Water Resources Planning and Management

EDITED BY

R. Quentin Grafton and Karen Hussey

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Water is an increasingly critical issue at the forefront of global policy change, management and planning. There are growing concerns about water as a renewable resource, its availability for a wide range of users, aquatic ecosystem health, and global issues relating to climate change, water security, water trading and water ethics. There is an urgent need for practitioners to have a sound understanding of the key issues and policy settings underpinning water management. However, there is a dearth of relevant, up-to-date texts that adopt a comprehensive and interdisciplinary focus and which explore both the scientific and hydrological aspects of water, together with the social, institutional, ethical and legal dimensions of water management.

This book will address these needs. It provides the most comprehensive reference ever published on water resource issues. It brings together multiple disciplines to understand and help resolve problems of water quality and scarcity. Its many and varied case studies offer local, regional and global perspectives on sustainable water management, and the 'foundation' chapters will be greatly valued by students, researchers and professionals involved in water resources, hydrology, governance and public policy, law, economics, geography and environmental studies.

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Foreword

Water Resources Planning and Management provides a unique insight into the problems our planet faces in terms of water quantity and quality, and what to do about it. It is the only book that adopts both a comprehensive and interdisciplinary focus to combine scientific and hydrological understanding with the social, institutional, ethical and legal dimensions of water management. Its contributions from some of the world's leading water experts, across many disciplines and with varied case studies from 19 different countries, makes it the ideal source of information for students, scholars and water practitioners.

Business as usual in terms of water management in many parts of the world cannot continue. This book provides an essential guide to change. It offers: (1) foundation chapters to understanding water (such as the water cycle, surface and groundwater interactions, and water ecosystems); (2) contributions on water planning and management (such as managing water trade offs, adaptive management of water, and managing environmental flows); and (3) chapters on the challenges and experiences of water management (such as Tar Sands of Alberta and Indigenous access to water in Australia). Whether you are concerned about groundwater contamination from arsenic in Bangladesh that has affected millions of people, want to understand Hydrology 101, or how to cope with the challenges of water scarcity in cities, this book has it all.

Simply put, *Water Resources Planning and Management* is a must read book for all who wish to make a difference in how to plan and manage our scarce water resources.

Until, and unless, the insights from this book are widely adopted, we risk further degradation to the most precious of all our natural resources.

The Earl of Selborne KBE FRS
Chairman
The Foundation for Science and Technology

6. Since 2004, it is possible for households who cannot afford to pay their water bill to claim financial help from a 'solidarity fund'.
7. About 4.5 billion of the 6 billion cubic metres are consumed. The rest is non-revenue water including water used in the event of fire, water used for network maintenance, and above all water leakages (IFEN, 2007).
8. Since 1998, a survey of about 5000 representative French local communities has been undertaken every three years. Information on the organisation, management, technical characteristics of the water and sanitation systems, and pricing of the water and waste water services are gathered.
9. There were 100 *départements* in France in 2008. *Départements* are administrative divisions roughly analogous to an English district or a United States county. The 100 *départements* are grouped into 22 metropolitan and 4 overseas regions.
10. For greater details on the estimation procedure, see Carpentier *et al.* (2006).

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Collaborative flood and drought risk management in the Upper Iskar Basin, Bulgaria

KATHERINE A. DANIELL, IRINA S. RIBAROVA AND NILS FERRAND

19.1 Introduction

This chapter outlines a recent collaborative water management project in the Upper Iskar Basin in Bulgaria, Europe, entitled 'Living with Floods and Droughts'. Based on a participatory modelling methodology, the project aimed to build the collective capacity of the region's stakeholders to manage flood and drought risks. The chapter starts by presenting the regional water management context and how the project was designed to manage some of the key issues identified by the region's stakeholders. This is followed by a description of the implemented participatory process, including descriptions of the methods used and analyses of the content elicited and examined in the process. Lessons learnt from evaluation of the participatory process are presented and discussed, along with some considerations for future initiatives.

19.1.1 Regional water management context

Extreme climatic conditions such as large floods and extended drought periods have increasingly occurred over recent years in Bulgaria, including in the Upper Iskar Basin in the region of Sofia. Since the early 1990s, serious water shortages have led to rationing of water, and there were severe floods in 2005 and 2006. There is now debate on whether these 'new' conditions are a consequence of global climate change or merely normal climate variability (Knight *et al.*, 2004; Kundzewicz and Schellnhuber, 2004). Water management in the Upper Iskar Basin presents many challenges, not just due to extreme flood and drought events or seemingly natural hazards, but also due to the transitory nature of the country's social and political spheres following the fall of the Communist regime in 1989 and the need to deal with its legacy of heavy industry, widespread pollution, and infrastructural system issues (Carpenter *et al.*, 1996; Hare, 2006). Despite large social and political changes, state governance structures have remained largely technocratic and hierarchical. There has been some decentralisation of responsibility towards local governments (Ellison, 2007), but transfer of resources accompanying it has been inadequate to ensure that their

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new responsibilities can be carried out effectively (Krastev *et al.*, 2005). With its recent move into the European Union (EU), Bulgaria is now required to improve the management of its water resources and resolve water use conflicts between industrial, urban, agricultural, ecological and other human needs in line with EU legislation, such as the Water Framework Directive (WFD). As outlined in the *Bulgarian Water Act 1999*, responsibility for water management in Bulgaria lies at the national and river basin levels. This management system is generally in line with the WFD (Dikov *et al.*, 2003), although other aspects of the Act, such as administrative arrangements across multiple levels (i.e. nation–basin–municipality) and between sectors (i.e. different ministries) to ensure adequate coordination, will require reworking to better align with WFD requirements (DANCEE, 2004). Failure to comply with the EU legislation and to improve water management practices within the required time frames will potentially result in financial penalties and reduced development aid.

19.2 The 'Living with Floods and Droughts' project in the Upper Iskar Basin

To improve management of water in the Upper Iskar Basin around Bulgaria's capital, Sofia, a number of initiatives were proposed as part of the European Integrated Project, 'AquaStress' (www.aquastress.net). These included a participatory risk management process to try to support regional co-management of floods and droughts (Ribarova *et al.*, 2006). How this process was collaboratively initiated, designed, implemented, and evaluated will be outlined in this section.

19.2.1 Project initiation and process design

The general needs for water management research initiatives in the Upper Iskar Basin had been identified by the Local Public Stakeholder Forum (LPSF), a diverse group of stakeholders from the region brought together as part of the AquaStress project. This group included national-level ministry officials, representatives from the Danube Basin Directorate, and representatives from private companies and community groups. Two of the key issues for water management identified in the region by the stakeholders were a lack of institutional coordination, and a lack of community capacity to cope with flood and drought events. After discussion of these issues by the project's Joint Work Team (a group of AquaStress project researchers and consultants interested in working in the Iskar region), a proposal to help manage flood and drought risks by using a process of 'Participatory Modelling for Water Management and Planning' (Daniell and Ferrand, 2006) was put forward and accepted by the LPSF. This water stress mitigation option had been previously defined as part of the AquaStress project. Pilot testing of the proposed process was carried out with Bulgarian students (Rougier, 2006). Following this test, a formal methodological design proposal of the 'Living with Floods and Droughts' multi-level participatory modelling project was then collaboratively created by three (non-Bulgarian) researchers (Ferrand *et al.*, 2006; Hare, 2006; Rougier, 2006). The stated objectives of the participatory process are outlined in Figure 19.1.

Iskar test site process goals

- Integrate and improve the overall communication between the different actors at different scale levels
- Develop an integrated view of the management system and how it can be sustainably managed over long periods of time
- Develop an integrated view of decision-making under conditions of long term uncertainties; thus formulating answers to the following questions:
  - How does one spend money wisely when deciding between flood and drought management?
  - How do management decisions for flood mitigation affect or constrain drought management and vice versa? How does crisis management affect or constrain long-term management decisions?
  - Are there win-win management strategies that can benefit both flood and drought management over long periods of time?
- Maintain the knowledge of good management across the different flood and drought periods
- Develop a common vision among the stakeholders about living with floods and droughts
- Evaluate management strategies in terms of different indicators, with respect to varying uncertainties and scenarios, rather than provide single definitive answers
- Look at the side-effects of crisis management on the long term effects
- Assess effects of crisis management on short and long-term financing of management
- Establish new social contracts and commitments in relation to flood and drought
- Bring stakeholders to consider what could happen in the worst case should there be in the future:
  - no management recognition between drought and flood management
  - no vertical communication and coordination between stakeholder scale levels
  - no long-term consideration of short term management strategies

Figure 19.1. Objectives of using a participatory modelling process for flood and drought risk management in the Upper Iskar Basin (Hare, 2006).

The methodology for the participatory modelling process was largely based on Daniell and Ferrand (2006) with the 'SAS (System, Actors, Solutions) Integrated Model' (Ferrand *et al.*, 2007) and a 'Group Model Building' approach (Pahl-Wostl and Hare, 2004) guiding choices on the internal modelling methods. The objectives were to be met by following a three-phase process, as shown in Figure 19.2.

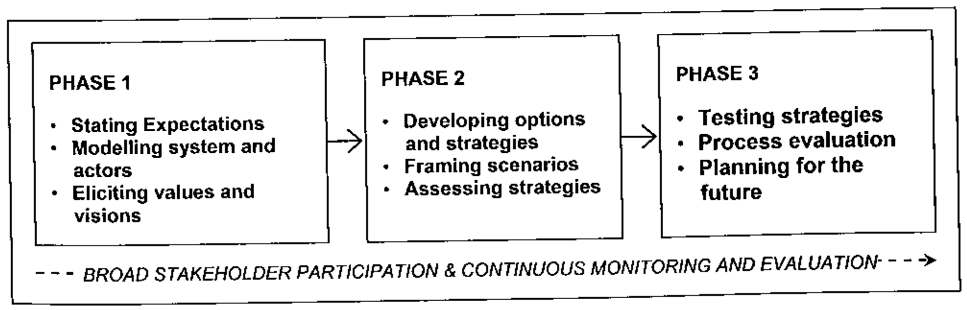

Figure 19.2. Proposed Iskar participatory risk management process (based on Ferrand *et al.*, 2006, and Hare, 2006).

The participatory process was designed to include a wide range of regional stakeholders, including national ministers and policy makers, private company representatives, NGO representatives, municipal mayors and council workers, national experts, and citizens from the region.

19.2.2 Process implementation

The implementation of the 'Living with Floods and Droughts' participatory modelling process for the Upper Iskar Basin was carried out from October 2006 to October 2007. Over 120 paid participants were involved in the process. The participants of the process and the methods used are presented in Figure 19.3.

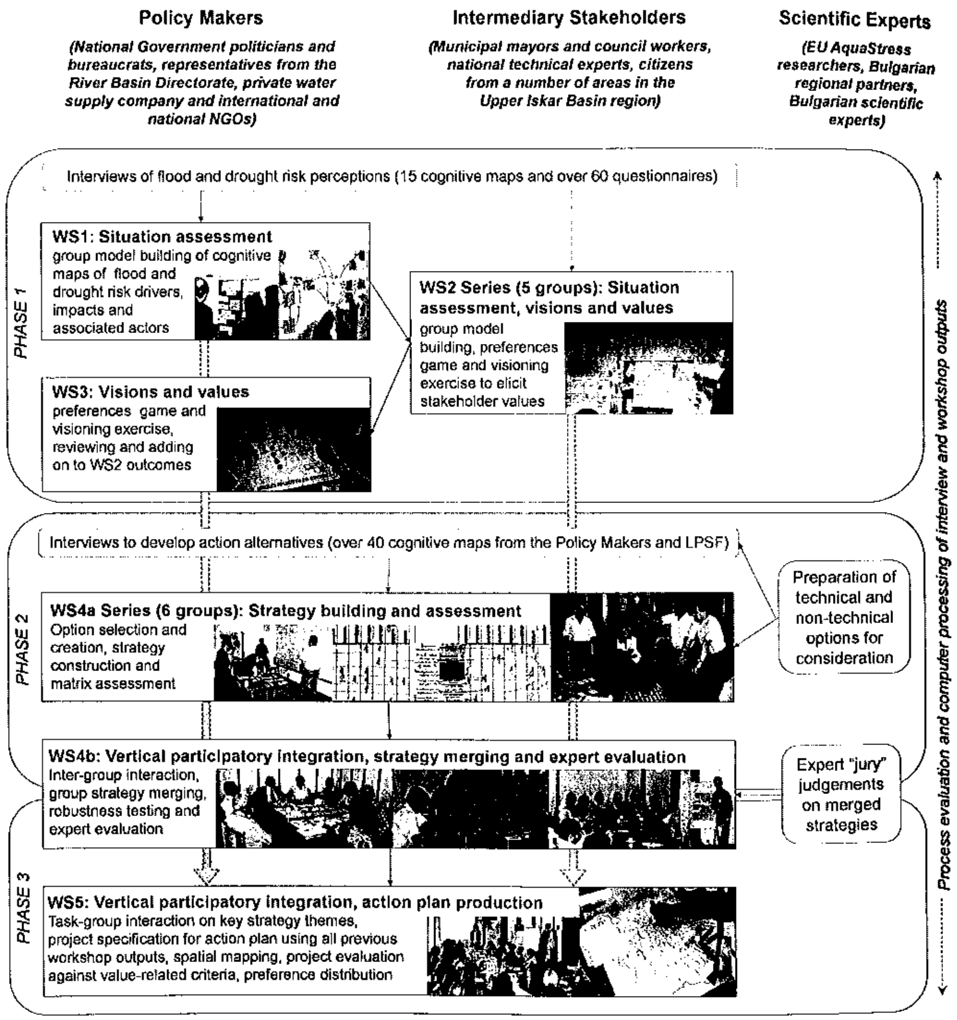

Figure 19.3. The implemented participatory process for the Upper Iskar Basin.

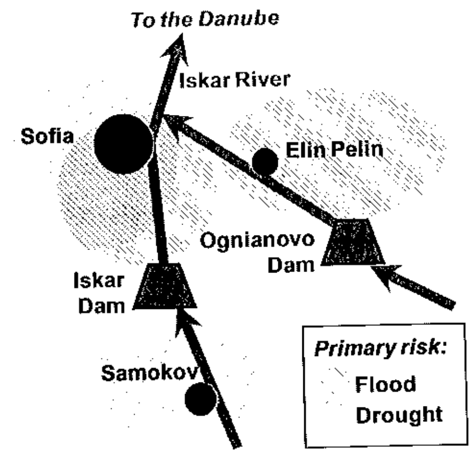

Figure 19.4. Areas of the Upper Iskar Basin considered for flood and drought risk management (adapted from Rougier, 2007).

For the participatory process shown in Figure 19.3, approximately 60 stakeholders were divided into 6 groups taking part in a series of 15 workshops, individual interviews, and evaluation exercises over a 1-year period. Some of the groups were concerned with both floods and droughts, and some with just floods or droughts, as outlined on the stylised regional map in Figure 19.4.

The six separate groups consisted of policy makers (floods and droughts), national experts and organised stakeholders of Sofia (floods and droughts), Sofia citizens (floods and droughts), Elin Pelin mayors and organised stakeholders (floods), Elin Pelin citizens (floods), and Samokov organised stakeholders and citizens (droughts). The last two workshops (WS4b and WS5) combined all 6 groups and involved approximately 35 participants each. The other 60 participants were only involved in the initial interviews. All of the participatory process activities with participants were carried out in Bulgarian.

Throughout the process, translations from Bulgarian to English were performed by the Bulgarian facilitators and process management team members. Computer processing was used to digitise the paper-based interviews and workshop results. The software used included CmapTools (Novak and Cañas, 2006) for transferring and analysing the cognitive mapping outputs; Protégé (Gennari *et al.*, 2002) for managing ontologies; Microsoft Excel for assessment matrices, action plan projects, and evaluation results; and Google Maps for spatial mapping of the proposed projects.

Extensive evaluation – including written questionnaires after each workshop (with 65%–100% return rates), facilitator and observer reports, and a number of interviews – was carried out to assess the impacts and the efficacy of the design and implementation of the participatory modelling process. Example content and evaluation results are presented in the next section.

19.3 Example content and evaluation results

In this section, the content and evaluation results from the participatory Iskar process have been chosen to present an overview of the diversity of methods used to obtain and analyse content and process evaluation data. In particular, elements of modelling the actors' 'flood and drought risk perceptions', 'visions and values', and 'management strategies and final project recommendations' are provided, as well as evaluation examples of participant perceived learning and efficacy of the process and methods.

19.3.1 Mapping regional flood and drought risk perceptions

The initial phase of the participatory Iskar process involved a number of cognitive mapping exercises that were carried out through interviews and Workshop 1, as outlined in Hare (2007) and Ribarova *et al.* (2008). The objectives of the exercise were to represent preliminary individual and group views on, and the relations between: (1) drivers of floods and droughts; (2) impacts of floods and droughts; and (3) actors responsible for changes in the system. Changes in perceptions of these issues through the rest of the participatory process could then be gauged as part of the process evaluation. Stakeholders from a range of societal groups were involved in the first set of exercises, as shown in Table 19.1.

The groups outlined in Table 19.1 participated in the mapping of flood and drought risk perceptions in different ways. The policy makers and the mayors took part in individual cognitive mapping interviews. These were followed by a phase of group model-building in three groups (policy makers A, policy makers B, and mayors) to produce joint cognitive maps. Both the experts and council workers also developed joint cognitive maps and the industry representative created an individual cognitive map. All cognitive maps were then computerised; an example is shown in Figure 19.5.

Based on a decision by one of the Bulgarian facilitators, the citizens did not directly develop their own cognitive maps; rather, individual interviews based on a specified set of questions were carried out and the results were then computerised into a cognitive map format.

The group cognitive maps and citizens' interview responses were analysed further to study the participants' perceptions of flood and drought drivers and impacts. The drivers, as identified by the different stakeholder groups, are presented in Figure 19.6 and the impacts in Figure 19.7. In each of the categories shown in Figures 19.6 and 19.7, the more technical issues are lightly shaded when identified by the group, and the less technical socio-economic drivers are darkly shaded.

Looking at the perceived drivers of floods and droughts in Figure 19.6, all of the groups discussed the technical factors of 'natural climate variability' and 'hydrotechnical infrastructure management'. The experts and industry groups focused predominantly on the technical issues, with only a few exceptions. The majority of the elicited socio-economic

Table 19.1. *Groups of stakeholders taking part in the preliminary interviewing and cognitive mapping process*

Group name	Description of group members	Total number in group
Policy makers	One parliamentary representative (from the Commission of Environment and Waters); Vice Minister of the Ministry of Disasters and Accidents; Director of the River Basin Directorate (Danube); representative Heads of Departments from the Ministry of Regional Development and Public Works, Ministry of Health, Ministry of Education and Science, Ministry of Economy and Energy, and Ministry of Agriculture and Forestry; as well as NGO representatives from Care and the Bulgarian Red Cross	10
Mayors	Mayors from villages with the worst flooding problems: Lesnovo; Ognjanovo; Ravno Pole; and Golema Rakovitza	4
Council workers	Vice Mayor of Elin Pelin municipality; the Lead Engineer of Elin Pelin municipality; and the municipality urban planning expert	3
Experts	Scientists in water-related fields from the Bulgarian Academy of Science and the University of Architecture, Civil Engineering, and Geodezy in Sofia	4
Industry	Head of the Water and Energy Department in the biggest industrial enterprise in the region – the metallurgical plant, 'Kremikovtzi'	1
Citizens	Representatives from the local villages and the town of Elin Pelin	100

drivers were only discussed by the policy makers, council workers and citizens. The policy maker groups, along with the citizens, noted financing and legislation enforcement as drivers. The drivers identified by the citizens covered the largest number of issues. However, unlike most other groups, the citizens did not identify public awareness as an issue, perhaps as it was too close for them to see their own awareness of floods and droughts risks as a driver or issue.

From Figure 19.7, the impacts elicited by the groups is seen as more homogeneous than the drivers in Figure 19.6. All of the groups considered reduction in well-being as an impact of floods and droughts. Most groups, except the experts and industry, also specifically noted the potential health impacts which result from floods and extended droughts. Land use impacts were especially mentioned as an effect of droughts, but not identified at

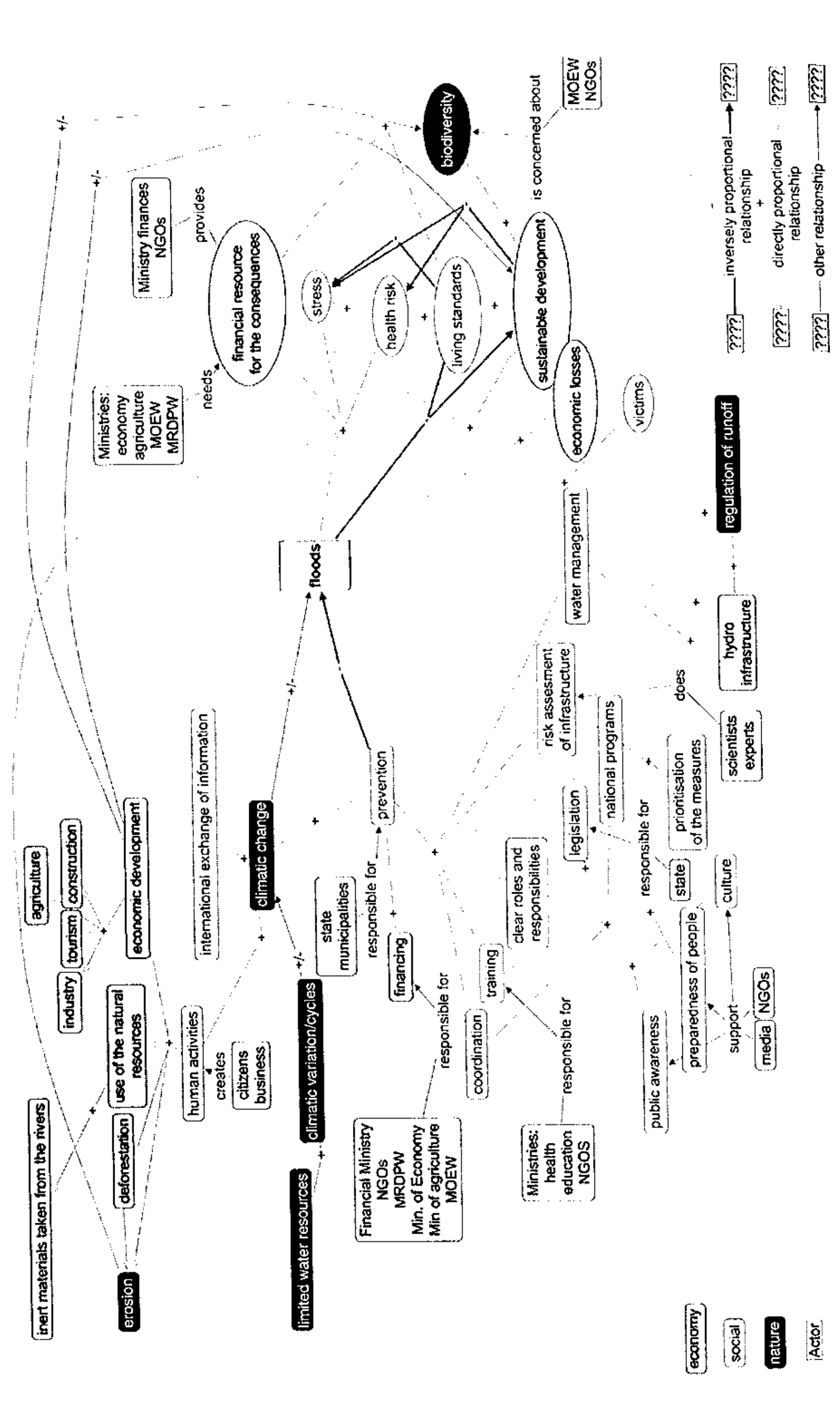

Figure 19.5. The flood section of the cognitive map developed by the policy makers' group B. Drivers are on the left of the box, 'floods' and their impacts on the right (Hare, 2007).

Drivers of flood and drought risks	Policy makers A	Policy makers B	Mayors	Council workers	Experts	Industry	Citizens	Total
Natural climate variability								6
Hydrotechnical infrastructure management (reservoirs, dykes, irrigation channels)								6
Topography								2
Vegetation cover								1
Land use type and management								4
Building of infrastructure								2
Water management		■			■		■	2
Industry		■		■		■		3
Global warming/climate change		■		■			■	2
Polluted/congested riverbeds			■	■		■	■	3
Deforestation		■	■	■			■	3
Legislation	■	■		■				3
Financing	■	■					■	2
Legislation enforcement, monitoring and risk assessment	■	■					■	2
Crisis management system	■							1
Human activities and behaviour							■	1
Public awareness	■	■		■	■			4
Clarity of role and responsibilities	■	■	■	■			■	4

Figure 19.6. Flood and drought risk drivers identified by the stakeholder groups. Light shading indicates technical issues and dark indicates less technical socio-economic drivers.

the municipality level. Only one group of policy makers identified the issue of population displacement as an impact of floods and droughts. More groups took note of the damage to private, rather than public, infrastructure from floods, with only the local authorities and citizens raising the public infrastructure issue. The experts, who were mainly technically trained water engineers or hydrologists specialising in hydrotechnical management and modelling, did not mention either private or public infrastructure that was separate from the water systems, or ecosystem impacts. Only one group of policy makers and the council workers identified governance challenges raised by emergency situations caused by floods and droughts. Further investigating the governance issue related to this last point, group model-building was used in the first section of the second workshop series for stakeholders

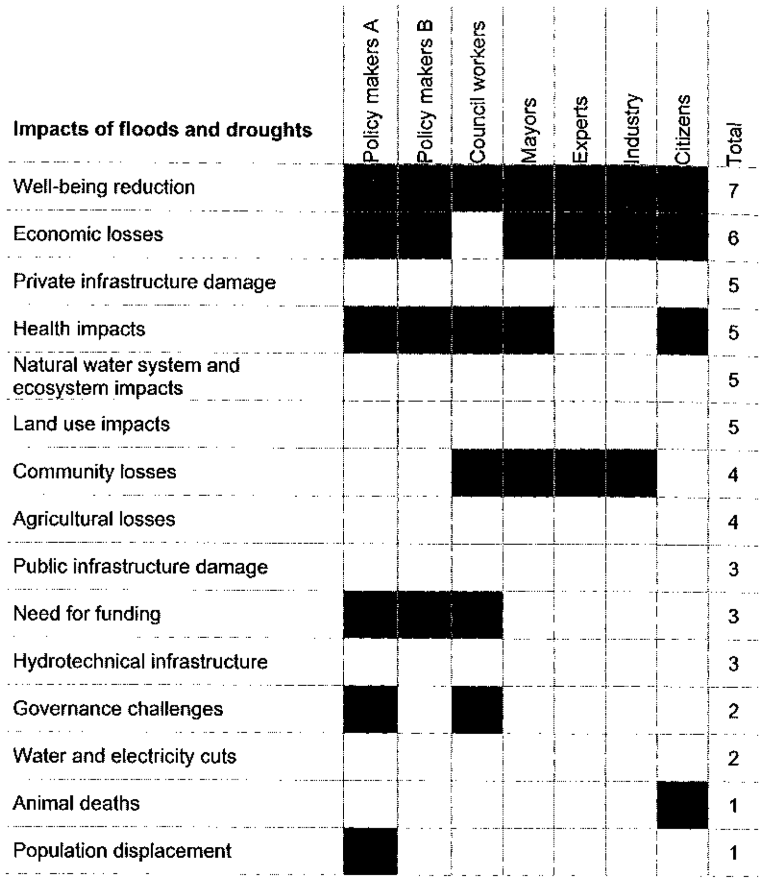

Figure 19.7. Flood and drought impacts identified by the stakeholder groups. Shading carries the same meaning as in Figure 19.6.

to make explicit their views on what actors affect, or are affected by, floods and droughts and what actions they were currently taking to mitigate the risks. These models were then shown to, and added onto by, the policy makers in Workshop 3.

19.3.2 Identification of visions and values

During the second section of Workshop series 2 (WS2 in Figure 19.3) and Workshop 3 for the policy makers (WS3 in Figure 19.3), participant values and visions for the future of the Iskar Basin and its communities were elicited using two methods. Initially, a 'preferences elicitation' game was used: here each group member, and then small groups, were asked to distribute a certain amount of money over their preferred economic sectors (agriculture, households, industry and nature), as well as between the different geographical regions of the Upper Iskar Basin (Samokov, Sofia and Elin Pelin). The instructions to participants

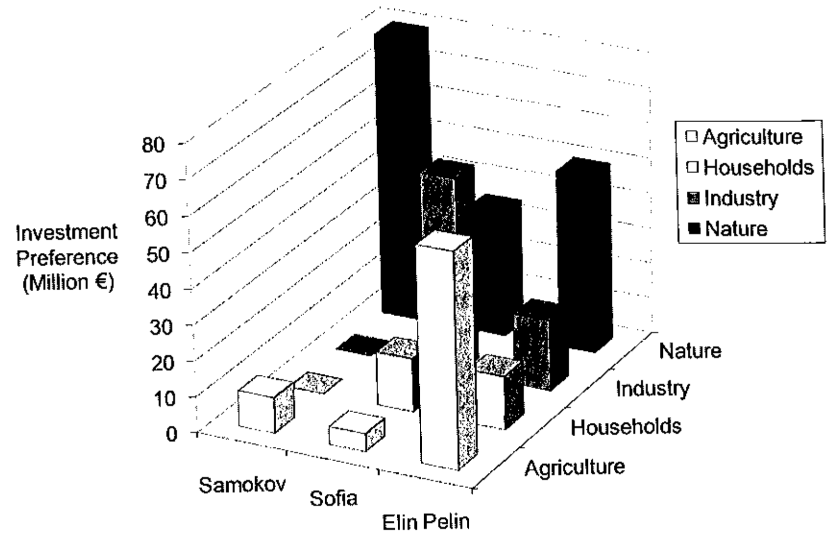

Figure 19.8. Accumulated results of the preference elicitation game of the six stakeholder groups (Rougier, 2007).

were: 'If the European Union decided to invest in three little projects of 10 million euros and one big one of 30 million euros in water management, choose where you would want these projects to be implemented' (Rougier, 2007). The averaged and accumulated results for the six groups are represented in Figure 19.8.

From Figure 19.8, a clear overall preference is shown for the protection and enhancement of the natural environment, in particular in the upstream areas. There also appears to be a strong preference for the reinstallation and financing of agriculture in the Elin Pelin area, and investment in industry in the Sofia region. The Elin Pelin region of the basin appeared to draw the overall preferences for funding. However, these results are likely to be biased by the participation of two groups from this region; reinforcing this view, the group of Elin Pelin organised stakeholders was the only group to distribute all of the money within their own area.

In the following visioning exercise, stakeholder groups were asked to think about positive and negative futures for 10 years' time. From this exercise, a list of visions drawn from the six groups was later classified by the project management team into eight categories of values that the stakeholders wished to preserve or enhance through the management of flood and drought risks. These values were 'to feel secure and healthy' (enhanced well-being); preserved ecosystems; sustainable agriculture; 'to share our lives' (enhanced community capacity); effective water supply; treated potable water and treated wastewater; effective management; and sustainable economy. The values were presented back to, and used by, the participants in the final mixed workshops for evaluating proposed projects.

19.3.3 Management strategies and final project recommendations

Phase 2 of the process started with the construction of flood and drought risk management options in the second series of interviews shown in Figure 19.3. These options, presented in the form of cognitive maps, were then used in Workshop 4a to create a range of flood and drought risk management strategies. These strategies underwent a qualitative matrix (multi-criteria) assessment, looking at the effects of management strategies on the categories of the preference distribution game (nature, industry, households, agriculture), as well as potential costs and who would be responsible for their implementation. These strategies from the six individual groups were then merged, based on joint perception of issues in Workshop 4b, the first combined group meeting. The robustness of these joint strategies was tested against extreme scenarios (e.g. dam failure or 5 degrees of warming). The strategies were also further evaluated by an expert jury, with some experts providing their own qualitative cost–benefit analysis to back up the judgements. Apart from this content, a particularly important result of WS4b was considered to be the relational aspects of the vertical group integration that took place, as can be seen from the process evaluation results in Section 19.3.4.

In the final flood risk response project planning workshop (WS5 in Figure 19.3), which was focused on the Elin Pelin zone at the request of the majority of participating stakeholders, the content results of all of the previous workshops were brought together by the project management team for use by the stakeholders. The development of projects for the risk response plan was created for five areas by 'task force' groups in the workshop to ensure sufficient and concrete specification of required projects. Three were set aside for preparedness planning involving: construction and infrastructure; education and capacity building; and planning, management, decision infrastructure, and monitoring. One task force was to work on needs for times of crisis (crisis management and action plan) and one focused on reconstruction after disasters (covering remediation and insurance). In total, 24 flood risk mitigation projects were proposed and mapped spatially, along with who should be responsible for carrying them out and over what period of time they should take place.

Each of the final proposed projects was also evaluated for its potential to support the list of eight values derived from the visioning activities in WS2 and WS3, as well as on the criteria of implementation problems the project would likely encounter (e.g. costs and infrastructure, social and institutional, or uncertainties in the execution). From these evaluations, it was shown that the category 'to feel secure and healthy', which would enhance well-being, would benefit people the most if all the projects were implemented, followed by the categories of 'effective management' and 'to share our lives (enhanced community capacity)'. The most likely costs to be encountered were categorised under 'costs and infrastructure', followed by 'social and institutional'. After all of these projects and evaluations were brought together in a large plan (in both paper and electronic format), participants had the opportunity to distribute a number of votes for the projects they would most prefer to be funded and implemented. The summary of the defined projects and which stakeholder groups supported them is presented in Figure 19.9.

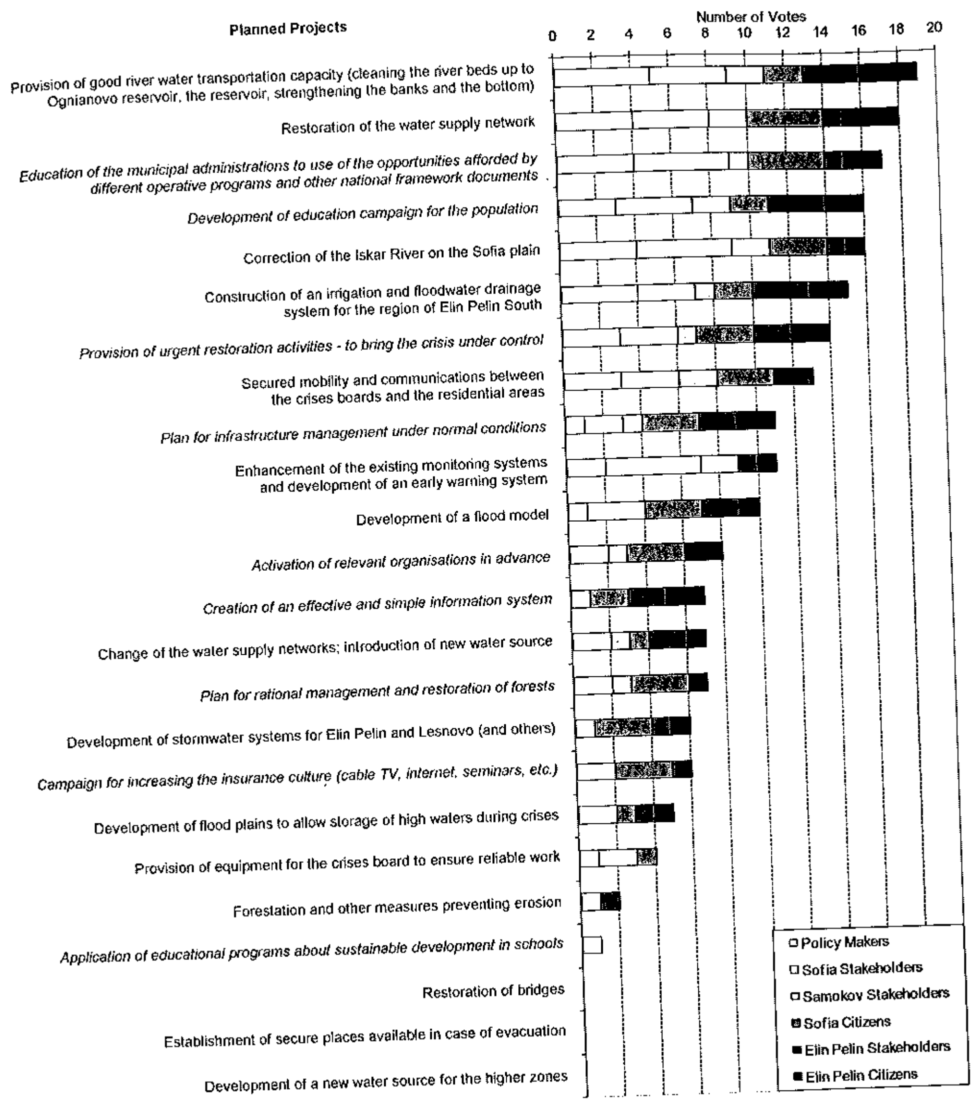

Figure 19.9. Planned projects and voting preferences in the Elin Pelin flood risk management plan. At left, less technical projects are in italics, and more technical ones in roman.

In Figure 19.9, the less technical projects have been placed in italic text, and the more technical projects placed left in normal text. We see that of the top five preferred projects, three were technical and two non-technical. The first two projects were restoration activities, showing the difficulties Bulgaria currently has to find funding to maintain and restore its infrastructure following flood events. The next two were broad-scale education campaigns, one directed at the municipal government level about how to prepare and find

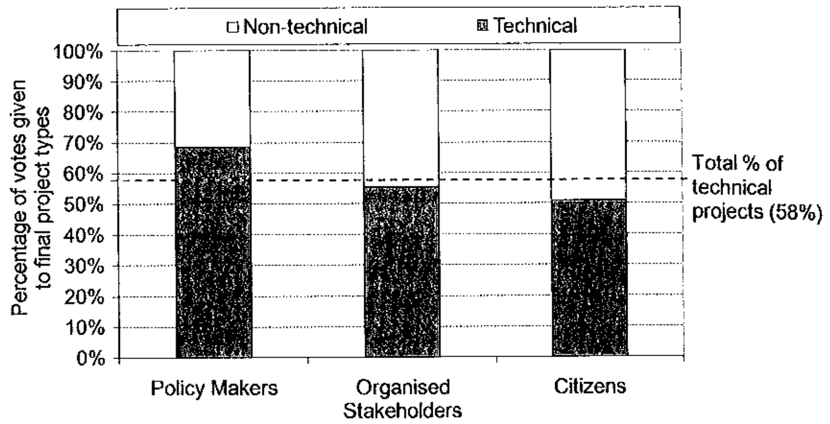

Figure 19.10. Stakeholder-type distribution of votes on technical and non-technical projects.

funding for flood (and drought) risk management, and the other directed at the general population about how to more effectively prepare for and cope with flood events. The last in the top five was a project to correct the current channel of the Iskar River to provide more control of flood drainage, another very 'hard' engineering solution. In total, 14 of the 24 final projects could be classified as largely technical and 10 as non-technical. The distribution of the different types of Iskar stakeholder votes over the final project types is given in Figure 19.10.

From Figure 19.10, it can be observed that at the end of the process the policy makers had a preference for more technical projects, while the citizens had an overall preference for non-technical projects. This is an interesting final outcome, considering the distribution of drivers of flood and drought that policy makers identified at the beginning of the workshop series, when they outlined a large number of more non-technical socio-economic drivers for floods and droughts. There could be a number of reasons for this change, although just two potential hypotheses are outlined here. First, since the list of prioritised projects was to access Bulgarian funds to finance projects, it is possible that policy makers took a pragmatic stance and voted for projects which had the best chances of being accepted (due to the largely 'infrastructural' nature of the funds). Second, policy makers may have voted for those projects which they themselves would be able to run and fund, i.e. those that were more technically orientated. This may well have been equally true for the citizens and municipalities voting for some of the non-technical projects which could occur under their control or with which they could more easily be involved. Whether this final voting underlies a strong appropriation of the process and willingness to personally continue to contribute to flood and drought management activities in the region is difficult to determine. It remains to be seen whether the stakeholders involved in the process will invest time after it finishes to seek out and obtain funding to make these propositions a reality.

19.3.4 Example evaluation results and insights

Evaluation formed an integral part of the 'Living with Floods and Droughts' project. A range of factors were sought out through the protocol used, including: the depth of learning of participants and organisers throughout the process; the adequacy of the process to meet a range of stakeholder and EU research project objectives; as well as the determination of any other effects, innovations, or general insights resulting from the process. Due to these wide-ranging objectives, the evaluation was multi-faceted and carried out from participant, process designer (Bulgarian and non-Bulgarian), and external perspectives. Questionnaires at the end of each workshop provided quantitative and qualitative participant responses. Workshop observation and content analysis, oral and written debriefing sessions and reports from process designers and facilitators, as well as participant and organiser interviews, then enriched the evaluation substantially. Example results, principally from the stakeholder participant evaluations, will be outlined here. Further results, as well as more information on the theoretical underpinnings and practical implementation of the evaluation protocol are available in Vasileva (2007) and Daniell (2008).

The participants' perceived depth of their own learning through the process was elicited from the responses to the quantitative section of the end-of-workshop questionnaires. This learning over the series of six workshop types, relative to a number of areas, is shown in Figure 19.11.

It appears from Figure 19.11 that the majority of participants perceived that they had learnt slightly more over the full workshop process about other stakeholders' points of view and relations than about floods and droughts, or the impacts of certain flood and

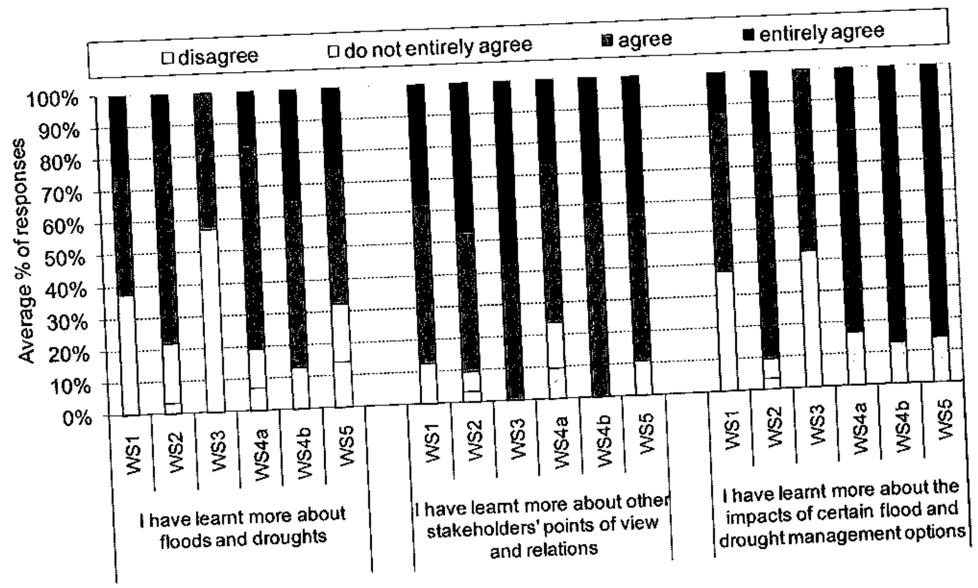

Figure 19.11. Participant-perceived depth of learning over the Iskar process.

drought management options. In WS3 for the policy makers group, learning was especially polarised towards learning about the points of view of others and relations, and not towards learning about floods and droughts. As WS3 had been designed by the project team with the prime objective of sharing, discussing, and building upon the other stakeholder groups' representations and visions of flood and drought risk management (J.-E. Rougier, personal communication, 2007), this was perceived by them as a positive result. WS4b had similarly been designed with the specific objective of helping the stakeholders get to know each other better, and was the only other perceived learning result where all participants agreed that they had learnt more about other stakeholders' points of view and relations. Such results help to provide evidence that effectively organised participatory processes can achieve specific pre-set shared objectives.

Further information on exactly what the participants had learnt during the process was found via the qualitative questions. Responses included learning about work methods and experiences of the group work (e.g. '*The new method of working*' and '*The shared experience of the participants in the process*'); and learning about collaborative problem identification and solution (e.g. '*I met different people during the F & D project with different points of view, opinions and ideas. These contacts and joint activities enriched my thorough vision and knowledge about the discussed problems*' and '*The different factors that influence floods & droughts; team work which provides better solutions*').

To analyse the overall adequacy of the process and the internal methods used with stakeholders, quantitative responses provided some positive evidence. Figure 19.12 presents the overwhelming response that the process received high levels of stakeholder legitimisation for their attendance. However, whether the same responses would have been as positive if the participants had not been paid by the EU research project is another question.

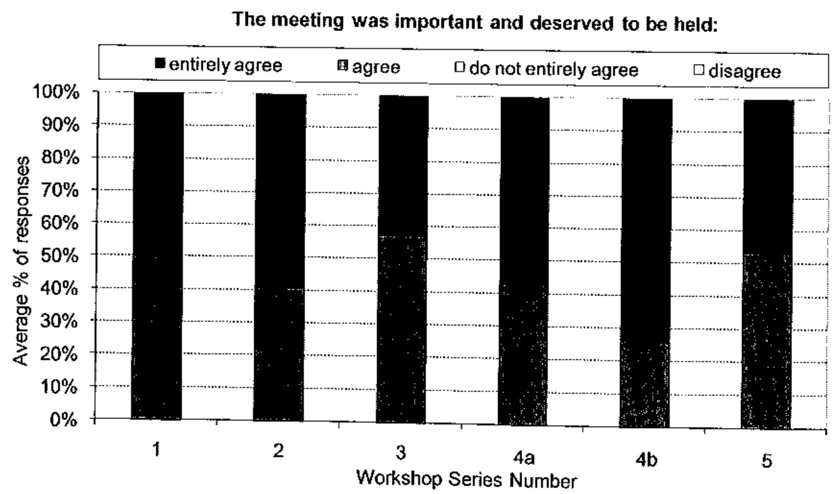

Figure 19.12. Participant-perceived importance of the participatory Iskar process.

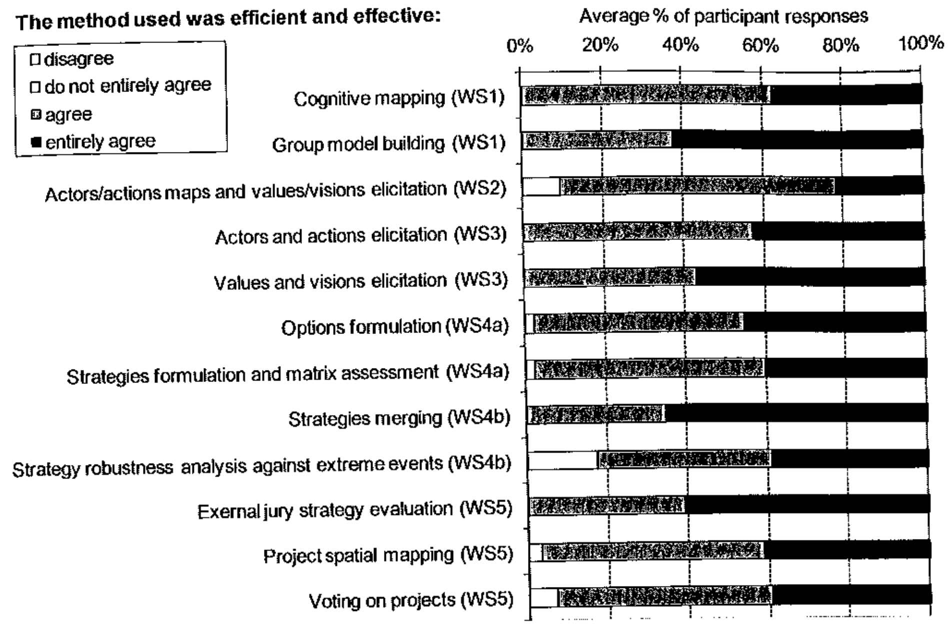

Figure 19.13. Participant-perceived efficiency and effectiveness of the process methods.

Likewise, it appears that from the majority of the stakeholders' perspectives, all of the methods through the participatory modelling process were considered to be efficient and effective for helping them investigate and manage flood and drought risks. The participant responses are shown in Figure 19.13.

From the stakeholder perspectives given in Figure 19.13, it appears, based on a percentage of responses ($n = 8$), that the group model-building of flood and drought risk perception maps in the first workshop was considered one of the most efficient and effective methods used in phase 1. The efficiency and effectiveness of this particular activity was also echoed by the private research consultant who designed and aided the Bulgarian regional partners with the implementation, and who thought the quality of the models was up to the best he had seen, despite being built in just over an hour (Hare, 2007). The 'strategies merging' and 'external jury strategy evaluation' from WS4b were the other two activities to be rated as the most efficient and effective, based on a larger number of respondents ($n = 23$).

Despite a small number of stakeholders not being entirely convinced of the efficiency and effectiveness of certain methods, the majority thought the whole participatory modelling exercise worthwhile. As stated by an LPSF member in the final written evaluations of the Iskar case study for the AquaStress project (which included the participatory modelling process and other activities): '*The methods and the methodology as a whole were efficient enough. Having in consideration the large number of people involved in the activities, it was hardly possible to find a more efficient way of achievement of the tasks*' (Vasileva, 2008).

19.4 Discussion

Following the brief outline of the Iskar process and some of its results, this discussion section will focus on providing some critical reflections on the process: first, on the qualitative participatory modelling approach used in the project; second, to what extent a way may be paved from technocratic to collaborative water management in Bulgaria; and finally, on the need for increased understanding of procedural complexity in collaborative water management processes.

19.4.1 Critical reflections on the qualitative participatory modelling approach

The Upper Iskar Basin's participatory modelling process used a range of modelling methods, as outlined in Figure 19.3. Most of these methods were of a qualitative nature, which included cognitive mapping, group model building, matrix assessment, robustness analysis, and spatial mapping, as well as many group discussions and other collective activities such as the preference distribution game, the expert jury, and the final project formulation. From the evaluation of the process and these methods, a number of lessons are worth discussing, and these might be useful for future processes and research.

First of all, the range of methods used in the interview series appeared to work effectively in aiding individual stakeholders reflect and formulate their own ideas about flood and drought risks; it also helped build modelling skills before meeting with other stakeholders. In the following group activities, collective 'buy in' to the ensuing modelling methods appeared strong, probably because stakeholders already had some training in the use of these types of methods (e.g. cognitive mapping), were adequately aided by the facilitators, and did not require a high level of numeracy. The highly visual qualitative methods used therefore was easy for both stakeholders and facilitators, and could be used to represent and link many types of knowledge (expert, local, political, judicial, etc.). Representing such a range of knowledge types may have been more difficult if quantitative or modelling methods had been used (potentially, such approaches lead to more 'black boxes' and require hidden calculations or data manipulation by the project team, which have been shown in other participatory processes to negatively affect stakeholders' trust in the models; Bots *et al.*, 2008). On the other hand, it may have permitted the investigation of system behaviours such as complex feedback mechanisms which are difficult for the human brain to grasp intuitively (Forrester, 1992) and which were almost certainly present in the Iskar case. Nevertheless, considering the level of investigations for flood and drought risk management that took place in the Iskar process, the qualitative modelling techniques that allowed stakeholders to outline their perspectives without presenting numerical answers seemed adequate (particularly since political decision-making is often based on good arguments, majority views, or other negotiated interests, all of which the qualitative process was able to support). However, for the final project planning workshop, quantitative cost–benefit estimates of potential decision options would have been

helpful, although even this could have been carried out up to a certain point without complex numerical models.

Interestingly, the strong stakeholder and facilitator appropriation of the qualitative modelling methods had some unexpected ramifications, including that as the methods were appropriated, the designed syntax of the models was often slightly adapted or modified (J.-E. Rougier, personal communication, 2007). This led to a range of challenges in the process which included the incompatibility and re-use of models as had been foreseen, including that qualitative or tendency 'calculations' using the models could not be performed and that results processing and synthesis activities were more problematic. In particular, the original joint cognitive maps of flood and drought risk perceptions and actors–actions models of the management situation (WS1 and 2) had been appropriated and adapted in different manners, so that there was not a model of the physical water and flood and drought risk management systems – i.e. the hydrological and other physical systems (e.g. economy, infrastructure, social, land use) and current actors' management actions' impacts on them – rather, there was a mix of actor networks, current and potential management actions, and risk drivers and impacts which were difficult to reconcile into one model. This meant that this work was a challenge to use (as intended) later in the process to analyse management options' impacts on the Iskar system, and in the end it was a project team-recreated model that was provided for use in the final workshop.

Considering the lessons learnt from the qualitative process used in the Iskar, it could be useful to further consider and analyse the issues of modelling methods, in particular the issue of model syntax appropriation and adaptation in other settings, in order to determine how future use of participatory modelling results could be improved, and complex feedbacks be taken into account (without losing the 'collective buy in' to the overall participatory process). Likewise, examining the circumstances or problem situations in which qualitative or quantitative modelling methods are more suitable, and to what extent the order of deployment of certain methods affects the process outcomes, warrants further research.

19.4.2 Paving a way from technocratic to collaborative management

The Bulgarian water sector has long been characterised by technocratic management systems and the work of scientific experts. Since the conversion of the country's Communist regime to a publicly elected government, the former rural community structures (based on work and equipment sharing in villages) have been dismantled, leaving rural populations with fewer services and collective capacities. Until recently, there has also been little concern for environmental or social impacts of management decisions and infrastructural projects. Although there is some evidence that Bulgarians are active participators in some sectors of social community life (Letki, 2004), there are few, if any, prior examples of collaborative multi-level inter-organisational water or risk management processes carried out in the country.

Early assessments by European researchers in the AquaStress project also brought to light that the Bulgarians they had met had little knowledge about participatory processes and their potential to aid the Upper Iskar Basin's water management (Hare, 2006). When considering 'risk' management, most attention early in the Iskar process focused on issues of better dealing with 'crises' of flood and drought, with relatively little consideration given to pre-emptive local community planning to reduce community vulnerability through capacity building. Instead, Bulgarians tended to consider it was the government's job to 'protect' them from flood and droughts and to reduce their susceptibility to such hazards. However, later in the process, participants began to understand the concept of 'risk' and the need to develop more holistic responses to it, including preparedness strategies. This was evidenced by the 13 pre-emptive projects put forward in the action plan in the final workshop.

In terms of whether the country's water management could move from a technocratic management approach to a collaborative one, some positive signs were witnessed through the Iskar process. In particular, despite the previous lack of experience in managing or involvement in participatory water management processes, the Bulgarian process organisers and participants exhibited great proficiency in facilitating, adapting to, and working in them effectively. Unlike some collaborative processes in other countries where 'over-participation' or 'token' participation is an issue (Cornwall and Jewkes, 1995; Daniell, 2008; Barreteau *et al.*, 2010), there was rather less cynicism surrounding the use of such a participatory process in the Upper Iskar Basin and apparent sustained interest in continuing the process, even after its official end. From our analyses of the Iskar case, the Bulgarian regional partners' championing and leadership were key to the success of the process, as were certain skills of the facilitators, including their cultural understanding and sensitivity; capacity to quickly learn to understand and use a variety of participatory methods; openness to a range of views; an ability to grasp the technical and non-technical arguments of the subject matter; assertiveness; trustworthiness; and effective communication skills. Considering the high levels of participant acceptance and proficiency in working through this process, it could be suggested that further participation initiatives in the Bulgarian context or similar countries may have a good chance of succeeding if the initiators and process organisers have sufficient skills and legitimacy to coordinate and champion such a process.

Investigating the possibility of further transitioning Bulgaria's technocratic management systems to more collaborative ones, it appears from the literature that despite Bulgaria's strong state structure, it is one of the Eastern European countries which has had (in 1993) the highest relative levels of citizen political engagement (higher than countries such as the UK and the US) and previous Communist party membership (prior to 1989); both of these factors appear to have positive effects on the potential democratisation of society and future citizen political involvement (Letki, 2004). In other words, compared to some other countries, in particular in Eastern Europe, Bulgaria appears to have a naturally high potential to successfully foster participatory methods, which may also explain why there have been other recent participation stories in Bulgaria in the domains of urban planning, energy, and nature conservation (see Watson, 2000; Staddon and Cellarius, 2002; Brinkerhoff and Goldsmith, 2006; Nakova, 2007). However, through historical analyses of previous types of water use or irrigation associations in Bulgaria, it has also been argued that citizen self-help and bottom-up collective action have rarely been seen in this sector and that there still seem to be impediments to establishing such user groups (Theesfeld and Boevsky, 2005). From our analyses of the Bulgarian project, this potential difficulty was also apparent, especially when working with some of the citizen groups who did not seem naturally inclined to help and coordinate themselves and instead asked for continued external support. More support and encouragement of local level capacity-building still appears necessary. Investigations into how education might support capacity-building, and how volunteerism could be encouraged, might prove fruitful.

19.4.3 Final thoughts for collaborative water management: the need for understanding procedural complexity

Although not presented in detail here, multi-level collaborative initiatives, such as the Iskar process, typically require organising teams, rather than just one individual designer and implementer. Working in a team requires the consideration of a range of issues that often may not be consciously considered by observers or participants of participatory processes. It is possible that different team members and participants may hold objectives that are not necessarily shared or coherent, as well as a variety of different skills, resources, values and preferences that are likely to affect how the final process is designed and implemented. Conflicts or ethical dilemmas can therefore arise, and these need to be managed or resolved if the stakeholder participatory approach is to be effective (see Cahill *et al.*, 2007; Sultana, 2007). Resolution is likely to require continuous negotiation and decision-making, such as consensus building or vetoing by more powerful project team members (perhaps the client, funding institution, or legally responsible project manager). Specific examples from the Bulgarian case can be found in Daniell (2008).

This means that, if collaborative water management is to be a success, two participatory processes (not one) need to be managed effectively. Table 19.2 lists common questions requiring investigation for managing these processes in cases where conflict or ethical dilemmas may surface.

In this chapter, analyses and discussion have focused on a number of questions in the column on 'stakeholder process for managing water systems', as well as the question of 'which participatory methods ought to be used and why'. However, it is worth stating that there were many other important questions investigated during the collective initiation, design, implementation and evaluation of the Iskar project, and these will require careful consideration before future collaborative water management processes begin.

Table 19.2. *Two sets of questions to investigate for collaborative water management*

Stakeholder process for managing water systems	Project organisation process for managing the participatory process
Why ought a water plan be created?	Who ought to be responsible for organising and managing the participatory process?
What ought to be the goals of the water plan?	How ought the scope and purposes of the water management plan be decided?
What ought to be the actions to achieve these goals?	How ought the decision be made on who ought to participate and when?
Who ought to be responsible for funding, resourcing and implementing these actions and when?	Which participatory methods ought to be used and why?
How ought progress towards these goals be measured?	Who ought to design, implement or facilitate the use of these methods with the participants?
How ought the plan be adjusted based on these evaluations?	Who ought to analyse and synthesise the results stemming from the participatory process?
	How ought the evaluation of the process take place and who ought to be allowed access to the raw data and final results?

19.5 Conclusions

This chapter has provided an outline and discussion of the 'Living with Floods and Droughts' collaborative water management project in the Upper Iskar Basin. The final implemented process was probably one of the first multi-level participatory modelling processes for flood and drought risk management, certainly the first in a country with very little previous experience with such participatory processes. Our extensive evaluation procedures were the source of several insights into the process and its benefits, including positive acceptance by stakeholders and appropriation of the process organisation and its methods by the Bulgarian facilitators. This process may pave the way to future collaborative water management initiatives in Bulgaria, even if further capacity-building may still be required until it becomes self-sustaining without external interventions. To what extent the Iskar process could be effectively adapted and transferred to other countries and problems still requires further analysis. It is possible that certain elements of the process implemented in Bulgaria may need adaptation before its application to other contexts, as they could be less appreciated or less feasible to implement. For example, in countries with low levels of education or literacy, models based on words may need to be adapted to pictures or photos. Similarly, the expert jury evaluation of the strategies that worked well in Bulgaria's predominant technocratic management culture could cause contention in cultures that are more prone to questioning 'expert' opinions. However, we think that the general structure of the process provides sufficient flexibility in choosing internal methods, and that with careful reflection

and a good process organisation team, it could be adapted to improve water management in a range of contexts and may inspire the adoption of similar collaborative water management processes elsewhere around the world.

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