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Integration

Frames in climate change communication and decision-making (IC10) – Synthesis

Joop de Boer

Arjan Wardekker

Jeroen van der Sluijs

Rien Kolkman

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Authors

Joop de Boer [1]
Arjan Wardekker [2]
Jeroen van der Sluijs [2]
Rien Kolkman [3]

1 Institute for Environmental Studies (IVM), VU University Amsterdam, Amsterdam
2 Copernicus Institute for Sustainable Development and Innovation, Utrecht University, Utrecht
3 Water Engineering & Management Group (WEM), University of Twente, Enschede

VU University Amsterdam

Universiteit Utrecht

UNIVERSITY OF TWENTE.

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Contents

Abstract

Abstract

The present report describes a frame-based approach to communication and decision-making on climate change, which has been developed in IC10, one of the "integration projects" in the Climate changes Spatial Planning programme.

Building on the multidisciplinary literature on the relationship between frames and decision-making, it argues that decision makers may gain from making frames more explicit and using them for generating different visions about the central issues. Frames are organizing principles that enable a person to interpret a situation and to communicate about it, without having to consider all the details. They can be used in very different ways:

- Frames can be used automatically: We say what we think without considering what others will understand.
- Frames can be used adaptively: We say what we think in a way that is adapted to what others may understand.
- Frames can be used strategically: We shape what we have in mind in such a way that others may share our frame.

Borrowing from the combination of theory and case studies, practical tools for supporting frame-based communication and learning were developed. Science-related issues, such as climate change, are often linked to only a few frames, which consistently appear across different policy areas. Indeed, it appears that there are some very contrasting ways in which climate change may be framed. These frames can be characterized in terms of a simple framework that highlights specific interpretations of climate issues.

A second framework clarifies the built-in frames of decision-tools. Using Thompson's two basic dimensions of decision, it identifies the main uncertainties that should be considered in developing a decision strategy. The paper characterizes four types of decision strategy, focusing on (1) computation, (2) compromise, (3) judgment, or (4) inspiration, and links each strategy to the appropriate methods and tools, as well as the appropriate social structures.

Our experiences show that the frame-based guide can work as an eye-opener for decision makers. Frames can particularly be of help in adding new perspectives to a decision process and in checking whether the participants are able to understand each other. Hence, it is important for all the actors involved (e.g. scientists, professionals, policy-makers) to be made aware that:

- Given the many aspects, there is no single correct way to frame climate change and the decision problems it generates in a particular context;
- "Taken-for granted" frames, including the frames that are "built-in" in decision tools, such as cost-benefit analysis, can subtly shape one's conceptions of reality;
- Decisions may gain from looking at weak signals of change through various scenario lenses;
- Persons with diverging arguments can only communicate meaningfully if their frames overlap to a certain degree;
- Decisional processes may be aided by reflecting on the frames that underlie controversy;
- Contrasting frames may be used to stimulate more active participation and enable policy-makers to avoid lock-in on a non-reflected frame.
- Increasing frame-awareness may open-up the process of decision-making from its very beginning.

1. The importance of frame-awareness

"A very helpful approach to understanding how climate change is framed, both generally, and in terms of decision-making and decision tools, is provided by de Boer et al. (2010). The critical point of clarity provided by this approach is that there is a relationship between the fundamental framing of climate change and the understanding of the decision problems it represents. This to a large extent determines the tools selected for the task of planning and the institutional structures required to deliver them." (Brown et al. 2011, p. 22).

1.1 Frames and framing

IC10 is one of the "integration projects" in the Climate changes Spatial Planning programme (CcSP). It aims to demonstrate how frame-awareness can be helpful for professionals who are involved in communication and decision-making on climate change. In brief, frames are organizing principles that enable a person to interpret "the situation here and now" and to communicate about it, without having to consider all the details. Such frames are used by each of us all of the time, but not in a way that is explicitly evident in our conscious experience. Frames are often "hidden" and taken for granted. Partly as a result of this, we frequently underestimate how communication can be hampered by differences in the frames we use. The same applies to any process that depends on communication, such as negotiating and decision-making.

Basically, in the context of communication, there are three very divergent ways to use our frames (Fairhurst, 2011).

1. We can use our frames automatically and say what we think without considering what others will understand. This is how an expert may talk to fellow experts, assuming that they will obviously use the same frame.
2. We can use our frames adaptively and say what we think in a way that is adapted to what others may understand. This is how an expert may talk to an audience of non-experts, following the conventional rules for communicating with others.
3. We can use our frames strategically and shape what we have in mind in such a way that others may share our vision. This is how a visionary expert may involve others in a process of decision-making, developing a collective sense of goals and strategies.

This report mainly addresses the second and the third way in which frames are used, focusing on communication and decision strategies in the context of climate-related planning. It will integrate evidence from many sources, because frames are the topic of research in such varied fields as anthropology, linguistics, cognitive psychology, social and organizational psychology, management science, sociology, communication and media studies, social movements research, policy science, science studies, and philosophy. Although there are slight differences between various definitions (e.g. Barsalou, 1999; Chong & Druckman, 2007; Goffman, 1974; Graf, 2006; Schön & Rein, 1994), "frames" are generally conceived as organizing principles that enable a person to develop a culturally accepted opinion about an issue. "Framing" then is the act of communicating that interpretation in ways that connect with others (Fairhurst, 2011).

1.2 Relevance for climate change adaptation

Well-founded frames are prerequisites for climate change adaptation, especially to facilitate the participation of non-experts, such as decision-makers and the public at large. Given that climate change is often seen as a science-based issue, the public's opinions about it are partly dependent on knowledge institutes and their tools, such as model tools, cost-benefit-analysis, and dialogue tools, each with its own built-in frames. Because different framings of an issue might significantly affect public participation, the present report will examine how frames can be made more useful in the context of decision strategies for climate change adaptation.

Our work is based on the notion that the complexities of climate change will confront experts, decision-makers and the public with different sorts of "reality". Indeed, climate change science and policy may especially be issues that can be framed and reframed in several ways (Nisbet, 2009; O'Brien, St.Clair, & Kristoffersen, 2010; Robinson et al., 2006; Schlumpf, Pahl-Wostl, Schönborn, Jaeger, & Imboden, 2001). For example, during much of the past three decades decision-makers had to deal with a reality in which climate change mitigation and adaptation were sharply separated both in science and in politics. Back in the 1980s, as Kellogg (1987) mentioned, "preventing (or delaying) the change" and "adapting to the change" were depicted as the two decision tree branches that showed the whole range of policy choices. In contrast to prevention, adaptation was the option for both sceptics and fatalists (Thompson & Rayner, 1998).

Recently, however, adaptation, and more particularly, a strategic approach to adaptation has been recognized as an essential part of climate policy by scientists (Pielke Jr., Prins, Rayner, & Sarewitz, 2007) as well as by policy-makers involved with the United Nations Framework Convention on Climate Change (UNFCCC, 2007) and the World Business Council on Sustainable Development (WBCSD, 2008). The contrasting interpretations of adaptation reflect crucial differences in the frames that shape how individuals and institutions conceptualize the relevant aspects of this issue.

Concepts and aspects are key parts of frames. As Fillmore and Atkins (1992) note, frames can often be created by or reflected in the language. For instance, references to specific patterns of climate change manifestations, such as "changes in snow" or "sea level rise", may activate a frame of semantic knowledge relating to the event. Because the frame of a complex event is never experienced directly in its entirety, subsets of frame information will become active to highlight some potentially relevant aspects (Barsalou, 1999). In the present example, climate change manifestations can be framed in an event-like structure that combines aspects regarding scene, agency, location and time-line (see Figure 1).

Figure 1 illustrates a formal representation of the frame, which includes the aspects "attribution to climate change" (which may be likely or unlikely), "identifiable places" (e.g. existing or latent), and "time horizon" (e.g. short or long term). The frame may possibly also include "uncertainty about science" (e.g. high or low), and "uncertainty about politics" (e.g. high or low). A kind of "tag" may be added to identify "trust in information" (e.g. high or low), based on information source monitoring (Strømsø, Bråten, & Britt, 2010).

Within this frame, the climate change manifestation can be understood as a specific co-occurring set of relevant aspects, e.g. "changes in snow" may be linked to a combination of "likely attribution", "identifiable place", "short time horizon", "low uncertainty", and "sea level rise" to a combination of "likely attribution", "latent place", "long time horizon", and "high uncertainty". Also, within a frame each aspect may be associated with its own frame and more specific sub-aspects. For instance, the uncertainty aspect can be displayed in different variants of uncertainty. This dynamic relational

structure makes frames flexible and context dependent, which is crucial for the interaction between science and policy.

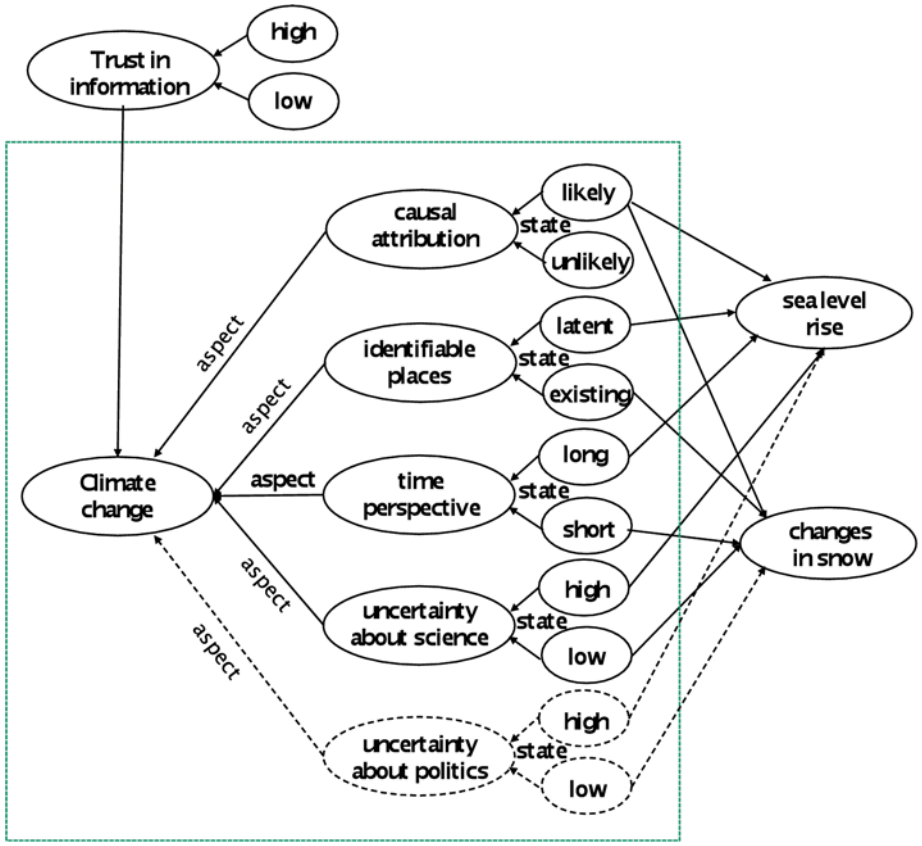

Figure 1.
Aspects of the climate change manifestations "changes in snow" and "sea level rise", represented by an event-like frame (inside the box).

Context is a key issue in science-policy interaction, as it describes the surrounding facts that add meaning to the frame. For instance, climate change manifestations have become increasingly salient to decision-makers and the public at large. As several authors (Dempsey & Fisher, 2005; Halsnæs et al., 2007; Kirshen, Ruth, & Anderson, 2008) emphasize, however, decision-making on adaptation should take into account that the expected impacts of policy options on society tend to be very context specific. This is partly due to the complexities of climate change itself, which may cause considerable uncertainty over climate change projections and its impacts (Dessai & Hulme, 2004; Lempert, Nakicenovic, Sarewitz, & Schlesinger, 2004). Also the role of other human-caused environmental changes, such as changes in regional land use patterns, can make a large difference to the end result. In particular, it is the specific combination of climate change and other environmental changes that may create the most significant impacts for society.

Consequently, decision makers should develop a strategy that is informed by a rich store of information and, at the same time, ensures a sufficient degree of flexibility and adaptability (Lindblom, 1990; Thompson & Tuden, 1959; Thompson, 2003). Whether their strategy for decision-making leads to adequate action will strongly depend on the way in which they frame the specific aspects of the situation, such as co-occurring sets of "time horizon" and "uncertainty" (Robinson et al., 2006; Schlumpf et al., 2001). For instance, instead of focussing on the question "How can we reduce uncertainty in our estimates of future climatic conditions?" it may be important to give more

attention to the question "Given that there is considerable uncertainty about our future, how can we best manage this coastal area to reduce risk and increase system resilience?"

The hierarchical tree-like structure that is depicted in Figure 1 can also be used to define the main aspects to be included in a decision support tool, such as multi-criteria analysis. In that case, it is the overall objective of the decision that becomes the key concept of the frame; it has to be split out into a number of aspects and criteria, which should be taken into account. This is just one example of how frames are built-in in methods and tools. Although there is often no single correct solution, making the frame more explicit may help to ensure that all the potentially relevant aspects are covered in a balanced and thoughtful way.

Because frames can often be created by or reflected in the language, the application of frames is partly a matter of finding the right concepts and conceptual relations. In addition, numerical and visual characterizations of situations can also be meaningful carriers of information. Applying frames may include:

- Developing strategically chosen and rhetorically stable concepts that can reconcile competing visions, such as the concept of climate proofing (Kabat, van Vierssen, Veraart, Vellinga, & Aerts, 2005);
- Using the power of numbers and the way they can be related to each other to create meaningful carriers of information, such as CO_2 equivalent measures;
- Making maps to analyse, design or negotiate spatial relationships in a particular context (e.g. Carton & Thissen, 2009);
- Creating graphics and other visualisations (e.g. Brönnimann, 2002), including works of art, to bring imagination to a project.

Hence, situated decision-making may well be facilitated by making frames and frame-based decision-strategies more explicit and using them for generating different visions about the central issues. It should be noted, however, that decision-makers may not simply be able to change their frame at will, because professional and organizational boundaries will articulate particular aspects of a situation (Callon, 1998; Thompson & Rayner, 1998). For instance, an engineer tends to use other frames than an executive (Schein, 1996). Yet, it is important for all of them to be made aware that:

- Given the many aspects, there is no single correct way to frame climate change and the decision problems it generates in a particular context;
- "Taken-for granted" frames, including the frames that are "built-in" in decision tools, such as cost-benefit analysis, can subtly shape one's conceptions of reality;
- Decisions may gain from looking at weak signals of change through various scenario lenses (Schoemaker & Day, 2009);
- Persons with diverging arguments can only communicate meaningfully if their frames overlap to a certain degree (Brockriede, 1992);
- Decisional processes may be aided by reflecting on the frames that underlie controversy (Schön & Rein, 1994).
- Increasing frame-awareness may open-up the process of decision-making from its very beginning.

1.3 Research objectives and approach

The IC10 project[1] was set up on the basis of the expectation that there is substantial room to improve communication and learning in climate-related interactions between scientific knowledge and groups of heterogeneous stakeholders who are involved in spatial planning. It had the following objectives:

- To make the role of frames and forms of sense-making in climate-related interactions more transparent for all the actors involved (e.g. scientists, practitioners, policymakers),
- To disclose for all involved the multi-disciplinary literature on these topics to identify the most relevant insights and tools,
- To support the actors by providing guidelines and practical tools to deal with frames and frame differences, based on empirical studies of sense-making.

Against this background, the following research questions were addressed:

1. What frames and forms of sense-making are used in climate-related interactions between knowledge institutes and regional stakeholders?
2. Under what circumstances and to what extent do the frames function as aids or hindrances for communication and learning on climate-related planning?
3. How can communication and learning be improved, especially by taking the role of frames into account?
4. Which guidelines and practical tools are relevant for actors such as scientists, practitioners and policymakers?

The project used a multidisciplinary approach that was adapted to the context of infrastructural planning and development, drawing mainly on expertise from social and organizational psychology, policy science, and science and technology studies. The approach was developed in interaction with a number of adaptation projects at the regional and local level, such as the Port of Rotterdam and the Province of Groningen (see below). Because processes of framing and reframing may take many years to develop, it was important to combine the short-term perspective of case studies with the long-term perspective provided by theoretical insights.

Unsurprisingly, it appeared that communication and learning in climate-related interactions can be improved substantially. Examples of problematic situations include controversies in water management (Kolkman, van der Veen, & Geurts, 2007) and issues concerning uncertainty in environmental assessment (Wardekker, van der Sluijs, Janssen, Kloprogge, & Petersen, 2008). Borrowing from the combination of theory and case studies, practical tools for supporting frame-based communication and learning were developed. Our work has provided a number of deliverables, such as guidance for uncertainty assessment and communication, and a frame-based guide to situated decision-making (see IC10 deliverables).

Our systematic approach to frames (de Boer, Wardekker, & van der Sluijs, 2010) was received positively by the national and international climate community. For instance, the main parts of it have been adopted by the UK Climate Impacts Programme (UKCIP) in its new guidance report on climate adaptation ("Managing adaptation: Linking theory and practice", see Brown, Gawith, Lonsdale, & Pringle, 2011).

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The next sections of this report give an overview of our approach and synthesized answers to the research questions mentioned above. Chapter 2 provides a short elaboration of frame analysis related to Questions 1 and 2. It presents a number of frames that are relevant for discussions on science-related issues, such as climate change. Chapter 3 will address some critical choices and assumptions of decision-making related to Questions 3 and 4. One of the most important choices is selecting a decision strategy, which, in turn, may shape the choices of appropriate methods and tools, as well as the social structure that fits the process. Finally, in Chapter 4 we present and discuss the key insights.

2. Frames applied to science-related issues

2.1 Frame analysis

Enabling the actors involved in decision-making to figure out what the crucial frames are is a challenging task. Frames can be expressed by various representations, such as how a problem is stated, who is expected to make a statement about it, what questions appear relevant and what range of answers might be appropriate. However, frame analysis is often hampered by the difficulty of unravelling the sheer flexibility and context-dependency of frames (Barsalou, 1999; Goffman, 1974). As mentioned before, the frame of an abstract term, such as a concept, an event, or a plan, is never experienced directly in its entirety. Even in hindsight, professional skill and knowledge may be required to carefully reconstruct the event-like structure of an environmental discourse (Hajer, 1995; Moser, 2005).

However, there is room for a more strategic approach, since frames are based on a shared cultural background of experiences, beliefs and practices. One option is to look at a strategic level for contrasting patterns of perception and communication. For example, the increasing salience of climate change manifestations sharply contrasts with the conceptualizations of climate change in terms of abstract and distal properties that were common in the recent past (Bord, Fisher, & O'Connor, 1998).

The term "*distal*" (versus "*proximal*") here and in the following text relate to having a more long-term (versus short-term) focus. The contrast between perceptions focused on distal and on proximal threats agrees with patterns of differences between distal and proximal levels of thinking (i.e. abstract versus contextualised) that have been reported in the literature (Liberman & Trope, 2008; Wakslak & Trope, 2009) and that are also of relevance for the interpretation of climate issues.

Another set of contrasts can be recognized when social actors try to influence each others' frame by using particular communication symbols (framing devices, see Gamson and Modigliani, (1989)). Important symbols include metaphors (e.g. Spaceship Earth), historical examples from which lessons are drawn (e.g. the most dramatic recent disaster), and visual images (e.g. picture of a polar bear). By adopting one of the frames they attempt to open certain positions in favour or against an issue. Presumably, much about this role of frames can be learned from the voluminous work that has been done in the field of science and technology controversies.

Social scientists who have analyzed public discussions on (policy relevant) science-related issues argue that these issues are often linked to only a few frames, which consistently appear across different policy areas (Gamson & Modigliani, 1989; Nisbet, 2009). For example, synthetic pesticides, such as DDT, have been framed as a blessing for humanity (before the year 1962), but also as "Pandora's box" (after the publication of Rachel Carson's Silent Spring in 1962), as a matter of specific risks and benefits to be decided on scientific evidence (with the rise of ecotoxicology as a science in the 1980s and 1990s), and as a key factor to keep certain industries competitive (along with each new pesticide regulation). These contrasts between promotion and prevention strategies can be linked to broader literature on goal directed behaviour (Higgins, 1997; 2000) and people's attitudes towards interventions in the natural world (de Boer, 2010).

2.2 Contrasting interpretations of climate-related issues

The frames applied to science-related communication suggest that two strategic contrasts can lay the ground for a simple framework to highlight interpretations of climate-related issues. The first contrast is the difference between a promotion or prevention orientation to goal-directed behaviour; the second involves taking a distal or proximal view on an object. The two are combined in Table 1. After a short explanation of this framework, it will be applied to various ways in which climate-related issues are being framed.

Table 1.
Two strategic contrasts combined.

Perceptual distance	Goal orientation and focus	
	Promotion orientation	Prevention orientation
Distal view (long-term, broad categories)	Using broad categories to represent general features and focusing on gaining positive outcomes (hits)	Using broad categories to represent general features and focusing on avoiding negative outcomes (errors)
Proximal view (short-term, narrow categories)	Using narrow categories to represent contextualized features and focusing on gaining positive outcomes (hits)	Using narrow categories to represent contextualized features and focusing on avoiding negative outcomes (errors)

Generally, a promotion orientation makes the person sensitive to positive outcomes and hits (as opposed to errors) that may be gained through aspirations, accomplishments, and ideals (Higgins, 1997; 2000). In contrast, a prevention orientation makes the person sensitive to negative outcomes and errors that have to be avoided by fulfilling one's moral obligations and responsibilities. This difference is not just a matter of personal mindsets – the orientations can be associated with certain institutions, subcultures within an organization, or occupational groups. Engineers, for example, are said to be safety oriented and inclined to "overdesign" for safety (Schein, 1996).

In line with the second contrast, taking a distal (versus a proximal) view on an object may evoke broad categories to represent its general features rather than its more contextual and incidental aspects (Liberman, Trope, McCrea, & Sherman, 2007). This may include more abstract moral principles to judge the object. In contrast, a proximal view induces categories that are narrower to represent more detailed and contextualized features. A proximal view is more constrained by concrete realities and it may very well go together with intentions to implement a plan (Goldstone

& Barsalou, 1998). Again, these perceptual differences also have cultural relevance. They are closely related to differences between holistic and analytical ways of thinking, each of which may have become more useful and more available in one culture than in another. For instance, Easterners tend to engage more in holistic perceptual processes whereas Westerners tend to engage more in analytical ones, but this preference should be seen as a matter of default (Nisbett, 2003).

2.2.1 A distal approach to prevention: "An Inconvenient Truth"

Building on this framework, Table 2 captures the different frames that may underlie discussions on science-related issues and provides relevant examples. Table 2's upper right cell represents a *distal* approach to *prevention-orientation*. Prevention-oriented frames aim to avoid errors in dealing with, for example, the earth's atmosphere or with climate change adaptation. This may be combined with broad categories of thinking about moral aspects of climate change.

Table 2.
Science-related frames (adapted from Nisbet, 2009) grouped into four strategic contrasts, with examples about climate issues.

Perceptual distance	Goal orientation and focus	
	Promotion orientation	**Prevention orientation**
Distal view (long-term, broad categories)	*Social progress frame* Defines the issue as improving quality of life or harmony with nature *Middle way frame* Puts the emphasis on finding a possible compromise position between polarized views *Example:* Plan to reconcile adaptation and mitigation	*Morality/ethics frame* Defines the issue in terms of right or wrong; respecting or crossing limits *Pandora's box frame* Defines the issue as a call for precaution in face of possible impacts or catastrophe *Example:* Al Gore's movie, An inconvenient truth
Proximal view (short-term, narrow categories)	*Economic development frame* Defines the issue as investment that improves competitiveness *Conflict/strategy frame* Defines the issue as a game among elites, a battle of personalities or groups *Example:* Climate Proof City	*Scientific uncertainty frame* Defines the issue as a matter of what is known versus unknown *Public accountability frame* Defines the issue as responsible use or abuse of science in decision-making *Example:* Sea level discussion

Al Gore's movie "An Inconvenient Truth" fits well into this pattern, calling for precaution in the face of potentially catastrophic impacts. Regarding the rise of the CO_2 concentration and the extrapolation thereof into the future, Gore noted that "Ultimately, this question is not political, but a moral issue ... If we allow that [the extrapolated rise] to happen, it is deeply unethical". He continued to describe various impacts that may occur when climate change remains unchecked, and noted that future generations will judge our actions today ("what were our parents thinking?"). Gore often stressed certainty and scientific consensus; other Christian voices in the public debate on climate change diverge on what is the most ethical way forward. In the United states, various groups and commentators discuss climate change as an ethical issue related to intergenerational equity, the implications for the poor, and the relation between humankind and nature (Wardekker, Petersen, & van der Sluijs, 2009). While the groups diverge in their assessments of policy strategies and the pro's, con's, outcomes, and fairness of these, they – including the climate-sceptical ones – use very similar ethical starting points and imagery (e.g. stewardship over "God's garden" and passing on the "gift of creation").

2.2.2 A proximal view of prevention: "The Deltacommittee report"

The work of the Intergovernmental Panel on Climate Change (IPCC) and the national report of the second Dutch Deltacommittee (Deltacommissie, 2008) on flood safety in the Netherlands take a more *proximal* view of *prevention-orientation* (lower right cell of Table 2). The Deltacommittee report aimed to develop an integrated vision for the Netherlands for centuries to come. Despite the report's long time horizon, it has a narrow, specific, concrete focus, for example, on specific sea level scenarios.

The report details the latest scientific insights on specific changes, their impacts, and possible policy options. As the uncertainty associated with projections on such long timescales is very large, the committee explored the plausible upper limits of regional climate changes (sea level rise and river discharge in particular) for the Netherlands. They assessed, through modelling, the implications thereof for long term water safety and fresh water supply. This upper-limit scenario assumed a global mean temperature rise of 6 °C in 2100 and accelerated sea level rise through rapid non-linear melting response to warming of the Greenland and Antarctic ice sheets.

The report's publication stimulated a lively public debate on dealing with scientific uncertainty in designing long term policy strategies. For example, many wondered whether the recommendations should be followed, considering the fact that the assumed scenario was considerably more extreme than the national meteorological institute's national climate scenarios. This debate on specific sea level scenarios distracted somewhat from the long term vision development that was intended. In contrast to the more holistic vision and viewpoints expressed in the report's chapter headings (e.g. "developing with the climate"), many of the recommendations were, in fact, fairly top-down engineering and implementation-oriented, such as national scale flood safety regulations and dike improvement, a mechanism to warrant long term availability of financial means required to maintain flood safety under the extreme sea level rise scenario, and the appointment of a national "delta director".

2.2.3 A proximal view of promotion: "Climate-proof city"

Both prevention-oriented frames contrast with two promotion-oriented frames. *Promotion-oriented* frames highlight the possible gains that climate-related issues can entail for society. A proximal example of this is the notion of a "climate-proof city" such as expressed in the city of Rotterdam, the Netherlands (lower left cell of Table 2).

The city, which host Europe's largest seaport, is adjacent to the North Sea, at the mouth of the river Rhine, and includes dike-protected areas below sea level as well as areas outside the dike defence zones (at 2.5-5 m above sea level). It is expected to face numerous challenges due to climate change. However, the municipality aims to establish a strong economy and attractive city. Being (and clearly appearing) well-prepared for climate change is considered an important factor in promoting these aims (see e.g. Wardekker, de Jong, Knoop, & van der Sluijs, 2010). The city aims to be a frontrunner on both adaptation and mitigation. It emphasises and advertises various strengths and ambitions, such as innovative action, initiative and leadership, reframing climate change from a "threat" to an "economic chance". In our workshop with local actors, many practical adaptation options were generated using concepts such as climate-proofing, resilience, and water as opportunity for urban development. In 2007, a city-wide programme, the Rotterdam Climate Initiative (RCI), was created to realise the ambitions, provide a concrete action plan (with clearly defined goals), and monitor the progress. The RCI includes partners such as the city's municipal departments, the port authority, the local environmental protection agency, and the local employers' organisation.

2.2.4 A distal approach to promotion: "Hotspot Groningen"

A more *distal, promotion-oriented* approach (upper left cell of Table 2) may be typical for attempts to reconcile potentially competing policy objectives, such as climate change mitigation and adaptation. At the regional level, this approach was taken in the north of the Netherlands, where the sea-bound "Hotspot Groningen" project was led by the Province of Groningen.

The project, at the interface between sea level adaptation, sustainable energy options and spatial planning, was designed by a landscape architect. In our workshop with regional actors, he emphasised that the concept of "growing with the trends" (versus "blueprint planning" to resist them) should play an important role to make the region climate-proof, and more generally "future-proof". The project's activities included stakeholder dialogues and creative workshops, as these were considered more suitable for structuring "wicked problems" and developing and creating societal support for options than "scientific analysis". Initially, the findings were intended to inform the Provincial Environment Plan, which provides the legal basis to integrate plans with respect to environment, traffic and transport, water, and spatial planning. However, tensions seemed to exist between the Hotspot project and the setup of the Plan. Although the Plan started with a phase of searching for inspiration regarding desirable futures, vision-development was replaced relatively quickly by an approach that focused on proximal intentions. The switch of frames may be attributed to the desire of the provincial deputy to have measurable targets that are legally enforceable. Although members of the Hotspot team were honoured with several international awards for their advanced planning concepts and designs, the provincial strategy has, in fact, moved from the upper left cell of Table 2 to the lower right cell.

2.3 Contrasting frames

Taken together the four cells of Table 2 can improve our understanding of the various ways in which climate issues may be framed. In addition, the contrasting features of the four cells indicate that none of the frames is a stand-alone guide to an adaptive choice. Each frame has its strengths and weaknesses in articulating the specifics of a situation. Prevention may have to be complemented with promotion (or vice versa), and the distal view of broad strategic planning needs a more implementation-oriented, proximal way of thinking about how measures can be organized. Hence, introducing a contrasting frame may be used to open-up the process of decision-making.

3 Frames built-in in decision tools

3.1 Decision strategies

In the process of decision-making, frames will have crucial impacts on the selection of a decision strategy. This refers in particular to those aspects of a particular frame that highlight uncertainty about science and uncertainty about politics. In other words, the question is whether the actors involved in decision-making need more scientific knowledge and/or more deliberation on preferences. These questions can fruitfully be addressed using Thompson's seminal approach to strategy development. According to Thompson, the two basic dimensions of decision are beliefs about (1) the cause/effect relations that are instrumental for what the decision might actually accomplish and (2) preferences regarding the possible outcomes of the decision (Thompson & Tuden, 1959; Thompson, 2003). Depending on the specifics of the situation, both dimensions can take a range of values. However, for the sake of clarity of the presentation, they are often dichotomized; i.e. the actors involved in decision-making perceive certainty or uncertainty regarding causation and certainty or uncertainty regarding outcome preferences.

Table 3 presents the patterns of uncertainty of the two dimensions. Whether cause/effect relations are believed to be uncertain may depend on several conditions, such as the actors' beliefs that the existing knowledge is incomplete, that there is inherent uncertainty or uncertainty due to competition with opponents (e.g. rivals in the market). Outcome preferences can become uncertain in situations where a single individual or organization appears to hold multiple, opposing preferences regarding the outcomes of possible actions. An additional type of uncertainty occurs when there are external constraints that make the actors involved in the decision dependent on others who hold veto power over some possible preferences. This may happen where regional decision-making is restricted by strategic planning processes that are coordinated by governmental institutions and other agencies (Few, Brown, & Tompkins, 2007). In sum, Table 3 may be very helpful in telling complete stories about uncertainty, including quantitative and qualitative aspects of uncertainty (Patt, 2007; van der Sluijs et al., 2005; van der Sluijs, Petersen, Janssen, Risbey, & Ravetz, 2008).

Table 3 also provides logical links between uncertainties and strategies of decision-making. Actors who are confronted with uncertainties regarding causation and outcome preferences should adapt their decision strategy to these issues (Thompson and Tuden, 1959; Thompson, 2003). Provided that there is at least a certain degree of commitment to reaching agreement, they may choose one of the four types of decision strategies.

- If the actors believe that there is enough certainty regarding both causation and outcome preferences, decision-making is relatively straightforward, although it may require a computational strategy to process voluminous data (upper left cell of Table 3).
- If outcome preferences are clearly known and shared but cause/effect relations are uncertain or disputed, the actors must rely on a judgmental strategy to find a solution (lower left cell of Table 3).
- In contrast, if cause/effect relations are certain but outcome preferences are uncertain or disputed, the actors need a compromise strategy to identify an acceptable preference (upper right cell of Table 3).
- Finally, if both causation and outcome preferences are uncertain or disputed, the most likely action of the actors is to avoid any decision on the issue, unless an inspirational strategy can be introduced to create a new vision or belief (lower right cell of Table 3).

Table 3.
The two basic dimensions of decision combined to identify different decision strategies (after Thompson, 2003).

Beliefs about cause/effect relations	Preferences regarding possible outcomes	
	Certain	Uncertain
Certain	Causation and outcome preferences are certain, data are voluminous *Computational strategy*	Uncertain due to • opposing preferences • external constraints *Compromise strategy*
Uncertain	Uncertain due to • incomplete knowledge • inherent uncertainty • competition with rival decision-makers *Judgmental strategy*	Uncertain due to • a combination of reasons from the upper right cell and the lower left cell *Inspirational strategy*

3.2 Suitable decision tools

Each decision strategy can be elaborated to find methods and tools with built-in frames that fit the strategy. Table 4 shows a number of options.

A *computational strategy* (upper left cell of Table 4) may rely on conventional forms of decision support, such as multi-criteria analysis tools (MCA) and cost-benefit analysis (CBA). The built-in frame of these methods sees the decision situation as a problem for which an optimal solution might exist, provided that trade-offs will be accepted. The notion of trade-offs can be an argument to opt for a transparent, quantitative evaluation of the options. CBA can identify the most advantageous solution or at least those options for which benefits are greater than the costs, because it may attach a monetary value to every aspect considered relevant to society. In fact, this monetarisation is framed as aggregating independent individual choices in a market context. However, CBA is not adapted to long time horizons (> 25 years) and may generate questions about the ethics of interest rates and long-term discounting (Stern, 2007; Turner, 2007).

Alternatively, the decision situation may be framed as a problem whose solution should satisfy a wide set of constraints (upper right cell of Table 4). Following a *compromise strategy*, the decision makers may want a course of action that is acceptable to all kinds of stakeholders. To find a common preference, participatory tools can be applied, such as community planning tools, which can be framed as building on deliberative democratic forums (Welp, de la Vega-Leinert, Stoll-Kleemann, & Jaeger, 2006). Such a frame involves some form of open, goal-directed conversation or "dialogue" between decision-makers, experts and other stakeholders, which may create favourable conditions for the exchange of diverging arguments. It should be noted, however, that people with diverging arguments can only communicate meaningfully if their frames overlap to a certain degree (Brockriede, 1992).

Table 4.
Methods and tools that are relevant for the decision strategies.

Beliefs about cause/ effect relations	Preferences regarding possible outcomes	
	Certain	**Uncertain**
Certain	*Computational strategy* • Cost-benefit analysis tools • Multi-criteria analysis tools • Accounting tools and physical analysis tools	*Compromise strategy* • Participative tools, e.g. stakeholder analysis and focus groups • Argumentation support tools • Negotiation tools
Uncertain	*Judgmental strategy* • Scenario analysis tools, expert panels, simulation gaming • Model tools (biophysical, socio-economic, integrated) • Checklists for judging model quality and uncertainties	*Inspirational strategy* • Cognitive aids, e.g. checklists for prompting new ideas, "rich picture" drawing • Development of learning-scenarios

Where outcome preferences are clearly known and shared but cause/effect relations are uncertain or disputed, the actors must rely on a *judgmental strategy* to clarify matters (lower left cell of Table 4). It is in particular the nature and the relevance of scientific uncertainty that can lead to difficult discussions between decision-makers and experts, as well as between experts among themselves (Dessai & Hulme, 2004; Lempert et al., 2004). Insight into the strengths and weaknesses of advanced tools such as influence diagrams (including Bayesian Belief Networks) and dynamic models (including computable general equilibrium models) will require an analysis of critical choices and assumptions. Uncertainty about the impacts of the behaviour of other people on the decision's outcomes may require a game theoretic approach.

Finally, an *inspirational strategy* (lower right cell of Table 4) may include tools to stimulate creativity, such as the development of learning-scenarios (Berkhout, Hertin, & Jordan, 2002). In fact, there are two diverging frames of creativity (Nguyen & Shanks, 2009). Some persons, such as the Hotspot Groningen team mentioned before, tend to emphasize the value of spontaneous insight and the magical "Aha!" moment that occurs when a long-sought idea suddenly appears at the conscious level. Other persons emphasize systematic approaches to exploring problems and potential solutions. The occurrence of insight is often associated with restructuring or reframing a problem space, for example, by putting the problem in a broader perspective or by zooming in on a particular detail. Both approaches should be supported by good preparation and the participation of people who have good knowledge about a particular domain and who are able to think flexibly and synthetically.

3.3 Suitable social structures

A closely related strategic consideration is the notion that institutions and groups have organized themselves differently to address different kinds of decision-making problems (Thompson & Tuden, 1959; Thompson, 2003). Hence, when the actors involved in decision-making want to adapt their decision strategy to the uncertainties regarding causation and outcome preferences, they also have to consider the social structures that are appropriate for the issues. Table 5 displays the most appropriate social structures for each of the strategies.

A computational strategy that is based on cost-benefit analysis, for example, should take into account that this tool can only be applied in a comprehensive way under specific conditions. Compliance with certain rules and conventions regarding the choice of discount rates is crucial to provide comparative insights into the financial costs and benefits of the options. Accordingly, the most appropriate setting for the use of cost-benefit analysis may be a bureaucratic structure that guaranties that every issue is routed to the appropriate specialist (upper left cell of Table 5). If public decision makers want authoritative statements about the results of computations, these will have to be produced by an official planning bureau or committee (e.g. the Deltacommittee). However, this does not preclude any other groups from using computational tools, such as a simplified or "quick scan" CBA, just for exploratory reasons.

Table 5.
Different social structures that fit the decision strategies.

Beliefs about cause/effect relations	Preferences regarding possible outcomes	
	Certain	Uncertain
Certain	Computational strategy in a bureaucratic structure	Compromise strategy in a representative structure
Uncertain	Judgmental strategy in a collegial structure	Inspirational strategy in an informal structure

A *compromise strategy* has to be developed if there is agreement by all parties regarding the expected consequences of the available alternatives but lack of consensus over preferences. From an organisational perspective (Thompson & Tuden, 1959; Thompson, 2003), the most appropriate setting to handle compromise types of issues economically and efficiently is a representative structure of intermediate size that facilitates detailed and subtle exploration of the several preferences (upper right cell of Table 5). In complex democratic societies, however, this type of rational problem solving should take into account that there are many ways to frame a representative structure and to develop criteria that include or exclude potential participants. For example, a framing of the "climate proof city" not widely shared by its residents might be contested by individuals and groups who feel excluded (e.g. Owens, 2000). As mentioned before, local decision-making may also be restricted by strategic planning processes that are coordinated at some higher level (Few et al., 2007). Hence, the social structure will often have to be adapted to fit the local cultural and institutional context in order to work.

A *judgmental strategy* is called for if causation is uncertain or disputed; this may require a collegial structure, such as a self-governing voluntary group that is competent by virtue of their expertise to make a judgment (lower left cell of Table 5). If none of the experts has indisputable and complete evidence, no member should be allowed to outvote or override the judgment made by other members and a majority judgment may be necessary. A specific variant is the Delphi method, which uses a model of "anonymous" interactions in a panel of experts (Kleindorfer, Kunreuther, & Schoemaker, 1993). However, what experts often take for granted as anonymous peer review is a frame that may not be shared by all the actors involved in decision-making. Hence, it is crucial that the production of information is not only perceived as credible and relevant but also as legitimate in the sense of being respectful of stakeholders' divergent values and beliefs, and fair in its treatment of opposing views and interests (Cash et al., 2003).

The fourth type of issue is one in which both causation and outcome preferences are uncertain or disputed (lower right cell of Table 5). In fact, these conditions make it difficult for all parties to prevent disintegrating tendencies, such as loss of contact or decreasing commitment to reaching agreement. Therefore, the actors involved may try to avoid any decision on the issue, unless a new vision or belief can be developed *(inspirational strategy*, Thompson & Tuden, 1959). Promoting the inspirational aspects of a decision strategy may require an informal setting that offers incentives for collective problem solving. Such a creative kind of activity may be stimulated by charismatic leaders or successful models of new visions. Metaphor development may be a significant step, since metaphors can provide a common language to communicate complex concepts to others and gain their support. The already mentioned case of Hotspot Groningen shows, however, that it is not easy for an informal group of creative professionals to overcome the political constraints of a government institution. Using Snow's notion of "frame bridging" (Snow, Worden, Rochford, & Benford, 1986), it may be said that the informal group was not equipped to bridge the gap between their frame regarding the issue and that of the formal organization.

Generally, decision makers should take into account that it is important to consider the match between decision strategy and social structure, especially if they want to change their strategy. For example, decision makers who operate in the context of a bureaucratic structure may not be in a good position for choosing another type of strategy than a computational one. If an organization, such as a governmental agency, adopts one of the four decision strategies as its dominant strategy, it may have to cooperate with other organizations to exercise a different kind of strategy, for example, to involve local stakeholders in a representative structure. Alternatively, it may be necessary to create a novel organization (or committee) to address issues for which traditional structures are ill suited.

Another strategic consideration is the relationship between the science-related frames and the decision strategies. Figure 2 illustrates that there may be a loose coupling between the various elements of decision-making. For example, an economic competitiveness frame may give rise to a computational strategy to check the optimum. Similarly, a morality frame may lead to a compromise strategy in order to check the constraints of a morally acceptable solution. A scientific uncertainty frame may require a judgmental strategy to clarify what is known versus unknown. And a social progress frame that aims to reconcile opposing policy objectives may have to be fleshed out by an inspirational strategy. However, these linkages are not the only possibilities and Figure 2 can be seen as a heuristic device.

Our interaction with a number of adaptation projects at the local and regional level showed that the information that is summarized in Figure 2 works as an eye-opener for actors involved in decision-making. This relates in particular to the exposé of contrasting frames and the way in which they may open-up decision-making. For instance, experts from knowledge institutes considered it very helpful to separate the various questions they received from policy makers into question regarding scientific uncertainty and questions about political uncertainty. They used this frame-based distinction to prioritise their research activities and to improve their communication with policy makers.

Based on these experiences we have written a tool catalogue in which we present characteristic examples of how various tools mentioned in Table 4 deal with framing (Wardekker et al., 2009). The examples are meant to demonstrate that it may be very fruitful to use more than one frame and more than one strategy after another. If the built-in frames are made more transparent, tools can be used as "boundary objects" or focal points around which knowing-in-practice may arise (Spee & Jarzabkowski, 2009); i.e. tools are not only important instrumentally for problem structuring,

problem solving and decision-making but also productively to stimulate interaction across professional boundaries and enable sufficiently shared meanings to move forward.

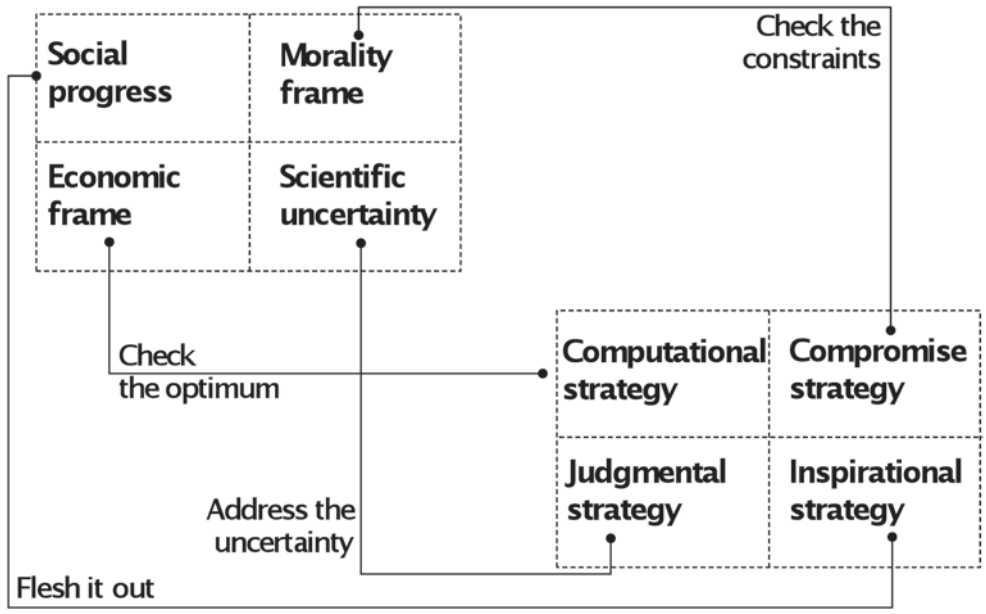

Figure 2.
Loose coupling between science-related frames and decision strategies.

4. Key insights and future work

4.1 Key insights

This report has discussed several crucial aspects of frames and their role in decision-making in the area of climate change. Frames can particularly be of help in adding new perspectives to a decision process and in checking whether the participants are able to understand each other.

Adding new perspectives may be crucial for several reasons. The first is that it opens up the option space so that new and otherwise overlooked response options may emerge. Another reason is that any complex decision is often nested within a broader set of aspects (Kleindorfer et al., 1993). These aspects may include promotion or prevention oriented objectives, as well as abstract long-term visions and more narrowly defined implementation-related issues. One of the experts in scenario development, van der Heijden (2004), notes that a single stand-alone scenario project does not very often lead to "blinding insights" on what to do. It does not sensitise decision makers to multiple interpretations of weak signals and may result in what Marx et al. (2007) call the single-action bias, that is a propensity to take only one action to respond to a problem, such as just raising the dikes, in situations where a broader set of remedies is called for, e.g. to make a system more resilient.

Adding new perspectives is also relevant because a single frame will induce a passive acceptance of the information given (Kahneman, 2003). Instead, contrasting frames may be used to stimulate more active participation in decision-making and include groups, such as knowledge producers and

stakeholders, who may fruitfully contribute to this process. A careful consideration of frames in their role of organizing principles may lead to a more in-depth understanding of the information tools that can be used to support situated decision-making. This will facilitate a better match between supply and demand of information among all the actors involved, i.e. knowledge producers, decision makers and stakeholders.

A closely related point is that actors can only communicate meaningfully if their frames overlap to a certain degree. If the frames of two persons share too little, they will be unable to co-operate in the same process and their interaction may result in a "dialogue of the deaf". In the context of climate related decision-making, however, overlapping frames are not self-evident. The tools that are available to support decision-making have been developed by experts from strongly divergent disciplines, covering both the natural and the social sciences. This divergence may create many frame-based problems. For example, due to the technical nature of computational tools, these decision support tools may become counterproductive if their outcomes cannot be shared with decision makers and stakeholders who see themselves as problem owners but have fundamentally different frames. If decision makers and stakeholders do not recognize how their input has been incorporated in the analysis, they will lose their trust in the legitimacy of the information production (Cash et al., 2003).

4.2 Future work

Raising frame-awareness is just the beginning. Future work should look for, on the one hand, connections to form a bigger picture of frame-based approaches, and, on the other hand, more information on the specifics of decision processes.

The present analysis of contrasting frames can be positioned between more cognitive and more political approaches to these issues. In a political context, there is at least a genuine tension between actors with different interests and frames. Those of them who have more power have more control over the frames that are being used. Yet, at points of policy-uncertainty, there are chances for less powerful actors to define the frame, at least temporarily. Because climate change manifestations may contribute to policy uncertainty, this is an important point, as revealed by the Hotspot Groningen case. What happened in this case has much in common with policy stories described by Schön and Rein (1994: p. 91) about designers who create a policy plan, which they put out into a larger arena, where other actors respond to the plan guided by their more implementation-oriented interests and frames. As they compete to control the plan, it may evolve in ways that differ from what any one of them had intended. Although this seems to be a classic problem of planners versus implementers, it should be taken into account that climate change manifestations may cause many disputes and much uncertainty. This prospect makes it necessary to perform more detailed research into how the problem of planners versus implementers is related to processes of decision-making on climate change adaptation.

One limitation of the project is that we did not address the issue of managing the decision process. Thompson and Tuden (1959) already referred to process-related problems, such as confusion of issues, structural constraints, inappropriate decision teams and expansion tendencies in decision issues. As decision makers change their beliefs about cause-and-effect relations, for example, types of issues that at one time are identified as appropriate for a judgment strategy may at another time be defined as computational problems, or vice versa. Also, different decision makers may respond to the same situation in different ways, some seeing it as a matter for computation, others as a judgment matter, and still others as requiring bargaining. According to Schoemaker and Day

(2009) moderate conflict, as opposed to little or extreme conflict, leads to the best decisions, but the conflict must be among ideas, not individuals.

If the issue to be decided is linked to serious pre-existing conflicts, strategy development should first create a more neutral starting point. Even then, however, both a judgmental and a compromise strategy may fail due to increasing tendencies of polarization. The heat of debate can lead experts who endorse a particular solution to overstate their case, discount missing information and refer to moral justification for the solution they prefer. When this occurs, the issue is no longer one of judgment but one of compromise. Similarly, an issue that seems fit for a compromise strategy may generate difficulties in the identification of causation. Next, proponents may discount causation theories endorsed by their opponents and dismiss the corresponding "facts". As a result of this polarization, parties may start to threaten each other with trouble on unrelated matters (Thompson & Tuden, 1959). Obviously, this is precisely what has happened in several climate-related discourses (Kellogg, 1987; Nisbet, 2009).

If sharp conflicts can be reduced or alleviated, reframing may help to open-up the process of decision-making (Schön & Rein, 1994). A crucial way to reframe a situation may result from changes in people's interpretations of a topic. For example, it may be helpful to put climate change adaptation and mitigation in the context of a higher-level objective, such as sustainable development (Robinson et al., 2006), thereby enabling decision-makers to spot options that they initially missed. Emphasizing the functional relationship with sustainable development makes it easier to combine the impacts of adaptation and mitigation with those of other environmental changes. Placing a particular issue in a larger context is not only relevant to handle bargaining issues, but it can also help to crystallize consensus about preferences if the parties involved are unaware of the similarities of their preferences.

Alternatively, reframing may occur by means of zooming-in on the actual specifics of a situation, for example, by organizing a site visit to a particular area. This may be the starting point of a more innovative approach to an issue.

An important area of further research is to examine whether the exposé of contrasting frames that was presented in this report will also be useful in other parts of the world. Although there are many differences between, for example, Asians and Westerners in how they conceptualize the world, these differences are now commonly thought of as different default hierarchies. For example, Westerners are more likely to insist on using formal logic, while Asians are willing to live with more contradiction, but this difference is not absolute (Nisbett, 2003). Moreover, in our approach there is room for both. The first group may see the decision situation as a problem for which an optimal solution might exist, to be found by a computational strategy. The second group may see the decision situation as a problem whose solution should satisfy a wide set of constraints, to be found by a compromise strategy. The main point is that all the actors become aware of these potentially hidden differences.

Overall, our experiences demonstrate that climate change manifestations may induce much uncertainty related to science and policy. In this context, a frame-based approach can contribute to a comprehensive repertoire of methods and tools for adaptation planning and implementation. In particular, presenting more than one frame may work as an eye-opener for actors involved in decision-making. Contrasting frames may be used to stimulate more active participation and enable policy-makers to avoid lock-in on a non-reflected frame. Because each frame may have its strengths and weaknesses in articulating the specifics of a situation, it may be fruitful to use more than one frame after another. In sum, decision-making may gain from making frames more transparent and promote systematic reflection on frames.

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Climate changes Spatial Planning

Climate change is one of the major environmental issues of this century. The Netherlands are expected to face climate change impacts on all land- and water related sectors. Therefore water management and spatial planning have to take climate change into account. The research programme 'Climate changes Spatial Planning', that ran from 2004 to 2011, aimed to create applied knowledge to support society to take the right decisions and measures to reduce the adverse impacts of climate change. It focused on enhancing joint learning between scientists and practitioners in the fields of spatial planning, nature, agriculture, and water- and flood risk management. Under the programme five themes were developed: climate scenarios; mitigation; adaptation; integration and communication. Of all scientific research projects synthesis reports were produced. This report is part of the Integration series.

Integration

The question is how to increase the 'adaptive capacity' of our society. Analysis of the adaptive capacity is related to the physical component (the feasibility of physical spatial adaptation) and to the existing institutional structures. Areas Climate changes Spatial Planning dealt with are: uncertainties and perceptions of risk; institutional capacity to deal with climate change; the use of policy instruments; and cost benefit analysis. Adaptation strategies must be in line with the current institutional structures of a policy area. For a proper decision process we developed decision support tools, such as socio-economic scenarios, the Climate Effect Atlas and other assessment frameworks.

Programme Office Climate changes Spatial Planning

c/o VU University Amsterdam, FALW

De Boelelaan 1085

1081 HV Amsterdam

The Netherlands

T +31 20 598 7318

c/o Alterra, Wageningen UR

P.O. Box 47

6700 AA Wageningen

The Netherlands

T +31 317 48 6540

info@klimaatvoorruimte.nl

www.climatechangesspatialplanning.nl