Science and Public Policy, 37(8), October 2010, pages 611–627
DOI: 10.3152/030234210X12767691861173; http://www.ingentaconnect.com/content/beech/spp

Room for the River: Room for Research? The case of depoldering De Noordwaard, the Netherlands

Marc Schut, Cees Leeuwis and Annemarie van Paassen

This paper explores the role of research in the context of the Dutch spatial planning procedure 'Room for the River'. We start from the idea that research is strategically used to create space in negotiation processes, where stakeholders often have competing claims on natural resources. Multiple data collection techniques allow us to reconstruct and understand the critical events that led to the decision to depolder De Noordwaard. Within each critical event we describe and analyse how research and other resources were mobilized by policy-makers and other stakeholders to open up or close down negotiation space. By doing so, this paper contributes insights into the factors that influence the effective mobilization and contribution of research towards exploring sustainable solutions to complex environmental problems.

ONE OF THE LARGEST CHALLENGES of our time is to find sustainable solutions to increasingly complex environmental problems. Complexity has two dimensions: firstly, the high level of uncertainty and ambiguity surrounding the nature of the problems; and secondly, the increasing number of stakeholders involved in exploring sustainable solutions. Complexity is not by definition a negative concept. The involvement of the general public, (agricultural) entrepreneurs, interest groups and other stakeholders could improve the quality of decision-making by opening up the decision-making process towards seeking legitimate, feasible and context-specific solutions (Huitema *et al.*, 2009). Nevertheless, natural resource management (NRM) is often subject to adversarial or distributive negotiations and conflict. It is difficult to find one solution that fits all stakeholders' objectives, and land and other natural resources have characteristics (limited quantity, extractability, culturally defined meaning and an uneven distribution) that by their nature lead to conflict (Cloke and Park, 1985: 60). This often gives rise to people having competing claims on natural resources and their management.

Most research strives to provide policy-makers and other stakeholders with an objective body of knowledge to weigh up, justify and evaluate their decisions (Ozawa, 1996: 221; Turnhout *et al.*, 2007). However, recent studies claim that research is rarely used in decentralized planning practice (cf. Opdam, 2006: 153). This has led us to rethink the concept of research effectiveness. Instead of fixed notions of research objectivity, credibility, legitimacy and relevance that can be attributed to the quality of the research itself, effectiveness becomes a social matter,

Marc Schut (corresponding author), Cees Leeuwis and Annemarie van Paassen are at the Communication and Innovation Studies Group, Wageningen University and Research Centre, P.O. Box 8130, 6700 EW Wageningen, the Netherlands; Emails: marc.schut@wur.nl, cees.leeuwis@wur.nl and annemarie.vanpaassen@wur.nl; Tel: +31 317 484635; Fax: +31 317 486094.

This research is part of the strategic research program 'Sustainable spatial development of ecosystems, landscapes, seas and regions', funded by the Dutch Ministry of Agriculture, Nature Conservation and Food Quality. The authors acknowledge the valuable contributions of colleagues and the reviewers of *Science and Public Policy* who provided constructive feedback on earlier versions of this paper. Special thanks are due to the people from De Noordwaard, the researchers who were interviewed and the policy-makers for their willingness to share their experiences with us.

Marc Schut is a PhD researcher at the Communication and Innovation Studies Group of Wageningen University and Research Centre (Wageningen UR), the Netherlands. His PhD research focuses on the role of research in societal negotiations and policy processes. Currently he is involved as a policy advisor in Mozambique, conducting research to support the development of a framework for sustainable biofuel production in Mozambique. Through his case studies and action-oriented research, he hopes to gather insights into the dynamics that influence the effective contribution of research towards sustainable solutions to complex environmental problems.

Cees Leeuwis is a professor of communication and innovation studies at Wageningen UR. He regards innovations as a balanced whole of technical devices, mental models and institutional arrangements. His research focuses on: the value of cross-disciplinary approaches to bringing about coherent innovations; the analysis of social learning and conflict management in networks; changing dynamics and arrangements in the knowledge infrastructure due to, among other factors, the privatization of research and extension; and the reflexive monitoring and evaluation of innovation support strategies and trajectories.

Annemarie van Paassen is an assistant professor in international rural development at the Communication and Innovation Studies Group, Wageningen UR. Within the domain of agricultural development and natural resource management, her research focuses on: social learning, negotiation and conflict management in multi-level innovation processes; the use of boundary-spanning tools such as simulation models for innovation; critical elements and the value of inter- and trans-disciplinary research; science communication; the role of (collaborative) research in innovation processes; and critical monitoring and evaluation of collaborative research.

where more subtle variables determine the impact of research in practice (Turnhout, 2009: 405). In line with Giller *et al*. (2008: 6), we believe that research in the context of competing claims may require new roles and responsibilities for research and researchers towards integrative negotiations and widening the space within which solutions can be sought.

The objective of this paper is to contribute insights about the dynamics that influence the effective mobilization and contribution of research to negotiation processes in the context of competing claims. In doing so, we hope to identify factors that determine how and to what extent research opens up or closes down space for stakeholders to explore sustainable solutions to complex environmental problems.

Empirical data for this study were gathered by analysing the Dutch spatial planning procedure 'Room for the River' which was initiated to explore and implement spatial security measures to accommodate water and increase the spatial quality of landscape, nature and culture. Our case study focused on the decision-making process that led to the depoldering of De Noordwaard, an agricultural area in the south-west of the Netherlands, which is the most substantial of the Room for the River projects. Depoldering can best be described as returning a piece of reclaimed land (a polder) to the sea or river.

Research, negotiation and space for change

In recent years, interest in the policy-informing role of research and research organizations has grown considerably (Boaz *et al.*, 2009: 255; Sterk *et al.*, 2009: 434). Although we have good reasons to assume that research does contribute to sustainable decision-making, experience shows that research is often not used in practice, or that it arrives in the public policy arena in fundamentally different ways than intended (Klosterman *et al.*, 2009: 13, 19). It has increasingly become clear that societal actors should not be seen as passive and obedient adopters of science-based policy solutions (Beck, 1992; Wynne, 1996; Giller *et al.*, 2008). Moreover, more research does not solve multiple interpretation of problems and possible solutions, and it cannot prevent research and its results from being ambiguous and contested (van Bueren *et al.*, 2003: 194). Other concepts used in this study are explained in the following two sections.

Research and negotiation in the context of competing claims

We start from the idea that research is strategically used by stakeholders to influence negotiation processes on spatial planning and NRM; we call this the 'contexts of competing claims'. According to Funtowicz *et al*. (1999: 14):

> The environment is a site of conflict between competing perspectives, values and interests, and the different groups and communities that represent them.

Van Eeten (1999: 185) and Koppenjan and Klijn (2004: 5–6) would describe such conflicts as 'wicked problems', generally characterized by:

- the involvement of many actors;
- disagreement about the nature of the problem and the desired solutions;
- highly complex decision-making that is unsuitable for standard operation procedures and organizational arrangements; and
- the blurring boundaries between research and politics.

Many have described the need to facilitate harmonious communication between stakeholders so that they can develop new — at least partly shared — problem definitions and cognitions on the basis of creative, participatory, social learning processes (Habermas, 1981; Cloke and Park, 1985; Röling, 1994). However, in practice these participatory decision-making processes often emerge as 'arenas of struggle' and 'dialogues of the deaf' with stakeholders acting strategically, rather than communicatively (van Eeten, 1999; Leeuwis, 2000; van Buuren and Edelenbos, 2004).

> The very spread and adoption by powerful actors of the language and discourse of participation and inclusion confuses the boundaries of who has the authority and who does not, who should be 'inside' and who is on the 'outside' of decision-making and policy making arenas. (Gaventa, 2006: 23)

As a possible solution, Giller *et al*. (2008) propose that, in the context of competing claims, negotiation should be at the heart of research approaches and conceptual frameworks, as it has the potential to enhance the constructive contribution of research to societal negotiation processes. The development of a negotiation framework to effectively mobilize and use research is also increasingly recognized as an essential component to promote sustainable development.

Research and space for change

According to Leeuwis and Aarts (forthcoming), space for change is a valuable concept for the analysis of the complex problems that are likely to be encountered in the context of competing claims. Negotiation processes are composed of stakeholders who are capable of strategizing and finding space for change in situations by manipulating resources and constraints (Villareal, 1992). Creating space for change implies a degree of consent, a degree of negotiation and a degree of power — not necessarily power stored in a given economic or political position (cf. Gaventa, 2006), but the possibility of control, of privilege, of a degree of authority and ability, be it in the spotlight or backstage, for fleeting moments or for long periods (Villareal, 1992). This change is not realized in the arbitrary, isolated and formalized space of a project, but arises from multiple interactions in and between networks, whereby phenomena like coincidence and self-organization play an important role (Aarts and Leeuwis, 2010). In order to understand how research may create negotiation space for stakeholders, it is necessary to study the interactions and discourses in which research is 'packed' and mobilized and (cf. Hajer, 1995).

For this study, space for change is conceptualized as the momentum or critical point at which the interaction and configuration between socio-cultural, political, legal, economic and biophysical spaces or perspectives provide space for innovation, breakthroughs or decision-making in negotiation processes.

Research approach

In order to understand the role and use of research, it is crucial to have insights into the specific characteristics and dynamics of the negotiation processes in which research is embedded and used (Turnhout *et al.*, 2007: 216). A first step towards this is therefore the development of an empirically based understanding of how research performs in practice. This was one of the reasons for adopting a case-study approach that permitted us profound insight into complex processes, thereby providing holistic and meaningful empirical data of real-life events (Yin, 2003). The Room for the River program complied with our main case-study selection criteria. The project is characterized by high complexity regarding the nature of the problem and the wide variety of stakeholders involved. We decided to focus on De Noordwaard as this case provides a high level of competing claims, is well-documented, and is the most substantial measure within the Room for the River program.

Adopting a constructivist approach allowed us to step outside the constraining dualism of right and wrong, subjectivity and objectivity, and to focus on how these interpretations arose among stakeholders, and what sustained them (Jasanoff, 1996: 275). It helped to prevent us from taking a normative position, and provided access to different (sometimes competing) stakeholders — all of which was necessary to develop a holistic understanding of the case.

Data for this study were gathered between February and November of 2008. In a triangular fashion we have used multiple data collection techniques to describe the case. Initially, we held four exploratory interviews with informants, who had a good historical overview of the case, without having a real stake in the problem. Subsequently, we held and recorded 12 in-depth interviews with key informants representing the most important stakeholder groups. In addition we paid several visits to the area and conducted informal interviews during these visits. We analysed multiple sources of secondary data, including over 130 newspaper clippings, numerous policy documents, technical and scientific reports and articles, and minutes of political and other meetings that enabled us to understand the case from multiple perspectives. It is important to mention that we would have liked to collect more data on negotiation by participating in the planning process. Unfortunately the Ministry of Transport, Public Works and Water Management (Ministry) was not keen on granting us access to the negotiation process, principally because of the sensitivity of the process as well as issues about trust between the government and the stakeholders in the area.

Interviews with our key informants combined with secondary data analysis allowed us to reconstruct and interpret the process. We used timeline analysis to identify critical events in the process, analysed the role of research during these critical events and whether, how, and for whom research opened up or closed down space in the negotiating process.

Setting the scene: Dutch water management

Whoever writes about Dutch water management must mention the 1953 floods in the south-west of the Netherlands, as they have significantly influenced Dutch water management ever since. During the

During the night 31 January/1 February 1953 a spring tide and a north-westerly storm caused flooding that killed more than 1,800 people, led to the evacuation of 72,000 people and caused considerable economic damage. It continues to have an impact on Dutch water management

night of 31 January/1 February 1953 a spring tide and a north-westerly storm caused flooding that killed more than 1,800 people and led to the evacuation of 72,000 people and huge economic damage (Ellemers, 1956: 7).

The Dutch are known worldwide for their battle with water, but the high-water episodes of 1993 and 1995 showed the inadequacy of dealing with peak discharges in the main rivers (the Rhine and the Meuse). In January 1995, around 250,000 people and much livestock had to be evacuated from the Meuse floodplain as the water levels rose in areas where many homes had been built on or near the water meadows in the floodplain (Wiering and Driessen, 2001: 286, 288). Although the dikes along the rivers Rhine, Waal and IJssel held, the total economic damage was estimated at US$1 billion (van Stokkom *et al.*, 2005: 78). Subsequently, the Dutch government was compelled to act and made a radical break, moving from vertical (dikes) to horizontal (spatial) security provisions (Warner, 2008: 173). Shortly after the high water of 1995, the policy guideline Room for the River was established (De Boer, 2003: 33), and in 1997 the concept of Room for the River was officially introduced in the Fourth National Policy Document on Water Management by the Ministry of Transport, Public Works and Water Management (1997). In 2000, the Commission on Water Policy for the 21st century (Commission WB21) concluded a study which recommended that, in addition to traditional measures such as strengthening dikes, the government should explore spatial measures that could accommodate water, and at the same time increase the spatial quality of landscape, nature and culture (Ministry of Transport, Public Works and Water Management, 2000).

In February 2001 the national government, provinces, municipalities and water boards signed a Starting Agreement WB21 to explore the opportunities for creating 'Room for the Rivers'. In line with the Room for the River policy document, the parties agreed to explore solutions for the short- to medium-term (5–20 years), but also take into account the longer-term consequences (20–50 years). The country was divided into the upper and lower river regions. In this paper, we focus on what happened in the lower river region, although some empirical findings relate to both. Another recommendation by Commission WB21 was the early integration of the general public and entrepreneurs in the planning process to increase awareness of the water problems, and create public support for future interventions (Ministry of Transport, Public Works and Water Management, 2000: 21–23). To ensure a decentralized approach, the policy process was organized according to a spatial planning procedure, which gives stakeholders legal rights to participate in the design, negotiation and decision-making process. A spatial planning procedure is divided into different phases. During the first phase, the government presents its proposal, accompanied by an environmental impact assessment (EIA), to the parliament. The second phase provides the public with the right to formally react to both the government's proposals and the EIA and results in the third phase: the cabinet's standpoint. Subsequently (during the fourth phase), this proposal has to be approved by the parliament and the senate to result in a formal government decision.

Case study: depoldering De Noordwaard

De Noordwaard (*Noord* = North, *waard* = dwelling mound) is an agricultural polder of 2,050ha located south-west of Werkendam. Polders are low-lying, flat areas reclaimed from the sea or rivers and protected by embankments or dikes, which are very typical of the Dutch landscape. De Noordwaard is wedged between *Brabantse* and *Sliedrechtse* Biesbosch which are divided by the river Merwede, which forms part of the Rhine river delta. In the south-west, the polder borders the National Park de Biesbosch, one of the largest national parks in the Netherlands. De Noordwaard accommodates 75 households, of which 26 are farms (van der Meulen, 2007). For centuries De Noordwaard has been subject to floods, diking and poldering projects. The first plans for nature development projects along the river Merwede originated in 1992. In line with the Ecological Main Structure (EU Natura 2000 legislation), part of De Noordwaard (600ha) was identified as forming a natural corridor between *Sliedrechtse* and *Brabantse* Biesbosch. Six farms were resettled and 600ha of agricultural land was made available for nature development. This made Brabant Province promise farmers that the rest of De Noordwaard would not be touched in the near future. In the literature we could only ascertain that *De Kievitswaard* would not be claimed for nature for at least 15 years (1998–2013) (RIZA and Bosch Slabbers, 1999; 2000). The nature development project was completed and opened in May 2008.

Critical events leading to the depoldering of De Noordwaard

Interviews with key informants and the analysis of secondary data allowed us to reconstruct the timeline

that led to the decision to depolder De Noordwaard. Together with the informants we identified the critical events along the timeline. Within each critical event, special attention was paid to the mobilization and role of research, and how it potentially opened up or closed down space for stakeholders in the negotiation process. Each section concludes with a short analytical reflection on what happened during the phase in question.

Establishment of flood risks and discharge norms After the flood in 1953, a delta commission was established to come up with a set of hydrological measures that should protect the Netherlands from immediate flood threats. One of their measures was the development of a normative protection system, based on flood risk. Initial norms for the river basin area were established at a flood risk of once every 3,000 years; this corresponded with a water discharge capacity of 18,000m^3sec^{-1} at Lobith, the town where the river Rhine enters the Netherlands.

Lack of support for ongoing strengthening of dikes led to the formation of the Becht Commission (1977) and the Boertien Commission (1993). The Becht Commission advised changing the flood-risk norm from once every 3,000 years to once every 1,250 years, corresponding with a water discharge capacity of 16,500m^3sec^{-1} for the river Rhine at Lobith (Project Organization Room for the River, 2005: 34). In 1993, the Boertien Commission recommended the maintenance of a flood-risk level of once every 1,250 years, but new mathematical methods resulted in a lower corresponding water discharge capacity of 15,000m^3sec^{-1} for the river Rhine (Project Organization Room for the River, 2005: 34). According to d'Angremond, an emeritus professor in hydraulic engineering at the Technical University Delft (TU-Delft), both commissions used incorrect data for calculating flood risk and water discharge capacity. He warned that:

> Discussions are often based on incomplete knowledge about historical and physical backgrounds, which can lead to misunderstandings and unwise decisions. (d'Angremond, 2001)

After the high water of 1993 and 1995, the Dutch government concluded that a turnabout in river management was necessary. Although the highest ever measured discharge at Lobith was 12,760m^3sec^{-1} in 1926 (Roth *et al.*, 2006: 25), new predictions on climate change, changing rainfall and river discharges opened up new extreme horror scenarios. The norm for peak discharge returned from 15,000m^3sec^{-1} to 16,000m^3sec^{-1}, and scenarios for 18,000, 19,000 and even 20,000m^3sec^{-1} were now taken seriously (Silva, 2001: 4; Roth and Warner, 2007: 521). Uncertainty about future discharge peaks led the government to decide that Room for the River's primary objective should be to make the delta flood proof up to a level of 16,000m^3sec^{-1} in the short- to medium-term (until 2015) and 18,000m^3sec^{-1} in the long term (2015–2050). Room for the River comprised the start of a national resilience study to provide more insight into the long-term capacity of the Dutch water system and its ability to discharge 18,000m^3sec^{-1}. In parallel, a spatial planning procedure was initiated to ensure early participation of the general public in the planning process to increase awareness about the water problems, to create public support, and to provide a platform to share their vision on the proposed measures and, if possible, co-design alternative solutions (Ministry of Transport, Public Works and Water Management, 2000: 21–23). The measures in the spatial planning procedure focused on achieving the short- to medium-term discharge objective of 16,000m^3sec^{-1}.

Reflection: Although the scientific foundations of the discharge norms were questioned by scientists like d'Angremond, Commission WB21 used them to shape the solution space in which Room for the River measures could be explored. The natural disaster and its human and economic consequences had created a sense of urgency and political space to tighten the discharge norms, forming the starting point (and financial space) for the resilience study and the spatial planning procedure; including legal procedures and 'rules of the game' for public participation.

Resilience study and 'box of blocks' In December 2002 the resilience study was published by the Ministry of Transport, Public Works and Water Management. The study put forward 600 potential measures for creating Room for the River in the Netherlands. Three key indicators: sustainable safety (based on 18,000m^3sec^{-1}), spatial quality and cost–benefit analysis, determined the selection of the 600 measures. The resilience study based its safety objectives on the third climate report of the Intergovernmental Panel on Climate Change (IPCC) and the climate scenarios undertaken by the Royal Netherlands Meteorological Institute (KNMI), which had also been used by Commission WB21 (Project Group Resilience Study, 2002: 15–17). Spatial objectives were based on the government's Fifth National Policy Document on Spatial Planning Part 3. The ranking system used in the resilience study for each of the key indicators resulted in a classification from top measures (scoring well on all three indicators) to negligible measures (low scores). The resilience study also contained a set of maps that displayed the geographical spread of potential measures.

Another output of the study was a computerized hydraulic model/scenario planning tool called 'box of blocks' (*blokkendoos* in Dutch). Whereas some describe the box of blocks as merely an indicative tool (Pleijte *et al.*, 2005: 75), others describe it as an instrument to: 'Quickly calculate the hydraulic consequences of a combination of measures' (de Boer quoted in: GeoVisie, 2006: 4). Initially, the box of blocks was mainly used by hydraulic engineers. During later phases, after the software had been

made more user-friendly, it was also used to facilitate the dialogue between policy-makers from different regions, demonstrating and visualizing the interdependencies of river delta management at the national level.

It is important to mention that depoldering De Noordwaard was not part of the 600 potential measures presented in the resilience study, mainly because of Brabant Province's promise to keep their hands off the area. To comply with safety objectives in the region, it was proposed to run two 'green rivers'[1] through the nearby land of Heusden and Altena. The green rivers were hydraulically 'very effective', but also 'highly problematic' given the environmental and social impact of the measure in the area (Project Group Resilience Study, 2002: 113–114).

Reflection: During this phase, research manifested itself in multiple ways, and was used to further elaborate and operationalize the space in which solutions to create Room for the River could be explored. The box of blocks was used to visualize the multi-criteria analysis of potential Room for the River measures and their water-lowering effect. As a research-based instrument, it facilitated dialogue and cooperation between policy-makers by visualizing the interdependencies of water management at the national level. During this phase, space for depoldering De Noordwaard seemed closed: green rivers were preferred, but equally contested in the region.

Interactive design sessions in the lower river region Parallel to the resilience study, four interactive design sessions were organized for stakeholders in the lower river region. The Bureau Lower River Region (BLRR) (in Dutch: Bureau Benedenrivieren), part of the Ministry of Transport, Public Works and Water Management, facilitated the sessions. The BLRR took the long-term discharge objective of 18,000m^3sec^{-1} as the starting point, whereas the spatial planning procedure had been initiated to devise short-term solutions for discharging 16,000m^3sec^{-1}. According to the BLRR facilitator: 'Focusing on 18,000 instead of 16,000m^3sec^{-1} was psychologically essential as the question became not *what* to do, but *when*'. This approach led stakeholders to conclude that: 'A big bang was preferable to cumulative smaller measures' (Bureau Benedenrivieren, 2004: 25, 27). During the sessions, stakeholders were supported by hydraulic experts brought in by the BLRR. Ecologists were not invited, because they would slow down the process, according the BLRR's facilitator. After the first design session, ideas were translated into maps. During the second session the maps were discussed and specified, leading to a list of 42 potential measures for the lower river region. Formally, depoldering De Noordwaard was still not part of the 42 potential measures. Informally, however, the measure had been discussed during the design sessions. Stakeholders started to understand that something substantial had to be done in the area to secure future safety. Besides the green rivers, the only alternative was 'doing something' in De Noordwaard, which would significantly contribute to the government's Room for the River objectives. Subsequently, the facilitation of the design sessions was mentioned by our respondents as another important factor in making the concept of 'doing something' in De Noordwaard discussable. The process facilitator described depoldering as a: 'very interesting, large-scale measure', and added that: 'Creating green rivers on peat soils was an idiotic idea that would ruin the landscape'. About creating public support for depoldering he said: 'It is a matter of sowing the seed, giving water, and after some time the plant will flower'.

Reflection: During this phase of operationalization of the Room for the River policy, space for depoldering De Noordwaard as a potential measure within Room for the River was strategically reopened. The BLRR was in firm control of who could sit at the negotiating table, the objectives, what was placed on the agenda, and what type of information and research were mobilized to inform the citizens about their options. This allowed the BLRR to create public support for depoldering by persuading stakeholders that: 'A big bang was preferable to cumulative smaller measures', as this would reduce uncertainty and public unrest in De Noordwaard. During later phases, the BLRR tactically used the 'preferred big bang' argument as a backstop in the process, even though the initial conditions that had resulted in public support for depoldering De Noordwaard had changed.

Two critical developments in December 2002 Two critical developments occurred in December 2002. Firstly, the 42 potential measures were presented to the regional steering committee lower river region, chaired by the Brabant Province delegate. The committee had the task of categorizing each of the 42 measures according to a 'go/no-go' classification system. During the meeting the green rivers through Heusden and Altena were classified as no-go. Several politicians claimed that there would be no public support for the measure. Depoldering De Noordwaard was discussed as a potential alternative, but was found to be far too sensitive because of the province's promise to the people of De Noordwaard. During the meeting, a rethink of the go/no-go classification system was suggested. An alternative system was proposed and accepted. Measures would now be classified as: unacceptable, controversial or non-controversial. Both the green rivers and depoldering De Noordwaard were classified as controversial.

Secondly, a representative of the Southern Netherlands Farmers' Organization (ZLTO) reacted in the regional newspaper *Brabants Dagblad* to the idea to depolder De Noordwaard. He claimed that:

> Sooner or later it will be over with agriculture in De Noordwaard. If that is the case, then preferably soon, so we can build a new living elsewhere. This will also create clarity for the people in the area of Heusden and Altena. Room for the River is a case of national importance. If this is so, then the government should also reap the consequences and pay a good price for our land. (*Brabants Dagblad*, 7 December 2002)

On 17 December 2002 the BLRR responded in the media that:

> We are doing everything in our power to prevent green rivers through the land of Heusden and Altena.
>
> The bureau is currently examining measures to discharge water through De Noordwaard; this can make the green rivers superfluous. (*Brabants Dagblad*, 17 December 2002)

The focus had officially shifted from green rivers to depoldering De Noordwaard.

Reflection: The events in December 2002 formed the final stages that created sufficient space for the BLRR to include depoldering of De Noordwaard as a potential measure for Room for the River; something the BLRR's facilitator had described as the 'flowering of the plant'. Preceding this momentum, public support had been tactically and patiently created during the interactive design sessions by 'sowing the seed and giving water'. Subsequently, broadening the classification system created the political space to include the measure in the spatial planning procedure, while simultaneously the provincial government was not directly violating its promise to the people of De Noordwaard. For antagonists of the green rivers this critical event opened up space, whereas for the antagonists of depoldering De Noordwaard space was closing down. For some farmers in De Noordwaard, who thought that depoldering was inevitable, this momentum opened up (financial) space in terms of the expected compensation, which shows that the opening up and closing down of space is closely related to stakeholder objectives.

From non-negotiable to preferred alternative By the end of January 2003, an information evening was organized to inform the broader public about the outcome of the first two design sessions (Bureau Benedenrivieren, 2004: 8). An increasing number of stakeholders entered the arena; some in favour of the green rivers, others in favor of depoldering De Noordwaard. The BLRR took the position that: 'The suggestion to make De Noordwaard a flowing-area comes from the ZLTO management' (*Brabants Dagblad*, 26 March 2003).

After the last of the four design sessions in November 2003, the steering committee determined their preferred measures for the lower river region. They presented a combination of measures, including the depoldering of De Noordwaard. In the media the BLRR explained that: 'The chance that De Noordwaard will be turned upside down is growing' (*Brabants Dagblad*, 7 November 2003). Within less than a year the status of depoldering De Noordwaard had changed from non-negotiable, to controversial, to preferred. Depoldering was now seen as inevitable, although not everybody in the area agreed on that.

Reflection: The space for depoldering De Noordwaard as a Room for the River measure, was captured by including it as one of the government's preferred measures in the spatial planning procedure. The BLRR's explanation that depoldering was suggested by farmers from the area, does not fully grasp the strategic shaping of space by the BLRR that made depoldering negotiable in the first place. Moreover, not all stakeholders from the area shared the idea that depoldering was inevitable.

Additional research on discharge peaks In 2004, trans-frontier research by Gelderland Province, the Dutch Ministry of Transport, Public Works and Water Management and the German Province of Nordrhein-Westfalen studied the probability of having peak discharges of 18,000m^3sec^{-1} at Lobith. The study used one- and two-dimensional hydrological simulation models that, amongst other things, included data on rainfall, groundwater and morphological projection, climate change scenarios by IPCC and evaluation of policy objectives by countries along the river Rhine. The research concluded that theoretically 18,700m^3sec^{-1} was possible, but that in practice, by the time the water reached Lobith, floods in Germany would have reduced it to 16,500m^3sec^{-1} (with a margin of error of 500m^3sec^{-1}) (Gelderland Province *et al.*, 2004: 3–6). A similar argument had been mobilized by De Boer, a researcher at TU-Delft, whose report:

> Ridiculed the 18,000m^3sec^{-1} scenario, claiming that the German river banks will flood long before the river reaches the Netherlands since current German efforts aim to control flooding at 14,600m^3sec^{-1}. (Warner, 2008: 184)

In his report De Boer concluded that: 'The problem of 18,000m^3sec^{-1} is therefore unrealistic' (De Boer, 2003: 75). In a newspaper article the BLRR would later respond that:

> Germany is fulfilling its agreement to take measures to lower the water levels. But what if Germany takes extra measures [such as heightening dikes] to speed up the discharge of water? (*Brabants Dagblad*, 20 April 2006)

However, it had been the Dutch government who had urged mandatory EU Water Guidelines legislation to

prevent countries such as Switzerland and Germany from passing on responsibility for dealing with high water-levels.

Reflection: Research by Gelderland Province *et al*. and TU-Delft re-opened the negotiation space by providing contra-expertise on Room for the River's objectives. The studies questioned the assumed discharge peaks that had formed the theoretical basis for exploring solution space in the resilience study. The studies were confuted by the BLRRwith arguments (What if Germany were to heighten the dikes?) that had no legal basis, as EU Water Guidelines legislation prevents other Rhine-delta countries from passing on responsibility for dealing with high water. The research created space for Noordwaard activists, who had powerful arguments on the basis of lower discharge peaks, with which to question the necessity of depoldering De Noordwaard.

Platform Save De Noordwaard and TU-Delft Platform Save De Noordwaard (Platform) was established in 2004, representing a number of agrarians and inhabitants in De Noordwaard who believed that no serious consideration had been given to a combination of smaller measures that could comply with Room for the River's objectives, and could make both the green rivers and depoldering De Noordwaard superfluous. One of the Platform's objectives was to involve independent experts who could discuss the measures and their contribution to Room for the River's objectives on equal terms with the Ministry (Pleijte *et al.*, 2005: 6).

In October 2004, the Platform mobilized research conducted by TU-Delft, famous for its expertise on hydraulic engineering and water management. TU-Delft was coordinating this student research project to explore alternatives to depoldering De Noordwaard taking natural (e.g. geological, environmental and morphologic dynamics), hydraulic (discharge distribution), socio-cultural (characteristic scenery and livelihood functions), legal (laws and procedures) and economic criteria (costs related to hydrological measures) into account. The report concluded that measures in De Noordwaard were necessary to discharge 18,000m^3sec^{-1}, but suggested alternative technical solutions for controlled flooding. By creating inlet and exhaust pipes, De Noordwaard could be used as a 'flowing-area' when really necessary: once every 500 years for discharges of more than 15,000m^3sec^{-1}, and once every 2,000 years for 18,000m^3sec^{-1}. By doing so, De Noordwaard could retain its agricultural function. Moreover, the researchers claimed that this plan would be far cheaper than the proposed measures (€100 million instead of €280–360 million) (TU-Delft, 2004: 4). In their conclusion they summarized:

> Questions remain on the necessity of a bypass through De Noordwaard, as alternative solutions might function equally well for the river system. The priority given in some reports to the environment are exaggerated and undermine the interests of the residents of De Noordwaard. (TU-Delft, 2004: 4)

The outcome of the research was not satisfactory for either the Platform or the BLRR. From the Platform's perspective, the study did not result in alternative measures for 'doing something' in De Noordwaard. According to BLRR, the proposed technical solution was: 'Unreliable and extremely dicey', and would: 'Never be accepted'. The BLRR continued that: 'The proposed solutions will lead to water inconvenience every 25–100 years and will cost at least €400 million'. The BLRR proposed to write a letter together with TU-Delft: 'To inform the people about the facts, because this story by TU-Delft should not live a life of its own' (*Brabants Dagblad*, 27 January 2005). Eventually, the alternative proposed by TU-Delft did not lead to anything tangible in the region.

Reflection: The Platform mobilized the TU-Delft research to explore alternatives to depoldering De Noordwaard. Through the TU-Delft research, they tried to open up economic (lower costs), biophysical (flooding when necessary) and socio-cultural space (housing and agriculture function remains intact) (TU-Delft, 2004: 4). Although the research created space, not much momentum was generated, as the proposed alternative did not match sufficiently with the Platform's objective.

The Platform and Wageningen UR Early in 2005, the Platform met some researchers from Wageningen UR. By that time, the Platform had received support from an emeritus professor of hydraulic engineering in exploring alternative measures that could save De Noordwaard. After learning that the Ministry was not willing to study their alternative, the Wageningen UR researchers recommended the Platform to apply for research funds through Wageningen UR's 'science-shop'.[2] After funds had been approved, the research started with two workshops in February and March 2005. During the workshops, experts from different universities agreed on a three-fold approach, aiming to:

- underpin the Platform's alternative with a qualitative landscape ecological system analysis;
- critically review the government's hydraulic model and its basic assumptions; and
- criticise the democratic process and find ways to penetrate political agendas (Pleijte *et al.*, forthcoming).

The group was aware of the sensitive situation:

> We knew that we were acting in a politically sensitive context, and then you know that is not only about rational argumentation, but also about going along in the political process.

As a result, the Platform lobbied for political support, which resulted in the Ministry's promise that a valid alternative to depoldering De Noordwaard would be studied seriously.

In June 2005, the research report was published and presented to the Ministry. The study mobilized previous studies by Gelderland Province *et al*. (2004) and De Boer (2003) that questioned the scientific underpinning of the sustainable safety objective of discharging 18,000m^3sec^{-1}; one of the basic assumptions used in the resilience study and the hydraulic model box of blocks. These arguments were not mobilized without careful consideration, as the Platform's alternative was capable of discharging 16,000m^3sec^{-1}, without depoldering De Noordwaard. This alternative measure, a trench through the *Sliedrechtse* Biesbosch, had been discussed during the interactive design sessions, but was found not to be feasible because of the existing European Bird Habitat Guidelines in that area. As the Ministry had mobilized this argument before, the study included scientific findings by Maas *et al*. (2003) to underline that:

> The s*troomdalgrasland* vegetation [vegetation type present in *Sliedrechtse* Biesbosch] could actually benefit from being alongside a trench.

Besides questioning the scientific underpinning of discharge peaks, the critique of the hydraulic model focused on its inability to run scenarios that would cause water from the river Rhine to flow into the river Meuse as a result of water-level disparity. Moreover, the model could only calculate water management effects downstream and not upstream, and the effect of rising sea-level was not included in the model (Pleijte *et al*., forthcoming).

Based on the analysis of democratic process the study challenged the focus on a 'big bang' over cumulative smaller measures. Both had advantages and disadvantages, but the BLRR's focus on the long-term objective of 18,000m^3sec^{-1} made the 'big bang' look inevitable. In their argumentation the Platform referred to other large-scale Dutch projects whose scale had become their costly weakness. Moreover, the initial conditions that had resulted in public support for depoldering De Noordwaard (clarity and good financial compensation) had changed. Neither of the conditions had been met, which fostered public unrest and uncertainty. Lastly, the study reviewed legal procedures, such as the selective use of the European Bird Habitat Guidelines. Alternatives to depoldering were often ridiculed by the government as a violation of these guidelines. However, if the government itself violated them, they could compensate for the loss of habitat in other areas. Another controversial legal issue was the so-called forerunner status of the project. One of the conditions for becoming a forerunner project was: 'Full support in the region for the preferred alternative of depoldering' (Pleijte *et al.*, 2005: 21). As long as the Platform was still exploring alternatives, there was not full support for depoldering. According to Platform members the forerunner status worked as a 'paralysing instrument' and a form of 'blackmailing' (*Brabants Dagblad*, 17 June 2005). It created social pressure, fuelled by the idea that a forerunner project would speed up procedures and positively influence financial compensation (Pleijte *et al.*, 2005: 23–24). Social pressure from the area eventually led to the end of the Platform's search for alternatives.

Reflection: When analysing this phase, we see that research was conducted and mobilized in a strategic manner. Qualitative landscape–ecological system analysis combined with the policy analysis and intertwined with local knowledge was used to improve the Platform's alternative and question the official government plan (Pleijte *et al.*, forthcoming). The study provided arguments that had been successfully mobilized in other (Room for the River) contexts, and questioned the basic assumptions behind Room for the River (discharge peaks), its hydraulic model (box of blocks), and democratic and legal procedures (e.g. forerunner status). Moreover, the Platform's alternative was proactively defended by providing answers to arguments the Ministry would use to contest the alternative plan. In their approach, the Platform's lobby created political space, and the science-shop provided the financial space for research which mobilized a strategic combination of socio-cultural, political, legal, economic and biophysical arguments to create space for alternatives to depoldering De Noordwaard.

The Ministry responds In the aftermath of the Wageningen UR research a number of events occurred. In July 2005, a regional newspaper reported that the Ministry had formally granted forerunner status to De Noordwaard. In a personal letter, the state secretary informed the Platform that their proposal was 'off the table' (*Brabants Dagblad*, 20 July 2005). In an additional letter send by the BLRR, three arguments for rejecting the alternative proposed by the Platform were presented. Firstly, they explained that the alternative was not new. A combination of measures had been discussed before, but found unfeasible during the design sessions: a 'big bang' was preferred over a combination of measures. Secondly, the alternative was short-term proof (16,000m^3sec^{-1}), but insufficient for discharging 18,000m^3sec^{-1} in the long term. According to the BLRR, this indicated that De Noordwaard had to be reserved for depoldering until 2015; a perspective found infeasible by the farmer and citizen organization. Thirdly, this would lead to extra costs.

Legal, procedural and financial, rather than biophysical and hydrological, arguments formed the main response to the research. In their feedback, the BLRR did not specifically criticize the Platform's alternative, nor did they respond to the argument that 18,000m^3sec^{-1} was physically impossible according to other research.

Reflection: The Ministry's ambivalence towards giving credence to research is remarkable. On the one hand they stressed the importance of scientific research, but on the other hand they easily ridiculed scientific research findings that conflicted with Room for the River policy. During interviews we heard arguments such as: 'These were emotions [not scientific data] presented by activists [non-objective scientists] who were subjective in their analysis and conclusions'; this suggests that the ability of research to create space is strongly related to the phase in the policy process, and the stakeholder objectives it seeks to support.

Government's Research and Verification Commission Despite the Ministry's feedback on the Platform's alternative, a hearing for clarification was organized on 20 April 2006, at which members of the government, researchers and experts, regional policy-makers and citizen participated. Menbers of the Platform and researchers from Wageningen UR were also present. During the hearing, experts claimed that: '18,000m^3sec^{-1} at Lobith is physically impossible' and has therefore 'no legal basis' (Research and Verification Bureau, 2006: 10). Moreover, the Platform's proposed alternative: 'Better fits in the history of the landscape' and 'has less negative effects on Bird Habitat Guidelines as suggested by the Ministry' (Research and Verification Bureau, 2006: 11).

On the basis of the hearing, the Commission for Transport, Public Works and Water Management asked for verification research on the (financial) argumentation behind the spatial planning procedure Room for the River (Research and Verification Bureau, 2006: 3). The research was conducted by the Research and Verification Commission, a commission that advises and supports the Dutch government through research, and by assessing research offered to the government. On 14 June 2006, the Research and Verification Commission offered its findings to the Commission for Transport, Public Works and Water Management. With regard to the alternative to depoldering proposed by the Platform, the commission concluded that:

> Different configurations are presented, almost all with different variables and not elaborated in detail. These have to be studied coherently if they are to be compared to the government's preferred alternative. The comparison in this verification research was therefore to remain very general. (Research and Verification Bureau, 2006: 11)

Nevertheless, the commission acknowledged that:

> Presenting a worthwhile alternative was made difficult and was constrained by giving De Noordwaard forerunner status. Progressive thinking (by the Platform) about a good alternative was undervalued, and the last version of the alternative was hardly evaluated individually. (Research and Verification Bureau, 2006: 11)

Moreover, the commission concluded that:

> It is not easy to compare alternatives from the region with the alternatives of the government. Citizens' alternatives are often less detailed; this subsequently increases the chance that the government's alternative will be preferred. (Research and Verification Bureau, 2006: 15)

About the discussion on discharge norms the commission concluded:

> The choice of 18,000m^3sec^{-1} has been explained by the state secretary, but is shrouded in uncertainty. That has been a constraint, because the choice of 18,000m^3sec^{-1} has been a determining factor in evaluating the several alternatives. (Research and Verification Bureau, 2006: 25)

Despite the Research and Verification Commission's evaluation, the spatial planning procedure Room for the River was unanimously approved by the parliament in July 2006.

Reflection: Although the Research and Verification Commission acknowledged that: 'Citizens' alternatives are often less detailed, and that this subsequently increases the chance that the government's alternative will be preferred', the alternative presented by the Platform was found too general to be compared with the government's preferred option. Although the Platform had offered a research-based alternative to depoldering and the commission had agreed with some of its findings, it did not create enough space to call into question the decision to depolder De Noordwaard. Besides the level of detail, this also had to do with the fact that the policy process had advanced to a phase where decisions had to be made. Validating the research by the Platform would have had far-reaching consequences, as it challenged basic assumptions (discharge peaks) behind the Room for the River policy. Subsequently, this could have provided jurisprudential space to other interest groups opposing Room for the River measures.

'Room for the River not based on solid scientific proof' On 14 November 2006, Room for the River was discussed in the Senate. When the Minister of Transport, Public Works and Water Managementcould not satisfactory answer the Senate's questions, the debate was suspended (Senate, 2006a). Soon thereafter a 'technical briefing' was organized, where the Ministry's experts informed the Senate about the strategic choices behind Room for the River. One of our interviewees explained

that: 'A technical briefing is often used to push something through the Senate'. We assume that besides the credibility and probability of Room for the River's safety objectives (discharge norms), financial, procedural and legal issues must have been discussed.

On 19 December 2006, the suspended debate in the Senate continued. When the peak discharge norms were discussed, the state secretary for Transport, Public Works and Water Management explained that:

> Half of the experts say that under certain conditions 18,000m^3sec^{-1} can flow into the Netherlands, the other half of the experts say that this cannot happen, because areas in Germany will have flooded by then. We have never argued that we have solid scientific proof, it is an administrative norm. (Senate, 2006b: 560)

During the debate a senator proposed a motion for project Veessen-Wapenveld, another project besides De Noordwaard which had been studied by the Research and Verification Commission. The senator requested a: 'Renewed planning process towards a reconstruction plan that does justice to agricultural values, spatial quality and the high-water task' for Veessen-Wapenveld (Senate, 2006b: 569). The state secretary approved the motion (Senate, 2006b: 573).

In December 2006, the senate approved Room for the River, and the spatial planning key decision (fourth part of the spatial planning procedure) was published (Project Organization Room for the River, 2006).

Reflection: Although all activities in the senate have to be codified and made available to the public, this is not mandatory for technical briefings. How research was mobilized and how it influenced decision-making during the technical briefing can therefore not be analysed. We assume that that besides Room for the River's safety objectives (discharge norms), financial and legal issues must have been discussed. Nevertheless, it is remarkable that the state secretary admitted that 18,000m^3sec^{-1} was a less scientific norm than initially claimed. Subsequently it turned out that there was still space to revise the spatial planning processes for Noordwaard-like areas such as Veessen-Wapenveld.

Analysis and discussion

The objective of this paper was to contribute to insight into the dynamics that influence the effective mobilization and contribution of research to negotiation processes in the context of competing claims, and to what extent research opened up or closed down negotiation space for stakeholders. In our analysis, we have tried to highlight what appear to be the key drivers that influence this.

Manifestation and packaging of research

The reconstruction of critical events demonstrated that research manifested itself in different forms, for multiple purposes, and during different phases in the process (Table 1). Research proved to be a powerful tool that influenced the policy and negotiation process, but whether it created space, and for whom, depended on numerous controllable and less controllable contextual factors. Good examples of less controllable factors can be found in the high-water incidents of 1993 and 1995 that opened up political and financial space to rethink Dutch water management, and the interview with the ZLTO representative that provided space for the BLRR to include De Noordwaard as a potential measure in the region. More controllable factors can be found in the way research is 'packed' (cf. Hajer, 1995). Increasingly, norms, criteria and indicators, interactive scenario planning tools, maps and other visualizations form an attractive and accessible way of packaging complicated research-based data that are strategically used to facilitate negotiation and decision-making processes. Such packaging enhances the accessibility and usability of research to which different groups of stakeholders can easily relate (cf. Klerkx *et al*., 2010). However, these tools require close attention and guidance as to their interpretation and the accuracy of their meaning, as was the case with the box of blocks. Packaging of research also includes the discourses used by researchers and experts when mobilizing their knowledge to support or facilitate negotiation processes and decision-making.

Research and stakeholder perceptions

The reconstruction of negotiation during the policy process demonstrates that the interpretation of what constitutes effective research relates strongly to stakeholder perceptions and objectives. Research in line with stakeholders' objectives is likely to be framed as credible, legitimate science, whereas

Our objective was to contribute insights about the key drivers of the dynamics that influence the effective mobilization and contribution of research to negotiation processes in the context of competing claims, and to what extent research influenced the negotiation space for stakeholders

Table 1. Overview of manifestation, packaging and role of research during policy process

Critical event	Manifestation of research	Packaging of research	Role of research in policy process
1. Flood risks and discharge norms	Flood risk norms, discharge norms, improved mathematical and statistical methods for calculating discharge peaks, hydrological measures, climate change scenarios, rainfall data, normative framework for public participation	Research reports and policy documents by Commissions Becht, Boertien and WB21, Fourth National Policy Document on Water Management, Policy Guideline Room for the River	Evaluate policy Elaborate policy, contra-expertise
2. Resilience study and box of blocks	Flood risk norms, discharge norms, 600 potential hydrological measures and their contribution to Room for the River objectives, indicators for sustainable safety and spatial quality, cost–benefit analysis, IPCC and KNMI climate change scenarios	Research reports, maps, models, policy documents such as Fifth National Policy Document on Spatial Planning, classification system based on key indicators, decision-supporting software (box of blocks), list of potential measures	Elaborate policy Operationalize policy
3. Interactive design sessions	Discharge norms, 42 hydrological measures and their contribution to Room for the River objectives, normative framework for public participation	Advice and expertise by researchers, minutes of meetings, maps, facilitation of decision-making, list of potential hydrological measures, brochures	Elaborate policy Operationalize policy
4. Two critical developments	Potential hydrological measures (including depoldering De Noordwaard) and their contribution to Room for the River objectives, indicators for sustainable safety and spatial quality, cost–benefit analysis	List of potential measures, advice by researchers, facilitation of political decision-making	Operationalize policy
5. From non-negotiable to preferred alternative	Preferred hydrological measures and their contribution to Room for the River objectives	Advice and expertise by researchers, minutes of meetings, facilitation of decision-making, maps, list of preferred hydrological measures	Operationalize policy
6. Additional research on discharge peaks	International flood risk projections and discharge norms, hydrological measures and their contribution to Room for the River objectives, morphological and hydrological developments, rainfall and groundwater index, IPCC climate change scenarios, evaluation of (inter)national policies, laws and legal procedures	International research reports, including one- and two-dimensional hydrological simulation models and scenarios, maps, tables and graphs	Evaluate existing (inter)national policy Operationalize policy Contra-expertise
7. Research at TU-Delft	Flood risk projections, discharge distribution, tidal movements, potential hydrological measures and their contribution to Room for the River objectives, analysis of geological, morphological and environmental data on areas, analysis of socio-cultural value and livelihood functions, cost–benefit calculations of different hydrological measures, policy analysis	Advice and expertise by researchers, research report including hydraulic models, maps, technical designs of hydraulic solutions and photos	Evaluate (inter)national policy (treaties, laws and legal procedures) Operationalize policy, contra-expertise
8. Research platform and Wageningen UR	Funding (science shop), qualitative landscape–ecological system analysis, critical review of hydraulic model and its basic assumptions (e.g. discharge norms), alternative hydrological measures and their contribution to Room for the River objectives, policy analysis (Bird Habitat Guidelines EIA, cost–benefit analysis, use of 'box of blocks'), process monitoring and evaluation of legal procedures (spatial planning procedure and forerunner status), analysis of socio-cultural value and livelihood functions, mobilizing lessons learned from comparable (research) projects	Advice and expertise by researchers, research report including photos, maps and alternative hydrological measures, research used for political lobbying	Evaluate (inter)national policy (treaties, laws and legal procedures) Contra-expertise, operationalize policy
9. Ministry responds	Ministry mobilized mostly non-research based arguments, referring to interactive design sessions and original discharge norms, on which more up-to-date research was already available	Letter from Ministry and BLRR to Platform containing legal, procedural and financial argumentation on why the Platform's proposal had been rejected	Defend elaboration of policy Operationalize policy
10. Research and Verification Commission	Research used as tool to verify and determine credibility of other research, discharge norms, evaluation of hydrological measures and their contribution to Room for the River objectives, analysis of financial argumentation, evaluation of policy making and legal procedures (forerunner status and stakeholder's legal rights in spatial planning procedure)	Advice and expertise by researchers, research report/policy advice including analysis of discharge norms, legal procedures and financial argumentation, comparing government preferred alternative vis-à-vis alternatives by interest groups	Monitor and evaluate policy-making (Verify) contra-expertise Operationalize policy
11. 'Room for the River not based on solid scientific proof'	Unknown due to lack of transparency by government. We assume that besides Room for the River's safety objectives (discharge norms), financial, procedural and legal issues must have been discussed	Technical meeting organized by Ministry's experts to facilitate political decision-making	Operationalize policy Monitor policy-making (Verify) contra-expertise

research mobilized by the opposition is often seen as less valid, credible and reliable. This is illustrated by the BLRR example that described the research by the Platform and Wageningen UR as: 'driven by emotions', conducted by: 'activists who were subjective in their analysis and conclusions'. The latter quote indicates that it is not only the interpretation of the research findings that is stakeholder dependent, but consequently also the role of the researchers. When research is being conducted in the context of competing claims it is therefore realistic to consider research findings as 'serviceable truths' or 'negotiated truths' (In 't Veld, 2000: 295; Giller *et al.*, 2008), and subsequently ask the question: truths for whom?

Phases and power

Our case study shows that how research is perceived and given credence is related to the different phases of policy and negotiation processes (see Figure 1). An example is the research conducted by Gelderland Province *et al*. (2004) and De Boer (2003) who questioned the probability of having discharge peaks of 18,000m^3sec^{-1} at Lobith. In the Room for the River context, this research was framed and approached as contra-expertise, threatening the elaborated Room for the River policy. However, eight years earlier a similar type of research had formed the foundation of the policy. Furthermore, the research by Gelderland Province *et al*. (2004) was international, and showed interdependencies that could have facilitated dialogue between the Netherlands and the other Rhine-delta countries (Germany and Switzerland). Eventually, the state secretary described the 18,000m^3sec^{-1} as an administrative rather than a science-based norm, whereas by that time (2006) more recent and more accurate research findings on discharge peaks by De Boer (2003) and Gelderland Province *et al*. (2004) were available to the government.

Solution space is often narrowed down in the early phases of policy-making. By the time a spatial planning procedure enters the legal public participation phase, both the preferred solutions, and procedures for evaluating alternatives by the general public have been elaborated. This implies a degree of power, affecting the:

> Opportunities, moments and channels through which citizens can act to potentially affect policies, discourses, decisions and relationships that affect their lives and interests. (Gaventa, 2006: 26)

As was acknowledged by the Research and Verification Commission, this made it difficult for citizens to present alternatives, within the appointed time, that contained the same level of research and detail as the government's preferred solutions.

Moreover, the interpretation of phases is stakeholder dependent, meaning that whereas some stakeholders may believe that a phase is concluded, e.g. De Noordwaard not being amongst the 42 potential Room for the River measures in the lower river region, others may understand that such options are still negotiable.

Negotiation and space

During each negotiation phase we could identify formal and informal negotiations. When negotiations provided an acceptable configuration between

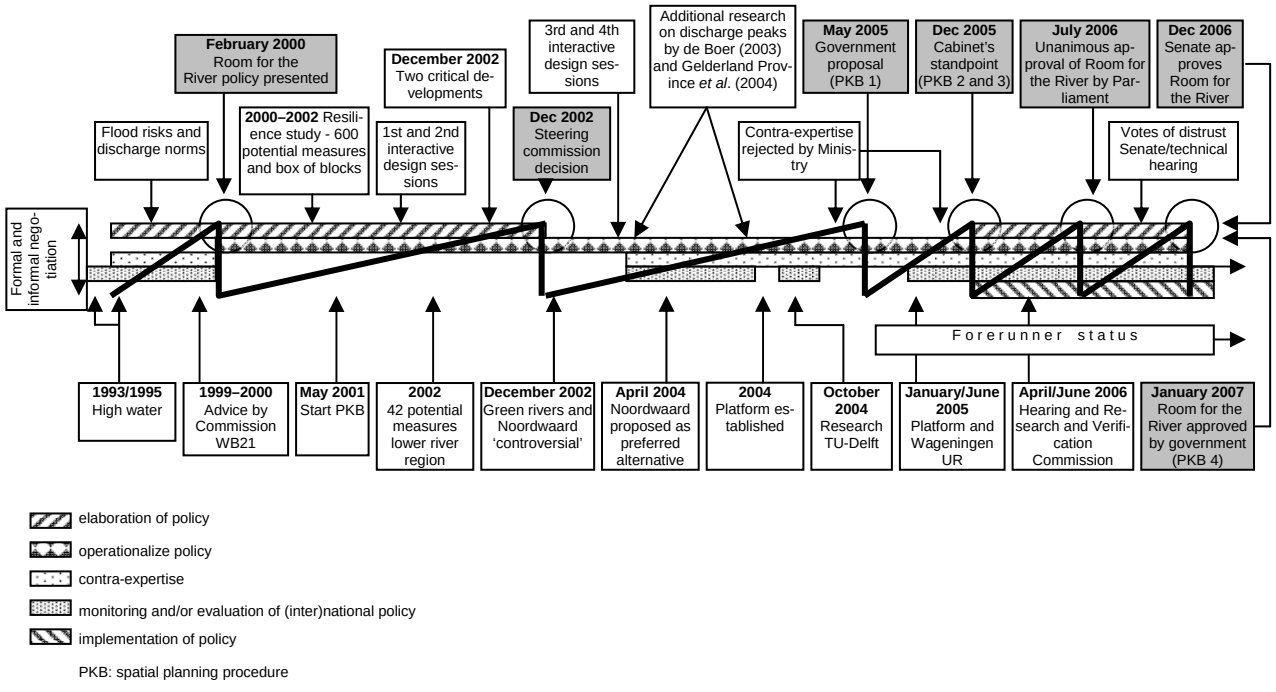

Figure 1. Timeline analysis of critical events in Room for the River/Noordwaard case study

Table 2. Examples of spaces from case study

Spaces	Some examples from case study
Socio-cultural space	Communication space, space for dialogue, space to participate, negotiation space, protest space, emotional space, relational space, space for trust, institutional space, cultural space, agricultural space
Political space	Space for political will, space for lobbying, space to revise policy processes
Legal space	Legal space to participate, negotiate and influence policy-making, procedural space, jurisprudential space, laws
Economic space	Financial space (for research), cost–benefit analysis, compensation space
Biophysical space	Technical space, hydrological space, (agro-)ecological space, environmental space, geographical space, morphological space, meeting space

socio-cultural, political, legal, economic and biophysical spaces (see Table 2), the momentum was captured, frozen or fixed, be it in (in)formal agreements, policy documents, minutes of meetings, maps or a list of potential measures. The formal decision-making moments in the policy process are indicated by the circles and grey boxes in Figure 1. However, we have seen that preceding such events, multiple formal and informal interactions in and between networks, and phenomena such as coincidence and self-organization (cf. Aarts and Leeuwis, 2010) influenced their course and outcome. The newspaper interview with the ZLTO representative shows that capturing these momentums does not have to be based on broad consensus, but can also be the result of an individual actor capable of finding space in negotiations by making use of mass media.

The momentums when space was fixed often formed the starting point for a new phase of negotiations. Once momentums of space had been captured, it became difficult to defreeze, change and refreeze them, something that was strategically used by the BLRR as a backstop in the process. As described in the previous section, this suggests that the mobilization of research in the right place at the right time by the right person is of crucial importance in relation to the effectiveness or impact of research. Nevertheless, the research by the Platform and Wageningen UR shows that, if strategic attention is paid to mobilizing the 'right' combination of socio-cultural, legal, economic and biophysical arguments, combined with political lobbying, space can still be created in phases when decisions appeared to be fixed.

Embeddedness of researchers

The embeddedness of a researcher in negotiation processes in formal and informal processes may enhance the effective mobilization of research in the context of competing claims. It can lead to better insight into the dynamics of the process (the history of the debate, stakeholder objectives, power relationships, interdependencies, phase) that influence when and in what form research can contribute to exploring sustainable solutions. Embeddedness during phases when policy is elaborated or operationalized may be more effective in terms of influencing the course of policy-making than criticizing or providing contra-expertise on decisions taken earlier in the process. This relates to both the content of the issue at stake, as well as to how procedures (e.g. space for public participation) could be organized.

However, we are aware that, especially in the context of competing claims, researchers are selectively and strategically involved and excluded from negotiation and policy processes. During this study we were repeatedly told that researchers who would slow down the process were strategically kept out of the interactive design sessions. This suggests a relationship between the nature of the problem, who is controlling the process, research disciplines, and the reputation of the researchers and their institutes, that influences the degree to which research can effectively contribute during different phases of policy or negotiation processes. That this is not univocal was illustrated by a staff member of the Ministry who explained that: 'TU-Delft and not Wageningen UR should provide the hydraulic expertise to evaluate measures'. But when TU-Delft did so, their alternative to depoldering De Noordwaard was described as 'unreliable and extremely dicey', and research by De Boer on the probability of dealing with $18{,}000 m^3 sec^{-1}$ discharge peaks were ignored.

Conclusion

This study demonstrates the relationship between the different phases in the policy and negotiation processes, the objectives and perceptions of stakeholders during these phases, and how research is interpreted and given credence. Research manifested itself in different forms and during different phases in the process. On the basis of their objectives, stakeholders tactically and selectively mobilized research as a 'strategic weapon' to manipulate the course and outcome of negotiation processes. This supports our idea that research, conducted or mobilized in the context of competing claims, will often be disputed and contested (cf. van Bueren *et al*., 2003), and could benefit from a negotiation-based approach. Within such an approach, research can support certain stakeholder perspectives or facilitate negotiations, but is also itself subject to negotiation (cf. Leeuwis, 2000; Giller *et al.*, 2008).

The degree to which research can open up or close down negotiation space, and for whom, depends on numerous contextual factors. These factors can be found in the (changing) nature of the problem and the composition of stakeholders, their objectives and power relations during different phases in the process. As Gaventa (2006: 29) explains:

> Certain powerful people and institutions maintain their influence by controlling who gets to the decision-making table and what gets on the agenda.

This is often to the disadvantage of less-powerful societal groups. Insights into the interrelationship between time (phases), spaces and forms of power are crucial for determining when, where and in what form research could contribute to configurations of socio-cultural, political, legal, economic and biophysical space that allow stakeholders to explore and identify sustainable solutions to complex environmental problems.

Increasing the effectiveness of research could benefit from more impact- or action-oriented research approaches where research and researchers are embedded in negotiation processes (cf. Adam *et al*., 2006). Embedding can enhance the probability that researchers will participate in both formal and informal negotiations, and adequately anticipate changing contextual factors that influence the effective contribution of research to exploring sustainable solutions during different phases in the process. However, we feel that the practical and institutional challenges posed by the current academic system and incentive structures do not always allow researchers the time, resources or mandate to become embedded.

This paper provides an incentive to rethink the roles of research, researchers and research institutes in the context of competing claims, but we would also like to stress that similar rethinking is needed for policy processes. Our analysis shows that policy processes leave very little space for the integration of new research findings once procedures have been elaborated or decisions have been made. We conclude that creating space to increase the effective contribution of research to integrative negotiations and exploring sustainable solutions to complex environmental problems consequently requires inventive restructuring of research, policy processes and the interfaces where they meet.

Notes

1. The term ‘green river’ is quite misleading, because no river or ditch is involved. The ‘river’ will consist of two dikes through the landscape that can discharge water in the event of a high water episode.
2. The science-shop works as an intermediary between science and society, where civil society interest groups and organizations can seek funds and scientific support.

References

Aarts, N and C Leeuwis 2010. Participation and power: reflections on the role of government in land use planning and rural development. *Journal of Agricultural Education and Extension* **16**(2), 131–145.

Adam, M, M Carrier and T Wilholt 2006. How to serve the customer and still be truthful: methodological characteristics of applied research. *Science and Public Policy*, **33**(6), 435–444.

Beck, U 1992. *Risk Society: Towards a New Modernity*. London, UK: Sage.

Boaz, A, S Fitzpatrick and B Shaw 2009. Assessing the impact of research on policy: a literature review. *Science and Public Policy*, **36**(4), 255–270.

Brabants Dagblad, 7 December 2002. *Noordwaard afstaan aan water: Prijsgeven landbouwgebied in Biesbosch houdt groene rivier Altena mogelijk buiten deur*. Brabants Dagblad, edition Heusden en Altena.

Brabants Dagblad, 17 December 2002. *'We bedenken de waterplannen niet voor onze lol' - Bureau Benedenrivieren zoekt in Land van Heusden en Altena naar maatregelen voor ruimte voor de rivier*. Brabants Dagblad, edition Heusden en Altena.

Brabants Dagblad, 7 November 2003. *Gaten in Bandijk geven water de ruimte*. Brabants Dagblad, edition Heusden en Altena.

Brabants Dagblad, 27 January 2005. *'TU-plan Noordwaard maakt geen kans'*. Brabants Dagblad, edition Heusden en Altena.

Brabants Dagblad, 17 June 2005. *'Koploperschap gaat de kant op van chantage'*. Brabants Dagblad, edition Heusden en Altena.

Brabants Dagblad, 20 July 2005. *'Beloften Noordwaard nu waarmaken'*. Brabants Dagblad, edition Heusden en Altena.

Brabants Dagblad, 20 April 2006. *'Geen nieuwe inzichten over prijsgeven van Noordwaard'*. Brabants Dagblad, edition Heusden en Altena.

Bureau Benedenrivieren (BLRR), 2004. *Benedenrivieren in Samenhang: Stand van zaken regionale voorkeuren Ruimte voor de Rivier*. April 2004. Rotterdam, the Netherlands: Ministry of Transport, Public Works and Water Management.

Cloke, P J and C C Park 1985. *Rural Resource Management: A Geographical Perspective*. Beckenham, UK and Sydney, Australia: Croom Helm.

d’Angremond, K 2001. *Pompen of Verzuipen - Pump or Drown*. De Academische Boekengids 29. Available at <http://www.academischeboekengids.nl/abg/do.php?a=show_visitor_artikel&id=105>, last accessed 26 June 2010.

De Boer, E 2003. *Het noodoverloopgebied: airbag of luchtzak? Een kritiek op het rapport van de Commissie Luteijn*. In opdracht van de gemeenten: Angerlo, Beuningen, Druten, Duiven, Kleve (D), Kranenburg (D), Millingen, Ubbergen, West Maas en Waal & Wijchen, Delft.

Ellemers, J E 1956. *De februari-ramp: een sociologie van een samenleving in nood*. Assen, the Netherlands: Van Gorcum.

Funtowicz, S O, J Martinez-Alier, G Munda and J R Ravetz 1999. *Information tools for environmental policy under conditions of complexity*, Environmental Issues Series No. 9. Copenhagen, Denmark: European Environment Agency. Available at <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.15.980&rep=rep1&type=pdf>, last accessed 29 June 2010.

Gaventa, J 2006. Finding the spaces for change: a power analysis. *Institute of Development Studies (IDS) Bulletin* **37**(6), 23–33.

Gelderland Province, Rijkswaterstaat Oost-Nederland and Ministerium für Umwelt und Naturschutz Landwirtschaft und Verbraucherschutz des Landes Nordrhein-Westfalen, 2004. *Grensoverschrijdende effecten van extreem hoogwater op de Niederrhein*. July 2004. Ministerium für Umwelt und Naturschutz, Landwirtschaft und Verbraucherschutz des Landes Nordrhein-Westfalen, Staatskanzlei Nordrhein-Westfalen, Bezirksregierung Düsseldorf, Staatliches Umweltamt Krefeld, Arbeitskreis der Deichpflichtigen im Regierungsbezirk

Düsseldorf, Provincie Gelderland, Ministerie van Verkeer en Waterstaat, Waterschap Rivierenland & Vereniging Nederlandse Riviergemeenten.

GeoVisie 2006. *Leven met Water* 5. Available at <http://www.geodelft.nl/files/files_org/34828h_geovisie_juli06.pdf>, last accessed 29 June 2010.

Giller, K E, C Leeuwis, J A Andersson, W Andriesse, A Brouwer, P Frost, P Hebinck, I Heitkönig, M K v Ittersum, N Koning, M T v Wijk and P Windmeijer 2008. Competing claims on natural resources: what role for science? *Ecology and Society*, **13**(2), 34.

Habermas, J 1981. *Theorie Des Kommunikativen Handelns. Band 1: Handlungstrationalität und gesellschaftliche rationalisierung. Band 2: Zur kritik der funktionalistischen vernunft*. Frankfurt am Main, Germany: Suhrkamp Verlag.

Hajer, M A 1995. *The Politics of Environmental Discourse: Ecological Modernization and the Policy Process*. Oxford, UK: Clarendon.

Huitema, D, E Mostert, W Egas, S Moellenkamp, C Pahl-Wostl and R Yalcin 2009. Adaptive water governance: assessing the institutional prescriptions of adaptive (co-)management from a governance perspective and defining a research agenda. *Ecology and Society*, **14**(1), 26.

In 't Veld, R J 2000. *Willingly and Knowingly: The Roles of Knowledge about Nature and the Environment in Policy Processes*. Rijswijk, the Netherlands: RMNO (Netherlands Advisory Council for Research on Nature and Environment).

Jasanoff, S 1996. Is science socially constructed - And can it still inform public policy? *Science and Engineering Ethics*, **2**(3), 263–276.

Klerkx, L, N Aarts and C Leeuwis 2010. Adaptive management in agricultural innovation systems: The interactions between innovation networks and their environment. *Agricultural Systems*, **103**(6), 390–400.

Klosterman, J, F Geerling-Eiff, M Schut, E v Slobbe, C T v Scheltinga and E Wielinga 2009. *Samen breien aan gebiedsontwikkeling. Verkenning van de theorie over het gebruik van wetenschappelijke kennis in gebiedsprocessen*. Document: LEI 2009-017; Alterra 1873. April 2009. The Hague, the Netherlands: LEI Wageningen UR.

Koppenjan, J and E H Klijn 2004. *Managing Uncertainties in Networks: A Network Approach to Problem Solving and Decision Making*. London, UK: Routledge.

Leeuwis, C 2000. Reconceptualizing participation for sustainable rural development: towards a negotiation approach. *Development and Change*, **31**(5), 931–959.

Leeuwis, C and N Aarts, forthcoming. Rethinking communication in innovation processes: creating space for change in complex systems. *Journal of Agricultural Education and Extension,* accepted for publication.

Maas, G J, B Makaske, P W F M Hommel, B S J Nijhof and H P Wolfert 2003. *Verstoring en successie: rivierdynamiek en stroomdalvegetaties in de uiterwaarden van de Rijntakken*. Alterra, Wageningen.

Ministry of Transport, Public Works and Water Management 1997. *Vierde Nota Waterhuishouding; Regeringsvoornemen; Den Haag, 1997*.

Ministry of Transport, Public Works and Water Management 2000. *Anders omgaan met water. Waterbeleid voor de 21e eeuw - Kabinetsstandpunt*. The Hague, the Netherlands: Ministerie van Verkeer en Waterstaat. Available at <http://www.verkeerenwaterstaat.nl/kennisplein/5/6/56284/wb21.pdf>, last accessed 29 June 2010.

Opdam, P F M 2006. Groenblauwe netwerken: brug tussen wetenschap en praktijk bij gebiedsontwikkeling. *Landschap*, **23**(3), 147–154.

Ozawa, C P 1996. Science in environmental conflicts. *Sociological Perspectives* **39**(2), 219–230.

Pleijte, M, M Schut and R During forthcoming. Flood mitigation case: reflexivity in action research. In *Knowledge in Action. The Search for Collaborative Research for Sustainable Landscape Development*, A v Paassen, J v d Berg, E Steingrover, R Werkman and B Pedroli eds. Wageningen, the Netherlands: Wageningen Publishers.

Pleijte, M, R During, A Gerritsen and L Stuyt 2005. *Noordwaard: over stromingen in denken over hoogwater en natuur: ruimte voor meer stromen om de Noordwaard*. Document: 215. Wageningen, the Netherlands: Wetenschapswinkel Wageningen UR. Available at <http://library.wur.nl/way/bestanden/clc/1769746.pdf>, last accessed 29 June 2010.

Project Group Resilience Study 2002. *Spankrachtstudie: de spankracht van ons rivierenland*. Ministry of Transport, Public Works and Water Management, VROM, LNV, Provincie Utrecht, Gelderland, Overijssel, Noord Brabant, Zuid-Holland, Waterschappen & Vereniging Nederlandse Riviergemeenten, The Hague. Available at <http://www.verkeerenwaterstaat.nl/kennisplein/2/2/225975/De_spankracht_van_ons_rivierenland-eindrapport_Spankracht.pdf>, last accessed 29 June 2010.

Project Organization Room for the River 2005. *PKB 1: Design Spatial Planning Procedure*. Ministry of VWS, Ministry of VROM and Ministry of Agriculture, Nature and Food Quality, Hardenberg. Available at <http://www.ruimtevoorderivier.nl/Hoofdsite/menu/Meer%20info/Publicaties/PKB%20deel%201>, last accessed 28 June 2010.

Project Organization Room for the River 2006. *Spatial Planning Key Decision (PKB 4) - Room for the River, Approved Decision*. Ministry of VWS, Ministry of VROM and Ministry of Agriculture, Nature and Food Quality, The Hague, the Netherlands. Available at <http://www.ruimtevoorderivier.nl/files/Files/Rapporten%20ed/PKB%20deel%204%20Engels/PKB%204%20Approved%20decision%20H01-H086.pdf>, last accessed 29 June 2010.

Research and Verification Bureau 2006. *Verificatie PKB Ruimte voor de Rivier*. Document: 30 080, No. 8. Parliament (Tweede Kamer). Available at <http://ikregeer.nl/document/KST98704>, last accessed 27 June 2010.

RIZA and Bosch Slabbers 1999. *Rivierverruiming en landschapsontwikkeling in de Biesbosch: Integrale Verkenning Benedenrivieren. Deelstudie Landschap*. The Hague, the Netherlands.

RIZA and Bosch Slabbers 2000. *Rivierverruimende maatregelen. Integrale Verkenning Benedenrivieren. Deelstudie Landschap*. The Hague, the Netherlands.

Röling, N 1994. Facilitating sustainable agriculture: turning policy models upside down. In *Beyond Farmers First,* I Scoones and J Thompson eds. London, UK: Intermediate Technology Publications.

Roth, D and J Warner 2007. Flood risk, uncertainty and changing river protection policy in the Netherlands: the case of 'calamity polders'. *Tijdschrift voor Economische en Sociale Geografie*, **98**(4), 519–525.

Roth, D, J Warner and M Winnubst 2006. *Een noodverband tegen hoog water: waterkennis, beleid en politiek rond noodoverloopgebieden*. Wageningen, the Netherlands: Wageningen UR.

Senate 2006a. *Planologische kernbeslissing Ruimte voor de rivier (30080)*. Document: EK 7. 14 November 2006, pp 275–284. Eerste Kamer, The Hague. Available at <http://www.eerstekamer.nl/behandeling/20061114/behandeling/f=/w30080h1.pdf>, last accessed 29 June 2010.

Senate, 2006b. *Planologische kernbeslissing Ruimte voor de rivier (30080)*. Document: EK 14. 19 December 2006, pp 559–575. The Hague: Eerste Kamer. Available at <http://www.eerstekamer.nl/9370000/1/j9vvhwtbnzpbzzc/vhgpgos1nxv9/f=x.doc>, last accessed 29 June 2010.

Silva, W 2001. *Hoogwaterbescherming langs de Rijntakken. Onzekerheden en omgaan met onzekerheden*. Document: 2000.179X. RWS/RIZA – Ministry of Transport, Public Works and Water Management, The Hague, the Netherlands.

Sterk, B, P Carberry, C Leeuwis, M K v Ittersum, M Howden, H Meinke, H v Keulen and W A H Rossing 2009. The interface between land use systems research and policy: multiple arrangements and leverages. *Land Use Policy,* **26**(2), 434–442.

TU-Delft 2004. *Project Noordwaard*. Delft, the Netherlands: TU-Delft. Available at <www.tudelft.nl/live/ServeBinary?id=71d43e36-aca8-4562-b75c-0fd28b6d2473&binary=/doc/Project Noordwaard.pdf>, last accessed 28 June 2010.

Turnhout, E 2009. The effectiveness of boundary objects: the case of ecological indicators. *Science and Public Policy*, **36**(5), 403–412.

Turnhout, E, M Hisschemöller and H Eijsackers, 2007. Ecological indicators: between the two fires of science and policy. *Ecological Indicators*, **7**(3), 215–228.

van Bueren, E M, E H Klijn and J F M Koppenjan 2003. Dealing with wicked problems in networks: analyzing an environmental debate from a network perspective. *Journal of Public Administration Research and Theory*, **13**(2), 193–212.

van Buuren, A and J Edelenbos, 2004. Why is joint knowledge production such a problem? *Science and Public Policy*, **31**(4), 289–299.

van der Meulen, Y A M 2007. Ontpoldering Noordwaard is omvangrijkste maatregel. *Land + water: magazine voor civiele en milieutechniek*, **47**(12), 82–84.

van Eeten, M J G 1999. 'Dialogues of the deaf' on science in policy controversies. *Science and Public Policy*, **26**(3), 185–192.

van Stokkom, H T C, A J M Smits and R S E W Leuven 2005. Flood defense in the Netherlands: a new era, a new approach. *Water International*, **30**(1), 76–87.

Villareal, M 1992. The poverty of practice. Power, gender and intervention from an actor-oriented perspective. In *Battlefields of Knowledge: the Interlocking of Theory and Practice in Social Research and Development*, N Long and A Long, pp 247–267. London, UK: Routledge.

Warner, J F 2008. *The Politics of Flood Insecurity: Framing Contested River Management Projects*. Wageningen, the Netherlands: Wageningen UR.

Wiering, M A and P P J Driessen 2001. Beyond the art of diking: Interactive policy on river management in the Netherlands. *Water Policy*, **3**(4), 283–296.

Wynne, B 1996. Misunderstood misunderstandings: social identities and public uptake of science. In *Misunderstanding science? The Public Reconstruction of Science and Technology*, A Irwin and B Wynne, pp 19–46. Cambridge, UK and New York: Cambridge University Press.

Yin, R K 2003. *Case Study Research: Design and Methods,* 3rd edn. Thousand Oaks, CA: Sage.