a scoping phase of a research project. Currently, researchers are usually required to include a problem definition and research outcomes in the proposal. They often do not have the resources to involve the potential users in the formulation of the project proposal. Consequently, the proposals mainly reflect the interest of researchers and some well-known stakeholders they normally work with. Experience however shows that an orientation or scoping phase or a pre-project is very important for the articulation of users' needs, building trust and commitment. This phase should also be financed. A disadvantage of this approach is that it makes it more difficult for research performing organizations to engage longer-term staff.

Avoid projects getting away with participatory rhetoric
Funding agencies require societally relevant research to be demand-driven, involving policy makers and/or other relevant stakeholder groups in the scoping, preparation, implementation, evaluation and outreach. Experiences show, however, that the interactions between researchers and the intended users of the results are often limited to the starting up phase and/or dissemination stage.

Projects tend to promise a lot at the beginning, including plans with respect to stakeholder participation, but are often not confronted with negative evaluations or consequences when a project is finished as the effectiveness of the stakeholder process is (with some exceptions) typically not systematically assessed. In order to enforce a stronger focus on societal relevance, funding agencies could consider building in an assessment of, amongst others, science- practice interactions, during the project, e.g. after a year, after which a project can be adjusted, or if necessary, ended. Disadvantage of this is, as above, that it may discourage the engagement of new research staff for a longer term. It requires additional efforts or outsourcing of the review by funding agencies, but would ensure that science-practice interactions are taken seriously.

Ensure co-funding from stakeholders involved
Participation of policy makers and practitioners can be improved when co-financing is required not only from research institutions, but also from policy and practice partners.

Box 6: Experiences from an analysis of a number of CIRCLE MED projects (Source: Bento et al., 2013)
'In order to reach a genuinely integrated science there is still a long way to go. A science that integrates multiple partners, researchers from the natural and social sciences and non-scientists, such as administration and local stakeholders, needs to diversify the means and the spaces of knowledge exchange. This is of course hindered by the current organization of science and administration. But the lack of cooperation and collaboration between scientists and non-scientists has also to be framed in a context in which natural and social sciences are disentangled. Interdisciplinarity is certainly part of this challenge of developing a science that is concerned with both natural and social dimensions in water and coastal resources and the sustainability of those elements. We argue that to go beyond wishful thinking, collaborative reflection on these topics is a first step. But is must be followed by changes of current policies defining scientific performance and the incentives underlying it. Right now current policies of low budgets, and demands for short term results, for science and administration, are great deterrents.' ■

Box 7: Private sector involvement
Private sector companies are increasingly involved in adaptation research, e.g., consultancy companies are increasingly entering the market for climate services. They are interested in developing innovative products and services (e.g. modelling software). They often perform the role of boundary organizations. Other private sector companies participate in adaptation research to build resilience within their own company or supply chain. These, often large, companies such as the insurance and energy sectors, and industries dependent on adequate water availability are vulnerable to climate change and its impacts.

Whilst increasingly placed on the wish list of funding agencies, in practice, private sector involvement is still infrequent. Climate change adaptation often emphasizes long-term public benefits, whilst companies operate under conditions of short-term individual benefit maximisation. Another difficulty is related to the public access of project results. Whilst climate change adaptation research is often funded from public money and thus implies knowledge sharing and in principle public availability of results, private companies are interested in keeping competitive advantage over their competitors which inhibits sharing of knowledge, both about risks and preferred adaptation responses. Working with business associations, as realized in the German Kompass programme in their series of national Stakeholder Dialogues, might be a way out of this dilemma, since these associations represent joint interests from specific sectors. Industry representatives show an interest if climate change topics are embedded in broader economic topics and challenges such as risk management and dealing with different corporate risks (e.g. risks of resource scarcity), cost-benefit analyses of adaptation measures or potential opportunities and innovation potentials related to adaptation (Rotter et al., 2013). Working with the private sector requires clear agreement about the public availability of specific project results. ■

Box 8: Dutch Knowledge for Climate programme as vehicle to organise science-practice collaboration

The Dutch Knowledge for Climate programme can be considered as a 'vehicle' connecting scientists and policy makers. The vehicle is organized in such a way that steering takes place at two levels i.e. strategic and operational level. An advisory board at the strategic (ministerial) level facilitates the creation of awareness and commitment of high level policy makers. This is very important for incorporating scientific findings in on-going and future policies and programmes and for encouraging other policy makers to be involved in on-the-ground projects. The board at the operational level addresses merely content and daily management issues which are important for ensuring climate adaptation research with impact in the regions. ■

Funding agencies are recommended to require these partners to co-fund the research project in order to guarantee its relevance to users and to enhance their motivation, commitment and ownership to actually use the project results. For researchers this means they need to look for potential users amongst policy makers and practitioners early on when developing their proposal, not shortly before submitting their proposal. There may be competing requirements from different funding organisations that would have to be resolved. Private sector parties require special attention (see Box 7 page 26).

Allow for learning and knowledge brokering in research programming
To enhance productive science–practice collaboration, funding agencies are advised to acknowledge and support adaptation research projects to evolve as a learning process. Proposal evaluations need to value elements that allow for development of productive science-practice interactions rather than requesting project proposals that are very much 'closed' and fixed, without sufficient room for flexibility. In fact, this implies a somewhat different approach by funders, where their role much more develops in a way of continuous process monitoring and checking for useful re-adjustments instead of a mere result or output evaluation at the end. This calls for a suitable form of dialogue between funders, researchers, policy makers and practitioners. Societally relevant research needs specific roles which are not foreseen traditionally, such as boundary workers, process facilitators, and implementation and integration specialists (Bammer, 2013). Funding agencies need to ensure that proposal reviews also assess the expertise of project staff in knowledge brokering, process facilitation and integration.

> **'We need places to exchange, around projects. Science needs to enter in the daily life of society.' (practitioner)**

Ensure integrating mechanisms
Funding agencies can ensure that societally relevant research projects provide for organisational mechanisms that enhances productive science-practice collaborations. Such an organizational structure can have various configurations. Regarding the way the Dutch Knowledge for Climate programme is set up and managed, the programme in itself can be seen as an integrating vehicle (see box 8 page 26). Another example of a build-in integrating mechanism is to organise a project around a specific location, such as science-practice or climate adaptation laboratories.

> **'A European climate adaptation forum can only become an effective science-policy community if some people stand up to organise e.g. online debates, conferences.' (policy maker)**

Science-practice or climate adaptation laboratories can also be organized around specific issues which are not place-bound, such as a sector strategy. Such labs would function as continuous and common learning environments for climate researchers and stakeholders and aim to facilitate interactive development of innovative decision-making tools to improve decision processes in specific sectors. Face-to-face gatherings between researchers, boundary workers, policy makers and practitioners around new models and decision-making tools allows for the definition of specific decision-making needs and regular evaluation of the actual capabilities of a model or tool. However, in order to create and maintain an 'alive and kicking science-practice community', there is need for professionals who actively organise these interactions. ■

7. Concluding and looking ahead

'Introducing peer review of policy plans and decisions and a societal review of scientific reports (and publications) would enhance mutual understanding between science and policy.' (researcher)

Productive science-practice interactions for climate change adaptation call for an approach of 'learning-by-doing' by the different parties involved. To date, institutional constraints and disincentives are the main roadblocks inhibiting a broader usability of climate science (Kirchhoff et al. 2013). This policy brief aims to contribute to learning from the experiences from CIRCLE-2 partner programmes and beyond. The colleagues consulted for this policy brief shared their experiences and insights from science and practice from a number of European countries and programmes. Also, there is a growing body of knowledge from the scientific literature, although it is sometimes widely dispersed. This policy brief aims to address the challenge of developing projects and programmes that will further enhance the productivity of science-practice interactions for climate change adaptation. The current shift of European research focus towards the grand societal challenges, notably in the Horizon2020 programme, will increasingly play a leading role in guiding research policies, programme development and funding, including Joint Programming. This also contributes to a growing need for better and more productive science-practice interactions. It tunes in with recent calls for furthering more sustainable ways of doing science and with increasing ambitions to transform practices in science aiming to reconcile knowledge supply with demand.

Learning systematically from practical experiences still needs to be improved. There is a need for additional and more systematic comparative studies, evaluations and development of conceptual frameworks and methodologies, building on action-oriented research on concrete cases of science-practice interactions. Such new research is needed, but also the exchange of lessons from existing practical experiences. Building on experiences and lessons from pioneering experts and programmes, this policy brief shows that much can be learned from exchanging lessons on successes, barriers and ways of tackling them, and sometimes also failures. This policy brief provides a stepping stone to inform future programme managers and developers and those preparing for the journey of productive science-practice interactions in concrete projects. Learning from practice inspires change. Taking an open approach and showing a willingness to experiment with new forms of collaboration will open up new ways forward towards mutual learning and enhancement of the practical relevance of knowledge for climate change adaptation. ■

'Methods to measure research success and related reward systems need to be changed accordingly.' (researcher)

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Relevant websites:

CIRCLE-2
http://www.circle-era.eu

Climate-Adapt
http://climate-adapt.eea.europa.eu

JPI Climate
http://www.jpi-climate.eu/home

Dutch Knowledge for Climate research programme
http://knowledgeforclimate.climateresearchnetherlands.nl/

German Kompass
http://www.umweltbundesamt.de/themen/klima-energie/klimafolgen-anpassung/kompass

German KLIMZUG research programma
http://www.klimzug.de/en/

Colophon

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