

How responsive are scientists and policy makers to the perceptions of Dutch and Flemish citizens living alongside the Scheldt Estuary?

Insights on Flood Risk Management from the Netherlands

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Abstract

This study focuses on the role that local knowledge can play in informing flood risk management in the Netherlands. First, the knowledge and perceptions of both citizens and scientists regarding flooding, and flood risk management, in the vicinity of the Scheldt Estuary in Northwest Europe are explored. Next, the responsiveness of scientists and policy makers to the perceptions of local inhabitants and their preferences regarding flood risk management measures is tested in two workshops. The shifts in the opinions of citizens, scientists and policy makers provide a measure of whether such a means of connecting local knowledge through to scientists and policy makers is able to influence the policy debate.

1. Introduction

Because flood prevention and amelioration measures influence the quality of the spatial environment, public participation in decision making on such measures in flood-prone areas would seem natural. Indeed, the European Water Framework Directive requires that citizens be involved actively in the long term management and monitoring of European water bodies (WFD 2000). Although such public participation is viewed as important in policy making in the Dutch lowlands, it is often rather reactive in character; the public is involved in the latter stages of a project and is asked to react to plans that are already fairly well established (Stolp 2006). Involving the public later in the process can be viewed as a missed opportunity to incorporate local knowledge into the planning process at a formative stage. However, involving the public earlier and organizing two-way communication is more easily said than done and much effort has already been directed at the provision of guidance documents for public participation design (WFD CIS (2005), HarmoniCOP 2005, Andre *et al.* 2006). More intriguing, is that this view of public participation rests on an underlying premise that accessing local knowledge and enabling social learning will improve the quality of the decision-making process. Given the complexity of the problem of flooding and the related management issues, it is clear that new approaches are required to ensure protection from water-related risks (Kabat *et al.* 2003; Pahl-Wostl, 2002a). In this study, conducted under the auspices of FLOODsite a European Union 6th Framework Directive project (FLOODsite 2005), we examine this underlying premise in two stages and explore the effect of local knowledge on the policy process.

First we explore the knowledge and perceptions of both citizens and scientists regarding flooding, and flood risk management in the vicinity of the Scheldt Estuary. Next, we focus on the responsiveness of scientists and policy makers to the perceptions of local inhabitants and their preferences regarding flood risk management measures. We specifically address the following questions:

- What knowledge do residents in the vicinity of the Scheldt Estuary have regarding flooding?
- What criteria do these citizens use, or would they like used, in the evaluation of the effectiveness of flood prevention and amelioration measures for the Scheldt Estuary?
- To what extent do these criteria differ from those used by scientists involved in improving the determination of the flooding risks?

- Do interactions between the scientists and citizens influence their preferences regarding flood risk management policy options?
- How does this accord with present policy processes?
- How do policy makers respond to this?

The final phase of the study will be completed in January 2008.

The major participants in the study are citizens living in the vicinity of the Scheldt Estuary and a small number of scientists attempting to bring new knowledge into the policy debate on the Scheldt Estuary. The differences in the criteria and preferences of the citizens, scientists and policy makers with respect to flood risk management measures prior to the interventions in the form of workshops form the background against which the changed preferences are interpreted. The shifts in opinion of citizens, scientists and policy makers provide a measure of whether such a means of connecting local knowledge through to scientists and policy makers is able to influence the policy debate. However, the resistance of either policy makers or scientists to new information, ideas and contact with citizens can form a barrier in the process. In contrast, the responsiveness of individual scientists and policy makers has the potential to improve the quality and adaptiveness of decision making related to flood risk management in the Netherlands.

2. The Scheldt Estuary and Environs

The Scheldt Estuary meanders from Vlissingen on the North Sea Coast of the Netherlands via the port of Antwerp to Gent in Belgium. The estuary is tidal along its full extent and is the only remaining estuary on the North western continental coast of Europe with a salinity gradient from seawater at the mouth to freshwater at its head (LTV 2001). It hosts vast tidal marshes, particularly at Saeftinghe near Bath and the Dutch-Flemish border and is home to a wide variety of fauna from macro-invertebrates to fish, seals and waterbirds. The Scheldt Estuary provides shipping access to the port of Antwerp, the Flemish economic centre. In 1999 to 2001, breaking with a 300 year tradition of conflict over the Scheldt, the Dutch and Flemish developed a joint Long Term Vision for the Scheldt Estuary (Zanting *et al.* 2002). In this broad policy document (LTV 2001) the triple functions of shipping, safety from flooding and the ecosystem are emphasized and the functions of fishing and farming receive less attention. Since then many activities have been undertaken under the auspices of the joint Dutch-Flemish project bureau ProSes (and then ProSes 2010 (2006))

aimed at the implementation of the developments necessary to achieve the long term vision. However, although the flood hazard estimates for the Belgian sections of the Scheldt Estuary are being updated (Marchand *et al.* 2006), there were no such activities planned for the Dutch sections, nor plans to undertake this jointly in the period 2005 to 2007. Similarly, we are unaware of attempts to involve citizens actively in planning for flood prevention or amelioration measures within this time period.

3. Method

Selection of participants

Seventeen citizens living in the vicinity of the Scheldt Estuary, who normally do not participate in research or policy processes dealing with flood risk management, were selected for participation in this study via a snowballing process. First we generated a list of preferred stakeholders on the basis of their professional or recreational activities and their rural and urban living environments. In addition we strove for equal numbers of Dutch and Flemish participants with sufficient variation in age, gender and nativeness to the area. Then, starting with a few general information sources, namely websites, the yellow pages and a representative on the municipal council of a town in the province of Zeeuws-Vlaanderen, we initiated email or telephonic contact with the people suggested to us via these sources. Often via yet another contact person, we were able to track down the respondents listed in Table 1.

Interviews with citizens

Semi-structured, in-depth interviews with each of the respondents listed as interviewees in Table 1 were then held in the period September to November 2005. The interviews lasted approximately 1,5 hours or longer and were conducted either at the homes of the respondents or at their places of work. Family members were often present during the interview. The respondents were questioned on their relationship with the area, their affinity with water, whether (and what) they thought about flooding and the risk of flooding, their or their family's experience of flooding (if any), their knowledge of evacuation plans, their ideas regarding evacuation and the recovery process after a flood.

Table 1 Categorization of respondents and workshop attendees

Occupation	Interviewee	Attended Workshop	Nationality	Age	Sex	Native
Farmer A	Yes	Yes	Dutch	40 - 50	Male	Yes
Farmer B	Yes	Yes	Dutch	40 - 50	Female	Yes
Farmer C (Partner of Farmer B)	No	Yes	Dutch	40 - 50	Male	Yes
Farmer D (Friend of Farmer B)	No	Yes	Dutch	30 - 40	Male	Yes
Farmer E	Yes	No	Flemish	50 - 60	Male	Yes
Fisherman	Yes	No	Dutch	40 - 50	Male	Yes
Recreational Fisherman	Yes	No	Flemish	20 - 30	Male	Yes
Recreational Fisherman	Yes	No	Dutch	20 - 30	Male	Yes
Hotelier	Yes	No	Flemish	40 - 50	Female	Yes
Camping Manager	Yes	Yes	Dutch	50 - 60	Male	No
Camping Employee (Son of Camping Manager)	No	Yes	Dutch	30 - 40	Male	No
Pastor	Yes	Yes	Dutch	60+	Male	No
Housewife (Wife of Pastor)	No	Yes	Dutch	60+	Female	No
Priest	Yes	No	Flemish	60+	Male	No
Wheelman	Yes	Yes	Dutch	60+	Male	No
Wheelman	Yes	No	Flemish	50 - 60	Male	Yes
Young person	Yes	No	Dutch	20 - 30	Male	Yes
Environmentalist	Yes	No	Dutch	30 - 40	Male	Yes
Environmentalist	Yes	Yes	Flemish	40 - 50	Female	Yes
Safety scientist	Yes	No	Dutch	30 - 40	Male	No
Civil engineer	Yes	Yes	Dutch	30 - 40	Female	No
Civil engineer	No	Yes	Dutch	20 - 30	Female	No
Civil engineer	No	Yes	Dutch	40 - 50	Female	No
Ecologist	No	Yes	Dutch	50 - 60	Male	No

The respondents were also asked specifically what they knew of measures to prevent or ameliorate flooding and factors they considered important in determining the efficacy of these measures. The respondents were encouraged to answer based on their life experience and provide their opinions, not those representing any particular group of people. The recorded interviews were subsequently written up and sent to the respondents for correction and comment.

Selection of scientists and interviews

The scientists interviewed (Table 1) were selected on the basis of their involvement in the broader FLOODsite project and the relevance of their fields of expertise to improved flood hazard estimation. They were interviewed in late October and November 2005. The interviews followed the same format as those of the local inhabitants, with the scientists answering an additional question regarding their bond with their field of study before specifying their bond with the Scheldt Estuary in particular.

Workshop with policy makers

A consultative workshop with five policy makers and advisors (2 Dutch, 3 Belgian) on the Scheldt Estuary and environs was held on 5 December 2005. Communication of the findings from the interviews with local inhabitants occurred. Comments from the policy makers and advisors on the findings of the study were requested and recorded for comparison with those of the respondents and scientists. This information was subsequently analysed and prepared for presentation back to study participants.

Workshop with citizens and scientists

A workshop for study participants was convened on 26 January 2007 at Emmadorp alongside the Scheldt Estuary. Seven of the original interviewees were present as well as 4 of their partners, relatives or friends. Only one of the scientists previously interviewed was present. Additionally, three other scientists involved in flood modeling tasks within FLOODsite participated in the workshop. The categorization of the workshop participants is presented in Table 1.

Upon arrival at the workshop and prior to its official opening, participants were required to fill in a questionnaire regarding the priorities that they would like policy makers to have regarding management measures for flood risk management of the Scheldt Estuary. This a-priori measurement

of their opinions was necessary to be able to establish the effect of the exchange of information and ideas between participants and between scientists and participants in the workshop itself.

The management measures are categorized as Flood Prevention Measures, Flood Defence Measures Designed to Ameliorate the Consequences During an Event and Management Measures for the Recovery Period, as well as a category of Overarching Management Measures (Tables 2 to 5). The list of management measures was initially generated by the authors (i.e. the scientists directly involved in the interviews) and later checked for completeness by the scientists involved in the flood modeling. The final list then reflected the measures mentioned by the respondents in the initial interviews as well as those considered in the modeling studies.

The results derived from the initial interviews and the reactions of the policy makers to these findings (Slinger et al 2007) were presented to the workshop participants and discussed. Participants responded with interest to the summarized views of their fellow respondents and the positive interest of the policy makers. The discussion focused on gaining a common understanding of the findings, rather than disputing these.

Thereafter, the preliminary results from the flood modelling study were presented by the scientists involved in the broader FLOODsite project. They communicated their understanding of the flooding risk in the vicinity of the Scheldt Estuary, now and in the future. Taking the 1953 flood as the point of departure, they presented simulations in which the consequences of continuing with present flood risk management policies in the face of sea level rise, population growth (or decline) and economic growth (or decline) were demonstrated (Klijn *et al* 2007). Participants were most intrigued by the choice of dike breaching locations, which had been chosen semi-randomly by the scientists involved. They were also interested to see the effects of secondary dikes in containing the flood. In addition, participants expressed interest in the implications of the flood modeling studies for evacuation options.

Next, posters for each of the flood risk management measures listed in the initial questionnaire were placed around the room. The workshop participants then came up with the advantages and disadvantages for each of these measures in a brainstorm session. These were then discussed so that differences in opinion could be made apparent rather than hidden.

Finally, the participants were requested to once again allocate priorities to

the management measures. This was undertaken by placing stickers on the posters of each management measure.

Analysis of scientific results

Following the workshop, the post-prioritization and the a-priori prioritization were compared to establish whether the new information and interaction between workshop participants had a measurable effect on their opinions. This information forms the focus of this paper and will be used in further structured interactions with policy makers planned for January 2008.

4. Results and Analysis

Results of the Interviews

The results derived from the interviews are reported extensively in Slinger *et al* (2007) and are summarized here for the sake of completeness. During the original interviews, we identified a depth of understanding of their living environment amongst the people of the Scheldt. Those with professions providing them with primary contact with the water showed an understanding of flooding comparable with that of the scientists. However, peoples' insights regarding the consequences of flooding and the recovery thereafter went deeper than scientific understanding and their comments regarding the (lack of) utility of some of the planned policy measures to promote safety from flooding were later confirmed as valid by policy makers. In fact, the policy advisors were surprised by the high quality of the information derived from the study.

Where we expected differences between the views of Dutch and Belgian respondents regarding flood risk management there were more differences between people with an affinity for water and those without, than between the Dutch and Belgians. Those who work or spend leisure time on, or near, the water (e.g. fisherman) had a deeper appreciation of the dangers of flooding than did the respondents with no affinity for water. In this, those with an affinity for water had an understanding more comparable with that of the scientists.

The findings regarding the peoples' perception of safety indicated that the Flemish had less faith in their dykes than the Dutch, but a higher level of

trust in their government following a flood event. There was a general lack of knowledge of evacuation plans, which did not surprise policy makers. Policy makers confirmed that to their knowledge there were no plans regarding clean-up actions following a flood or undertakings made with international organizations to continue operations in the Netherlands or Belgium following such a flood event. They acknowledged the citizens rights to concern in this regard. The length of time taken for expropriation of farming land (for de-poldering or harbour expansion) and the indirect effects of this on farming communities and individual citizens were also acknowledged as justifiable concerns.

In contrast to the opinions of the scientists, the policy makers and advisors didn't view knowledge of future land-use as essential to effective flood risk management.

Results from the Workshop

The prioritization allocated by the workshop participants to the different management measures prior to the workshop and after receiving information from scientists and exchanging views with other workshop participants, are summarized in Tables 2 to 5.

Prior to the workshop, the single most favoured of the flood prevention management measures was an Early Warning System (Table 2). However, the total number of positive votes allocated to widening, heightening and strengthening the primary dikes (sea dikes) far outstripped all other measures, representing 26 % of the total positive vote. After the workshop, the sea dikes received the highest priority of any measure and the early warning system was still favoured.

The least favoured of all other measures prior to the workshop were Large and Small scale de-poldering, which received 21 % and 31 % of the negative votes, respectively (Table 2). Small scale de-poldering for nature development was particularly unpopular. A more nuanced picture was present following the workshop. The least favoured measure was Large scale de-poldering in the Western Scheldt. This was discussed in detail during the workshop because modeling studies had clarified that this measure was ineffective in ensuring safety from flooding but was still beneficial for the environment. Small scale de-poldering was then divided into two management measures Small scale de-poldering in Belgium and Small scale de-poldering in the Western Scheldt with the idea that a combination of functions such as nature development, recreation could be possible in these

areas. The voting on these new measures then became marginally positive for Belgium, somewhat negative for the Western Scheldt or principally against. The latter opinion was held solely by farmers.

Table 2: Prioritization allocated to the management measures aimed at flood prevention. The a-priori measurement is indicated by Pre and the measurement taken at the workshop after interchanges of information and opinions occurred is indicated by Post. Positive votes are indicated by + and negative votes by -.

Flood Prevention Measures	Pre		Post	
	+	-	+	-
Early Warning System	16	0	15	0
Flood defence barrier e.g. Maaslandkering	2	3	8	3
Overschelde canal: channeling Western Scheldt water to the Eastern Scheldt	5	6	0	12
Primary dikes (zeedikes)	0	0	3	0
Widening	13	1	24	0
Raising	17	0	1	0
Strengthening / armouring	16	0	5	0
Large scale de-poldering (several large areas e.g.. Braakman polder)	2	18	1	28
Small scale de-poldering (many small areas along the Scheldt Estuary)	0	0	0	14
Nature development	4	12	0	0
Extending the floodplain storage capacity	6	6	0	0
Other functions e.g. recreation	4	8	1	2
Western Scheldt	--	--	0	4
Belgium	--	--	5	0
Total	85	54	63	63

The Overschelde canal initially received mixed reactions. In the final voting, the scientists voted heavily against this measure. A large flood defence barrier such as the Maaslandkering initially received mixed, relatively neutral reactions and received slightly more positive reactions following the discussions.

The workshop participants were favourably disposed towards measures designed to reduce the impact of flooding should it occur. The most favoured measure prior to the workshop is compartmentalization (secondary dikes) with a sound information network and communication running a close second followed by safe havens and evacuation (Table 3).

Table 3: Prioritization allocated to the management measures aimed at ameliorating the consequences during the event. The a-priori measurement is indicated by Pre and the measurement taken at the workshop after interchanges of information and opinions occurred is indicated by Post. Positive votes are indicated by + and negative votes by -.

Flood defence measures designed to ameliorate the consequences during an event	Pre		Post	
	+	-	+	-
Secondary dikes or compartmentalization	14	0	10	2
Limiting housing and industrial development in low-lying areas	7	4	6	7
Prevention of an environmental disaster from factories and ships by regulating the storage of hazardous and chemical substances, evacuation exercises and protecting factories with dikes	8	1	8	1
Dike inspection	6	1	13	0
Evacuation (incl. detailed plans and large scale exercises)	10	1	7	1
Safe havens (and route to them)	11	0	18	0
Extensive, sound information network (TV/Radio/Internet) and communication to citizens	12	0	4	0
Limiting the reduction of the discharge capacity in the upper reaches of the Scheldt Estuary	--	--	1	0
Total	68	7	67	11

Following the workshop in which the role of secondary dikes in containing a flood, but possibly causing deeper inundation locally, the preferences had shifted slightly away from compartmentalization. The creation of safe havens and inspection of the dikes became the most favoured measures. This reflects a growing understanding on the part of the participants that evacuation out of the area would not be possible for all citizens and that a safe haven located relatively near by was likely to offer more safety in the short term and make rescue at a later date possible. Dike inspection was viewed as necessary because the people most threatened could then be evacuated first and others warned to go to the safe havens. Participants expressed a need to know which buildings or dikes were highest in their area. Farmers indicated that they knew, but the other participants were more doubtful.

Doubts were expressed about prohibiting or limiting the development of low-lying land and this received both more negative votes in the post test than the pre-test.

Although the management measures orientated at the recovery period only received about 10 % of the overall positive votes, the view that there should be a state fund for compensation following a flood was supported both in the pre- and post tests (Table 4). The idea that plans for the recovery of the region following a major flood should be made even now received support. This was discussed during the workshop with participants expressing concern regarding the possible cost to companies and yet supporting the idea that employment opportunities and commitments to re-invest by existing companies would help in establishing an image of stability for the region. In contrast, the notion that individuals could be responsible for taking out insurance against flooding and flooding damage received more negative than positive votes initially. This changed slightly following the workshop with more people in favour than against.

Table 4: Prioritization allocated to the management measures for the recovery period. The a-priori measurement is indicated by Pre and the measurement taken at the workshop after interchanges of information and opinions occurred is indicated by Post. Positive votes are indicated by + and negative votes by -.

Management measures for the recovery period	Pre		Post	
	+	-	+	-
Private Insurance for flood damage	2	6	4	2
National disaster fund	9	0	11	0
Socio-economic plan for recovery following a flood e.g. agreements with large companies regarding employment provision and their return to the area	7	3	8	1
Total	18	9	23	3

This concurs with the voting on the overarching management measure regarding the revision of the role of citizen-state, which was predominantly and strongly negative prior to the workshop and remained largely negative thereafter (Table 5). The harmonization of management measures across the border was allocated relatively little priority by the workshop participants.

Table 5: Prioritization allocated to overarching measures. The a-priori measurement is indicated by Pre and the measurement taken at the workshop after interchanges of information and opinions occurred is indicated by Post. Positive votes are indicated by + and negative votes by -.

Overarching management measures	Pre		Post	
	+	-	+	-
Harmonization of flood risk management between the Dutch and the Flemish e.g. dikes of the same height at the border	6	4	4	2
Revision of the roles and responsibilities of the citizen in relation to the state e.g. the self-reliance of the English citizen	1	11	2	8
Total	7	15	6	10

5. Discussion and Conclusions

In summary, prior to the workshop, the participants indicated that in regard to flood risk management measures they wished policy makers to focus 47 % of their attention positively on flood prevention measures, 38 % on flood amelioration during an event, 10% on recovery following a flood and 4 % on overarching measures. In contrast, they indicated with 63 % of the negative vote that they wished policy makers not to focus attention on certain of the flood prevention measures. In total, flood prevention received 57 % of all votes prior to the workshop.

Following the discussions and information exchange, participants indicated that they wished the policy makers to spread their positive attention more evenly over the flood risk management phases, namely: 40 % to flood prevention measures, 42 % to flood amelioration during the event, 14 % to the recovery period and 4 % to overarching measures. They were even more directive regarding their wish that attention be diverted from certain flood prevention activities (now 72 % of the negative vote) and only moderately to slightly negative about the other phases of flood risk management.

Following the initial interview round, we had established that there was knowledge of flooding and living with the danger of flooding amongst the citizens living alongside the Scheldt Estuary. Consequently, the shift exhibited by participants at the workshop to spread attention more evenly

over the flood risk management phases represents learning by the citizens about the value of redundancy in combating a natural hazard (Klijn *et al* 2007). Participants also expressed this after the workshop, additionally indicating a desire for information on potential safe buildings in their area. This indicates a potential change in behaviour from trying to evacuate along a busy, low-lying road to seeking a refuge in the area should a flood occur.

Interestingly, scientists were most impressed by the robust common sense of the citizens and the complete absence of panic even when one of the “breach locations” in a simulation was discovered to be very near to the house of one of the participants. Scientists who participated in the workshop indicated that they had gained respect for the integrated way in which individual citizens dealt with the issues associated with flooding risks and their ability to comprehend and comment on the results presented to them. They also gained knowledge on the probable evacuation behaviour of the citizens and the value they placed on information and the right to choose whether to leave or remain in the area during an emergency.

Clearly, local knowledge has been communicated to scientists and policy makers and new scientific knowledge has been communicated to citizens, causing them to adapt their thinking. However, not all scientists wished to participate in the workshop. So, we have only been able to test and validate this means of improving scientific knowledge in the policy process for the scientists willing to participate. Clearly, local knowledge has no effect if a scientist is resistant or unable to expose himself to it in a workshop setting. The information garnered from the workshop of 26 January 2007 will be presented to policy makers in a further workshop in January 2008 in order to complete the feedback loop from citizens and scientists to policy makers. Only then will we be able to ascertain how influential local knowledge and adapted scientific knowledge can be in the flood risk management policy process on the Scheldt Estuary.

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