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Perspectives on future flood management: discovering patterns of thinking

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Abstract This paper presents the different perspectives on future flood management in the Lower Rhine region, based on the results of a series of interviews and a Q-sort. Both were conducted in preparation of a series of stakeholder workshops supported by expert modelling. The interviews were conducted to explore the personal perspectives of Dutch and German stakeholders concerning flood management on the Lower Rhine. The Q-sort allowed for a structured identification of common ground and distinct patterns of thinking. Three patterns were identified, which can be referred to as 'Guaranteed safety', 'Risk acceptance' and 'Spatial solutions'.

Key words flood management; future; interview; perspectives; Q-sort; Rhine; transboundary

INTRODUCTION

Transboundary river basin management is often dominated by strategic negotiation between countries defending their national interests. In order to deal better with the complexity of current and future water management, reflection on the perspectives of all relevant stakeholders is needed. (Self) reflection can be stimulated by identifying different "patterns of thinking". These are more or less consistent combinations of interrelated facts, values, uncertainties and assumptions, and form the basis for the positions taken in (transboundary) discussions and negotiations.

As part of the research projects ACER and NeWater, a scenario study is being carried out in cooperation with the Dutch-German Working Group on Flood Management (AG) and other stakeholders. In the AG a broad range of governmental experts from NorthRhine-Westphalia (NRW) and The Netherlands (NL) exchanges and jointly produces information. The objective of the study is to support the exchange of perspectives about expected and desired developments until 2050 and in this way aid the development of robust, cross-boundary strategies for future flood management along the Rhine. In order to reach this aim, a series of stakeholder workshops is being organised. Sophisticated hydrological and hydraulic modelling will support the evaluation of strategies under various scenarios for autonomous developments.

In preparation of the first workshop, semi-structured interviews and a Q-sort were conducted. In this paper we discuss the methodology used, as well as the obtained results. We focus on the identified similarities and differences between the elicited perspectives.

METHODOLOGY

Interviews

To get an overview of existing perspectives, semi-structured interviews were conducted with all 17 members of the AG and six other stakeholders, including agricultural, navigational and nature organisations. The interviewees were asked to state their personal point of view on current flood management, recent trends, expected future trends, the desired situation in 2050 and strategies to reach this situation. An overview matrix of all individual answers was made to support the interpretation of the data and the identification of similarities and differences between the perspectives.

Q-sort

Q methodology (Stephenson, 1953; Brown, 1980) was used to make the interview results of the members of the AG more explicit. It is an appropriate method to systematically elicit individual perspectives on a certain topic and to identify underlying patterns of thinking (for an introduction to the method see van Exel & de Graaf, 2005). A strength of the method is that it does not require these patterns to be known or hypothesised in advance (Donner, 2001). In a Q methodological study (or simply "Q-sort"), a set of statements is prepared, the statements are sorted by a group of respondents according to a specific instruction, and the resulting data are interpreted using factor analysis.

Based on the interview results and literature study, a sample of 46 statements was prepared, reflecting a broad range of perspectives on future flood management. The sample has been structured in statements about current flood management, autonomous developments, strategies and the desired situation in 2050 (similar to the interview questions). During the sorting, respondents had to assign a fixed number of statements to each of the categories +3, +2, +1, 0, –1, –2 and –3, in an iterative way. The categories represent a gliding scale from strong agreement to strong disagreement with the statements.

Instead of face-to-face sessions, an online tool was used to conduct the Q-sort. This allows the respondents to perform the sort at any convenient time, researchers have to invest less time conducting the sort, and the Q-sort can more easily be spread across a large number of people. Disadvantages are the potentially lower response rate and the limited possibilities for explaining to participants how to perform the sorting task and for asking them why they sort the statements in a particular way.

To analyse the raw Q-sort data, the PQMethod software has been used. It uses factor analysis to calculate the correlation between the scores assigned to the different statements. This allows for the identification of typical patterns of scoring (factors), shared by subgroups of the respondents, which can be distinguished from other patterns of scoring. Furthermore, it allows for quantifying the correlation between individual scoring patterns and these factors, and for identifying statements for which the scores do and for which the scores do not significantly differ between the factors (also called contention and consensus statements).

RESULTS

Interview results

The 23 interviewees have similar perspectives on many points. In general, they agree that the climate is changing, the economy will continue to grow and flood risk will increase. However, viewpoints on the actions to be taken to deal with climate change differ between the Netherlands (NL) and NorthRhine–Westphalia (NRW). Some of the interviewees from NRW state that the long-term effect of climate change on peak discharges is still uncertain, and that it is not useful to consider them in current flood management. The Dutch interviewees are more convinced that climate change will lead to higher peak discharges and that we should anticipate future problems by taking action now. At the same time, current strategies in NL are more aimed at providing "near absolute safety" to the citizens. In NRW, damage minimisation and self-responsibility are emphasised much more. A possible explanation for this is that the potential damage and number of casualties in NL is much higher than in NRW (IKSR, 2006).

Most interviewees agree that creating more space for the river between the dikes and in retention areas is a useful strategy for dealing with current and possible future problems. New insights and models could enable a basin-wide optimisation of (controlled) retention. Many interviewees identified the need for implementing "new" approaches, such as flood risk management, which is aimed at reducing the probability of all failure mechanisms of the flood prevention system (e.g. instability of dikes or malfunctioning of closable barriers) and the negative consequences of failure. The opinions about the desirability of more differentiation in safety standards and of controlled flooding varied. Although these strategies were seen as promising to reduce the residual flood risk, ethical considerations and local opposition were seen as serious barriers for implementation.

There is agreement that EU Directives will probably lead to more international and basin-wide cooperation. The members of the AG agree that the informal, technical cooperation in which they are engaged is a successful example of this. There are, however, considerable differences in opinion about the desired institutional setting for flood management. Some advocate a stronger river basin authority, others more local influence.

Q-sort results

Eight members of the AG responded to the Q-sort. The small number of responses reflected a relatively broad basis of agreement and allowed for identifying only three distinct patterns of thinking. In this section we first describe the common basis by summarising the consensus statements. Subsequently, we explain the differences in perspectives by sketching the three identified factors, which we name: safety guaranteed, risk acceptance and spatial solutions (see also Table 1).

Consensus statements With respect to autonomous developments, the respondents mutually agree that spatial pressure along the river will not decrease.

Table 1 Factors, distinguishing statements and their scores.

Factor and # respondents	Distinguishing statements (shortened) for factor with significance $P < 0.01$	Factor values A	B	C
A. Guaranteed safety $N_{TOTAL} = 3$ $N_{NRW} = 2$ $N_{NL} = 1$	Simple governance structure beneficial	+3	–1	1
	Because of floods in Germany, $Q_{Lobith} < 17.000$ m^3 s^{-1} until 2050	+3	0	0
	Standard methods for determining safety standards / design discharges	+3	0	–1
	Better maintenance required	+2	–1	0
	Citizens and businesses should feel safe, instead of be aware of risk	0	–3	–2
	Where technical measures are difficult floods should be accepted	–3	+2	+1
B. Risk acceptance $N_{TOTAL} = 2$ $N_{NRW} = 2$ $N_{NL} = 0$	Better computer technology will lead to valuable, new insights	+1	+3	0
	Current safety standards are adequate	–1	+3	–1
	5-yearly review of design discharge guarantees up-to-date flood prevention	–1	+3	0
	More attention to smaller floods required, instead of extremes	–2	+2	–1
	Effects of climate change are unclear, so we better wait with taking action	–3	0	–3
	Climate change will significantly increase peak discharges until 2050	0	–2	+2
	Holding back water in basin is useful to decrease peak discharges	+3	–2	+2
	Agricultural / economic activities are currently not valued high enough	0	–3	+1
	Dike heightening is an effective and efficient future strategy	–1	–3	–1
C. Spatial solutions $N_{TOTAL} = 2$ $N_{NRW} = 1$ $N_{NL} = 1$	Better integration water management and spatial planning required	+1	0	+3
	Because possibilities spatial measures is decreasing, fast action is needed	+1	0	+3
	In 2050 the river should revitalised and meandering between retreated dikes	0	0	+3
	More controlled retention is needed and should be optimised basin-wide	0	–1	+2
	Climate change will significantly increase peak discharges until 2050	0	–2	+2
	Creating a larger flow profile for the river is a sufficient strategy until 2050	+1	+1	–2

Concerning strategies until 2050, the respondents strongly agree that: (a) informal cooperation is essential in transboundary flood management; (b) NGOs and the public should be more actively involved in flood management; (c) flood management should not be decentralised; and (d) there is a need for better disaster management plans. In addition, there is a relatively high amount of consensus about the statements that represent the desired situation in the year 2050. The respondents agree that current high safety levels should still be guaranteed, the Rhine should accommodate a broad range of user functions, and the landscape should be open and enjoyable for living and recreational uses. A strong river basin authority is in general desired as well.

Factor A "Guaranteed safety" Three respondents have a perspective that is strongly correlated to factor A. The main idea is that national governments should prevent any large flood, to make sure citizens and businesses feel safe. Therefore it is important to approach long-term developments proactively. Because of upstream flooding, peak discharges at Lobith will not exceed 17 000 m^3 s^{-1}. Besides holding back the water in the basin, better maintenance of existing dikes, rivers and flood plains is important for preventing floods. The governance structure should be simple and clear and methods to determine design discharges and safety standards should be harmonised.

Factor B "Risk acceptance" This factor matches with the perspectives of two respondents. They agree that safety standards in NL and NRW are adequate, and that the 5-yearly review of safety levels in NL makes sure they remain so. Facts about climate change are still unclear and a significant increase in peak discharges is not expected. Thus, it may be better to wait with related actions until better models and insights have been developed. Currently, there is a more pressing need to pay attention

to smaller floods and local issues. Dike heightening and holding back the water in the basin are not useful, but "soft" measures such as offering compensation or insurance for flood damage and creating awareness are.

Factor C "Spatial solutions" Two respondents have a perspective that is strongly correlated to factor C and agree that climate change will significantly increase peak discharges at the Lower Rhine. Related problems can only be solved through large-scale spatial measures. Because spatial pressure decreases the range of possible measures, it is important to take action fast. Creating space for the river by enlarging the flow profile is not sufficient. In addition, water should be held back in the basin and more controlled (emergency) retention areas should be established. Moreover, by 2050 there should be enough space for a natural and meandering river. In order to realise these types of measures, a better integration of water management and spatial planning is essential.

DISCUSSION

The interviews allowed for an open expression of relevant issues. These issues were integrated in the Q-sort statement sample, in order to make it both comprehensive and recognisable for the respondents, and to stimulate the use of their personal underlying criteria, while sorting (cf. Donner, 2001). Categories based on the respondents' backgrounds (e.g. nationality) played a large role identifying patterns in the interview results. Factor analysis of the Q-sort results allowed for a more structured identification of common ground and distinct patterns of thinking. The low number of respondents limited the representativeness of the results for the whole AG and the number of factors that could be identified. Still, more patterns were identified than with the interview analysis. In short, interviewing and Q methodology complemented each other well.

Other issues that had an impact on the results can be summarised as follows:

- To allow for clear communication and good understanding, a native German and a native Dutch speaker cooperated in the elicitation process. Still, the communication in German, Dutch and English may have caused some misunderstanding;
- In analysing the Q-sort data the analyst chooses the number of factors to be identified. In order to explore a large amount of the variance in perspectives, we chose to analyse three factors. However, the maximum number of factors based on their Eigen values would be two. Therefore we tested the sensitivity of our choice by performing the analysis for two factors as well. The main difference was that in the latter case factor A and C were combined in one factor, focusing on active anticipation of changes.
- Finally, it should be realised that perspectives can change. The results of the interviews and Q-sort both reflect the perspectives only at a specific moment in time.

CONCLUSIONS

The elicitation and analysis of perspectives on future flood management resulted in the identification of several similarities and differences in perspectives. Interviewing and

Q methodology were used subsequently in order to use their complementary benefits. Three specific patterns were made explicit (without using any prior categorisation of the analyst). One of these, "Spatial solutions", was not recognised as such in the analysis of interview data. With an increasing number of respondents, Q methodology can be increasingly helpful in discovering implicit or hidden patterns (cf. van Eeten, 2001).

The interview results indicate that the severe consequences of an extreme flood in the Netherlands and the focus on guaranteeing safety lead to a proactive approach to climate change and spatial developments. Some of the German perspectives reflect that it may be better to wait with large scale measures until more is known about future developments such as climate change, and to focus on preparedness, self-responsibility and damage minimisation. The patterns of thinking identified in the Q-sort can be summarised as follows: (a) national governments are supposed to prevent extreme floods from happening and prepare for future changes; (b) no additional effort should be paid to resisting highly uncertain floods, but the focus should be on a proper reaction to floods; and (c) large-scale spatial measures are needed very soon to be able to cope with strong future changes.

Eliciting and analysing different perspectives could be a method for emphasising differences or even conflict, especially if stability of perspectives is assumed. This is not the case in the current research. The results of this analysis will be fed back to the stakeholders, in order to stimulate reflection and constructive discussion towards a more shared perspective on future flood management. In order to evaluate whether perspectives converge, changes will be measured over a series of workshops. Furthermore, in order to get a more comprehensive insight in the perspectives on future flood management on the Lower Rhine, the Q-sort will be set out in a broader public.

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