On the relationship between risk perception and climate proofing

Knowledge for Climate
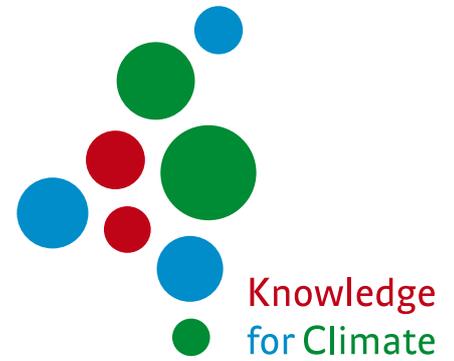
On the relationship between
risk perception and climate proofing

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Summary

This document provides the results of a scoping study into the role of risk perception in shaping climate proofing the Netherlands. The main points are the following.

What is the problem?

- Climate change cannot be perceived directly; hence, decision-making on mitigation and adaptation has to be informed by reports on detection and attribution of climate-related signals.
- As long as the impacts of climate change do not become manifest in 'strong signals', such as actual disasters, decision-making will depend on the perceptual capacity to see the significant meaning of 'weak signals'.
- Interpretation work directed at 'weak signals' often involves risk perception; this is an interpretation of an event based on one or more dimensions of the risk-frame (which include the likelihood of harm and one's vulnerability to harm).
- The perception of climate-related risks (floods, droughts, heat stress, diseases) and their geographical variation is crucial for developing adaptation policy and for communication about collective and individual choices that affect risks.
- However, continuous changes in the political, economic, scientific and ethical environment of decision-making and communication will make it very difficult for all actors to avoid simplifying interpretations and misleading perceptions, which may well result in a 'dialogue of the deaf' that hampers climate proofing.

What aspects of the problem need further research?

- Against this background, there is a need among the Dutch Hotspots for research into the question: What conditions can make risk perception work as a positive and not as a negative factor in climate proofing the Netherlands?

Sub-questions	Potential knowledge users
How can policy-makers and practitioners be enabled to understand the role of risk perception dimensions in:	
- fostering a sense of problem ownership among the public and avoiding a 'dialogue of the deaf',	Ministry of Transport, Public Works and Water Management (and other ministries)
- preventing property devaluation as a result of changing location choices by household and firms	Municipality of Rotterdam, Havenbedrijf
- supporting the design and implementation of building precautionary measures	Water boards, municipalities (Rotterdam)
- promoting the adoption of appropriate protective measures by households and firms, and avoiding non-protective responses	Ministry of the Interior and Kingdom Relations, water boards, municipalities
- developing novel insurance options	Insurance companies, municipality of Rotterdam
- ensuring that residents and employees are well-prepared to take context-specific actions in case of an emergency	Water boards, municipalities (Rotterdam, Dordrecht)

1. Aim and scope

Climate proofing the Netherlands will involve the building of hard infrastructure to reduce risks in the proactive and prevention stages of the safety chain and also the use of 'softer' measures, such as insurance schemes or evacuation plans, in the preparation stage [Kabat, Van Vierssen, Veraart, Vellinga & Aerts, 2005]. The organization of these activities requires a participatory approach in which strategies are discussed at all administrative levels. This means that, sooner or later, policy-makers, professionals, residents and business owners will be confronted with each others' perceptions of climate-related risks. As the recent past has shown, such a confrontation may be a recipe for misunderstandings and controversies.

Although there is a core meaning to the concept of 'risk', the word means different things in different situations. For instance, the policy objective of making the public more aware of climate issues by '*increasing risk perception*' can in fact refer to:
- increasing the perceived likelihood of specific unwanted events, and / or
- increasing the feeling of personal vulnerability to stressful events.

As these are quite different policy impacts, it is important to consider what the word risk means and why it is crucial to take risk dimensions, such as likelihood and feeling of vulnerability, into account.

The role of risk perception in shaping climate proofing the Netherlands is an open issue in the Knowledge for Climate programme. Several of the programme's geographical hotspots that are vulnerable to the effects of climate change have indicated to be interested in this topic (e.g. *Onderzoeksagenda Waterkader Haaglanden* and *Waterplan Rotterdam*). Moreover, a number of recent policy documents, such as *Versterken waterbewustzijn en waterbewust gedrag*, has selected risk perception as one of the key research needs in flood safety management [De Bruijn, 2008; Ministerie van Verkeer en Waterstaat and Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2008]. There is a need for a better understanding of what risk perception is, whether it will help or hamper the solution of public policy problems, why that may happen, and what policy makers can do to converge their policy with the perceptions of residents and business owners.

The present study addresses the knowledge gaps that need to be filled to support the Knowledge for Climate programme and its Hotspots. Specifically, the study aims at the following objectives:
- To make multidisciplinary knowledge on risk perception accessible to potential users;
- To make a brief inventory of knowledge demands;
- To give suggestions for further research.

The study is based on multi-disciplinary, behaviour-oriented background literature, a focus group discussion and individual interviews with representatives of agencies connected to the Hotspots.

Chapters 2 and 3 describe the relevant background knowledge. Chapter 2 presents an introduction to risk perception and the role of frames. Chapter 3 sets out to explain the differences between framing climate change and climate proofing. Finally, Chapter 4 addresses how perception can be translated into policy. This is the basis for the identification of knowledge gaps and the suggestions for further research.

The list of persons who were consulted is provided in Appendix 1. Appendix 2 contains a short report (in Dutch) on the focus group discussion with representatives of the Hotspots.

2. Risks, frames and climate change

After a short introduction to the perception of risks, this chapter will explain the background of the risk-frame and the main risk dimensions. Then it will emphasize that climate change is still very much a science-related issue. Because this linkage plays an important role in climate-related discussions among scientists and non-scientist, a simple framework is outlined that demonstrates how perceptions are being shaped by underlying principles.

2.1 Risks

Basically, risks are not directly perceived – what people call 'risks' are particular interpretations of observed phenomena. These interpretations crucially involve the notions of chance and harm in relation to a positively valued object (asset) and a chosen action (see Figure 1). This pattern can be revealed by linguistic analysis. When searching for linguistic evidence for the meaning of the English word risk[1], Fillmore and Atkins [1994] found at least five senses for the noun:

1. Dangerousness, a dangerous situation ('*too much risk attached to it*');
2. Unpleasant possibility ('*the risk of being killed*');
3. Someone or something dangerous (to/for) ('*he is a big risk*');
4. The possibilities against which one can buy insurance ('*to insure against all risks*'); and
5. The chance or hazard of commercial loss ('*there can be no success without risk*').

Hence, there are various uses of the term. Interestingly, in some of its uses the word risk represents something computable. In insurance settings, for example, 'risk' seems to have a pre-defined meaning about what insurance covers [Hamilton, Adolphs, and Nerlich, 2007].

In other settings, the various uses of the term risk just share some reference to the notion that the future is uncertain, and that among the alternative possible futures that one faces are some that one might want to avoid [Filmore and Atkins, 1992]. This interpretation can be found, for example, in discussions about when climate change will become 'dangerous' for the environment; the latter was an important issue at the 1992 United Nations Framework Convention on Climate Change [Lowe & Lorenzoni, 2007].

2.2 The risk-frame and its risk dimensions

The major uses of the term risk can be explained by a frame-based approach. Theoretically it is assumed that people cannot understand the meaning of a word, such as risk, without access to all the essential knowledge that relates to this word. This essential knowledge is captured by an underlying organizing principle or frame. As Fillmore and Atkins [1992] note, frames can either be created by or reflected in the language. A word activates, or evokes, a frame of semantic knowledge relating to the specific concept it refers to.

Frames demonstrate that individuals represent many relations conceptually. The risk-frame can be seen as a relational structure of abstract story components that involve not only chance and harm but also a protagonist, an asset, a choice, an action, a risky situation (see Figure 1). Such a frame enables individuals to understand the word's meaning with reference to a structured background of experiences, beliefs or practices [Barsalou, 1999]. Once individuals can master the word to a culturally acceptable degree, they have an adequate understanding of it.

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[1] The English word 'risk,' the French 'risque,' and the Dutch 'risico' are derived from the Italian words 'risco' or 'risico'.

It should be emphasized that the frame of an abstract term, such as risk, is never experienced directly in its entirety. Depending on the circumstances, subsets of frame information (subframes) become active to highlight specific risk dimensions. This insight has been one of the most important results of research into the perception of technological hazards. The vast literature on this topic [e.g. Sjöberg 2000; Slovic, 1992; Vlek and Stallen, 1979] has identified a number of (partly overlapping) risk dimensions; the most important of which are:

- the degree to which exposure to the risk is voluntary,
- the likelihood of harm,
- one's vulnerability to harm (or lack of control over harm),
- the extent of harm a hazard would cause, and
- the degree to which sources of risk information can be trusted.
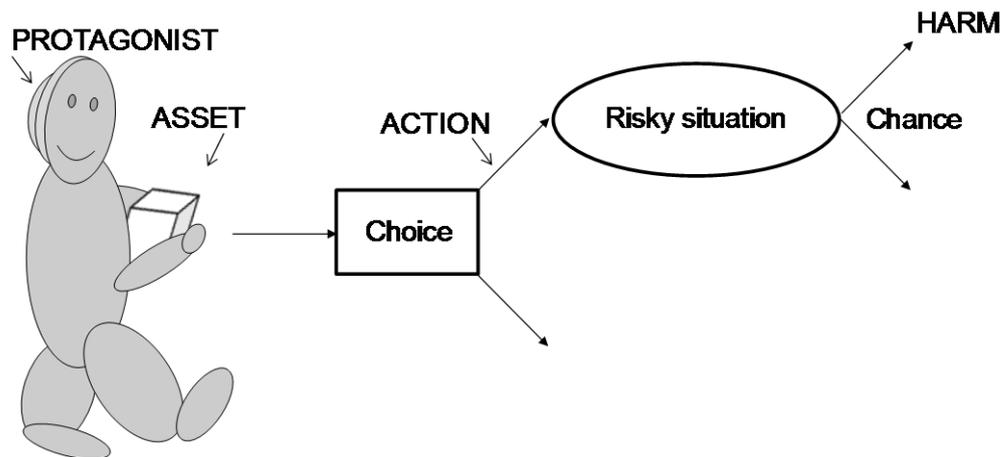
Figure 1. What people call a 'risk' is a relational structure of abstract story components (adapted from Fillmore and Atkins, 1992).

The value-laden meanings of the different risk dimensions demonstrate that frames are not just personal mindsets but mainly cultural structures. Frames are underlying structures of perception, knowledge, and behaviour, which are studied by researchers 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, and science studies. One of the reasons why it is often difficult to reveal their role is their 'hidden' or 'taken-for-granted' character.

Frames shape in a 'hidden' and taken-for-granted way, for example, how a problem is stated, what questions appear relevant and what range of answers might be appropriate. A specific example is the 'safety chain,' a set of risk dimensions developed by professionals. The safety chain approach to risk and crisis management is based on a crucial distinction between five major stages of a hazard life cycle (pro-action, prevention, preparedness, response and recovery). This semantic framework for safety engineering practice may characterize a typical professional in this field.

In cases of policy controversies, frames also affect how social actors interact with other actors and take shared or opposing positions regarding an issue. Policy controversies arise in the politically coloured process of policy design when shifts in the situation, internally or externally generated, trigger conflicts of interests rooted in the actors' divergent frames [Schön and Rein, 1994]. Accordingly, an analysis of competing frames (or subsets of frame information) may help to make the positions of the opponents more transparent and negotiable. Presumably, much about the role of frames can be learned from the voluminous work that has been done in the field of science and technology controversies [Gamson & Modigliani, 1989; Nisbet, 2009].

In sum, it appears that risk perception can be described as an interpretation of an event based on one or more dimensions of the risk-frame. This means that there is room for different interpretations. People often underestimate how, for example, risk communication can be hampered by differences in the risk dimensions they use (e.g. one person focusing on the likelihood dimension and the other on trust). If the frames of two opponents share too little, they will even be unable to communicate.

2.3   'Dangerous' climate change

Although there is no standard methodology to measure frames, they can be better understood by analyzing contrasting opinions. In the past decades, studies in many countries have examined whether citizens perceive climate change as a risk in the sense of being 'dangerous for the environment' [Bord, Fisher, & O'Connor, 1998; Kempton, Boster, & Hartley, 1995; Lorenzoni & Pidgeon, 2006; Slimak & Dietz, 2006]. These studies revealed that many citizens of the developed countries saw global climate change as an issue with potentially serious but geographically and psychologically distant consequences.

However, some extreme weather events, such as severe rain- and river-based floods, have had a significant impact on risk perceptions in certain regions [De Boer, 2007] Among the citizens of these regions, the levels of worry about climate change and natural disaster were relatively high and both variables were significantly correlated. The weather events may have contributed to a process in which risks that were largely distal were reframed into more proximal risks with consequences that are much closer to people's personal lives.

Looking into more detail, dangerousness is not the only frame information that is relevant here. Because climate change is still very much a scientific issue, it is one of the policy areas that regularly generate debates among scientists and non-scientists. Social scientists who analyzed public discussions on science-related issues found that these issues are often linked to a few frames that 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 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).

2.4   Framework of perceptual contrasts

To clarify their meaning, the eight frames identified in the literature can be characterized in terms of two perceptual contrasts.

The first contrast involves a promotion or prevention orientation to goal-directed behaviour [Higgins, 1997; 2000]. Generally, a promotion orientation makes the person sensitive to positive outcomes and hits that may be gained through aspirations, accomplishments, and ideals. 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 9-20]. Another example is that a prevention-oriented attitude towards nature may clarify the way in which citizens of Western countries nowadays talk about 'nature knows best' or 'nature needs a little help' [De Boer, 2009].

The second contrast involves taking a distal or proximal view on an object. A distal view may evoke broad categories to represent general features of the object 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 also more constrained by concrete realities, including how other people do things. The person's attention may focus on important, goal-based aspects, or actively suppress irrelevant aspects [Goldstone and 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 [Nisbett, 2003].

Figure 2 combines the two perceptual contrasts and presents four cells that reflect promotion or prevention orientations in combination with a distal or a proximal view. Building on that framework, Figure 3 captures the different frames that may underlie discussions on science-related issues. In addition, each cell provides an example of a matching climate-related issue.

	Promotion orientation	Prevention orientation
Distal view	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	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)

Figure 2. Two perceptual contrasts combined.

The four cells in Figure 3 illustrate that there are major differences between the ways in which climate-related issues are being framed. Without going into details, it can be said that Al Gore's movie, *An Inconvenient Truth*, reflects holistic and moral thinking about climate change, calling for precaution in the face of potentially catastrophic impacts.

	Promotion orientation	Prevention orientation
Distal view	**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 > Plan for a tulip-shaped island	**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 > Al Gore, An inconvenient truth
Proximal view	**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 > 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 > Report Second Deltacommittee

Figure 3. Science-related frames (adapted from Nisbet 2009) grouped into four perceptual contrasts, with examples about climate issues.

In the Netherlands, the report by the second Deltacommittee [2008] takes a more proximal view, drawing on the latest scientific insights on plausible upper limits of regional sea level rise (i.e. using narrow categories). The report's publication stimulated a lively discussion on scientific uncertainty. Both Al Gore's movie and the Deltacommittee report demonstrate the characteristics of a prevention orientation, which aims to avoid errors in dealing with the earth's atmosphere.

In turn, 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. These frames may be linked to the notion of a 'climate proof city', such as the city of Rotterdam, which emphasizes its competitiveness by advertising its various strengths. A more distal view is reflected by the plan for a tulip-shaped island near the Dutch coast, which can be seen as a means of reconciling the objectives of land reclamation and coastal management.

2.5   Relevance of the framework

It should be emphasized that Figure 3 is meant to improve our understanding of the various ways in which climate issues may be framed. The importance of the contrasts is threefold.

Firstly, the contrasting pairs indicate that each frame may be a necessary but certainly not sufficient condition for effective decision-making. 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. Therefore, there is no reason to claim that, independent of the context, a certain frame is better than the others.

Secondly, contrasting frames may be used to support effective decision-making. One of the characteristics of frames is that they tend to induce a passive acceptance of the information given [Kahneman, 2003]. Because each frame may have its strengths and weaknesses in articulating the specifics of a situation, introducing a contrasting frame may open-up decision-making and enables people to adapt their ways of reasoning and understanding to novel and complex worlds.

Thirdly, scientists and non-scientists will also use the contrasting pairs to influence decision-making in the future. Social actors, such as policy-makers, often try to influence each others' frame by using particular communication symbols (framing devices), such as historical examples from which lessons are drawn (e.g. the most dramatic recent disaster), metaphors and visual images (e.g. picture of a polar bear). By adopting one of the frames they will try to open certain positions in favour or against an issue. Hence, it can be expected that the different frames will continue to shape climate-related communication in the years to come.

2.6   Conclusion

Risk perception is an interpretation of an event that is based on one or more dimensions of the risk-frame. There is room for different culturally acceptable interpretations. In addition, some other frames may be used in societal debates on climate-related issues. These include a social progress frame, an economic competitiveness frame, a moral boundaries frame, and a scientific uncertainty frame. These frames will continue to shape climate-related communication in the years to come.

3. Reframing distal risks into proximal risks

This chapter will explain that there are crucial differences between the frame that people tend to use to understand climate change and the frame that is required for a proper approach to climate proofing. The differences are growing in importance, because the coming years will show a continuous process of risk communication about climate issues. As described below, what has to happen is that risks with a distal character are reframed into more proximal risks.

3.1 An event-like frame

Although the frame of an abstract issue, such as a concept, an event or a plan, is never experienced directly in its entirety, it is feasible to highlight some of the issue's potentially relevant aspects [Barsalou, 1999]. Figure 4 demonstrates that climate change can be framed in an event-like structure that combines aspects related to 'causal attributions', 'identifiable places', 'time horizon', and additional 'uncertainties'. Each aspect has links to its relevant states, such as 'likely' or 'unlikely' in the case of causal attribution. Particular combinations of the aspects enable understanding of specific patterns of climate change manifestations, such as 'changes in snow' (likely attribution, identifiable places, short time horizon, low uncertainty) and 'sea level rise' (likely attribution, more latent places, long time horizon, high uncertainty). As stated before, this is just an example.
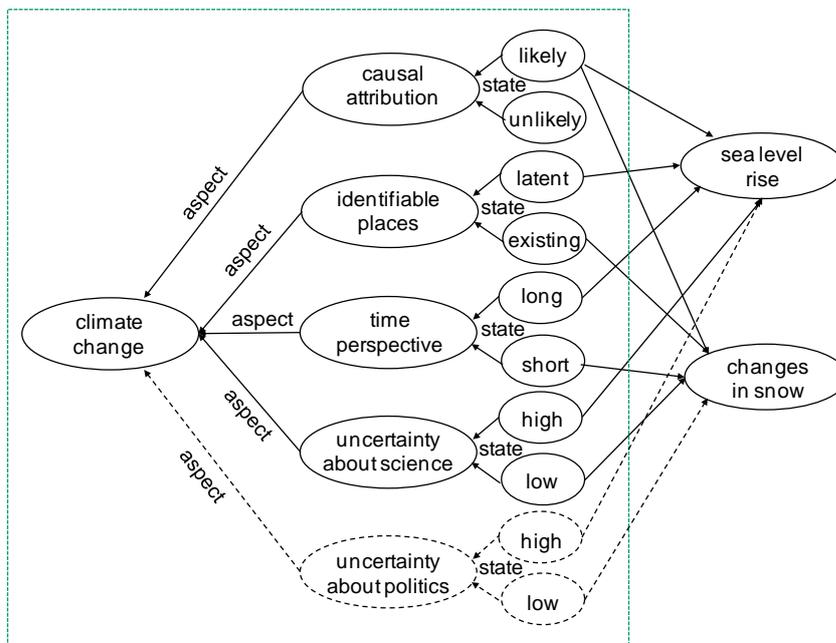
Figure 4. Main characteristics of the climate change manifestations 'changes in snow' and 'sea level rise', represented by an event-like frame (inside the box) that combines various aspects of the climate change concept.

Without going into all the details of Figure 4, it should be noted that the figure's key point in the present discussion involves the causal attributions. The other aspects should not be neglected, however. As mentioned in Chapter 2, climate change is often seen as a science-based issue and an important aspect of such an issue is the link with uncertainty. Both scientists and non-scientists can frame climate change in ways that may or may not highlight uncertainties in science. Another point is what will happen with uncertainties in politics (shown dashed in Figure 4). Again, this issue will not be pursued here.

3.2 Common cause and common effect models

Causal attributions reflect frames that create specific relational structures, such as storylines and mental models of causal processes. In view of this, it should be emphasized that thought processes on manifestations of climate change cannot be used directly in mental models of climate proofing. The

reason is that the former refer to common cause models and the latter to common effect models [De Boer, 2008]. The nature of this difference is pursued below.

The crucial differences between common cause and common effect models can be demonstrated by people's beliefs about, on the one side, living animals and, on the other side, artefacts. Even preschool children assume that living things have vital forces inside them that are responsible for growth and activity [Keil, 2006]. In contrast, artefacts are developed to serve a function or a purpose. Preschool children, for example, do understand that dogs are different from tables. Dogs and other living animals are seen as having an essence that works as a common cause of different dog-like phenomena (see Figure 5). Conversely, young children conceive of artefacts in terms of functions. The table-like function is the common effect that is produced by the different constituting elements from which tables are assembled.

Generally, people assume and prefer a common-cause structure regarding 'natural' categories [Ahn et al., 2001]. Common-cause models are relatively easy to understand and can flexibly be extended or reduced [Kinchin, Hay and Adams, 2000]. In contrast, common-effect models require more knowledge about the constituting elements and their mutual relationships.

The common-cause model is not only relevant for purely natural phenomena, but also for people's relationship to the habitable earth. It captures the idea of humans as geographic agents who changed the earth from its hypothetical pristine condition [Glacken, 1967]. The common-cause is that human activities are threatening the essence of nature; e.g. people are playing with things they barely understand, such as the earth's atmosphere.

The common-cause model may help people to become aware of the many ways in which climate change can become manifest, such as by changes at the North pole, in the Alps, in sea level and in patterns of rainfall. This understanding (e.g. Figure 4) may to a certain extent be in line with established scientific knowledge, such as the 'joint attribution approach' [Rosenzweig, 2008], which involves a meta-analysis of the physical and biological impacts of anthropogenic climate change.

In contrast, making a country climate proof by adaptation and mitigation measures requires a completely different mental model. Climate proofing should be driven by opportunities for technological, institutional and societal innovations, rather than purely by fear of the negative effects of climate change [Kabat et al., 2005]. In short, climate proofing is a common effect of different constituting elements that have to be balanced carefully. The contrast between the two models is shown in Figure 6.
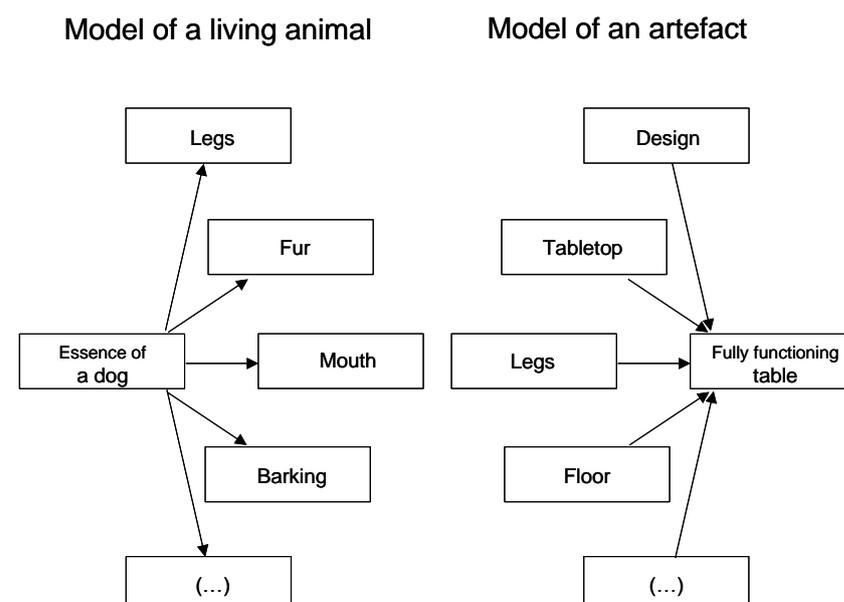
Model of a living animal   Model of an artefact

Figure 5. Two mental models: The dog's essence is a common cause; the functioning table is a common effect.

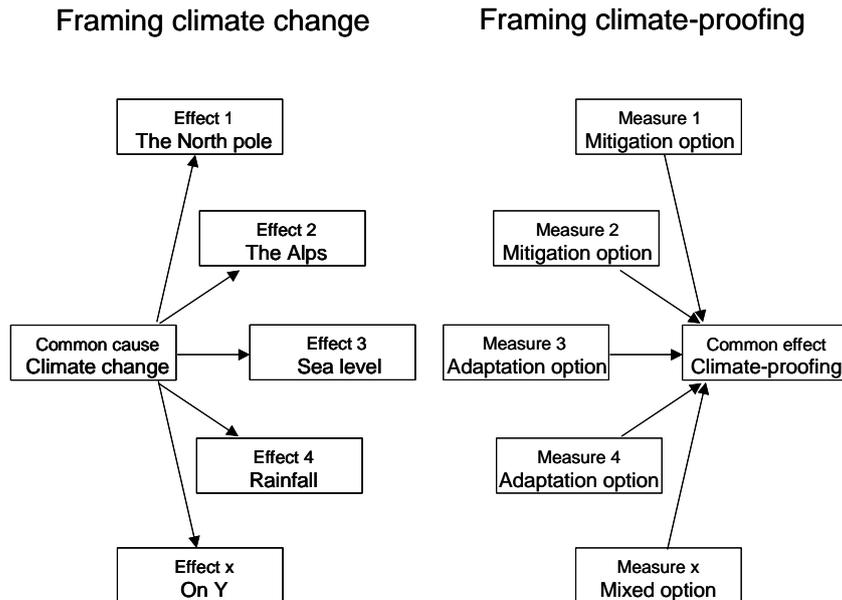Framing climate change   Framing climate-proofing

Figure 6. Two mental models: Climate change is a common cause; climate-proofing is a common effect.

The shift from thinking about climate change to thinking about climate proofing will not happen automatically. It requires a process of reframing, because, by its very nature, a frame tends to induce passive acceptance of the information given. Usually, if an observation does not fit the frame it is the observation rather than the frame itself that is being questioned. Hence, an active approach is often called for.

3.3 Active reframing

Active reframing implies that thinking about climate change at a distal level has to be supplemented by thinking at a proximal level. In the past, uncertainty about climate change may have lead people to conceptualize it in terms of abstract and distal properties [Wakslak and Trope, 2008]. As more information comes available on its concrete manifestations and consequences reframing will be inevitable. One of the options for active reframing is considering a situation from different perspectives to make different aspects of it salient. This process is already going on because increasingly climate-related data are provided that inform regional and local perspectives.

The psychological difference between distal and proximal levels is a topic of much research today [Liberman and Trope, 2008]. A distal view may focus on distant future actions. It is closely related to different dimensions of psychological distance, such as distance across time and space, social distance and distance in the sense of considering hypothetical assumptions. Conversely, a proximal view may include implementation practices. Thinking about the how of an activity relates to steps that are psychologically near, such as the detailed and contextualized features of implementation. Although this line of research has not yet been applied to climate proofing, some tentative expectations can be outlined.

3.4 Shocks

Any new information on the prospects of people's family or work may to a certain degree act as a 'shock' to their current situation [Lee and Mitchell, 1997]. Notably, the shock can be a positive, neutral or negative event. Over time, sequences of shocks may occur. Future societal communication about the various manifestations and consequences of climate change will include issues that fit into the science-related frames mentioned in the previous chapter, such as big plans for climate proofing and appealing investments that improve competitiveness, but also moral concerns about crossing limits that should not be crossed, and scientific uncertainty about what is known.

Additionally, there will be communication about potential proximal measures, such as measures to counteract rising flood risks in certain areas. Whether intended or not, this communication may affect many decisions that residents and business owners make about the living and working conditions in

these areas. People's responses will depend on how they construct a personal decision frame with which to interpret the implications of the events.

In some cases, people might frame the situation as a binary choice between staying in or moving out of the area with rising flood risks. However, there are other frames and decision paths that people can take. When they receive new information about their environment, for example, they may reappraise the value of investments in their property and reconsider the value of risk-reducing measures or insurance. From an economic perspective, this involves balancing the costs and benefits, but the balance will depend on how the options are framed.

3.5   Multilevel processes

The notion that people may construct a personal frame and take a decision path goes beyond the traditional economic view of decision-making. The broader view is that real world decisions depend on multilevel processes [e.g. Beach, 1990; Carver & Scheier, 1998; Carver & Scheier, 2002; Lee & Mitchell, 1994; Liberman et al., 2007; Vallacher & Wegner, 1987]. Although these authors use slightly different terms to specify the processes, it can be stated that effective decision-making on climate proofing will require the following elements:

- a distal view to keep an eye at long-term values, such as 'the why' of staying in the area with rising flood risks,
- a proximal view to stimulate implementation intentions, such as 'the how' of risk-reducing strategies, and
- a 'bridge-like' guiding principle that energizes and directs behaviour by linking processes at distal and proximal levels.

An example of a bridge-like guiding principle is the responsibility for the tasks associated with home ownership or membership of a community that fosters a culture of self-reliance [McGee and Russell, 2003].

A culture of self-reliance and the notion of manageable risk may enable people to adapt, adjust, and change course direction, if necessary. These are important aspects of resilience. In order to communicate the notion of manageable risk, all process levels are relevant. Obviously, without 'the how' of risk-reducing strategies, people might get overwhelmed by a shock. Alternatively, without paying attention to long-term values and a guiding principle, people might just take a single action, assuming that this is enough to close the case [Marx et al., 2007]. Such a single action effect is often overlooked by policy-makers who want to raise awareness.

3.6   Broader implications

In addition to this brief description of active reframing, some broader implications should be mentioned.

Reframing does not always start with a shock to the current situation. The process may also start unobtrusively. Over time, both the living conditions in a certain area and the residents can change, such that elements of the situation no longer fit with the residents' long-term values and guiding principles. Sooner or later, a lack of fit can lead to a growing concern about the prospects of their family or work.

Further, given the social and spatial context in which residents and business owners take decisions on aspects of living and working, the outcomes will also affect the image of the area. Hence, the decisions that the owners make can affect climate proofing both directly (e.g., via the measures taken) and indirectly (e.g., by changing the vital image of the environment).

Finally, it may not be the risk-frame as such, but the science-related frames that play the largest role in this context (a social progress frame, an economic competitiveness frame, a moral boundaries frame, and a scientific uncertainty frame). The impacts of these frames on climate proofing could be positive or negative. For instance the economic competitiveness frame may induce worries among residents who have reason to fear that rising flood risks will decrease the value of their property.

Alternatively, the economic competitiveness frame might also increase the investment appeal of insurance among residents and business owners. There is one study that suggests that people prefer

to invest in something that offers them the opportunity to salvage something positive from a potentially negative situation [e.g. Connor, 1996], but other explanations are possible.

3.7   Conclusion

Climate change may be relatively easy to grasp if it is conceived as a common cause of different changes in nature. That is important to raise public awareness of the issue. However, climate proofing will involve a different mental model. This model should consider all the measures necessary to produce the common effect of a climate-proof country. Such a mental model is far more difficult to communicate. Risks with a distal character have to be reframed into more proximal risks. Various science-related frames may have positive or negative impacts on this process.

4. Translating perception into policy

Although the previous chapters have demonstrated that there is a lot of background knowledge about perception, there is still the question how perception can be translated into policy. In particular the key role of frames in shaping perception, communication, network interaction and decision-making has to be elaborated to make it fit for purpose of climate proofing. The elaboration should be adapted to the needs of the Hotspots and the way in which they see their role in the coming years. The present chapter addresses the main user needs.

4.1 Acting on 'weak signals'

In the case of climate change, the role of perception cannot easily be underestimated, because decision-making on mitigation and adaptation has to be informed by reports on detection and attribution of climate-related signals. As long as the impacts of climate change do not become manifest in 'strong signals', such as actual disasters, decision-making will depend on the perceptual capacity to see the significant meaning of 'weak signals'. Obviously, this notion is reflected in the series of reports produced by the Intergovernmental Panel on Climate Change [e.g. Carter et al., 2007].

Interpretation work directed at 'weak signals' often involves risk perception [e.g. Kasperson, 1992; Weick and Sutcliffe, 2001]. In the previous chapters, it has been argued that risk perception can be conceived as an interpretation of an event that is based on one or more dimensions of the risk-frame (e.g. voluntariness, the likelihood of harm, one's vulnerability to harm or control over harm, the extent of harm a hazard would cause, one's trust in sources of risk information). There is room here for different culturally acceptable interpretations. This relates to the predefined, computable meaning of risk used by scientists and the non-predefined interpretation by non-scientists.

The perception of climate-related risks (floods, droughts, heat stress, diseases) and their geographical variation is in particular relevant because the impacts of policy options on climate change adaptation appear to be very context specific [Halsnæs et al., 2007]. It is the specific combination of climate change and other environmental changes, such as changes in regional land use patterns, that may create the most significant impacts for society. Therefore, perceptions are crucial for developing adaptation policy and for communication about collective and individual choices that affect risks.

In addition, it should be noted that scientists and non-scientists will also use other frames to influence decision-making. The point is that climate change is still very much a scientific issue [Robinson et al., 2006]. The science-related frames include a social progress frame, an economic competitiveness frame, a moral boundaries frame, and a scientific uncertainty frame. These frames will continue to shape climate-related communication and decision-making in the years to come.

Hence, acting on 'weak signals' will require many interactions and dialogues [e.g. De Boer, Goosen, & Huitema, 2003; Ministerie van Verkeer en Waterstaat & Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2008]. Moreover, continuous changes in the political, economic, scientific and ethical environment of decision-making will make it very difficult for all actors involved to avoid simplifying interpretations and misleading perceptions. This may well result in a 'dialogue of the deaf' that hampers climate proofing.

4.2 Types of activities affected

The collective and individual choices that are affected by risk perceptions relate to activities at different geographic scales and in different stages of the safety chain. Recent studies provide the following information about risk perception impacts at national, regional and local level in the context of pro-action, prevention and preparedness.

Data at a country level suggest that risk perception (% of the population agreeing that climate change is 'dangerous') is correlated with the priority that is given to climate change issues in national policy-making [Tjernström and Tietenberg, 2008]. Different kinds of democratic channels also mattered a great deal in how the perceptions affected policy. These results are in line with the notion that public participation may foster a shared sense of ownership of the problem if it is well-framed [Few, Brown, & Tompkins, 2007; McGee & Russell, 2003].

At the level of a regional housing market, the international literature indicates that flood risk perception, informed by flood zone designation and insurance premiums, might affect location choices and property values. However, these impacts are not observed easily, for example, because living near the coast can also be attractive. Hence, sales price differentials may only be revealed after controlling for amenities [Bin, Kruse, and Landry, 2008]. Nevertheless, news on rising flood risks might induce worries among residents or business owners about the decreasing value of their property.

Awareness of physical vulnerabilities to hazards is an important dimension of risk perception. Dependent on their location, residents may frame climate change in a way that articulates its associations with sea-level rise and/or rain- and river-based problems [De Boer, 2007]. However, comparatively little research has been conducted on the influence of people's location and proximity on perception of risk [Brody, Zahran, Vedlitz, & Grover, 2008]. In the Netherlands, there are some reports on citizen opinion surveys in various parts of the country, which give information about risk-related opinions of the residents in these areas [B&A Groep, 2006; TNS Nipo, 2006; 2007]. However, this work is not embedded in the scientific literature.

At the regional and local level, risk perceptions are also relevant for the adoption of building precautionary measures, such as elevated building configuration or flood adapted use [Kreiblich et al., 2005]. This can be an important way of motivating residents in flood-prone areas to take their share in damage prevention. For example, in the context of the 2002 flood at the river Elbe and its tributaries, damage ratio for contents was reduced by 48% due to flood adapted use and by 53% due to flood adapted interior fitting.

Generally, risk perception is related to the adoption of various kinds of protective behaviour that can prevent negative consequences of a hazard [Brewer et al., 2007; Miceli, Sotgiu, & Settanni, 2008]. However, the actual role of risk perception in shaping health behaviour is an undecided issue. In particular, there is no agreement in the literature about the relevant dimensions of the risk-frame, which may involve likelihood judgments, sense of vulnerability, or extent of harm a hazard would cause.

One or more dimensions of the risk-frame also affect the willingness to pay for insurances against damage caused by floods. This is a new topic in the Netherlands. The adoption of insurance options is complicated by various other factors, such as private investments in damage mitigation measures, residents' expectancies about compensation of flood damage by the government, and the design of insurance schemes [Botzen, Aerts, and van den Bergh, 2008].

In the preparation stage of the safety chain, simply influencing risk perception may be insufficient to cause residents to behave appropriately [Grothmann and Reusswig, 2006; Terpstra and Gutteling 2008]. Additionally, risk communication should address issues of context-dependent action, including the possibility, effectiveness and costs of private precautionary measures. Moreover, this communication should avoid elements that produce non-protective responses.

Although many issues deserve further empirical research, these studies demonstrate that risk perception can affect collective and individual choices that are extremely relevant for policy-making. Hence, more knowledge on these potential impacts may help discover how risk perception can work as a positive and not as a negative factor in climate proofing the Netherlands.

4.3   User needs

Our focus group discussion with Hotspot representatives revealed that policymakers and practitioners are in particular worried about the potential negative impacts of communication failures on climate proofing in relation to floods (see Appendix 2). There is a general lack of knowledge and confidence about the way in which positive communication results can be achieved, such as fostering a shared sense of ownership of the problem and effectively communicating the notion of manageable risk.

Based on the focus group discussion and the recent literature a set of user needs has been identified. The main question to be addressed is:

What conditions can make risk perception work as a positive and not as a negative factor in climate proofing the Netherlands?

Research into this question should enable policy-makers and professionals to understand the role of risk perception dimensions in their work. This can be achieved by developing methods that Hotspots can apply to recognize the frames that underlie the ways in which policymakers, practitioners (e.g. journalists), residents and business owners perceive climate proofing and its background.

The link with practical tools has been elaborated in a number of sub-questions. The next scheme gives an overview of the sub-questions, the potential knowledge users, and the state of present knowledge of the topic.

Sub-question	Potential knowledge user	Present knowledge
How can policy-makers and professionals be enabled to understand the role of risk perception dimensions in:		
- fostering a sense of problem ownership among the public and avoiding a 'dialogue of the deaf',	Ministry of Transport, Public Works and Water Management (and other ministries)	Some studies have been done in other fields
- preventing property devaluation as a result of changing location choices by household and firms	Municipality of Rotterdam, Havenbedrijf	Limited knowledge
- supporting the design and implementation of building precautionary measures	Water boards, municipalities (Rotterdam)	Limited knowledge
- promoting the adoption of appropriate protective measures by households and firms, and avoiding non-protective responses	Ministry of the Interior and Kingdom Relations, water boards, municipalities	Several studies have been done in other fields, but there are undecided issues
- developing novel insurance options	Insurance companies, municipality of Rotterdam	Some pioneering work (Botzen, Aerts, and van den Bergh)]
- ensuring that residents and employees are well-prepared to take context-specific actions in case of an emergency	Water boards, municipalities (Rotterdam, Dordrecht)	Some pioneering work (Terpstra and Gutteling 555-65)]

Each of these sub-questions can be linked to research into broader themes. For example, risk perception can be put in the context of economic welfare theory to determine the potential impact of the risk dimensions on the estimated monetary value of safety measures.

Another topic is the relationship between risk perception and the way in which the members of a policy network try to shape the outcomes of policy design and implementation. Risk perception may also raise ethical issues, for instance, about the way in which society should put weight on the various risk dimensions. However, research into these topics goes beyond the needs of the Hotspots at the moment.

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Appendix 1: List of persons who were consulted

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Appendix 2: Report on focus group discussion (in Dutch)

Verslag Groepsgesprek kennisvragen risicoperceptie KvK
Geïnterviewden: Betrokkenen Hotspots Rotterdam en Grote Rivieren
Datum gesprek: 9 december 2008

Aanwezig: Dhr. J.C.J.H. Aerts (Grote Rivieren & IVM), dhr. R. Ammerlaan (Hh Delfland), mevr. J. Besselink (dS+V), dhr. R.J. Bonte (namens provincie Gelderland), mevr. C. Bosscher (Ontwikkelingsbedrijf Rotterdam), dhr. E. Hovingh & mevr. A. Kleijburg (HH Schieland en Krimpenerwaard), dhr. W.A. de Vries (dS+V), dhr. J. de Boer (IVM, verslag).

Toelichting vooraf

Voordat de kennisvragen aan de orde komen, geeft dhr. De Boer een toelichting op het onderwerp risicoperceptie, die vooral is bedoeld om de verscheidenheid van mogelijk relevante aspecten naar voren te brengen. De kern van het begrip risicoperceptie is de mate waarin een persoon zich kwetsbaar voelt in verhouding tot de mate waarin hij of zij de situatie in de hand meent te hebben. Zoals figuur 1 (links) laat zien hangt dit af van de interpretatie van informatie en daarmee van het referentiekader ('frame') dat de persoon hanteert. Figuur 1 (rechts) laat zien dat bijvoorbeeld een analytisch frame tot een ander beeld leidt van zaken die bij elkaar lijken te horen (koe en kip vormen de categorie 'dieren') dan een holistisch frame (koe hoort bij het gras). Het analytisch frame is onder andere van belang voor het denken in termen van kansen.
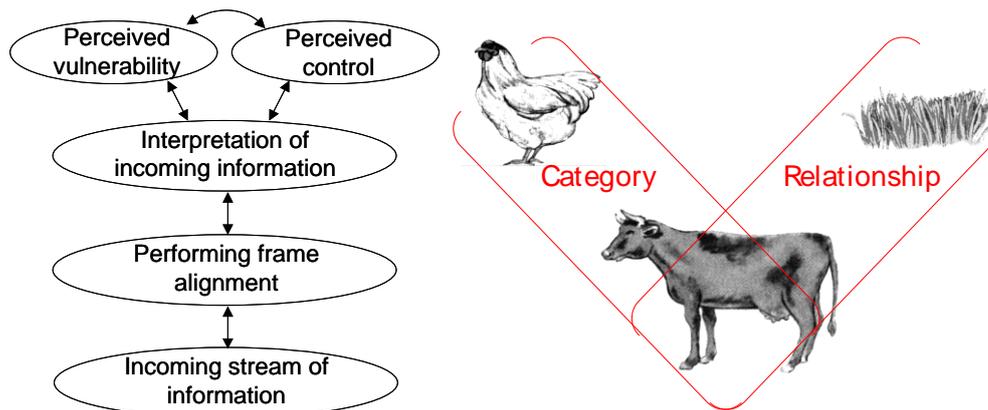
Figuur 1. Links: kern van het begrip risicoperceptie en de rol van het referentiekader ('frame') dat de persoon gebruikt.

Rechts: Voorbeeld van de rol van frames bij het beantwoorden van de vraag: Welke twee horen bij elkaar en verschillen van de derde.

Een ander relevant onderscheid is dat tussen promotiegerichte en preventiegerichte frames. Wie met een promotiegericht frame naar de wereld kijkt, ziet vooral positieve kansen die benut zouden moeten worden; wie een preventiegericht frame hanteert heeft vooral oog voor fouten die moeten worden vermeden. Figuur 2 demonstreert dat er in feite 4 combinaties van frames zijn die bij een onderwerp als klimaatverandering elk tot een ander beeld kunnen leiden. Zo toont de film van Al Gore vooral een holistisch en preventiegericht beeld van de wereld, waarbij het accent komt te liggen op de vraag hoe de mens op een moreel verantwoorde wijze met de atmosfeer zou moeten omgaan. Eveneens preventiegericht is het rapport van de Deltacommissie, maar dit benadrukt de wetenschappelijke analyse van kansen en gevolgen.

	Promotion orientation	Prevention orientation
Holistic approach	**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 > Plan for a tulip-shaped island	**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 > Al Gore, An inconvenient truth
Analytical approach	**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 > 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 > Report Second Deltacommittee

Figuur 2. De vier combinaties van frames die bij het onderwerp klimaatverandering elk tot een ander beeld kunnen leiden.

Bij een promotiegericht, analytisch frame komt het beeld naar voren van investeren in een stad die 'climate proof' moet zijn en ook de competitie met andere steden aan moet kunnen. Tot slot zijn er de holistische plannen, zoals dat van het tulpvormige eiland, waarmee allerlei op het eerste gezicht tegenstrijdige wensen in één groot design kunnen worden gecombineerd.

De vier cellen van figuur 2 zijn bedoeld om te laten zien dat deze frames tot heel verschillende ideeën kunnen leiden over wat op zeker moment het belangrijkste risico is (kwade kansen verkleinen of goede kansen niet missen). Het is niet zo dat het ene frame altijd beter is dan het andere; elk heeft sterke en zwakke punten, maar vermenging van frames leidt tot verwarring. Vaak is het wel zinvol om een onderwerp afwisselend vanuit het ene en het andere frame te benaderen.

Het gangbare onderzoek naar risicoperceptie sluit aan bij de preventiegerichte analytische benadering. Aan bewoners van een gebied wordt bijvoorbeeld gevraagd naar de kans die zij denken te lopen om het slachtoffer te worden van diverse ongewenste voorvallen, waaronder een overstroming. Dit kan op diverse manieren worden uitgewerkt. In figuur 3 worden typen van onderzoek naar risicoperceptie onderscheiden naar methode, bron van de informatie en tijdsdimensie.

Method	**Source of information**		**Time dimension**	
	Citizens / owners	Outside observers	Current situation	Future situation
Focus groups	X		X	
Surveys	X		X	
Quasi experiments	X		X	
Panel studies			X	X
Professional opinions		X	X	X
Scenario analysis	X	X		X

Figuur 3. Typen van onderzoek naar risicoperceptie, onderscheiden naar methode, bron van de informatie en tijdsdimensie.

Risicoperceptie wordt vaak in relatie gezien met risicocommunicatie. Figuur 4 toont drie typen van communicatie over verschillende soorten beslissingen. Communicatie bij noodsituaties is van een hele andere orde dan communicatie om bewustwording van risico's te bevorderen of om bewoners te betrekken bij het oplossen van lokale problemen. Deze onderwerpen zijn verbonden met verschillende schakels van de veiligheidsketen en kunnen niet zomaar in één onderzoek worden meegenomen.

Type of risk communication	Providing information in an emergency situation	Developing facilities to inform the population about risk and risk management	Involving the public in decisions on priorities for risk management
Main communication goals	Pre-warning and warning of (parts of) the population to prevent or to mitigate damage Providing behavioural guidance Where necessary, providing reassurance	Increasing public awareness and understanding of risk Encouraging personal disaster preparedness and risk reduction behaviour Providing detailed background information to all relevant organizations	Common problem solving Identifying local hazards Developing options Increasing trust and credibility in decision making Managing and resolving conflict between stakeholders

Figuur 4. Typen van risicocommunicatie, onderscheiden naar de aard van de beslissingen die aan de orde zijn.

In aanvulling op de toelichting wijst dhr. Aerts erop dat de aanwezigen desgewenst de eigen regio als case kunnen inbrengen in een door hem geleide grootschalige enquête onder huishoudens. Hierin wordt risicoperceptie gekoppeld aan vragen over wat mensen willen, zoals investeren in verzekeringen en maatregelen om schade te verminderen.

Kennisvragen

De aanwezigen benadrukken dat de kennisvragen voor KvK een duidelijke relatie met klimaatverandering moeten hebben. Zij schetsen hierbij het volgende perspectief.

Bewoners en gebruikers van laaggelegen gebieden zullen de komende jaren steeds weer met het onderwerp klimaatverandering worden geconfronteerd, bijvoorbeeld via beelden van rampen die ergens in de wereld plaatsvinden, rapporten van commissies, en ander nieuwsmateriaal. Daarmee kunnen de bewoners en gebruikers een andere voorstelling krijgen van datgene wat er in hun situatie zou kunnen gebeuren. Dit kan bij hen reacties oproepen waar de overheid weer op moet reageren.

Daarnaast zullen in het kader van beleidsvoorbereidingen en planvorming méér gegevens beschikbaar komen, ook in de vorm van kaarten, over mogelijke negatieve gevolgen van klimaatverandering met een nadere specificatie van plaatsen waar risico's relatief groot of klein zijn. Het is onvermijdelijk dat overheden over de nieuwe inzichten en getallen gaan communiceren. Dit is evenwel niet eenvoudig gezien de verschillende manieren waarop allerlei personen nu reeds 'aan de haal gaan' met getallen die niet kloppen. Naar verwachting zal zo'n getalsmatige benadering ook niet overkomen bij bewoners en gebruikers.

Afgezien van specifieke situaties waar bewoners direct aan veiligheidsmaatregelen meewerken, zoals in de binnenstad van Dordrecht, wordt er momenteel over dit soort risico's nauwelijks gecommuniceerd. Het gevolg is dat bijvoorbeeld mensen die een huis kopen dat op een waterkering staat of in het buitendijksgebied ligt, hierover niet worden geïnformeerd. Voorts kunnen onbedoeld tegenstrijdigheden ontstaan door onderwerpen waarover wel wordt gecommuniceerd: zo zou het propageren van de Tweede Maasvlakte als aantrekkelijke hooggelegen vestigingsplaats, op z'n minst

vragen kunnen oproepen bij bewoners en bedrijven in het nabije buitendijksgebied. Ook in het rapport van de Deltacommissie zijn tegenstrijdige boodschappen opgevallen.

Het probleem van overheden is dat communicatie met burgers over deze onderwerpen noodzakelijk is, maar dat ze niet weten wat die communicatie zal oproepen en hoe ze die zo kunnen aanpakken dat

1. mensen de risico's beseffen en weten wat ze zo nodig zelf moeten doen,
2. zonder dat onnodige onrust wordt gecreëerd,
3. zonder dat onbedoelde effecten op locatiekeuzes worden veroorzaakt,
4. maar zo dat waar mogelijk een positief investeringsklimaat wordt bevorderd.
5. Dit is niet alleen een probleem van dit moment; het zal blijvend aandacht vergen in combinatie met wisselende externe omstandigheden. Daarom is ook van belang:
6. wat de invloed is van feitelijke gebeurtenissen (New Orleans, etc.),
7. en hoe die een wisselwerking kunnen krijgen met overheidscommunicatie.

Hoewel de communicatie voor een deel een kwestie is van politieke keuzes en gevoeligheden, zou kennis over risicoperceptie een belangrijke bijdrage kunnen leveren aan het ontwikkelen van passende strategieën. Het gaat dan om kennis op vrij basaal niveau over kwesties die voortdurend in discussies naar voren komen, zoals de vraag of bepaalde getallen (16000 18000 kuub) nu wel of niet gecommuniceerd moeten worden, en waarom sommige dingen (kaartbeelden) in het buitenland wel kunnen en hier niet.

Voorts is van belang dat discussies over communicatie zich ook kunnen uitstrekken tot de boodschappen die zijn af te lezen aan de inrichting van een gebied. In sommige gebieden, zoals de geplande nieuwbouw in de Zuidplaspolder, zullen bewoners door de fysieke omstandigheden meer worden geconfronteerd met de dynamiek van het water dan in andere gebieden, zoals Wateringse Veld. Het vermoeden bestaat dat dit tot gevolg heeft dat ze zich meer bewust zijn van de risicosituatie en er beter op zijn voorbereid, waardoor ze feitelijk misschien veiliger zijn dan de onvoorbereide bewoners van gebieden waar de kansen in theorie kleiner zijn. Dit zou nader bekeken moeten worden, waarbij mede de vraag rijst hoe onvoorbereide bewoners wel kunnen worden voorbereid.

De kennis wordt voor de hotspots relevanter als het onderzoek wordt afgebakend in termen van locatiespecifieke doelgroepen of sub-hotspots, zoals:

- binnendijks versus buitendijks,
- bewoners versus ondernemers,
- gevestigde bewoners/gebruikers versus nieuwkomers (nationaal, internationaal),
- gebieden waaraan de dynamiek van water al dan niet is af te lezen.

Bij het identificeren van casussen moet naar vergelijkbare fasen in de veiligheidsketen worden gekeken, zoals de pro-actiefase of de preparatiefase. Een punt van overweging is nog of onderzoek zich alleen zou moeten richten op overstromingen of ook op andere klimaatgerelateerde risico's, zoals hittestress in de stad of eventuele invloeden van klimaatverandering op industriële veiligheid.

Afspraken

De aanwezigen willen in principe betrokken blijven bij het onderzoek. De waterschappen bekijken nog wie namens hen aan tafel zal zitten. Verder is er belangstelling van het Havenbedrijf, de Veiligheidsregio en Rijkswaterstaat. Wellicht is er ook belangstelling bij Rotterdamse projectontwikkelaars en wooncorporaties (actie van dhr. De Vries) en bij DG Water. Verzekeringsmaatschappijen zijn via dhr. Aerts in beeld.
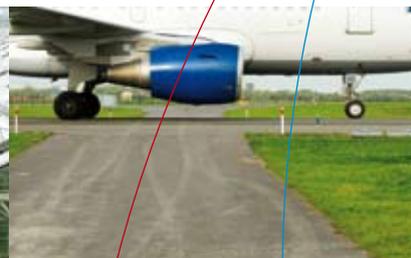
To develop the scientific and applied knowledge required for climate-proofing the Netherlands and to create a sustainable knowledge infrastructure for managing climate change

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