Tom Raadgever · Dries Hegger *Editors*

# Flood Risk Management Strategies and Governance

Springer

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ISBN 978-3-319-67698-2 ISBN 978-3-319-67699-9 (eBook)
https://doi.org/10.1007/978-3-319-67699-9

Library of Congress Control Number: 2017959883



Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

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# Foreword

For long, discussions among scientists, policymakers and 'practitioners' gave the impression that science, policy and practice were living in separate worlds due to a lack of exchanges and of clear transfer of knowledge and expectations. This debate is not new, and we can trace discussions back to before the 1990s. From the time of adoption of the Water Framework Directive (WFD 2000) and later of the Floods Directive (2007), it has become clear that a proper governance in the water risk management sector was strongly relying upon a proper transfer of scientific outputs to various steps of the policy process (design, negotiation, implementation). However, mixing scientists, practitioners and policymakers and asking them apparently straightforward questions such as 'what do we know, and what scientific information may I use to justify policy orientations?' often resulted in difficult debates, owing to different ways of looking at managerial and operational issues.

Interactions among different actors who belong to the overall governance system clearly show that the different worlds have difficulties to directly communicate and that they need 'intermediaries' to cohabit and evolve together. This was featured at an early stage in the way working groups of the so-called WFD Common Implementation Strategy were operated, one dealing with flood risk management.

A strong culture of exchanges has hence been developed from 2004 with the FLOODSite project which contributed to the knowledge base used during the

negotiation process of the Floods Directive. Other initiatives later focused on aspects of flood risk management, e.g. climate change impacts on flood risks, flash floods, flood resilience in urban environments, etc. concentrating on the broad scope of resilient flood risk governance with the STAR-FLOOD project.

Teams composed of different actors (scientists, policymakers, practitioners) are in a better position to integrate scientific knowledge into policy implementation practices. This is particularly true regarding various technical steps embedded into the Floods Directive, which is itself closely connected to the Water Framework Directive river basin management planning. These concern, e.g. risk assessment and mapping, monitoring, design and implementation of action programmes. The incorporation of climate change considerations in the current policy debates, tending to make the second generation of river basin management plans 'climate-proof', is another dimension that needs to be tackled.

It is now clearly demonstrated that flood risks are increasing in Europe due to urbanisation and the effects of climate change. While the Floods Directive provides a large EU umbrella for managing existing and emerging risks, specific flood risk management strategies are developed by EU member states with often few practical interactions among them, despite the sharing of information within the Flood Working Group of the above-mentioned WFD Common Implementation Strategy. In this respect, the STAR-FLOOD project developed a comparative assessment of flood risk governance in Belgium, England, France, the Netherlands, Poland and Sweden to extract lessons learnt that could be of common interest for an improved resilient flood risk governance. This book is about these developments. It has been written by experts covering different facets of flood risk governance, providing views and perspectives from different angles, i.e. researchers, practitioners and policymakers.

In the first part, the book reflects the experience of six countries (viz., Belgium, England, France, the Netherlands, Poland and Sweden) in flood risk management and governance, discussing various approaches which reflect the principle of subsidiarity, i.e. implementation of the Floods Directive according to national/regional situations regarding flood risks and management practices used to tackle them. This takes into account different ways to involve public and private actors in flood risk governance and discusses how strategies could be improved in the context of the Floods Directive.

The experience gathered by the STAR-FLOOD project provides a thorough evaluation of resilience, efficiency and legitimacy. These are closely linked to flood risk management strategies which are, however, not necessarily sufficient to enhance resilience as discussed in the book. Interactions among the scientific community and stakeholders are also explored with recommendations regarding resilience issues and flood risk governance.

The second part of the book translates the project's key conclusions into best practices and recommendations for policymakers and practitioners. These concern management practices (related to different types of floods) with discussions on enhanced preparedness (i.e. not only dealing with flood defence), involvement of and interactions between different actors in charge of implementing strategies and other governance issues.

Overall, this book provides a highly relevant and timely state-of-the-art knowledge that will be of interest to policymakers and practitioners as well as scientists working in the area of flood risk management.

Research Programming and Policy Officer
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Dr. Philippe Quevauviller

# Preface

As project coordinator of the STAR-FLOOD research project, I am very proud to present you this book. I am convinced that collaboration between researchers, policymakers, NGOs, consultants and other stakeholders is essential for improving flood risk management. A concerted effort is needed to make Europe more flood resilient!

Part I of this book spreads the main results and conclusions of the European Union's Seventh Framework project STAR-FLOOD (www.starflood.eu). The project investigated strategies for dealing with flood risks in 18 vulnerable urban regions in 6 European countries: England, Belgium, France, the Netherlands, Poland and Sweden. STAR-FLOOD focused on governance aspects, from a combined public administration and legal perspective.

Part II is specifically written for policymakers and practitioners in flood risk management. It intends to point out why organisational or *governance* aspects are essential for implementing a broad and integrated flood risk management approach. It provides you with recommendations and good practices that can give you new insights and inspire you to improve your own policies and practices.

I hope you will enjoy reading this book and that you will get inspired to apply STAR-FLOOD recommendations in your own field of work!

Yours sincerely,

Project coordinator STAR-FLOOD
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# Acknowledgements

The editors thank the STAR-FLOOD partners and all others who cooperated in any way to the STAR-FLOOD project for their contribution. This book is based on the work that was done in all work packages.

The work described in this book was supported by the European Union's Seventh Framework Programme through the grant to the budget of the integrated project STAR-FLOOD, Contract 308364.

# Executive Summary

Flood risks in European countries are increasing due to urbanisation and the effects of climate change. For that reason, several countries are attempting to diversify their portfolio of flood risk management strategies. Besides improvement of flood defences, the strategies of proactive spatial planning, flood mitigation, flood preparation and recovery are prominently on the agenda. The EU FP7 project STAR-FLOOD (2012–2016) has engaged with the governance questions related to this diversification. It made a comparative assessment of flood risk governance in Belgium, England, France, the Netherlands, Poland and Sweden to derive design principles for appropriate and resilient flood risk governance.

Part I of this book (Chaps. 1, 2, 3, 4, 5 and 6) describes the main findings of the project from a researcher's perspective. Part II (Chaps. 7, 8, 9, 10, 11, 12 and 13) is meant as a practitioner's guidebook. It describes common challenges and good practices in flood risk governance.

The six countries showed large differences in their approaches to diversification. In the Netherlands, Poland, France and Belgium, we see a desire to create a back-up layer of contingency. England has been diversified for 65 years, while Sweden is currently diversifying due to climate change concerns. In most countries, the practical on-the-ground implementation of diversified strategies is lagging behind intentions as laid down in discussions and policy plans. In Chapter 2, a range of drivers for and barriers to diversification is discussed.

Diversification inevitably leads to involvement of more different public and private actors, different governmental levels and different sectors. This will lead to fragmentation. Chapter 3 reflects on the need for bridging processes and mechanisms to address this issue. On the one hand, various public and private actors need to become more strongly involved in flood risk governance. On the other hand, multilevel governance is needed, whereby it should be ensured that any shift of financial and executive tasks is accompanied by a shifting of formal powers and resources.

Diversification also leads to dynamics in rules. However, in some cases, a lack of rules can be witnessed, especially in cases in which certain strategies have not yet been implemented to a significant extent. Chapter 4 reviews several of these rules,

including the Floods Directive (Directive 2007/60/EC) of which the general logic and approach are endorsed but for which also possibilities for improvement are identified. The chapter goes on by reviewing the different types of (financial and other) resources present and necessary in the six researched countries. Recommendations for using them in a more effective and efficient way are made.

Chapter 5 presents the results of our evaluation of resilience, efficiency and legitimacy. Diversification of flood risk management strategies is a necessary but not sufficient precondition for enhancing resilience. Resilience is closely linked to appropriateness in view of physical circumstances and existing institutional and social contexts. Efforts to improve resource efficiency by increased application of (societal) cost benefit analyses were found to contribute to resource efficiency, but in some countries were perceived as rather technocratic. In terms of legitimacy, the researched countries are doing well on access to information and transparency, procedural justice and accountability. The most potential for improvement lies with the criteria of social equity, public participation and acceptability.

Chapter 6 first reflects on strengths and weaknesses of the chosen research approach in STAR-FLOOD and concludes that the intensive interaction within science and with stakeholders is recommendable for future European projects. The chapter goes on by discussing the identified governance design principles. These pertain both to the process and outcome of flood risk governance. The chapter reviews each of them in turn, thus specifying how following these principles may lead to the best possible achievements in terms of resilience, efficiency and legitimacy.

Part II of the book translates the project's key conclusions into best practices and recommendations for policymakers and practitioners. Chapter 7 emphasises the urgency of flood risk management, as flood risk is the number one natural risk in Europe. Although the types of flooding, flooding probability and potential consequences differ between the analysed countries, it is argued that in all countries, flood risk management should be improved, in order to deal with the large and increasing risk.

Although flood risk management in Europe has traditionally focused on the strategy of flood defence, it is more and more recognised that one should be prepared for floods as well. A mix of strategies can reduce loss of lives and social, economic, environmental and cultural losses and enable recovery after a flood event. Yet, there are no 'one-size-fits-all' solutions. An optimal mix has to be tailored to the physical and societal context and needs to be based on societal and political priorities. Strategies can be evaluated against three ultimate aims of flood risk management: resilience, efficiency and legitimacy (see Chap. 8).

The main message of Chap. 9 is that to ensure the implementation of flood risk management strategies, a good organisation or governance is essential. This means that (1) the relevant actors take responsibility and collaborate to implement the strategies, (2) the strategies are embedded in the actors' discourses, (3) the implementation is backed up by formal and informal rules and (4) the actors have the necessary power and resources. All these governance aspects need to function together. As improving governance often depends on many actors in multiple

interconnected and non-linear processes, it requires ongoing effort, many iterations and sustained networking and capacity building.

Chapters 10, 11, 12 and 13 describe common challenges and good practices from the analysed countries related to four themes or stages in the flood risk management cycle:

- Chapter 10: “Integrated Planning, Coordination and Collaboration”
- Chapter 11: “Before a Flood Event” (flood defence and spatial planning)
- Chapter 12: “During a Flood Event” (disaster management)
- Chapter 13: “After a Flood Event” (recovery)

An overview of all identified good practices is provided in the Quick Reference Chart, which indicates the countries and their flood risk management strategies, governance aspects and ultimate aims that good practices relate to.

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# Part I
# Scientific Conclusions on Resilient, Efficient and Legitimate Flood Risk Governance in Europe

**Dries L. T. Hegger, Peter P. J. Driessen, and Marloes H. N. Bakker**

# Chapter 1
# Researching Flood Risk Governance in Europe

**Dries L. T. Hegger, Peter P. J. Driessen, and Marloes H. N. Bakker**

## 1.1 Flood Risk Governance in Europe

European countries, especially urban areas, face increasing flood risks due to urbanisation and the effects of climate change (Alfieri et al. 2015; Kundzewicz et al. 2017; Winsemius et al. 2015). Of all the natural hazards in Europe, flooding is the most common, and accounts for the largest number of casualties and highest economic damage (Guha-Sapir et al. 2013). Unlike other natural hazards, no European country is free from the risk of flooding. Between 2000 and 2005, Europe suffered nine major flood disasters, which caused 155 casualties and economic losses of more than € 35 billion (Barredo 2007). The 2013 floods in central Europe caused 25 casualties and 15 billion dollar economic damage (according to (re)insurer Munich Re). The Winter 2013/14 flooding in England resulted in 5000 homes flooded and caused 17 casualties and over 2 billion pounds worth of damage.

In October 2015 the French Rivièra was severely flooded causing at least 19 casualties and significant damage. These recent events highlight the challenge and importance of improving the flood resilience of societies.

It is increasingly argued that a diversification, coordination and alignment of Flood Risk Management Strategies (FRMSs), including flood risk prevention through pro-active spatial planning, flood defence, flood risk mitigation, flood preparation and flood recovery, will make urban agglomerations more resilient to flood risks (Aerts et al. 2008; Hegger et al. 2014, 2016; Innocenti and Albrito 2011; Van den Brink et al. 2011; Wardekker et al. 2010; Wesselink et al. 2015). Diversification in FRMSs is one of the approaches underlying the EU Floods Directive (Directive 2007/60/EC). Diversification is said to require new flood risk governance arrangements (FRGAs) that should aid the implementation of the strategies.

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T. Raadgever, D. Hegger (eds.), *Flood Risk Management Strategies and Governance*, https://doi.org/10.1007/978-3-319-67699-9_1

Besides new FRGAs, a diversification of flood risk management strategies may require changes in existing arrangements and their linking together and alignment (Hegger et al. 2014). Efforts at such a diversification are ongoing in several countries and successful to a varying extent. At the same time, some countries like England have been diversified in the sense that all flood risk management strategies have been established for 65 years and all strategies are regarded as equally important at the national scale.

As the subsequent chapters of this book will substantiate further, flood risk governance that enhances societal resilience and is considered efficient and legitimate is of pivotal importance. Effective implementation of flood risk management strategies is considered as a necessary precondition for resilience. To understand how change towards more resilient, legitimate and efficient flood risk governance can be brought about, it is crucial to look at how flood risk governance has evolved in the past. This provides insights into how change can be implemented and into potential entry points as well as barriers to change. The studies underlying this book show that Belgium, England, France, the Netherlands, Poland and Sweden differ in the extent to which they managed to diversify and align Flood Risk Management Strategies (Hegger et al. 2016). Based on a comparison of these countries, some recurring drivers for and barriers to diversification could be identified. In addition to that, the establishment of bridging processes and mechanisms that facilitate linkages between flood risk management strategies and the related actors, rules and sectors as well as linkages within sectors are essential, as is the need to further engage private actors and citizens in flood risk governance (Wiering et al. 2017; Gilissen et al. 2016). Current policies and legal systems at the level of the EU, the national and the regional level have been evaluated, and as well as strengths, some opportunities for further improving them have been identified. The goal of this book is to provide an overview of the key conclusions and recommendations of the EU FP7 STAR-FLOOD project in terms of relevant knowledge that may help to develop governance design principles for flood risk governance arrangements and to derive implications for policies and law at the level of the EU, its member states, regional authorities, and public-private partnerships.

## 1.2 The Relevance of a Governance Perspective on Flood Risk Management

For a long time a natural and technical science perspective has dominated the research on Flood Risk Management. When the Floods Directive (Directive 2007/60/EC) was being developed, the directive text was drawing significantly on findings from projects carried out within the Sixth Framework Programme (FP6) in the period 2002–2007 (Kundzewicz et al. 2017). In particular, the FLOOD-site project provided a scientific foundation for the directive text adopted in 2007. Subsequent projects provided enhanced knowledge on climate change impacts, e.g. the WATCH project and regional assessments, for instance in the Mediterranean area with the CIRCE project (ibid). In FP7 in 2007–2013, research was more focused on implementation issues, e.g. related to improved early warning of flash floods with the


**Fig. 1.1** Overview of integrated projects funded by the European Commission (source: Philippe Quevauviller)

IMPRINTS project, and disentangling the notion of flood resilience within the CORFU project (Quevauviller 2011). A graphical depiction of the interrelationships between the projects is provided in Fig. 1.1.

Other issues addressed in previous European research projects included, amongst other things, technologies for improved safety of the built environment (FLOODprobe/SMARTeST); the costs of natural hazards (ConHaz); integrated multi-hazard vulnerability assessment (ENSURE); social capacity building (CapHaz-Net); adaptive water management under uncertainty (NeWater); emergency management (UrbanFlood), risk assessments, future scenarios and technical measures (IRMA SPONGE, FLOODsite and HYDRATE). Although some programmes, like NeWater, have addressed social-scientific research questions, social-scientific, comparative European institutional and legal studies on flood risk management are still rare, fragmented and limited in scope and are mostly carried out at the national level and within the national legal context.

There is obviously a clear gap in terms of governance-focused research and research expertise from public administration and legal fields. Flood risk management is not only a technical issue of building flood defences and developing flood warning systems. It is also a matter of activating governmental and non-governmenal actors, stimulating fruitful cooperation between these actors, putting the right legal, economic and communicative instruments in place, securing connectivity between relevant policy sectors and between administrative levels, enhancing risk awareness

among societal groups, and provoking societal debates on future perspectives and associated transformative pathways (Driessen et al. 2016). In order to improve flood resilience in the face of urbanisation and climate change, a governance perspective has complementary insights to offer (Hegger et al. 2014; Dieperink et al. 2016). It tests governing actors' abilities to collaborate, tests the presence and efficacy of policy instruments, provides understanding of the mechanisms through which strategies, actors, levels and sectors can be bridged and may inspire changes in societal debates and institutional settings. Change may require specific resources (finance, knowledge), legal changes and/or coordination to ensure a clear division of responsibilities and the presence of a legal framework that enables the implementation and enforcement of newly developed flood risk policies and approaches. All this has to take place in adherence to normative values and principles held in societies, which may include effectiveness, legitimacy, social equity, transparency, subsidiarity and efficiency (Driessen et al. 2016). A better insight into governance challenges and the conditions that may help address them is relevant for societal actors that have the ambition to diversify FRMSs in order to improve resilience.

To reach the desired outcome of improving societal resilience to flooding, governance is pivotal. This is reflected in adaptive governance literature (e.g. Chaffin et al. 2014: 64) in which it is argued that "adaptive governance is essential for dealing with complexity and uncertainty associated with rapid global environmental change. Social ecological systems should be managed holistically to either increase resistance to undesirable change or to transform a system to a more desirable state". Adaptive governance is seen as a precondition for achieving adaptive management (ibid), which can be understood as the enabling of "…a social-ecological system to sustain itself through learning-by-doing and cooperation and to avoid collapse, while enhancing a system's capacity to respond to changing circumstances" (Den Uyl and Driessen 2015: 189). This perspective sees adaptability as a pre-condition of resilient systems, and emphasises change. This literature on adaptive governance often stresses that system resilience will benefit from a variety of pathways or strategies. Scholars stress diversity, polycentricity and flexibility (e.g. Folke et al. 2005; Pahl-Wostl et al. 2007).

Just like other water-related challenges (e.g. OECD 2014), there is no one-size-fits-all solution for addressing flood risk governance challenges (Driessen et al. 2016; Wiering et al. 2017). The STAR-FLOOD project has, however, increased our understanding of flood risk governance practices, explained and evaluated these practices, and – based on these insights – formulated design principles and conditions for improving flood risk governance in different contexts. This was the reason for devising our second starting assumption on appropriateness, i.e. that a successful implementation of a diverse, resilient, set of FRSs – requiring a combination of old and new strategies and coordination of different strategies – in a certain area is only possible if these strategies and their coordination are seen as efficient and legitimate by the actors involved and hence are properly institutionally embedded given the opportunities and constraints of their physical and social context.

Concretely, the STAR-FLOOD project has developed the following types of contributions to the state or the art of (flood risk) governance and legal literature. It has provided insights into:

- Stimulating and hampering factors for a diversification of flood risk management strategies (see also: Aerts et al. 2008; Hegger et al. 2014; Innocenti and Albrito 2011; Van den Brink et al. 2011; Wardekker et al. 2010; Wesselink et al. 2015);
- The necessity to coordinate and align these strategies and the importance of bridging mechanisms (see also: Gilissen et al. 2015; Koskenniemi and Leio 2002; Rijke et al. 2013; Voß et al. 2007);
- The characterisation of flood risk governance arrangements and sub-arrangements in various countries and essential similarities and differences (see also: Bubeck et al. 2015; Wiering et al. 2017);
- The functioning and implementation of the Floods Directive in six European countries (see also: Hartmann and Driessen 2017; Priest et al. 2016);
- The necessary interrelationship between flood risk management and spatial planning and between flood risk management and emergency management (see also: Hartmann and Driessen 2017; Gilissen et al. 2015; Kolen and Helsloot 2014);
- How literature on social-ecological resilience can be specified for the floods domain and the factors stimulating and hampering enhanced flood resilience (see also: Alexander et al. 2016a; Hegger et al. 2016; Folke 2006; Klijn et al. 2008; Mens et al. 2011);
- The functioning of formal rules and regulations and the tension between legal certainty and flexibility (see also: Van Rijswick and Havekes 2012; Goytia et al. 2016).
- Divisions of responsibilities between public and private parties (the public-private divide) (see also: Meijerink and Dicke 2008; Runhaar et al. 2014; Mees et al. 2014; Mees et al. 2016a) (Fig. 1.2).

**Fig. 1.2** In STAR-FLOOD public administration and legal scholars join their forces

## 1.3 Research Aims and Questions

STAR-FLOOD's main research question was: "What are resilient and appropriate Flood Risk Governance Arrangements (FRGAs) for dealing with flood risks in vulnerable urban agglomerations in Europe?" The different chapters of this book provide elements of the answer to this main research question. The STAR-FLOOD project investigated how current flood risk governance arrangements can be strengthened or redesigned to enhance societal resilience to flooding. To this end, an assessment has been made as to what extent existing governance arrangements support or constrain the diversification of Flood Risk Management Strategies as well as the extent to which such a diversification of strategies enhances societal resilience to flooding. One of the most encompassing definitions of resilience is the one adopted by the Resilience Alliance, which defines resilience as:" ...the capacity of a social-ecological system to absorb or withstand perturbations and other stressors such that the system remains within the same regime, essentially maintaining its structure and functions. It describes the degree to which the system is capable of self-organization, learning and adaptation" (http://www.resalliance.org/resilience). This definition encompasses multiple capacities of importance for flood resilience, namely the capacity to resist floods, the capacity to absorb floods and to recover from them and the capacity to adapt – including the capacity to learn, improve and experiment – in order to be better prepared for dealing with future floods (Klijn et al. 2008; Liao 2012; Mens et al. 2011).

In the course of the research, STAR-FLOOD used and reflected upon two starting assumptions:

**STAR-FLOOD's Starting Assumptions**

**Assumption 1:**
Societal resilience to floods is enhanced if multiple Flood Risk Management Strategies are implemented simultaneously and are aligned.

**Assumption 2:**
A successful implementation of a diverse, resilient, set of FRMSs – requiring a combination of old and new strategies and coordination of different strategies – in a certain area is only possible if these strategies and their coordination are appropriate. They should make efficient use of resources and should be considered legitimate by the actors involved. In so doing, they should ensure proper institutional embedding given the opportunities and constraints of their physical and social context.

Both assumptions reflect current debates in literature and practice regarding a diversification of FRMSs. In these debates it is argued that many countries have a dominant focus on flood defence. It is claimed that not all floods can be prevented and hence that this strategy should be complemented with additional strategies,

including flood risk prevention, flood mitigation, flood preparation and flood recovery. Strategies should, however, be implemented in such a way that they fit in their physical and institutional contexts. Important local/regional circumstances that need to be taken into account are: differences in exposure to flood risk; differences in flood experience; differences in normative values; differences in the legal rules governing the distribution of responsibilities and rights to flood protection and differences in the degree of flood awareness present in a society (Ek et al. 2016a).

## 1.4 Research Approach and Methods

### *1.4.1 Research Approach*

To analyse Flood Risk Governance Arrangements, the STAR-FLOOD project draws on the Policy Arrangements Approach (PAA). Policy arrangements have been defined as "a temporary stabilisation of the content and organisation of a policy domain" (Van Tatenhove and Leroy 2000). By studying the development of these policy arrangements over time, the degree of stability or change in these arrangements can be analysed. The PAA claims to link up all relevant dimensions of a policy domain (actors, discourses, rules and resources) and hence enables a study of the policy arrangement as a whole. The approach has been applied in earlier studies of environmental policies, nature conservation and water management (Arts and Van Tatenhove 2006; Van Tatenhove and Leroy 2000; Wiering and Arts 2006). Two

**Key Terms Used in the STAR-FLOOD Project**

**Flood Risk Governance Arrangement (FRGA)** – The arrangement of actors, rules, resources and discourses united under the shared goal of Flood Risk Management (FRM). Thus FRGAs can be thought of as the institutional constellations resulting from an interplay between actors and actor coalitions involved in all policy domains relevant for flood risk management—including water management, spatial planning and disaster management; their dominant discourses; formal and informal rules of the game; and the power and resource base of the actors involved (Hegger et al. 2014). FRGAs comprise several sub-Flood Risk Governance Arrangements (sub-FRGAs), being the distinct arrangements of actors, rules, resources and discourses directed towards a distinct goal of FRM, embedded within an overall FRGA. For instance, spatial planning aims to minimise the exposure of people and property to flood risk. Both units of analysis are examined within this research.

**Flood Risk Management Strategy (FRMS)** – Certain flood risk management measures can be categorised within a distinct strategy, according to their

(continued)

intended goal. Categories include prevention, defence, mitigation, preparation and response, and recovery (Hegger et al. 2014). These strategies address different aspects of the risk equation (exposure, hazard and consequences). Prevention includes those measures that minimise the exposure of people/property to flood risk (e.g. through planning conditions). Defence and mitigation strategies minimise the likelihood and/or magnitude of the flood hazard through the use of measures that either act to resist (e.g. flood wall) or accommodate water (e.g. flood storage), respectively. Finally, preparation and response and recovery strategies serve to lessen the consequences should a flood event occur.

**Bridging mechanisms** – organisations, concepts, policy instruments, financial instruments or tools that facilitate alignment and/or integration between public and private actors, policy levels and policy sectors (Wiering et al. 2017; Gilissen et al. 2015).

features make the approach particularly useful for analysing FRGAs. First, the approach combines and integrates different concepts within frameworks of policy analysis (e.g. policy network models, discourse analysis, the advocacy coalitions framework and regime theory in international relations) and includes both structure and agency—related elements of institutional analysis, thus choosing a more sociological approach (Giddens 1984). Other approaches are less comprehensive in terms of the dimensions that are included. Second, the approach allows for a certain inclusion of legal factors in the analysis, especially in the rules and resources dimensions. FRGAs can be analysed at different scales, including local, regional, national, transboundary river basin scale, and the international scale.

To help us identify FRGAs, the STAR-FLOOD project refers to the notion of Flood Risk Management Strategies (FRMSs), categorised as prevention, defence, mitigation, preparation and response, and recovery. A number of Flood Risk Management measures can be grouped into these strategies. These five types of strategies include the strategies identified within the EU Floods Directive (Directive 2007/60/EC). The Floods Directive advocates the '3Ps', namely, prevention, protection and preparedness. A strength of this approach is that it acknowledges the temporal element of when certain measures are implemented within the FRM cycle. Building upon this, the Strategies referred to within the STAR-FLOOD project extend this temporal dimension to also account for measures employed within the recovery phase of flooding. Further attention has also been given to the notion of protection, which has been unpicked further and divided into the two strategies of defence and mitigation. Whilst measures employed in these strategies have a shared aim, (i.e. to minimize the likelihood and/or magnitude of the flood hazard), the distinction was justified on the basis that the measures employed within these strategies differ in terms of their treatment of water. Whereas defence measures act to resist and control water, in contrast mitigation measures aim to accommodate water

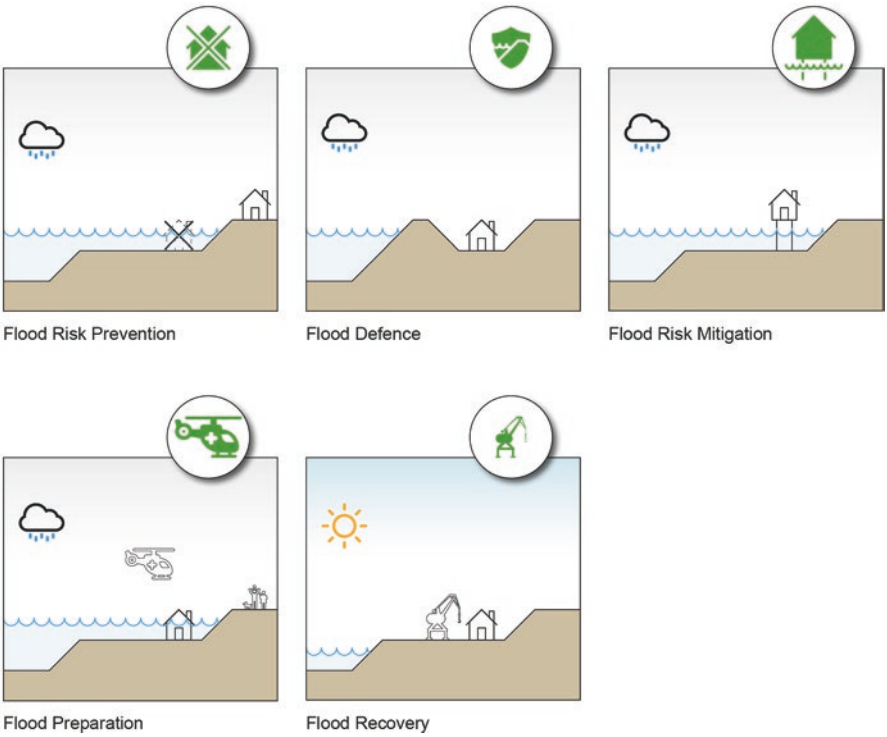


**Fig. 1.3** Overview of the five Flood Risk Management Strategies identified within STAR-FLOOD

and work with natural processes. Thus there are clear discursive differences between the implementation of defence and mitigation measures. Adopting the risk equation (where risk is a function of exposure * hazard * consequences), the STAR-FLOOD strategies are organized as illustrated in Fig. 1.3.

The conclusions reported in this book have been derived from conceptual and empirical work carried out throughout the project. This work comprised the following steps: (i) analysis of flood risk governance, with a focus on stability and change therein; (ii) explanations for the dynamics (both stability and change) found; (iii) evaluations according to the desired outcomes of societal resilience, efficiency and legitimacy; and (iv) comparison followed by formation of design principles and success conditions.

For the **analysis** of flood risk governance, the four dimensions of the flood risk governance arrangements approach (actors, discourses, rules, resources) have been used. Details on the operationalisation of the four dimensions and the indicators used can be found in Larrue et al. (2013). An institutional mapping of current FRGAs was complemented with an analysis of the historical dynamics therein. This was done since a thorough understanding of dynamics in policy and governance requires that these dynamics are studied longitudinally (Hegger et al. 2014; Larrue et al. 2013).

To acquire understanding of the mechanisms through which flood risk governance changed or remained stable, **explanations** have been made. To do so, insights from prominent theories and frameworks on public policy change have been used: the Multiple Streams Framework (MSF) (Kingdon 1984; Zahariadis 2007), Punctuated Equilibrium Theory (PET) (True et al. 2007), the Advocacy Coalitions Framework (ACF) (Sabatier and Jenkins–Smith, 1993; Sabatier and Weible 2007), the Institutional Analysis and Development Framework (IAD) (Ostrom 2007); change agency literature (Brouwer and Biermann 2011; Caldwell 2003; Huitema et al. 2011) and discursive theories (Hajer and Versteeg 2005; Jorgensen and Phillips 2002; Schmidt 2008, 2011). These have been translated into five types of explanatory factors: (i) physical circumstances; (ii) physical and social infrastructure; (iii) structural factors; (iv) characteristics of agency and (v) shock events. We have taken into account that these five factors may be found *within* but also *external* to flood-relevant policy domains (an example of the latter concerns e.g. major developments in political culture at the national level). We also bear in mind that each factor may contribute both to stability and to change. STAR-FLOOD's explanatory framework is introduced in more detail in Larrue et al. 2013.

**Evaluations** of flood risk governance have been made to assess the ways in which current FRGAs enable or constrain societal resilience to flooding in urban areas as well as the efficiency and legitimacy of flood risk governance (Alexander et al. 2016a). These are normative statements about what flood risk governance should achieve. In order to evaluate the extent to which flood risk governance is achieving these desired outcomes (i.e. resilience, legitimacy and efficiency), we have identified a number of criteria (see Table 1.1) to measure these and a range of indicators to operationalise these criteria (Alexander et al. 2016a). STAR-FLOOD discerned three facets through which societal resilience can be assessed; these include the i) capacity to resist flooding (i.e. minimise the likelihood and/or magnitude of the flood hazard), ii) capacity to absorb and recover from a flood event and iii) the capacity to adapt (including the capacity to learn, innovate and improve) (Hegger et al. 2016). Through this aspect of evaluation we examined the starting assumption of the project and examined the extent to which a diversified set of FRMSs are embedded within flood risk governance in each country; and in turn, the extent to which this is shown to support societal resilience to flooding at the national and case study scale. Legitimacy was also approached as a multi-faceted concept and operationalised via several criteria, including *social equity, accountability, transparency, participation, access to information, procedural justice* and *acceptability.* Ultimately flood risk governance should be deemed appropriate, whereby structures of governance and institutions 'fit' the problem at hand. Rather than imposing notions of good or poor governance, this framework advocates a more context-specific perspective on appropriateness in line with the *logic of appropriateness* described by March and Olsen (2008).

Effectiveness (e.g. of strategies, measures) in terms of problem solving and goal achievement has not been included as a desired outcome in itself. Instead, we see it as a necessary condition for societal resilience, efficiency and legitimacy.

**Table 1.1** Outcomes, criteria and indicators for evaluating flood risk governance

| Desired outcomes of governance | Evaluation criteria | Some example indicators to assess criteria |
|---|---|---|
| Societal resilience | Capacity to resist | The assembly of measures/projects/or governance arrangements is shown to have enhanced the ability of the social-environmental system in terms of reducing the likelihood or magnitude of flood hazard. |
| | Capacity to absorb and recover | The assembly of measures/projects/or governance arrangements is shown to have enhanced the resilience of the social-environmental system in terms of reducing the consequences, enabling the system to absorb and/or quickly recover. |
| | Capacity to adapt | Opportunities for learning and evidence that 'lessons learned' are implemented. |
| Efficiency | Economic efficiency | The flood risk governance arrangement or sub-entities of governance (e.g. FRM measures, projects or sub-arrangements) use financial resources in an efficient manner, based on the ratio of desired output(s) to input(s) |
| | Resource efficiency | Concerns for resource efficiency are widely evident within the flood risk governance arrangement (and delivered activities), as well as within the legal framework and/or are taken into account in amendments and reforms |
| Legitimacy | Social equity | The distribution of costs and benefits are fully considered within the decision-making process and communicated to those affected |
| | Accountability | There are opportunities for stakeholders to challenge decisions that have been made and hold decision-makers accountable |
| | Transparency | The decision-making process is transparent so all can see how decisions were made (e.g. public inquiries) |
| | Participation | Public participation has been sought through various stages in the decision-making process, based on a model of knowledge exchange |
| | Access to information | Stakeholders have equal access to relevant information about the problem and how it will be managed |
| | Procedural justice | The process of resolving disputes is considered to be fair |
| | Acceptability | Decisions are accepted by stakeholders |

From Alexander et al. (2016a)

**Identifying Governance Design Principles** Based on the outcomes of analyses, explanations and evaluations, strengths, weaknesses and opportunities and threats for flood risk governance in Belgium, England, France, the Netherlands, Poland and Sweden have been identified and reported in six publicly available country reports (Alexander et al. 2016b; Ek et al. 2016b; Kaufmann et al. 2016; Larrue et al. 2016;

Matczak et al. 2016; Mees et al. 2016b). After conducting the country-specific studies, a comparison of FRMSs, FRGAs and explanatory factors in all countries was made and strengths, weaknesses, opportunities and threats from a more comparative perspective were identified (Ek et al. 2016a; Wiering et al. 2017). This has led to the identification of design principles. These include success conditions related to the implementation of strategies – recommendations for actors at national/regional/local level; success conditions related to bridging between domains (e.g. between water management and spatial planning; between water management and disaster management) – and between all levels (EU, national, regional and local); success conditions related to the improvement of European/international legal frameworks and policies (Ek et al. 2016a).

### *1.4.2 Research Methods*

Empirical research was carried out in six European countries – Belgium, England, France, the Netherlands, Poland and Sweden – and 18 urban agglomerations therein. These countries were interesting since at the time the research was conducted they were are all in the process of implementing the EU Floods Directive (FD, 2007/60EC). However, they differ tremendously from one another in terms of physical conditions, actual flood experience, their departure point in terms of the FRMSs and FRGAs that are in place, and their administrative and legal context, amongst other things (Hegger et al. 2016). The project has assessed flood risk governance from a combined public administration and legal perspective. Flood risk governance arrangements (actors, discourses, rules and resources) at the national level and at the level of three case studies were analysed, explained and evaluated. The box below provides an overview of the countries and case studies included in the project.

STAR-FLOOD's research approach can be characterised by intensive cross-country and cross-disciplinary dialogue throughout the project. Several research methods were used by policy analysts and legal scholars. Based on jointly developed guidance documents, all partners conducted empirical analyses and evaluations of flood risk governance in their country, both at the national level and at the level of three case studies focusing on specific urban areas that were used to illustrate and further explore developments at the national level. Data collection methods applied in all countries are: desk research (analysis of policy documents, legal texts, case law, literature); semi-structured interviews (70 in Belgium, 61 in England, 64 in France, 45 in the Netherlands, 54 in Poland and 19 in Sweden), legal comparison, and at least one workshop with stakeholders in each country. Next to this there were several occasions in which the comparison of strategies, arrangements and resilience capacities was discussed with all six country teams. Several plenary discussions and discussions in small groups were held throughout the project.

**Overview of Case Studies and Rationalities for Selection**

The aim of the three case studies selected in each country was to gain insight into the overall national approach to flood risk management. Therefore, case studies were chosen that are either examples of this national approach, or illustrations of a deviation from this approach.

**Belgium**

- *Antwerpen* – Flanders' biggest city. Example of new measures that aim to create win-win solutions between flood defence and flood mitigation measures; the Scheldt is also a trans-boundary river.
- *Geraardsbergen* and *Lessines* – two small cities on the river Dender, with Geraardsbergen in the Flanders Region and Lessines in the Walloon region. Interesting examples of the implementation of flood prevention instruments.

**England**

- *Lower Thames* – Opportunity to explore the implementation of a multi-scale flood risk management scheme within the context of Partnership Funding.
- *Hull* – Exploring efforts to integrate surface water mitigation within a defence-reliant regime.
- *Leeds* – Balancing flood risk with economic development through localised cooperation and innovative measures.

**France**

- *Nevers* – Example of the renovation of old protection infrastructures led by a master plan of the intermunicipal body. The city also exemplifies implementation of the national policy, with a few adjustments for the local context.
- *Le Havre* – Highlights the role played by the inter-municipal body in identifying innovative solutions for combining risk management and agricultural development and in challenging the State's expertise and authority in the definition of the marine submersion problem.
- *Nice* – Provides two contrasting examples of the local implementation of flood risk policies, on the rivers Var and Paillon.

**Netherlands**

- *Dordrecht* – Provides an example of a discourse on the so-called multi-layered safety focusing on probability-reducing and consequence-managing measures.
- *Nijmegen* – is one of 39 Room for the River project sites that adopt a more integrated, eco-system based approach to FRM.

(continued)

– *Westergouwe/Zuidplaspolder area* – Example of a more or less mainstream approach, i.e. development in high flood risk area, but with adoption of mitigative solutions.

**Poland**

– *Slubice* – A border city on the Odra, close to Frankfurt an der Oder (example of trans-boundary flood risk management), highly vulnerable to flooding (located in depression).
– *Poznan County* – an example of a flood-prone area that was not severely hampered by the floods of 1997 and 2002.
– *Wroclaw* – a city severely harmed by the flood of 1997; pilot project and frontrunner.

**Sweden**

– *Gothenburg* – has experience with flooding and has been working actively with flood risk management for at least 10 years. A large scale flood protection project is underway.
– *Karlstad* – this municipality has experience with flooding and has been working actively with flood risk management for at least 10 years. There is a local flood management programme for Karlstad.
– *Kristianstad* – one of the most flood-prone areas in the country where flood risk management is clearly visible on the local political agenda. Kristianstad is claimed to be a role model for Swedish flood risk management. Defensive measures have been established.

## 1.5 Overview of the Deliverable Reports and Journal Articles Underlying STAR-FLOOD's Key Conclusions

The reader who is interested in the more detailed results underlying the key conclusions as discussed in this book is referred to the reports and papers listed in the box below. These are currently available, most of them through www.star-flood.eu and through the online journal portals.

**Overview of the Deliverable Reports and Journal Articles Underlying STAR-FLOOD's Key Conclusions**

Work Package 1 – problem analysis of Flood Risk Governance in Europe

Bakker MHN, Green C, Driessen PPJ, Hegger DLT, Delvaux B, Van Rijswick HFMW, Suykens C, Beyers JC, Deketelaere K, Van Doorn-Hoekveld W,

(continued)

Dieperink C (2013) Flood Risk Management in Europe: European flood regulation. STAR-FLOOD Consortium, Utrecht, the Netherlands. ISBN: 978-94-91933-04-2

Dieperink C, Green C, Hegger DLT, Driessen PPJ, Bakker MHN, Van Rijswick HFMW, Crabbé A, Ek K (2013) Flood Risk Management in Europe: governance challenges related to flood risk management (report no D1.1.2). STAR-FLOOD Consortium, Utrecht, the Netherlands. ISBN: 978-94-91933-03-5

Green C, Dieperink C, Ek K, Hegger DLT, Pettersson M, Priest S, Tapsell S (2013) Flood Risk Management in Europe: the flood problem and interventions (report no D1.1.1). STAR-FLOOD Consortium, Utrecht, the Netherlands. ISBN: 978-94-91933-02-8

Hegger DLT, Green C, Driessen PPJ, Bakker MHN, Dieperink C, Crabbé A, Deketelaere K, Delvaux B, Suykens C, Beyers JC, Fournier M, Larrue C, Manson C, Van Doorn-Hoekveld W, Van Rijswick HFMW, Kundzewicz ZW, Goytia Casermeiro S (2013) Flood Risk Management in Europe: Similarities and Differences between the STAR-FLOOD consortium countries. STAR-FLOOD Consortium, Utrecht, the Netherlands. ISBN: 978-94-91933-05-9

Work Package 2 – assessment framework of flood risk governance in Europe

Alexander M, Priest S, Mees H (2016) *A framework for evaluating flood risk governance.* Environmental Science and Policy 64:38–47

Alexander M, Priest S, Mees H (2015) Practical guidelines for evaluating flood risk governance. [In] Larrue C, Hegger D, Trémorin JB (Eds). Researching flood risk governance in Europe: A framework and methodology for assessing flood risk governance. STAR-FLOOD deliverable report (Report No. D2.2.1)

Bruzzone S, Larrue C, Rijswick HFMW, Wiering M, Crabbé A (2016) Constructing collaborative communities of researchers in the environmental domain. A case study of interdisciplinary research between legal scholars and policy analysts Environmental Science and Policy 64:1–8

Larrue C, Hegger DLT, Trémorin JB (2013) Researching Flood Risk Policies in Europe: a framework and methodology for assessing Flood Risk Governance (report no D2.2.1). STAR-FLOOD Consortium, Utrecht, the Netherlands, ISBN: 978-94-91933-01-1

Larrue C, Hegger DLT, Trémorin JB (2013) Researching Flood Risk Policies in Europe: background theories (report no D2.2.2). STAR-FLOOD Consortium, Utrecht, the Netherlands, ISBN: 978-94-91933-01-1

Hegger DLT, Driessen PPJ, Dieperink C, Wiering M, Raadgever GT, Van Rijswick HFMW (2014) Assessing stability and dynamics in flood risk

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governance: an empirically illustrated re-search approach. Water Resources Management 28:4127-4142
Hegger DLT, Van Herten M, Raadgever T, Adamson M, Näslund-Landenmark B, Neuhold C. (2014). Report of the WG F and STAR-FLOOD Workshop on Objectives, Measures and Prioritisation Workshop

Work Package 3 – empirical studies in Belgium, England, France, the Netherlands, Poland and Sweden and report of the case study workshops

Alexander M, Priest S, Micou AP, Tapsell S, Green C, Parker D, Homewood S (2016) Analysing and evaluating flood risk governance in England – Enhancing societal resilience through comprehensive and aligned flood risk governance. STAR-FLOOD Consortium, Utrecht. ISBN: 978-94-91933-07-3
Ek K, Goytia S, Pettersson M, Spegel E (2016) Analysing and evaluating flood risk governance in Sweden - Adaptation to Climate Change? STAR-FLOOD Consortium, Utrecht. ISBN: 978-94-91933-10-3
Hegger DLT, Bakker MHN, Raadgever GT, Crabbé A (2016) D3.1 Country and case study workshop report. STAR-FLOOD Consortium, Utrecht. ISBN: 978-94-91933-12-7
Kaufmann M, Van Doorn-Hoekveld WJ, Gilissen HK, Van Rijswick HFMW (2016) Analysing and evaluating flood risk governance in the Netherlands. Drowning in safety? STAR-FLOOD Consortium, Utrecht. ISBN: 978-94-91933-11-0
Larrue C (Ed.), Bruzzone S, Lévy L, Gralepois M, Schellenberger T, Trémorin JB, Fournier M, Manson C, Thuillier T (2016) Analysing and evaluating Flood Risk Governance in France: from State Policy to Local Strategies. STAR-FLOOD consortium, Utrecht. ISBN: 978-94-91933-08-0
Matczak P, Lewandowski J, Choryński A, Szwed M, Kundzewicz ZW (2016) Flood risk governance in Poland: Looking for strategic planning in a country in transition. STAR-FLOOD Consortium, Utrecht. ISBN: 978-94-91933-09-7
Mees H, Suykens C, Beyers JC, Crabbé A, Delvaux B, Deketelaere K (2016) Analysing and evaluating flood risk governance in Belgium. Dealing with flood risks in an urbanised and institutionally complex country. STAR-FLOOD consortium, Utrecht. ISBN: 978-94-91933-06-6

Work Package 4

Choryński A, Raadgever GT, Jadot J (2016) D4.2 Experiences with flood risk governance in Europe; a report of international workshops in four European regions. STAR-FLOOD Consortium, Utrecht
Gilissen HK, Alexander M, Beyers JC, Chmielewski P, Matczak P, Schellenberger T, Suykens C (2015) Bridges over troubled waters: An interdisciplinary framework for evaluating the interconnectedness within

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fragmented domestic flood risk management systems. Journal of Water Law 2512–26

Matczak P, Wiering M, Lewandowski J, Schellenberger T, Trémorin JB, Crabbé A, Ganzevoort W, Kaufmann M, Larrue C, Liefferink D, Mees H (2016) Comparing flood risk governance in six European countries: strategies, arrangements and institutional dynamics. STAR-FLOOD consortium, Utrecht

Wiering M, Kaufmann M, Mees H, Schellenberger T, Ganzevoort W, Hegger DLT, Larrue C, Matczak P (2017) Varieties of flood risk governance in Europe: How do countries respond to driving forces and what explains institutional change? Global Environmental Change 44:15–26.

Work Package 5

Ek K, Pettersson M, Alexander M, Beyers JC, Pardoe J, Priest S, Suykens C, Van Rijswick HFMW (2016) Best practices and design principles for resilient, efficient and legitimate flood risk governance – Lessons from cross-country comparisons, STAR-FLOOD Consortium, Utrecht

Ek K, Raadgever GT, Suykens C, Bakker MHN, Pettersson M, Beyers JC (2016) An expert panel on design principles for appropriate and resilient flood risk governance – lessons from a workshop in Brussels. STAR-FLOOD consortium, Utrecht

Dieperink C, Hegger DLT, Bakker MHN, Kundzewicz ZW, Green C, Driessen PPJ (2016) Recurrent Governance Challenges in the Implementation and Alignment of Flood Risk Management Strategies: a Review. Water Resources Management 30:4467–4481.

## 1.6 Outline of the Report

The outline of this part of the book is as follows. Chapter 2 discusses the extent to which Flood Risk Management Strategies are being diversified – which is assumed to lead to increased flood resilience – as well as drivers for and barriers to such a diversification. Chapter 3 deals with the establishment of bridging processes and mechanisms that facilitate linkages between Flood Risk Management Strategies and help overcome fragmentation as well as the actors involved in flood risk governance and the division of responsibilities between public and private actors, including citizens. Chapter 4 is about observed diversification of rules and regulations relevant for flood risk governance and the challenges related to the development of appropriate rules that are enforceable and enforced. It furthermore discusses the resources needed to make flood risk governance more resilient. In Chap. 5, our evaluation of the resilience, efficiency and legitimacy of flood risk governance is provided. Implications for research, policy and law at the European, national and regional level are discussed in Chap. 6.

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# Chapter 2
# Diversification of Flood Risk Management Strategies – Necessity and Importance

**Dries L. T. Hegger, Peter P. J. Driessen, and Marloes H. N. Bakker**

## 2.1 The Extent to Which Diversification Is Taking Place

As substantiated in the introduction chapter, an argument can be made that diversification of the portfolio of flood risk management strategies (FRMSs) makes countries more flood resilient (Hegger et al. 2014). As a first step towards scrutinising this assumption, it should be assessed whether and to what extent diversification is actually taking place, both in policy discourses and in practice. In all countries, the usefulness of diversification is acknowledged, although the extent to which it is actually being realised differs between countries.

*At the discursive level*, a distinction can be made between England and Sweden on the one hand and the other four countries on the other (Alexander et al. 2016; Ek et al. 2016; Kaufmann et al. 2016a; Larrue et al. 2016; Matczak et al. 2016; Mees et al. 2016). In England and Sweden, each of the five FRMSs are deemed as equally important in FRM, thus there is no overtly dominant strategy at the national scale (albeit this may vary under different local conditions). In the Netherlands and Poland, strategies other than flood defence are seen as back-up strategies used for reducing residual risks. The same is true in Belgium and France, although here prevention and mitigation are sometimes applied instead of defence. In these four countries, there is evidence of discursive dominance of certain strategies: a strong prevention discourse in France, a focus on defence in the Netherlands, on emergency management in Poland (also in practice) and on defence, prevention and mitigation in Belgium. The country-specific preference for a particular portfolio of FRM strategies is a result of the physical and institutional context in these countries. Hence, it is not possible to a priori determine whether one approach is preferable over the other (Hegger et al. 2016; Wiering et al. 2017). Ultimately flood risk governance

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T. Raadgever, D. Hegger (eds.), *Flood Risk Management Strategies and Governance*, https://doi.org/10.1007/978-3-319-67699-9_2

should be deemed appropriate, whereby structures of governance and institutions 'fit' the problem at hand. Rather than imposing notions of good or poor governance, this framework advocates a more context-specific perspective on appropriateness in line with the *logic of appropriateness* described by March and Olsen (2008).

In all countries, except England, on the ground implementation of a diversified set of strategies is lagging behind discourses on diversification. While all countries can be said to be diversified in that all strategies have been implemented at least to some extent, especially in Belgium, France, the Netherlands and Poland, there is a relative dominance of the flood defence strategy. Implementation of strategies other than the dominant one is taking place but at a slow pace.

## 2.2 Drivers for Diversification

In all researched countries, we found drivers for diversification. A distinction can be made between specific actor-, discourse-, rules- and resource-related drivers (Hegger et al. 2014) as well as more general and encompassing drivers (Wiering et al. 2017).

### *2.2.1 Actor-Related Drivers*

**Policy entrepreneurs** at several levels of government were found to play a crucial role in putting water safety issues on political agendas, often by exploiting windows of opportunity formed by catalyst floods that helped to facilitate change. For instance, in England policy entrepreneurs have played an important role in establishing 'best practices' in FRM, at both national and local scales (Alexander et al. 2016). Another example is the specially appointed Delta Commissioner leading the Dutch Delta Programme (although this programme was initiated not as a reaction to floods but in anticipation of increased flood risks). But also at local level, we found that a crucial role was played by these policy entrepreneurs in several municipalities in different countries, e.g. in Dordrecht and Wroclaw. Policy entrepreneurs were generally easy to identify since several interviewees pointed to the important role played by them. Traits that were frequently attributed to them were political sensitivity, networking capabilities, the potential to familiarise themselves with the rationalities used by different actors with different interests, their charismatic leadership and their intrinsically motivated drive to improve flood policies.

**Bottom-up initiatives initiated by local actors**, including local governments and residents. Especially in France, England and the Netherlands, there are examples of such local initiatives. These initiatives hold the promise of exploiting innovative potential in society, ensuring that flood management schemes are tailored to local situations and they can serve as niches, places where learning about innovative flood management options and their implementation is taking place. The rise of bottom-up initiatives can be linked to the devolution of certain responsibilities in FRM, resulting in local actors having more powers to implement different types of

measures. Secondly, with stretched resources and strict funding rules in each country, practitioners need to look to alternative measures to address risk, because defence is not an economically viable option in all locations. Thirdly, there is scope for true 'bottom-up' initiatives i.e. community- or household-led initiatives which are actively encouraged in several countries.

### *2.2.2 Discourse-Related Drivers*

A discursive shift away from a purely technocratic view of FRM due to the fact that **notions of sustainability and resilience** have been actively discussed (Wiering et al. 2017). Examples of rising alternative discourses include safety or risk-based discourses, integrated flood risk management and eco-system based management, climate change and environment or sustainable development. Also, the concept of 'resilience' itself often promotes community involvement in risk strategies, as seen in England. These discourses can lead to an increasing diversification of arrangements (e.g. the traditionally strong role of prevention in France, or the 'making space for water' discourse in the Netherlands and England, and Belgium strengthening prevention). However, such discourses have varying effects: the climate change debate led to increased attention to FRM and mitigation in Sweden, yet has had little visible impact in Poland, and despite minor changes in discourse has largely maintained the defence dominance in the Netherlands (Wiering et al. 2017).

### *2.2.3 Rules-Related Drivers*

**Enforceable rules and regulations**. The Water Assessment in the Flemish region in Belgium was found to be effective in forcing local actors to consider flood **risks** in urban development as it enables water managers to prohibit the granting of building permits and offers the possibility of making these permits subject to specific conditions (e.g. taking mitigating measures) (Mees et al. 2016). However, this instrument can only be truly effective when the conditions that are included in the permit pursuant to the conclusion of the water assessment, are consistently followed up in the field and subsequently enforced. Otherwise, competent authorities have no way of knowing whether this instrument is, in fact, effective. The more rules and regulations leave room for interpretation, the more they seem to enable adaptation, as the rules can be interpreted differently if changes in flood risks necessitate this (Goytia et al. 2016). On the other hand: the more room for interpretation and policy freedom, the more risk that actors keep on the old and well-known track as changes might be more difficult to implement than 'business as usual' and rules that leave more room for interpretation may also be more difficult to enforce. For instance, in the Netherlands, spatial planning authorities always had the power/authority and the legal instruments and a legal duty to take flood risks into account, but they were not willing to use these instruments. The focus always had been on short term profits

that go with urban development. The large amount of policy freedom and flexibility resulted in the neglect of flood risks and the minimal use of prevention and mitigation strategies. This changed when more binding rules were developed (Beleidslijn ruimte voor de rivier).

### *2.2.4 Resource-Related Drivers*

The availability *of* **financial resources** has proven to be a crucial determinant for diversification, but at the same time previous investment decisions may create path dependencies (Van Buuren et al. 2016; Wiering et al. 2017). In the Netherlands, there is a specially established Delta Fund which receives one billion Euros per year in order to finance improvements in water safety and fresh water supply, but it is still uncertain to what extent these finances are invested in stimulation of diversification. The CatNat recovery mechanism in France finances the Barnier fund (i.e. through retaining a percentage of the sums collected) which undertakes measures of risk prevention. The CAT-NAT scheme is financed with insurance premiums paid by citizens. This ensures that recovery is a strong strategy in France, next to defence. At the other extreme, we found that resources in Poland are lacking and that the implementation of FRM strategies in this country is dependent on revenues from European funds like the EU Cohesion Fund.

**Technical improvements** in flood risk management can be seen as an important driver: had there been no improvements in mapping and modelling risks (including improved data and knowledge such as the availability of longer historical records), implementing current spatial planning and insurance systems would be a lot more complicated, even impossible. Beyond FRM, technological progress includes remote sensing, computational power and the availability of modelling tools, amongst other things.

### *2.2.5 Drivers Encompassing Several Dimensions (Actors, Discourses, Rules, Resources) Simultaneously*

An important contextual factor is formed by a **more general shift from 'government' to 'governance',** whereby the state is only one steering actor amongst others (Driessen et al. 2012; Van Rijswick and Havekes 2012). This is reflected in the procedural approach of the Floods Directive (Priest et al. 2016). In the field of FRM, Europeanisation plays a significant role in this process. An important legislative step in the evolution towards enhanced participation has been the UN Aarhus Convention of 1998, which established the right of individuals and their associations to have access to environmental information and participate in environmental decision-making and to access to the courts. Closely related to this, EU directives such as the EIA directive and the WFD oblige member states to involve the public

in FRM decision-making. Particularly in Poland the increase in public participation was strengthened by requirements attached to investments financed by EU funds.

**Floods as trigger events** also contributed to change. In Poland, the 1997 floods were a trigger to increase attention to crisis management in FRM and to reorganise its structure (Matczak et al. 2016). Whereas earlier the main competence lay with the national army, it is now divided between State Fire Brigades and provincial, county and municipal emergency planning services, and has thus become a 'multi-level' responsibility. In England, the 1998 floods were a driver for more diversification by way of improved flood warning systems and the launch in 1999 of national annual flood awareness campaigns by the Environment Agency, which continued for around 10 years until they were complemented with more local awareness-raising activities (Alexander et al. 2016). The floods in 1998 in Flanders and in 2002–03 in Wallonia were also found to be drivers for diversification, and the floods of 2010 led to substantive legislative changes in the Flemish region (Mees et al. 2016). In the Netherlands, the near floods in 1993 and 1995 stimulated a shift towards flood risk mitigation through The Room for the River programme and more natural approaches to flood risks (Kaufmann et al. 2016a). In France, the Xynthia event strengthened the focus on risk on coastal areas, quite forgotten until then (Larrue et al. 2016).

**Europeanisation** in terms of the establishment of a single European market, identity and currency has had a mixed influence on diversification and dominance in FRM. In some countries (e.g. the Netherlands), EU directives like the Floods Directive were implemented along the lines of the existing defence-oriented approach, though with a stimulus to faster implement the risk approach in legislation, and as such did little to challenge the defence dominance. In England overall the Floods Directive can be seen to be only causing minor changes or reinforcements to the existing rules governing flood management. In other countries (e.g. Belgium), EU directives and participation in EU research projects did stimulate increased attention to new approaches to FRM, such as risk-based management and nature-based approaches. Europeanisation can also drive both dominance and diversification within the same country: in Poland, access to EU funds strengthened the focus on defence, but EU directives also introduced or strengthened flood risk mapping and nature-based approaches, in turn reinforcing the position of environmental NGOs. In France it increased the weight of central government power on FRM at local level.

## 2.3 Barriers to Diversification

Regarding barriers to diversification, we found three more general and encompassing barriers:

A **lack of resources** often formed an important reason for a lack of investments in flood risk governance and for a lack of diversification. For instance, Poland, while lacking resources for flood defence, still sees defence as the most desirable strategy. In Belgium, a lack of resources has been found to impede an effective flood preparation.

Various mechanisms, which can be grouped together under the heading of **"sunk costs" and "path-dependency"** form a second barrier. The aforementioned terms refer to the fact that any commitments made to dominant strategies (often flood defence) in the past make a diversification to other strategies less likely and desirable. We see that in all countries the past investments in structural defence infrastructure are described as stabilising forces. Existing urban development in flood-prone areas will also make diversification less likely (e.g. as in the West of the Netherlands). High financial investment in flood infrastructure – with its created flood risk expertise in epistemic communities – leads to increasing returns and 'sunk costs'. This decreases the practical possibilities to implement alternative measures (Poland, France, the Netherlands) and might make further investments in dikes the most cost-efficient solution (the Netherlands). We also found that the incentive to change regulations (rules) tends to be limited due to high transaction costs when changing administrative arrangements and developing new expertise and infrastructure (resources), although the STAR-FLOOD project also identified examples of rules that were changed relatively easily or that in their existing form already allowed for diversification. This points to an increasing need for those actors who have responsibility, power and instruments to actually use these powers and instruments.

Third, while **floods** have been shown to play an important role in putting water safety issues on political agendas, as in Poland and all other countries, in some cases they were also found to have a tendency to **mainly reinforce the dominant logic of flood defence** (safety first). Such reasoning has been found amongst other things in the Netherlands and Poland (Kaufmann et al. 2016a, b). Seen in this way, floods are not necessarily just a driver for diversification, but also for strengthening specific existing strategies. For instance, the 1998 and 2000 floods in England led to significant improvements to emergency management and flood warning.

## 2.4 Lessons for the Necessity of and Possibilities for Diversification[1]

STAR-FLOOD's first starting assumption deals with the question of to what extent having a diversified and aligned set of strategies in place leads to resilience. This question cannot be answered in a straightforward way, but should be approached from at least two perspectives. A first perspective, with which e.g. Liao (2012) would agree, is that diversification of FRM strategies is indeed necessary to achieve resilience. Reliance only on flood defence and – seemingly associated – increasing capacity to resist is undesirable when taking into account current and potential future flood risks in times of urbanisation and climate change. An approach solely reliant on resistance is not sufficiently flexible to easily take these new risks into

[1] The text in this section is largely based on Hegger et al. (2016).

account while at the same time there might be failure of the infrastructure or a flood above design standards. Seen from this perspective, a country like the Netherlands is taking a significant risk because the actual consequences of floods are likely to be dramatic (with a large degree of societal disruption). While part of the risks taken are the result of choices made in the past combined with inescapable physical circumstances, we have also found that e.g. in current planning decisions flood prevention has a relatively low priority compared to other spatial functions. Put in other words, perfect, absolute flood resistance is not possible. A system may withstand load, but not without limits. According to a statistical design concept, defences should withstand a design flood, e.g. 100-year flood, but may fail if the actual flood is much higher. Therefore, at least from the first perspective, a more disaster-conscious society needs to be built. The dominating stance should be to seek safe-fail (safe in failure) in addition to unrealistic fail-safe (safe from failure) solutions, (cf. Kundzewicz and Takeuchi 1999).

From a second perspective, which is a potential criticism on the first perspective, diversification does not (necessarily) guarantee resilience. After all, a retrospective evaluation shows that countries in which all strategies are in place to a large extent and that have a high capacity to absorb and recover and capacity to adapt are not the countries with the lowest casualties and losses, and one could even argue that a resilience approach does not explicitly aim to avoid these. In England, there still seems to be room for improvement in terms of further risk reduction, although this criticism should be viewed in the light of normative viewpoints held in England, in which it has been accepted that some floods may happen while it is intended to resist some other (large) floods. England is more resilient to flooding by having this diversification and flooding has not (yet) caused a complete rethink of flood risk management, which may be indicative that to a great degree the system seems to be working, although it has prompted significant reviews, including the current Government's National Flood Resilience Review.

These observations necessitate us to nuance our starting assumption that diversification leads to more/increased resilience. Diversity of FRMSs in itself is not enough to guarantee societal resilience, indeed each strategy must be effective in its own right. Moreover, the analysis performed by each STAR-FLOOD country demonstrates the importance of effective mechanisms and processes connecting certain FRM strategies, policy domains and actors (Wiering et al. 2017). Therefore, returning to the project's starting assumption, it is clear that diversification of FRMSs is only a partial prerequisite for societal resilience. Another crucial observation is that the diversification of FRMSs is motivated by different factors. In the Netherlands, Poland and to some extent France and Belgium, efforts to develop FRMSs beyond flood defence are partly driven by the desire to create a back-up layer of contingency (or 'fail safes') should defence measures fail. This is not the case in England, where diversification simply characterises the approach to flood risk governance that has been established for ca. 65 years. Diversification of FRMSs in Sweden is primarily motivated by an increased number of actual events, combined with the increased risk for floods that is assumed to accompany climate change. We conclude that diversification of FRMSs does not necessarily guarantee resilience but that it

**Fig. 2.1** STAR-FLOOD team on quay in Antwerp

may contribute to it as being one of the essential preconditions. However, as we have seen, also other factors increase resilience (Fig. 2.1).

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# Chapter 3
# Enhancing Connectivity Between Strategies by Bridging Actors, Levels and Sectors

**Dries L. T. Hegger, Peter P. J. Driessen, and Marloes H. N. Bakker**

## 3.1 The Link Between Fragmentation and Diversification

Diversification of flood risk management strategies that is appropriately institutionalised seems to be desirable, provided that this is done through an integrated or aligned approach. In an extreme case, this could be done by avoiding fragmentation altogether. In such a case, a single actor, being a public or private entity, organisation, department, group or even individual would be solely responsible for all tasks related to flood risk management. In practice, such an extreme example does not exist and it would be unlikely that it would occur in the future. Instead, different **types of fragmentation** can be identified (Gilissen et al. 2015):

- Different actors in different sub flood risk governance arrangements are responsible for different FRM strategies (as in France and Poland).
- Different actors within a sub flood risk governance arrangement are responsible for the same FRM strategy (e.g. different actors for different scale levels, as in England, Belgium and the Netherlands).
- Different actors in different sub flood risk governance arrangements are responsible for the same FRM strategy (e.g. different actors for protection against pluvial and fluvial flooding, as in the Netherlands).
- Different actors within the same sub flood risk governance arrangement are responsible for different FRM strategies (e.g. water managers focusing both on flood defence and flood mitigation, as in Belgium).

In case fragmentation occurs, it is necessary to establish bridging mechanisms: all kinds of interlinkages between actors, aiming to intensify interactions in their

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T. Raadgever, D. Hegger (eds.), *Flood Risk Management Strategies and Governance*, https://doi.org/10.1007/978-3-319-67699-9_3

pursuit of various FRM strategies in order to cope with the difficulties potentially resulting from fragmentation (ibid).

We found differences in the extent to which countries have managed to implement such an integrated and aligned approach and the degree of fragmentation present. In England, Belgium and Sweden, several sub flood risk governance arrangements have been identified that do not vary widely in terms of their power basis. While the English system consists of numerous actors, different resources, discourses and levels of governance, the level of cooperation between actors, the legal instruments or the informal bridging processes push the English case towards a more integrative approach. A similar finding applies for Belgium, although the federal structure of the country was found to lead to complexity and hence fragmentation. In the Netherlands, we found a relatively dominant water system sub-arrangement. Diversification is taking place mainly within this sub-arrangement. Preparation and prevention are being mobilised within this sub-arrangement, but this is less so the case for the recovery strategy. The Dutch multi-hazard oriented safety regions are still operating at a relative distance from the water system sub-arrangement. Especially in France and Poland we found that the actors operating in different sub arrangements are each operating within a relatively narrow scope and bridging mechanisms were found to be lacking or ineffective (Matczak et al. 2016). One of the main examples of fragmentation is that between water management and spatial planning. As will be detailed below, countries differ in the extent to which effective bridging between the two domains is achieved.

We conclude that diversification of FRM strategies may lead to fragmentation and that this in turn may hamper flood resilience and the effectiveness and legitimacy of FRM. In many countries efforts to overcome this fragmentation are underway and bridging processes and mechanisms between actors, sub flood risk governance arrangements and FRM strategies are being developed. This leads us to assume that fragmentation as found in the STAR-FLOOD project may not be seen as permanent but as a stage that several countries have to go through. Coordination of strategies and bridging between them is taking place to an increasing extent. Good practices in overcoming strong fragmentation can be derived from Belgium (Mees et al. 2016a, b). This country's administrative system, with much power going to the level of the regions (Flanders, Walloon and Brussels Capital Region) has resulted in fragmentation but also in the development of many bridging mechanisms, some of which will be discussed in subsequent sub-sections. The English system has also been reported to be extremely fragmented and complex in the distribution of FRM responsibilities, but on the other hand it has been shown to be a highly flexible governance arrangement (Alexander et al. 2016).

## 3.2 The Involvement of Governments, Businesses, NGOs and Citizens in Flood Risk Governance

### *3.2.1 The Role of Governmental Actors in Flood Risk Governance*

Governmental actors at different levels play a role in flood risk governance. A distinction can be made between actors at the international/European level, national level actors, and actors operating at the regional/local level. The six countries researched in the STAR-FLOOD project are engaged in a struggle to achieve a balance between local flexibility and coordination at the national level, with some countries lacking coordination (e.g. Sweden) and others lacking resources at local level to be able to execute the responsibilities attributed to local actors. With some risk of overgeneralisation, it is often local and regional actors that implement FRM measures, while the responsibility for maintaining a strategic overview as well as implementing measures of supra-local importance lies at the national level. At the supra-national level, mostly procedural steering (e.g. EU Floods Directive) and the development of principles and decision-making frameworks (e.g. OECD water governance principles) is taking place.

### *3.2.2 The Role of Businesses in Flood Risk Governance*

To enhance flood resilience, the input of a diverse set of resources and capacities is needed, which are not all available within governmental institutions. Instead, several private actors on a spectrum from fully private companies to quasi commercial actors (e.g. English utility companies which are privatised but heavily regulated) should be involved (e.g. Alexander et al. 2016).

A good practice in terms of moving towards public-private cooperation is the Partnership Funding scheme implemented in England in 2012. Grant-in-Aid (GiA), available through the Department for Food, Environment and Rural Affairs (Defra) and administered by the Environment Agency, must be supported by funding sourced at the local level, via Local Authorities, the private sector or civil society (Defra 2011); thus the costs for the project are distributed across funding partners according to risk sharing arrangements and defined in a legally-binding contract. This approach means new types of actors, with a financial stake in FRM, can enter into the governance arrangements at the project scale. In those countries where a private insurance mechanism is applicable to support ex-post compensation following floods, a good balance between public rules and private implementation is crucial, and cooperation between the public and private actors is thus indispensable. For example, the legislator/public authorities have an important role to play in setting forth regulations and instruments with the goal of promoting, incentivising or enforcing the uptake of preventative measures or, for example, adaptive building measures by citizens.

### 3.2.3 The Role of Community Groups, NGOs and Citizens in Flood Risk Governance

Importantly, citizens and NGOs are not always aware of flood risks, their action perspectives in dealing with them and their legal position. For instance, they are legally entitled to flood protection in dike-protected areas in the Netherlands, but not in countries like Belgium and England (Kaufmann et al. 2016; Mees et al. 2016a, b; Alexander et al. 2016). We see some room for improvement in how flood managers and politicians could communicate flood risks and action perspectives to private actors. We see it as a challenge for flood managers to communicate risks and provide or suggest the options for dealing with them. This includes addressing the question of whether to focus on probability reduction or reduction of consequences as well as considerations regarding how costs and benefits should be divided, in more accessible language. The increasing availability of flood maps, serious games and other (spatial) information systems should facilitate this enhanced risk communication. On the other hand, we also found that citizens sometimes showed limited interest in flood issues, even in cases of large flood risk.

Citizens are, however, crucial actors in flood risk management. In their capacity of residents they can take actions in and around their own homes, e.g. decreasing the amount of hardened surface, and flood proofing their houses. Furthermore, citizens have a right to know the flood risks in their areas (e.g. Floods Directive) and from a democratic legitimacy perspective they should have a say in what is seen as acceptable levels of risks. Moreover, they should be able to protect their interests, e.g. by going to court in case they want to challenge governmental or private actors that negatively affect the flood safety of their property or alternatively, if they are disadvantaged by flood protection measures. For instance, if a decision has been made that some residents would need to evacuate in case of a flood rather than being protected by defence measures, it should be possible to challenge such a decision before a court. Vice versa, the possibility should be offered to go to court to challenge the decision to realise flood protection measures.

In practice, in all countries, we found that authorities at different levels are struggling with how best to engage the public in flood risk management. First of all, albeit to different extents, there is a lack of flood risk awareness in several countries, most notably in the Netherlands, Belgium and Sweden (Kaufmann et al. 2016; Mees et al. 2016a, b; Ek et al. 2016). In these countries, citizens were found to lack concrete knowledge on the potential consequences of flooding for their property, the probability of this occurring and the available options should a flood occur. Flood awareness is more present in France, England and especially Poland, countries that have relatively frequent flood events. Communicating flood risks to citizens is made difficult by the highly technical language of flood managers (e.g. scientific calculation of return periods or recurrence intervals), which is poorly understood by the public or poorly communicated (Klijn et al. 2008). Moreover, in some of the researched countries there is an institutional culture of only consulting/transferring knowledge to the public, as opposed to more two-way communication/participation techniques now encouraged.

Nevertheless, policy makers should consider critically whether flood awareness campaigns are the best investment to enhance citizens' capabilities to prepare for floods. Research shows that the main explanatory factor for appropriate flood risk behaviour is experience with flooding and closeness to water (Matczak et al. 2016; Wiering et al. 2017). In countries/regions where floods do not regularly occur, there may come a tendency to wonder whether it pays off at all to invest in trying to raise the public's awareness. Would it not be better instead to develop the crisis coordination strategy in such a way that, during a flood, it can be immediately communicated to residents what they should do? However, because of EU and domestic regulations, such investments are necessary and inescapable from the perspective of having access to information and having the right to know about flood risks. Besides that, risk communication during a crisis will be vastly facilitated by pre-event knowledge and awareness. During a crisis so many developments are taking place that it would be difficult to delay such essential things as risk communication, where people are difficult to reach, and who may react irrationally/differently than expected. If nothing else, highly exposed and socially vulnerable groups should be identified (elderly, single-parents, migrants, deprived households etc.) and receive (extra and tailored) risk communication.

In all countries, FRM practitioners interacting with the public reported a tendency of citizens to attribute much responsibility for dealing with floods to governmental actors combined with a preference for engineered flood defence solutions. This was found to a larger extent in the Netherlands, Belgium and Poland than, for instance, in England and France (Alexander et al. 2016; Ek et al. 2016; Kaufmann et al. 2016; Matczak et al. 2016; Mees et al. 2016a, b; Larrue et al. 2016). But strikingly, in France, Belgium and England this attitude runs counter to citizens' legal position when it comes to floods. Whereas in the Netherlands citizens living in dike protected areas have legal rights to flood protection through the Constitution and safety norms established in the Water Act, in France, Belgium and England there is no explicit constitutional legal right to flood protection and powers of flood authorities are permissive in nature. In most countries, these authorities base their decisions regarding acceptable levels of risks on cost-benefit analyses.

The lack of public engagement in the prevention and mitigation of flood damage appears to be a barrier to improving flood resilience. But the pursuit of a more balanced distribution of public-private responsibilities is hindered by the current attitudes among some citizens who consider FRM to be a governmental, rather than an individual, responsibility. In order to make a responsibility shift possible, it is recommendable to make it the result of an open public debate. In the field some positive experiences have been reported at the local level where residents have been included from the beginning of the decision-making process, in which it was discussed which measures against flooding should be taken by whom, thereby providing clarity about the distribution of responsibilities. Examples of this approach can be found in England, with the establishment of Community Flood Emergency Plans. Such a comprehensive co-production of flood-relevant policies by citizens and authorities may help to counteract the tendency to involve citizens only in phases where the main policy measures are already decided by policy makers, and

citizens are only approached as purely executing actors (Mees et al. 2016a). Involvement in earlier phases can increase complexity but can improve the legitimacy of the whole process. The question can be raised if such a citizen-inclusive approach to flood management would also be worthwhile to pursue when discussing issues such as the level of safety for which a country aims, the concept of appropriate protection within the Floods Directive and the question of whether protection by defence should be replaced by spatial measures or evacuation.

Another example of improving citizen involvement in FRM is the increased use of technology, for instance through smartphone apps, alerts, websites and flood maps (Alexander et al. 2016). However, these information platforms leave out certain highly vulnerable groups because they demand a pro-active choice by citizens to search for information. The elderly might not have access or consider searching for this information, single parents might not have time, immigrants/expats might not understand the information if it is only available in the country-specific language, and deprived households might not have smartphones or connections to have constant access to these apps. Mechanisms to foster community engagement are underway. Amongst other countries, in the UK there was found to be an increased focus on self-reliance e.g. through flood action groups. The Environment Agency and Local Authorities are now actively encouraging the formation of such community groups in areas of known flood risk and work with the National Flood Forum to assist and advise groups in their formation and continued functioning. Another good practice in involving the public in flood management is the Flemish duty to inform, implying that sellers of properties have to actively inform potential buyers of flood risks on their property. This information dissemination with regard to the flood-prone character of the location of the building should be undertaken widely, i.e. in all internet publicity, and brochures. This instrument could also be implemented in other countries as well without the necessity to overhaul the existing institutional and legal settings in these countries. It does not require substantial resources for implementation, and promotes risk awareness with citizens in an effective manner.

### *3.2.4 Towards Multi-actor Co-production*

As the previous sections have shown, public-private cooperation in flood risk management should be seen as 'multi-actor co-production' in the sense of further developed forms of participation, public private partnerships and self-realisation. This interpretation seems more productive than the, much more narrow, interpretation of 'letting market parties/companies do more in flood risk governance'. Co-production is most outspoken in discourse and practice in England, and is emergent in France and Flanders (Alexander et al. 2016; Larrue et al. 2016; Mees et al. 2016a, b). By contrast, FRM in the Netherlands and Poland remains almost exclusively reliant on governmental protection measures. Further diversification of FRM strategies as discussed in this report makes it increasingly unlikely that a limited number of governmental actors can oversee and implement complete portfolios of FRM strategies, hence co-production becomes a necessity. Co-production can be seen as a form of

bridging between actors and strategies in the sense that governmental actors adopt rules as coordinators and facilitators of FRM strategies and measures rather than that of implementers.

## 3.3 Bridging Between Administrative Levels: Reconciling the Need for Local Flexibility and Coordination

We found that in all STAR-FLOOD countries it turned out to be challenging to balance the need for local flexibility and coordination. Too much top-down steering may hamper the possibilities for implementing tailor-made solutions, while too little coordination may hamper learning between regions and also hamper efforts to tackle up-stream/down-stream issues. Some countries seem to be doing a better job in striking a balance. In Sweden, dealing with flood risk is predominantly a local issue (Ek et al. 2016). Sweden knows strong municipal self-governance. This is to some extent to be evaluated as positive, since it allows for flexible and tailor-made approaches, but through a lack of coordination at the national level, there is the risk of several municipalities "reinventing the wheel". Also, counter-intuitively, in France there was found to be much room for local initiatives through inter-municipal cooperation and in particular through local flood action plans (PAPIs) (Larrue et al. 2016) (Fig. 3.1).

Some examples of more balanced multi-level governance (MLG) processes were also found. Dutch policy programmes such as the recently finalised 'Room for the River' programme, a national policy programme consisting of 30 projects to increase space for water along several major watercourses in the Netherlands and

**Fig. 3.1** STAR-FLOOD session at the knowledge conference of the Dutch Delta Programme, Wageningen, 23 April 2013

the Delta Programme, a strategic programme to develop a long-term perspective on ensuring flood protection and fresh water availability, can be characterised as cooperation between governmental actors at several levels. While this cooperation was not without struggles, the dominant message from studies of these programmes is a positive one (Van Buuren et al. 2014). Also in Belgium and England we see mechanisms that enable MLG to take place. In England it is the Environment Agency that maintains a strategic overview of FRM for all types of flooding, while Lead Local Flood Authorities and Internal Drainage Boards amongst other actors have responsibilities for local-scale FRM. In Belgium, the role of spatial planning and environmental departments within municipalities is becoming increasingly important (Mees et al. 2016a, b). Coordination of and inspiration to their actions is provided at the level of the regions, in Flanders by the Flemish Environment Agency (VMM), in Wallonia via the river contracts, which operate at sub-basin scale. In Poland, a dominant role is played by governmental actors at the regional and national level, to some extent hampering local flexibility.

These struggles between levels of government are taking place against the background of a broader tendency towards decentralisation. We found that this decentralisation de facto often leads to shifting the financial and executive burden from national to local governments, while the national governments keep holding the strings. Instead, FRM needs a good combination of top-down and bottom-up working. On the one hand, at a high level, strategic discussions should be held on, for example, the risks that we as a society are willing to accept, the division of responsibilities in dealing with these risks, etc. On the other hand, more room should be created for bottom-up work: local stakeholders (preferably at hydrological level) draft flood risk plans together, based on their objectives and are hereby supported with funding and expertise from the higher governments (national and EU-level). The river contracts in Wallonia and France could serve here as a good example.

## 3.4 Bridging Between Flood Risk Management Strategies

### *3.4.1 A Bridging Role for Spatial Planning: Strengthening Flood Prevention and Flood Mitigation*

Spatial planning is supposed to be holistic and hence integration of flood risk considerations in spatial planning would in principle be conducive to addressing flood risks, in particular by strengthening the strategies of flood prevention and flood mitigation. Spatial planning's task is to organise spatial demands of a society; it needs to promote spaces for economic development, space for housing, for nature etc. Often, the various priorities present come into conflict with FRM. If and how flood risk considerations are taken into account is a matter of priority and requires balancing with all other spatial claims. Such integration of flood issues in spatial planning exists on paper – although more for new building areas (e.g. through the sequential and exception test in England) than for existing areas – but in practice it is not

always effective. In all STAR-FLOOD countries we found examples where FRM comes into conflict with other priorities, such as economic development and housing supply. This needs not to be a problem as long as those with a stake in the prioritisation were adequately represented in a well-informed political debate about acceptable levels of risk. However, this is not always the case, implying that flood risks receive insufficient priority. Regulations exist, but they are not always addressing this specific point or the regulations need further development. In general, besides sometimes a lack of powers to enforce we find a lack of enforcement in the sense that existing regulations are not used in accordance with their full potential, for instance in cases in which spatial planners in principle have the power to regulate development, constrain it or put requirements to it from a floods perspective.

We found some good practices, e.g. the Water Assessment and Signal Areas in Belgium (Mees et al. 2016a, b). The Water Assessment has been subject to a substantial reform following an initial negative evaluation after the floods of 2010, which has significantly improved the application of the instrument. Attention is thus paid to the effectiveness of the existing instruments. Enforceability by public and private parties of the instruments is a crucial element in ensuring actual implementation. Also in France, strong policies exist that may prohibit urban development in at risk areas and are actually enforced (e.g. PPRI). As opposed to that, in the Netherlands spatial planning has been found to be too flexible when it comes to addressing flood risks (Kaufmann et al. 2016). While flexible rules in principle allow for adaptive policies, in the Netherlands they have been found to be hampering a consideration of flood risks in spatial planning, as there is still a dominant discourse amongst planners that flood managers should have a serving role to planning and should enable spatial development (OECD 2014; Van Rijswick and Havekes 2012; Wiering and Immink 2006).

Besides limited prioritisation, another factor hampering the consideration of flood risks in spatial planning is the lack of exchange of practical knowledge, although this is improving in several countries, a lack of insights in costs and insufficient development of building requirements for flood proof building.

To conclude on this point, we argue that while it would probably be unrealistic to ban development on the floodplain altogether as so much development has already occurred, there is a need to invest in adaptive development and retrofitting existing urban areas at risk of flooding to enhance adaptive capacity (e.g. with Sustainable Urban Drainage Systems).

### *3.4.2 The Role of Spatial Planning in Emergency Management: Bridging Between Defence, Prevention and Preparation*

Flood preparation is present in all researched countries. In all countries, a distinction can be made between at least two activities: flood forecasting and emergency management. The former is strongly linked to meteorological services, as is the case

in England where the Environment Agency and the MET Office have formed a partnership called the Flood Forecasting Centre. On the other hand, emergency management in all countries is embedded in institutions related to more general crisis management (e.g. Safety Regions in the Netherlands; Local Resilience Forums made up of category 1 and 2 responders in England; the national Contingency agency in Sweden and similar organisations in France, Belgium and Poland). Flood emergency management is embedded within a multi-hazard approach in which similar organisations deal with multiple types of (natural or man-made) hazards. This can in itself be evaluated as positive, since despite the specifics of flood hazards vis-à-vis other hazards, the same types of responses (informing the community, evacuation, providing shelters) are often required.

On the other hand, there is also a need to strengthen the linkages between emergency management and other flood-relevant policy domains. For instance, spatial planning is needed to ensure that the spatial conditions for emergency management are available, including evacuation routes on higher grounds and shelters. The extent to which this is taken into account has been reported to vary between countries. We also found that in some cases (e.g. in the Netherlands) contingency agencies seem to give relatively low priority to floods vis-à-vis other issues of external safety. Another issue, to be discussed in more detail in the next chapter, is the need to stimulate appropriate behaviour of citizens, which in several countries, especially in Belgium, the Netherlands and Sweden, was found to be relatively low.

### *3.4.3 Bridging Between FRM and the Insurance Sector: The Link Between Prevention and Recovery*

Incentives can be created through the insurance/compensation sector to ensure that after floods societies do not simply 'return to normal' but that they learn and adapt to minimise future damages. In principle, there is much potential within the recovery strategy for promoting preventive action, for example in terms of discouraging citizens from living in high-risk areas, and taking mitigation measures, such as adaptive building efforts. We found that there is still much room for improving existing legal frameworks so that these enable a better linking of recovery, prevention and flood mitigation. Possibilities are to promote resilient reinstatement of flood-affected areas through recovery mechanisms and the removal of legal barriers preventing the establishment of link-inducing measures (Suykens et al. 2016).

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# Chapter 4
# Rules and Resources for Flood Risk Governance

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## 4.1 Flood Risk Governance Rules

### *4.1.1 The Implementation of New Rules and Regulations at the National and Regional Level*

Diversification of FRM strategies goes along with a diversification of rules and regulations related to flood risk governance. On the one hand, diversification makes various existing rules and regulations related to flood-relevant policy domains other than water management relevant for flood risk governance. This holds, for instance, for spatial planning acts and regulations, or regulations related to contingency agencies in the researched countries. On the other hand, efforts at diversification have resulted in the implementation of new, specific rules and regulations and related policy programmes. Examples include the multi-layered safety approach as laid down in the Dutch Delta Programme; various spatial planning regulations such as the Water Assessments in Belgium and the Netherlands; specific plans for comprehensive flood protection measures (Hoogwaterbeschermingsprogramme in the Netherlands; Sigma Plan in Belgium); and flood risk prevention plans (PPRIs) in France (Kaufmann et al. 2016; Mees et al. 2016; Larrue et al. 2016).

When it comes to the implementation of new rules and regulations at the national and regional level, the following recurring points for improvement were identified, some valid for only some countries, others for several countries:

- There is often a lack of enforceability of rules that stimulate risk prevention through pro-active spatial planning, or it is difficult to apply the correct rules.

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T. Raadgever, D. Hegger (eds.), *Flood Risk Management Strategies and Governance*, https://doi.org/10.1007/978-3-319-67699-9_4

- In all countries there is a need to build in flexibility in existing rules and procedures, so that competent authorities can adapt to changing circumstances.
- A financing system for FRM measures should be developed in line with the normative principles for who is responsible. For instance, for the Netherlands the OECD suggested that spatial developers in flood prone areas (or the authorities that agreed with these developments), should pay for flood risk management (OECD 2014a).
- Setting up transparent decision-making processes for flow improvement and (upstream) water retention, involving affected stakeholders both in earlier and later planning stages.
- Finding areas suitable for retention is not only a technocratic exercise but requires also participatory decision-making processes.
- In several countries there is the need to adjust building codes to overcome the legal impossibility for municipalities to enforce most of the structural measures as many of them go beyond national building codes. This could be done by attribution of relevant powers to the local level, or by delegation based on existing acts.
- Responsibilities should be clarified and formalised (e.g. in a national disaster law): who is responsible for prevention, defence, mitigation, preparedness, emergency response and recovery?

### *4.1.2 The EU Floods Directive (Directive 2007/60/EC)*

The Floods Directive (FD) provides procedural rules which EU Member States have to comply with, including the designation of areas of potential significant flood risk (first completed in 2011), the production of flood hazard and flood risk maps (first completed in 2013) and the production of flood risk management plans (FRMPs, first completed in 2015). It is difficult in many countries to determine what changes have been caused by the Floods Directive and what changes would have occurred anyway. Nevertheless, we have indications that the Floods Directive is providing several positive contributions towards improving flood risk governance, amongst other things through its emphasis on the fact that floods cannot be avoided, although perhaps with the downside that the FD does not oblige or encourage Member States to avoid floods where this could be possible. Especially in new EU Member States such as Poland but also in Sweden, the Floods Directive was found to have had an important agenda setting function in terms of discussing measures belonging to several Flood Risk Management Strategies and stimulating a shift to preventive strategies rather than only reactive strategies such as recovery and defence. The FD has also been shown to legitimise flood management actions by flood managers and the designation of resources for it (Hegger et al. 2014; Wiering et al. 2017). Flood maps and flood risk management plans in several countries have been shown to encourage so-called spatial water governance in which spatial planning is organised in a more water-conscious way (Hartmann and Driessen 2013) at the sub-basin scale. Besides that, the process of implementing the FD has fuelled knowledge

exchange between countries, e.g. in the framework of the Working Group on Floods of the Common Implementation Strategy of the Water Framework Directive. For example, a workshop of this group co-organised by STAR-FLOOD has facilitated discussion on the types of objectives and measures and their prioritisation, enabling countries to learn from those MSs that have progressed furthest (Hegger et al. 2014). Possibly, the fact that the FD is a Directive, thus binding for the Member States, and not merely a strategy has enhanced its impact since now it has the status of a legal instrument instead of a communication or guideline.

On the other hand, we found that France and especially the Netherlands have chosen to implement the FD in what in the Netherlands was literally termed "a sober and expedient way" (Hegger et al. 2014) in order to avoid administrative burdens. This may be explained by the fact that for these two countries the FD was a formalisation of an approach that was already emerging or implemented. It should also be noted that these two countries were the initiators of the FD, already had the policies they would like to see encouraged in place and – lying downstream of several major European rivers – mainly pushed for the FD to further encourage transboundary cooperation and action taking by upstream countries. There is also some anecdotal evidence (Hegger et al. 2014) that Member States may be reluctant to put overly ambitious objectives in their FRMPs in order not to be held accountable for them. This increasingly procedural approach may hamper the access to justice of citizens, as they might not be able to easily challenge the contents of the Plans before the relevant courts in the absence of substantive, binding measures included therein. Strikingly, while the FD explicitly addresses the issue of environmental damage and pollution caused by floods, this was rarely an issue in the countries researched in STAR-FLOOD.

Based on STAR-FLOOD's findings, we conclude that in general the FD's focus on procedural requirements is appropriate in the sense of what seems to be feasible given the large diversity between countries in terms of their physical circumstances, historical pathways in dealing with flood risks and normative principles held. Nevertheless, it must be stated that this focus weakens the legal strength of the FD, since a procedural approach limits the possibilities to hold authorities accountable for ambitious goals in terms of reducing flood risks and does not enable EU citizens to realise flood risk management measures. Furthermore, in specific situations, there is a need for more substantive requirements also to act in accordance with the subsidiarity principle.

Although STAR-FLOOD's findings can be interpreted as an endorsement of the overall logic and scope of the FD, the research has identified several possibilities for improvement, to be possibly taken up in the next implementation round (until 2021). First, procedural requirements should be refined and some substantive requirements could be added, so that they force Member States to adopt principles of good flood risk governance. Such principles include issues such as the ones laid down in OECD's water governance principles: a clear allocation of roles and responsibilities; achieving governance at different appropriate scales; effective cross sectoral coordination; securing hard and soft capacities; ensuring that policy relevant data and information are available; considering the governance financing nexus; having sound regulatory frameworks in place; stimulating the potential to innovate; improv-

ing integrity and transparency for greater accountability; engaging all stakeholders and allow for balanced distribution of resource among them; managing trade-offs between users, places and generations; and assessing governance processes and outcomes in order to learn, adjust and improve (OECD 2014a, b). For instance, a substantive requirement regarding the content of Flood Risk Management Plans could be added to explicitly address the issue of responsibilities of actors. Also bridging mechanisms could to some extent be included in the FD, for instance the duty of property sellers to inform potential buyers of flood risks as is currently present in England and the Flemish Region as well as in France. Second, it would be worthwhile to critically re-evaluate the content of the FD for enforceability by citizens and to make clear what they can ask for in the courts. The FD's role could be strengthened if citizens could go to court or otherwise enforce decisions by authorities to assign an area as facing potentially significant flood risk (this has now been decided mostly in a top-down fashion) or to enforce the inclusion of specific objectives and measures in Flood Risk Management Plans. Third, it was found (Larrue et al. 2016) that time pressures arising from the need to swiftly finalise flood risk management plans restricted the room for manoeuvre of local initiatives, suggesting that a too stringent enforcement of formal obligations of MSs may be counter-productive. In International River Basin Districts, the FD could go further in setting forth cooperation requirements between states sharing these Districts and to provide clarity on important concepts in the Directive (Priest et al. 2016; Suykens 2015). This could also be done by way of preliminary questions to the court of justice. In shared river basins, the fully fledged procedural approach whereby Member States have full discretionary powers and no substantive cooperation requirements to implement FRM strategies and measures would not be justified, since measures promulgated in one country could have visible effects in other countries in the same river basin. The directive could require an overarching FRMP in transboundary situations be undertaken which would include joint key definitions of the key elements (e.g. a significant increase in risk) and ensuring that they are agreed within these transboundary situations). Cooperation requirements should at least include obligations to: exchange knowledge regarding important data such as projected discharge levels of river basins; and inform downstream countries of planned FRM measures and assessing the potential for negative impacts downstream. Other, more far-reaching requirements would be to include the obligation to consider FRM measures at the level of a whole river catchment or to set-up a joint knowledge infrastructure.

### *4.1.3 Subsidiarity, Responsibilities and Coordination*

According to the subsidiarity principle, devolution of decision making to the lowest appropriate scale, with collaboration and coordination at the highest level necessary should be strived for. This principle is widely endorsed, not only at the level of the EU but also at the national level in many European countries. The principle is essentially a political choice based on knowledge that multi-level governance works

better to create legitimacy and resilience. But this goes with fragmentation and the fragmentation should be addressed in a way that it doesn't hamper effective or legitimate flood risk management. The findings presented in the previous sections should be read in this light. For instance, while the FD is a useful instrument for triggering change, Member States have to decide themselves what to do and how to do this. The force of the directive can be used to enforce more basin cooperation (even though there are political trade-offs). Since countries differ in terms of the formal division of responsibilities and the protection levels offered, a discussion about who is responsible for what is recommended, at the national level as well as at the EU level (Fig. 4.1).

**Fig. 4.1** Water level measurement in Dordrecht, the Netherlands

## 4.2 Flood Risk Governance Resources

### *4.2.1 The Financial Resource Base in the Six STAR-FLOOD Countries*

All STAR-FLOOD consortium countries show a wide diversity in terms of the sources of the finances available for different FRM strategies. In all countries, different funding schemes can be identified for different strategies. Flood defences are more often paid for through public schemes, while countries differ, amongst other things, in terms of the sources for their recovery schemes. With some risk of oversimplification, we can say that France and the Netherlands show a general tendency to finance FRM through public funding schemes. In England, even though there is the Partnership Funding approach which aims to encourage private investment, approximately 70% of schemes are still funded through public money. Thus, England has diversified its sources of money but it is still largely publicly funded. Belgium and Sweden can be ranked in between the positions of France/the Netherlands and England. Poland relies much on European funds and, de facto, also on the individual actions of citizens who have to recover from floods (Alexander et al. 2016; Ek et al. 2016; Kaufmann et al. 2016; Larrue et al. 2016; Matczak et al. 2016; Mees et al. 2016).

In the Netherlands, there is a strong publicly funded resource base for flood defence as well as long term funding for measures needed to adapt to climate change, available through the Delta fund. In France, there is a strong recovery system (the so-called CAT-NAT system which is both public and private). England has recent experience with partnership funding schemes, but these are not yet functioning optimally. Poland has a significant lack of resources, while in Sweden there are limited dedicated resources for FRM, which is – mostly – pursued instead through measures that have been established for other public goals (e.g. hydropower dams). In Belgium, resources are well-developed in most strategies) but lacking in the preparation strategy.

While the logic behind the FD has been to foster transboundary cooperation and knowledge exchange related to floods, other European policies' logic is to respond to major natural disasters and express European solidarity in disaster-stricken regions within Europe. This was, for instance, the reason for creating the European Solidarity Fund in 2002 (Regulation (EU) 661/2014).

We can conclude that, although various funding mechanisms are in place, in some cases there is still under-investment in particular strategies. At the same time, debate is needed on how scarce financial resources are mobilised. An important policy issue for the coming years will be to have political debate and make political choices in order to combine the (perceived and sometimes already legally settled) 'right to be protected' of citizens with the decreasing resource base many public authorities are facing and make decisions that societal actors find legitimate. Resources may also play a key role in bridging, for instance by ensuring that actors

involved have the necessary skills, and that private actors receive sufficient payment to increase their willingness to let their land function as flood storage.

### *4.2.2 Knowledge, Skills and Attitudes as Crucial Resources*

Knowledge and the ability to learn is to be seen as a crucial resource. Continuous improvement through R&D Programmes and knowledge infrastructure has been shown to be important. In terms of these knowledge infrastructures, the Netherlands has been shown to be a frontrunner, amongst other things through the sustained presence of strong water-related knowledge institutes, the setting up of the Delta Programme (a national policy programme focusing on long-term strategies for dealing with floods and fresh water supply) and the presence of dedicated temporary research programmes (e.g. Knowledge for Climate; Water & Climate; Topsector Water) (Kaufmann et al. 2016). Within such programmes, we see the development of new knowledge, exchange of existing knowledge and joint knowledge production in regional projects (Hegger and Dieperink 2015). England also has extensive knowledge infrastructure, e.g. Defra/EA research & Development programme. The R&D Programme provides the Flood and Coastal Risk Management (FCRM) evidence for policy and operational needs, across the Environment Agency, Defra, Welsh Government, Natural Resources Wales, Lead Local Flood Authorities, Internal Drainage Boards and other operating authorities. The programme develops and synthesises scientific best practice emerging from academia and operational practice both in the UK, Europe and Internationally. This is steered by four Theme Advisory Groups (TAGs), which help identify and prioritise research needs. TAGs comprise up to 20 advisors from across the FCRM stakeholder community, blending topic experts and sector representatives. e.g. Living with Environmental Change (LWEC) – established in 2007 as an innovative partnership of 22 public-sector organisations that fund, carry out and use environmental research, evidence and innovation. Its aim was to provide decision-makers in government, business and society with the knowledge, foresight and tools to mitigate, adapt to and benefit from environmental change (http://fcerm.net/about). In France, every 2 years a meeting grouping all French actors related to floods is organized by the Ministry of the Environment (Assises nationales des risques naturels). This allows for exchanges of experiences between these actors. Also at national level de CMI Mixt Committee devoted to floods also constitutes a space for exchange of experiences. EU research funding could further stimulate the development of knowledge infrastructures, which can be said to be in need of further development in several countries. Another resource which played a key role in England is the use of formal evaluations of flood policies by leading experts (Alexander et al. 2016). An important point of attention is that investments in knowledge development could easily lead to or reinforce path dependency by strengthening epistemic communities related to specific strategies (Wiering et al. 2017).

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# Chapter 5
# Evaluations of Flood Risk Governance in Terms of Resilience, Efficiency and Legitimacy

**Dries L. T. Hegger, Peter P. J. Driessen, and Marloes H. N. Bakker**

## 5.1 Evaluations of Resilience[1]

In STAR-FLOOD, the notion of flood resilience was disentangled into three capacities as criteria for determining the degree of flood resilience, being the capacity to resist, the capacity to absorb and recover and the capacity to adapt. Regarding the first criterion, *capacity to resist*, differences were found between the six countries. The Netherlands, Belgium and France can be characterized by a dominant focus on defences, which functioning can be said to be effective in the sense that they generally live up to the standards set for them (Kaufmann et al. 2016; Larrue et al. 2016; Mees et al. 2016). A same dominance is present in Poland, but here effectiveness of flood defences is lacking, as the floods of 1997 and 2010 showed (Matczak et al. 2016). In Sweden and England, there can be said to be a more holistic approach to FRM in which resistance measures are considered vis-à-vis other types of measures (Alexander et al. 2016; Ek et al. 2016a, b). Measures to store water, both through upstream retention and urban drainage, are being implemented in the Netherlands, France and especially in England and Belgium. In Belgium an increase in the amount of hardened surface is being counterbalanced, while such development is barely counterbalanced in Poland. Although defence was found to be dominant and effective both in the Netherlands and France, they face some or even significant lack of maintenance respectively. This issue is relevant also for other countries, including England. Similarly, Sweden can be said to be dealing flexibly with flood risks with some examples of flood defence infrastructures in some municipalities while temporary small-scale defences are used in many situations. Sweden differs from

[1] This text is based on Hegger et al. (2016).

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T. Raadgever, D. Hegger (eds.), *Flood Risk Management Strategies and Governance*, https://doi.org/10.1007/978-3-319-67699-9_5

the other evaluated countries in that flood risks are relatively low, so the need to build resistance through flood defences is very local by nature.

The six countries also vary in terms of their *capacity to absorb and recover*. The Netherlands and Poland rely significantly on the defence strategy, thus resistance is the main focus. In the Netherlands, development of mitigation (which is also a resistance capacity) and preparation measures backs up the dominant defence strategy. These measures are receiving increasing but still limited attention in the Delta Programme, a national programme on flood management and fresh water supply, through the Multi-Layered Safety approach which explicitly aims to diversify flood risk management strategies. England has a sophisticated flood warning and crisis management system. Poland has made significant improvement in terms of this flood preparation, while this strategy can be said to still need further development in the Netherlands, Belgium and France.

The *capacity to recover* requires resources to be applied after a disturbance. It comprises financial resources as well as material ones and institutional ability. The main systems are public disaster funds and insurance systems, or hybrid mechanisms. Such systems are in place in all countries, although they are governed in different ways (e.g. through public or private mechanisms). In terms of available resources in relation to flood risks, France seems to do well, while Poland seems to be at risk. In Belgium, ex-post compensation procedures improved with the inclusion of flood events in fire policies.

Flood risk governance in the investigated countries finally differs in its *capacity to adapt*. In all countries we witness some changes in recent decades, indicating that all are adaptive to some extent. All countries have stronger and weaker points in relation to their adaptive capacity. England seems to have most strengths compared to the other countries, with relatively well-developed flood awareness of citizens and a strong learning culture. Hence, adaptive capacity in England can be said to be high. This, by the way, does not mean that flood risks are reduced, damage is diminished or that citizens feel protected but rather that they are used to floods and used to deal with the damage. Other countries show a more mixed view in terms of their strengths and weaknesses and hence their adaptive capacity can be said to be moderate. Belgium, France, Sweden and especially the Netherlands report a relatively low flood awareness of citizens, an important aspect of adaptive capacity, while flood awareness in Poland, due to catastrophic floods in 1997 and 2010, is high. Established systems for learning are in place in the Netherlands, France and Belgium. Other aspects of adaptive capacity found in the research include: (i) the presence of systems for risk analysis: in Sweden and the Netherlands, established systems for risk analysis are in place, in the Netherlands focusing on the maintenance of flood defences, in Sweden focusing on multiple risks, including floods; (ii) the ability of civil servants to react flexibly to changes in the legal system and in political constellations. This was found in Belgium and Poland.

We found that none of the researched countries can be regarded as resilience champions in that a very high degree of resilience was found for all three capacities. Instead, we see that the Netherlands have a very high ‘capacity to resist’, Belgium and France a very high ‘capacity to absorb and recover’, while England is especially

strong on capacity to adapt. Poland and Sweden's achievements are lower, scores in Poland from low to medium-high, and in Sweden from medium to high, in individual categories. In Poland significant progress has been made in capacity to adapt by establishing the crisis management system. With some risk of over-simplification, it seems that the implementation of a more diverse portfolio of strategies contributes to a higher capacity to absorb and to adapt, obviously provided that the strategies have been implemented effectively and have been aligned.

In terms of policy implications, we argue that a thorough and broad analysis of the flood risks and potential measures against them is necessary in different countries. Every strategy needs to be considered in such an analysis. In the end, the country needs to be able to resist, absorb and recover from flooding. However, a full suite of strategies can only ensure resilience if each strategy is implemented effectively. Diversification should not lead to an underinvestment in all strategies. Furthermore, it is crucial that lock-in effects are avoided as much as possible, so that different strategies could be applied in the future, e.g. by not building a flood retention zone now but making sure it remains unbuilt so it can be developed as one in the future.

## 5.2 Evaluation of Efficiency[2]

In the analyses performed within the STAR-FLOOD project, we have focused on whether there is empirical evidence indicating that efficiency is an important issue in flood risk management in each country; whether concerns for resource efficiency are widely applied within the flood risk governance arrangement and/or taken into account in decision-making. In general, a regular practice of analysing the societal costs and benefits has been interpreted as an enhancing factor for resource efficiency.

The frequency at which cost benefit analyses are used differs across the analysed countries: while there are well-established practices in England, and analyses are becoming increasingly common in all countries (e.g. the Netherlands, Sweden and parts of Belgium (Flanders)), such analyses still seem to be less frequently applied in France. In Poland, although standard cost-benefit analysis procedures are applied to particular projects, funding spent for flood risk governance is fragmented and the vested interests of administration and business groups play an important role in resource allocation. This makes an analysis of resource efficiency in Poland difficult.

In the researched countries, decisions to invest in permanent defence structures are generally preceded by an assessment of the expected benefits and costs of the project. Challenges may for instance be related to how monetary values are estimated for the expected future benefits in terms of reduced flood risk. Permanent flood defences are high-cost investments with a long life span, while their expected

[2] This text is largely based on section 2.2 of Ek et al. (2016a).

benefits are associated with significant uncertainties. If investment decisions are not based on long-term, forward planning also taking possible impacts of climate change into account the resource efficiency may well be challenged.

However, although cost benefit analyses could potentially contribute to increased transparency and knowledge about the costs and benefits associated with different flood risk management strategies, concerns have been raised by local authorities, for instance in Flanders, Belgium, that cost benefit analysis is a technocratic manner of decision-making that they have little insight into. In Poland, there is a focus on gaining additional funds through realising investments in flood defence, which has created a short-term oriented budget maximisation, rather than using resources where they are most needed. There is also a lack of adequate and coherent data, which constitutes an obstacle to conducting comprehensive and independent evaluations of the resource efficiency of flood risk management. An overly rigid use of cost benefit analyses may thus come at the expense of reduced legitimacy. On the other hand, if flood risk management is using financial, physical and/or human resources in an inefficient way, or if it is difficult to trace how money is being spent, this may also have a negative impact on the legitimacy of flood risk management.

Different examples of potentially beneficial measures or instruments that have not been implemented as a result of inflexibilities in decision-making and/or legislation are mentioned as factors possibly restricting resource efficiency. For example, in some countries (England, Sweden and the Netherlands) small-scale property based measures, such as so-called check valves, are currently underutilised and property owners have limited or no incentives to invest in such measures (e.g. the costs in case of floods are spread out across all insured or protected parties).

## 5.3 Evaluation of Legitimacy[3]

In the context of evaluating the current (and to some extent past) FRGAs from the perspective of legitimacy, the Aarhus Convention and the European legislative framework play an important role. However, within the STAR-FLOOD project, the multi-faceted concept of legitimacy was interpreted not only from a legal point of view, but also from a social science point of view. This approach led to the development of a range of specific criteria in order to assess the extent to which flood risk governance arrangements can be described as legitimate (Ek et al. 2016b). As indicated in the introduction, seven criteria for evaluating the legitimacy of flood risk governance have been identified: social equity; access to information and transparency; procedural justice and accountability; public participation and acceptability. Each criterion will now be discussed in turn.

- **Social equity** – In the researched countries, systems range from a strongly prevailing solidarity principle in France, to a market-based insurance system in

[3] This text is largely based on section 2.3 of Ek et al. (2016a).

England, implying that a number of (potential) tensions concerning social equity can be distinguished. A first tension, connected to the solidarity principle, manifests itself in the ex-post compensation sphere, where citizens who are not at risk of flooding are often also contributing to the compensation of others. Similarly, social equity issues have been identified when it comes to beneficiaries of defensive measures. Some citizens, e.g. in the Netherlands, are entitled to different levels of flood protection to others, while at the same time the presence of flood protection encourages further urban development. On the other hand, it can be said to be in the interest of all citizens that the economically most important areas in a country receive the highest level of flood protection.

- **Access to information and transparency** – In general, access to information and transparency do not seem to be problematic in the researched countries. All countries have implemented the Aarhus Convention into their own legal system and make legislation and policy documents available to the wider public. In Sweden for instance, all official documents are in principle public. Everyone may request and study them, without having to provide information regarding identity or purpose for the request. In general, since the implementation of legal instruments such as the Aarhus Convention, the availability to the public of flood risk information has improved, and for instance in England, both public awareness of flood risks and transparency in policy decisions on flood risk management has increased. Transparency is also enhanced by independent reviews and responses to significant flood events, such as the thorough evaluation of the November 2010 floods in the Flemish Region by the Coordination Committee on Integrated Water Policy and the accompanying policy recommendations.
- **Procedural justice and accountability** – In relation to the EU Floods Directive, stakeholders' access to justice, in terms of enforcing their rights to participate in or challenge decisions, is limited. Citizens can only enforce their right to have Flood Risk Management Plans actually established and not that the Flood Risk Management is appropriate (see case ECJ C-237/07 Ek et al. 2016a). Citizens do not have other recourses with respect to substantive issues stemming from the FD (Ek et al. 2016b). For access to justice, each country relies on national rules. In Belgium, the Netherlands and Sweden, access to administrative courts is relatively inexpensive, and court decisions from the highest administrative courts are available in a relatively short time span. However, litigation costs and judicial backlog, resulting in judicial proceedings extending over longer periods of time, were identified as constraining factors to achieving procedural justice. In Poland, for instance, there is a discrepancy between the lack of resources from civil society to go to court and the dominant position of the administration and investors. Moreover, this constraining factor is further enhanced by judicial backlog and the general lack of trust in Polish state institutions. Also in England, there are discussions on the existence (in practice) of social inequities regarding access to justice, for instance issues concerning financial costs involved, and restrictions being made to legal aid are raised.
- **Public participation** – The Aarhus Convention holds the obligation for Parties to provide for early public participation, when all options are open and effective

public participation can take place. The public participation procedures must hereby include reasonable timeframes for the different phases, allowing sufficient time for informing the public and for the public to prepare and participate effectively during environmental decision-making (art. 6, 3-4). Moreover, each Party must ensure that due account is taken in the decision of the outcome of the public participation (article 6, 8). Participation is also included in the Floods Directive. However, the requirements are vague and there are no specific guidelines on what constitutes effective participation or on the objectives of active citizen participation. There is thus a large variability across Member States in terms of the implementation of these requirements.

- **Acceptability** – Legitimacy also implies that the decisions and the processes involved in decision-making are accepted by stakeholders. Acceptability is therefore an important aspect of the legitimacy of any flood risk governance arrangement. However, it is difficult to quantify in a precise manner as it very much relates to perceptions of stakeholders. There are objective indicators, however, to identify what the constraining factors related to acceptability are and how it can be improved. In all STAR-FLOOD countries, acceptability could be improved, in the first instance through raising awareness of the population to flood risks and the implications thereof (Fig. 5.1).

**Fig. 5.1** Flood proof building in Hamburg, Germany (Source T. Raadgever)

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# Chapter 6
# Implications for Risk Governance Research and Practice

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## 6.1 Implications for Flood Risk Governance Research

### *6.1.1 Reflection on STAR-FLOOD's Research Approach*

#### 6.1.1.1 Key Features of the Approach

As mentioned in the introduction, STAR-FLOOD's research approach has the following key features:

- The project combined social-scientific and legal approaches, achieving dialogue and synergy between multiple disciplines.
- The project made comparisons between countries and case studies, whereby all researchers used a similar framework for analysis, explanation and evaluation.
- The work was carried out in close cooperation with stakeholders at the European, national, regional and local level. Throughout the project they were involved in workshops (e.g. case study workshops in each country, two expert panels; four international workshops and various additional sessions at conferences) and over 300 interviews. During the project, the scope of the workshops shifted from collecting information and identifying the knowledge needs of stakeholders towards disseminating research findings and validating research results.

In order to achieve dialogue between the involved disciplines, maximise comparability of the findings and link the research to policy and practice, we chose for intensive forms of cooperation. Researchers within the project had frequent exchanges of ideas with other researchers, both within and across the participating countries; the coordinator provided frequent feedback on draft products produced

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T. Raadgever, D. Hegger (eds.), *Flood Risk Management Strategies and Governance*, https://doi.org/10.1007/978-3-319-67699-9_6

by all (including through several visits to all partners); a common conceptual and methodological starting point was developed, with the Policy Arrangements Approach as an overall framework for combining the input of researchers from various disciplines; and meetings were held very frequently, both in the form of plenary consortium meetings and in the form of Academic Master Classes (AMCs). Besides that, also frequent workshops with stakeholders were held, as reported in Choryński et al. (2016); Ek et al. (2016b); Hegger et al. (2014); Hegger et al. (2016). Overall the approach used appeared to be very fruitful, but also time consuming.

#### 6.1.1.2 Strenghts and Points for Improvement of the Research Approach

The STARFLOOD approach was evaluated by the partners during the final consortium meeting (March 2016). Based on this evaluation, the following strengths and points of improvement were identified.

**Strengths of STAR-FLOOD's Research Approach**
Partners and coordinator shared the overall impression of a successful and well-coordinated project. Strong points that were emphasised by several partners are:

- **Intensive interactions** between the involved researchers, including workshops and meetings in different cities. Researchers indicated that these intensive interactions fostered mutual understanding, amongst other things in terms of each other's disciplinary approaches and of the specificities of FRM systems in the different countries. An atmosphere was created in which such issues are not taken for granted, but on the other hand questioned along with approaches from other countries.
- **Learning and training by junior researchers**. The various forms of cooperation, in particular the Academic Master Classes, were highly valued. These provided the junior researchers in the project with training in various relevant research skills, including: theoretical approaches for policy and legal analysis; public administration and legal approaches for evaluating governance; skills in setting up comparative research; doing discourse analysis; setting up workshops; and writing and publishing papers.
- **Good complementarities**. The different disciplines involved in the project as well as the specific expertise of some partners were seen as complementary and enriching.
- **Good atmosphere**. All in all, the atmosphere of working together was evaluated as very positive.
- **Strict intermediary deadlines.** An approach was chosen in which partners had to make available intermediary products at specific moments, to allow for frequent exchange and feedback. This approach was endorsed.

**Points of Improvement**
Partners indicated the following points of improvement:

- Be **stricter on key definitions** early stage of the project. Key definitions of important concepts were discussed frequently. Amongst other things, a glossary

of key terms was developed by the coordinator with input from all partners, providing an overview of different interpretations of concepts. Halfway the project, in April 2014, this document was finalised and included for each concept a recommended interpretation for the purpose of the STAR-FLOOD project. The development of this glossary was endorsed, but it was suggested that later projects could come up with a recommended definition in an earlier stage in the project to minimise conceptual confusion.

- **Start earlier with comparisons, lessons/recommendations** (more iterative process). While benchmarks for country comparison were on the agenda from the beginning onwards, it can be recommended to also start with the substantive comparison from the outset. Country-comparison (WP4) and the identification of design principles (WP5) should be given a larger role vis-à-vis country-specific analysis (WP3 in STAR-FLOOD).
- **Discuss the conceptual approach and the substantive issues covered in the project simultaneously.** In Work Package 2 and at the beginning of Work Package 3, much discussion was held on the conceptual approach and the precise scope of the empirical research. Only after closure on these issues was achieved, the discussion shifted to the more substantive policy and legal issues of the project. We recommend to discuss and address both issues simultaneously, as these discussions may enrich each other.
- **Make early agreements on how to deal with differences in disciplinary reporting and publication styles**. It was ensured that the country reports (WP3) would remain relatively concise, to provide readers with easy access to the key findings. This constituted a tension, however with the need to discuss legal information in some detail. Part of the legal information in STAR-FLOOD is now not included in the WP3 reports, but in background documents that are not publicly available. Although this information is present in journal articles written on the basis of the empirical research, it would also be advisable to include the legal background information, for instance as appendices to the reports or in an online resource.
- **Provide even more structure to facilitate the interdisciplinary approach**. It was suggested that even more concrete structure could be offered to achieve more integration between policy analysts and legal scholars, for instance through case workshops, field trips, debates with practitioners etc.
- **Be more lenient regarding the content and scope of intermediary products in an early stage of the project.** Strict intermediate deadlines were evaluated as positive, but in an early stage the things to deliver could be more general (e.g. template) instead of lengthy texts, in order to avoid large time investments in products that require substantial revisions afterwards.
- **Involve end-users in the project in an earlier stage**. While intensive workshops with end-users were held throughout the project, valorisation of research and dissemination of findings will even be more enhanced if end-users are also involved as partners in the project from the start.

#### 6.1.1.3 Overall Recommendations for Future European Projects

Based on our experiences as discussed in the preceding two sub-sections, we conclude that interdisciplinary comparative and complementary research that leads to innovative insights requires the intensive forms of cooperation and the high degree of coordination as pursued in the STAR-FLOOD project. Intensive exchanges were necessary to ensure that all researchers were taking a common conceptual and methodological starting point, that integration between social science and legal research was achieved, that the country-specific deliverables are of excellent quality and to a large extent comparable, and that a common framework for comparison and identification of design principles was used. In hindsight, it can be said that the ambition to arrive at cumulative, coherent and comparable research was challenging, required much coordination effort, but was on the other hand also extremely rewarding as it enabled us to truly adopt an integrated and comparative perspective and to arrive at nuanced findings as detailed in all STAR-FLOOD deliverables. To summarise, based on our experience we argue that project proposals for large integrated European projects (e.g. within Horizon 2020) should have the following characteristics in order to maximise the chance for success. A proposal should:

- Decide between two mutually exclusive approaches in terms of the **structure of Work Packages**. WPs can be organised according to concrete overall steps in the research (e.g. assessment framework; empirical research; comparison; design) instead of according to specific disciplinary or issue-oriented activities. While the former approach, the one followed in STAR-FLOOD, is in our view more ambitious and rewarding, applicants should be aware that it requires strong coordination efforts and may at times be challenging.
- Identify concrete actions to achieve intensive knowledge exchange between countries and disciplines as well as training activities for junior researchers.
- Identify specific **moments at which decisions will be made** regarding important issues such as the definitions of key concepts, the main features of the conceptual approach used, the scope of the empirical research, and the table of contents of specific deliverables and provide a justification for the timing.
- Involve **end-users** as partners in the project from the outset.
- Design an approach in which country and case study analyses and their comparison co-evolve through an iterative process.

### *6.1.2 Issues for Further Research*

We see the following three clusters of potential follow-up research: (i) validation, application and further specification of STAR-FLOOD's research findings in real-life contexts; (ii) follow-up research on specific aspects of flood risk governance that were shown to be important as well as research in countries and regions other than the STAR-FLOOD countries; (iii) application of the research approach

followed in STAR-FLOOD in other empirical domains. Each of these three clusters will now be discussed in turn.

(i) **Validation, application and further specification of STAR-FLOOD's research findings**

Within STAR-FLOOD, design principles were identified based on the findings of the empirical research. The design framework developed in STAR-FLOOD can be used for more design-oriented research efforts, in which possible improvements in FRM are studied by proposing concrete governance options to actors in the field and discussing and refining these together with them. Specifically, research and experimenting into public-private arrangements at the regional/local level should be further pursued. Also the exchange of good practices between countries and even between regions in single countries has proven to be especially inspiring both for researchers and for actors implementing FRM in practice. We therefore suggest the following (Hegger et al. 2016):

- To further pursue **knowledge co-creation projects** in which researchers collaborate with other societal actors around concrete local and regional FRM issues. In so doing, specific attention should be paid to the role of long-term visioning and imagination in this, as it was shown to enhance risk communication and the adoption of a long term perspective.
- The design principles developed in STAR-FLOOD could be further developed into a more direct **hypotheses testing approach**.
- Design-oriented research can be carried out by **participating in INTERREG projects** with a specific regional focus.
- Specific follow-up research that sets forth mechanisms in countries and at EU level for improving FRG in specific countries can be carried out.
- Follow up research on **trans-boundary flood risk management** and the improvement of the Floods Directive in this regard; including the development of shared concepts and the assessment and eventual further development of legal instruments for trans-boundary cooperation.
- Follow up research on the effectiveness and legitimacy of the procedural governance approach taken in the Floods Directive.
- Follow up research on the effectiveness and depth of the at this moment rather generic **participation requirements** in the Floods Directive.

(ii) **Follow-up research on specific aspects of flood risk governance that were shown to be important as well as research in countries and regions other than the STAR-FLOOD countries**

Empirical research as carried out within STAR-FLOOD can be further extended to countries, regions and catchments regions not included in the STAR-FLOOD project. This will lead to cumulative research and complementary insights and good practices. This research should put more emphasis on the occurrence and performance of different forms of multi-level governance as well as aspects related to

trans-boundary flood risk governance. In follow-up research, the following specific aspects could be addressed further:

- Social vulnerabilities of different societal groups in relation to multiple hazards.
- Specific governance challenges related to the implementation of **flood mitigation/resilient architecture** and the role of spatial planning therein could be addressed in more detail.
- The issue of budget cuts of public authorities and how this impacts FRM could be addressed in some detail.
- The **power and effectiveness of different types of bridging mechanisms** that may help to improve links between flood risk management strategies and may avoid blurred responsibilities.
- The role of critical infrastructure in flood events and how private actors operating them acted in case of a flood.

(iii) **Application of the research approach followed in STAR-FLOOD in other empirical domains**

STAR-FLOOD's research approach for carrying out a comparative social science/legal study into governance issues can be applied to other empirical domains. For instance, the following topics could be addressed through an approach that is similar to the one used in STAR-FLOOD:

- Research on drought.
- Climate adaptation in cities and regions.
- Nature-based approaches for multi-hazard issues.
- Integrated approaches to sustainable cities and regions (including green regions, green transformations).
- Integrated multi-hazard and disaster risk reduction research.
- Flooding as a cause of pollution (Fig. 6.1).

## 6.2 Implications for Flood Risk Governance Practice

### *6.2.1 Introduction*

Based on results of the evaluation of flood risk governance in terms of the extent to which it enhances societal resilience to flooding, resource efficiency and legitimacy, success conditions have been identified (Ek et al. 2016a, b) which can be formulated as design principles. Key terms are defined below.


**Fig. 6.1** STAR-FLOOD End-conference, 4–5 February 2016, Brussels, Belgium (Source: N. Booister)

**Defining Successful Flood Risk Governance; Success Conditions and Design Principles (see Ek et al. 2016a, b)**

**'Successful' flood risk governance** is understood as governance that achieves the desired outcomes of resilience, efficiency and legitimacy.

**Success conditions** are those institutions, procedures, rule-types, resources etc. that need to be in place in order to successfully deliver different aspects of flood risk governance. These can be translated into concrete recommendations.

**Design principles** are understood as sub-objectives which are supposed to contribute to the achievement of overall goals.

We make a distinction between design principles for improving flood risk governance processes on the one hand, and more specific design principles and good practices related to each of the three desired outcomes (societal resilience to flooding, resource efficiency and legitimacy) on the other hand. Principles related to flood risk governance processes are more encompassing than those related to their outcomes, since they are not only dealing with the question of how specific desired outcomes can be reached, but also with the question of which outcomes are desired by and for whom? Furthermore, these recommendations may be conducive to several desired outcomes simultaneously. The more specific principles in Sect. 6.2.3 on the other hand, focus more on the 'how' question.

### 6.2.2 *Design Principles for Improving Flood Risk Governance Processes*

This section discusses eight design principles for improving flood risk governance processes. After introducing each principle, challenges related to its implementation are discussed, as well as concrete recommendations for addressing these challenges.

**Societal actors, including public authorities, businesses, community groups and NGOs should be clear about the flood risks they are facing, the level of protection that is present and about how responsibilities for handling them have been divided**.

Societal actors generally endorse this principle. It is also a principle to which public authorities need to comply in order to act in line with the Aarhus Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters. Implementing it is, however, challenging. Public authorities are still struggling with how to undertake risk communication, and in several countries a lack of risk awareness amongst private parties has been witnessed. Amongst other things, following flood events it is tempting for politicians to promote a 'defence paradigm', yet this is sometimes at odds with national policy and academic consensus that a risk-based approach is the best way forward. In order to deal with this challenge, we recommend the following:

- Politicians and decision makers at different governmental levels should make the effort to pro-actively communicate which levels of flood risk, both in terms of probability and potential consequences, societal actors are facing. They furthermore need to make explicit to what level of support by authorities societal actors are currently entitled both by law and by custom. This will bring debate on acceptable levels of risk and the question of who is responsible for dealing with them into the open and ensure that businesses, community groups and citizens know what to expect.
- We recommend having on open, broad (political and societal) debate about shifting responsibilities between public and private actors. The outcome of the debate should lead to more clearly defined roles for governments/citizens, to be laid down in documents that are open for public consultation and public scrutiny.
- Public acceptance of FRM policy is challenged by the occurrence of flood events and subsequent 'politicisation of floods'. Authorities cannot wait for risk communication until a flood occurs. On the other hand, although very challenging, improving "water consciousness" should be continuously on the agenda.
- Managing societal expectations is key. There is a need to promote consistency in communication from the EU, national to local scale.

**Flood-relevant policies should adopt a forward planning approach and take into account future changes, including climate change**.

- Climate change projections should be embedded in FRM policy (and vice versa) to support forward-planning, e.g. in national policy strategies, planning documents through to the design of defence schemes (e.g. adaptive management is advocated). A long-term strategic approach (ca. 50 to 100 years) to decision-making is needed that enables adaptability and flexibility (because of uncertainty) to ensure that future risks and uncertainties are accounted for.

**Knowledge infrastructures should be developed, and joint knowledge production processes and cultures of learning should be stimulated**.

Institutional cultures for learning appear to be well-established within several STAR-FLOOD countries, but there are limited opportunities for exchanging these lessons within and between countries, especially between research and practitioner communities. Conferences, workshops and research consortiums are one way of transferring knowledge but these often exclude practitioners. The outputs from projects provide an important means of disseminating research findings in an accessible way, but do not enable the active exchange of ideas and dialogue. Hence, to further stimulate joint learning, we recommend:

- To establish a flood risk governance knowledge exchange platform, nationally and internationally

**Private actors, including business, community groups and citizens should adopt partial responsibility for their own risk**.

Engagement of private parties is needed, both for substantive and for normative reasons. Also public-private synergies in the context of recovery are relevant, e.g. in Belgium where private insurance is dominant, with a public fall-back mechanism. Here, cooperation between the two entities is important. A lack of risk awareness, a lack of incentives for engaging in FRM and, often, the existence of specific rights or customs regarding divisions of responsibilities is hampering public-private cooperation. Also, while the European Commission has a large interest in stimulating public-private partnerships, in our research we did not find many examples of these and hence further insights regarding how state-business and state-society partnerships should be designed, how they could be useful and how they could enhance capability are still needed. In some cases, partnerships may even have negative effects (even more stakeholders). To address these challenges, we recommend:

- To interpret public-private cooperation as ‘multi-actor coproduction’. This includes co-planning whereby citizens participate in the decision-making process of FRM measures, e.g., development of river basin management plan, emergency plan; co-delivery; participation of citizens in the implementation of FRM measures, e.g., flood protection measures at household-level; and comprehensive co-production: participation of citizens in both the decision-making and implementation of FRM measures, e.g., development of FRM plan in cooperation with

residents, whereby both citizens and authorities are responsible for the implementation of certain measures (Mees et al. 2016). Co-production can be set up in the pursuit of societal resilience, but also to increase efficiency and distribute responsibilities more equitably.

**Flood risks should be dealt with at multiple scales and flood risk governance should take place at the most appropriate level**.

A multi-scale approach is needed as well as efforts to mitigate flooding at the property and community scale, either through the implementation of property-level measures to enhance capacities to resist flooding, or through preparatory activities to enhance capacities to respond and recover. To achieve this aim, the subsidiarity principle is often adhered to. This principle implies that governance should take place at most appropriate level, being the lowest level possible, but the highest level necessary. Applying subsidiarity is challenging, however. On one side, in some cases flood risk management within European countries still follows a strong top-down approach, complicating the development of approaches tailored to local situations. On the other side, subsidiarity is easily equated with 'decentralisation'. However, decentralisation is only subsidiarity to the extent that devolution of powers to lower levels of government can be said to be appropriate and is accompanied with devolution of the necessary resources. In order to achieve the right balance between bottom-up and top-down steering, we recommend the following:

- National governments and the EU have an important role to play by **supporting** (funding & expertise) and **approving** flood risk policy planning at regional level (preferably within hydrological boundaries). Local, tailor-made solutions should be **stimulated** and **facilitated** since these are often the best way of detangling multi-actor, multi-sector and multi-level governance problems in flood risk governance.
- The EU should support local developments by providing a subsidy system for stakeholder platforms at catchment scale. These platforms include all relevant stakeholders in the sub-catchment and draft a flood risk management plan based on their objectives, which is (financially) supported by EU/national governments (Benson et al. 2012).

**Flood risks should be taken into account in spatial planning and receive the level of priority that is in line with what society considers acceptable levels of risk**.

Taking flood risks into account in spatial planning is challenging for different reasons. There are different experiences with the extent to which local leaders give sufficient priority to flood risks. While there are good examples of policy entrepreneurs promoting a water sensitive approach to urban development (e.g. in Dordrecht) also counter-examples can be given, and in France the mayor of a small seaside village was even sentenced to 4 years in prison for behaving irresponsibly towards flood risks. The STAR-FLOOD project has furthermore found that there is an intricate link between the strategies of flood recovery and those of flood prevention and

mitigation. It was found that in some cases strong recovery mechanisms may disincentivise prevention and mitigation, and that recovery systems should focus on preventive and mitigation measures at individual property level. For instance, the CAT-NAT system in France has been found to discourage prevention. Also in Belgium, risk prevention is promoted through the legislative insurance framework, which discourages building in high-risk areas. Moreover, we cannot ignore the legacy of past decision-making or the fact that extensive development has already taken place in areas at flood risk. In order to make next steps in reconciling flood management and spatial planning, we recommend:

- To use flood zones to direct planning decisions.
- To discourage future development in areas at high risk of flooding.
- To put provisions in place for cases in which development in flood risk areas cannot be avoided. It should be made clear who is responsible for damage (this could be the project developers who have a stake in developing an area), and it needs to be ensured that development is adaptive (e.g. raised floor heights, use of SUDS) to minimise future damages should a flood occur.
- Strategies for 'retrofitting adaptation' are required.
- If no further development is allowed in an area, this may lead to unintended consequences such as economic and social deterioration. Policy makers should be aware of these consequences and should develop novel ways of fair burden sharing.

**Formal flood-relevant rules and regulations should be clear for all involved, enforceable and enforced**.

There is sometimes a lack of clarity of rules. Legal frameworks could more explicitly mention when and for what they are applicable. This is especially needed with regard to the development of the multi layered safety of combined strategies. Furthermore, what is needed is enforcement of the rules we have, for instance in the field of spatial planning. In some countries, changes in legislation have proven to be a problem in itself. This is exemplified by Poland, a country that after the transition of 1989 went through massive administrative and legal changes. To improve the working of rules and regulations, we recommend:

- To improve enforcement mechanisms in spatial planning through legal instruments. This also requires political will to enforce legislation (see the next design principle), increased powers within competent authorities and detailed guidance on building on the floodplain, to name a few. Legal frameworks should pay as much attention to the scope of the legal instrument as to how the instrument should be implemented, followed up and what the consequences are in the case of non-compliance.
- There is a need to establish incentives for better cooperation between actors operating within distinct spatial planning and FRM policy domains (e.g. as seen in England) and deliver a more integrated approach.

**More experience should be gained with applying catchment-based approaches to FRM**

The value of applying cross-sectoral Catchment-Based Approaches (CaBA) currently encouraged in water and environmental policy continues to be debated in the FRM field. Further evidence is required to demonstrate the effectiveness of this approach for alleviating flood risk and its potential for maximising the efficient use of resources.In principle, there are various opportunities for trans-boundary flood risk governance to lead to more flood resilience. Adopting the normative starting point that flood risks should not only be addressed locally but also considered at the basin scale, trans-boundary flood risk governance is desirable and moreover required by the Floods Directive and one of the reasons for EU action. STAR-FLOOD, admittedly, has not explicitly addressed trans-boundary flood risk governance (e.g. the work of the Rhine, Meuse and Scheldt commissions) as such but has focused on flood risk governance at the country and case study level. Nevertheless, we find it surprising that we came across relatively few examples of trans-boundary FRG, and there still seems to be much room for improvement in terms of enhancing trans-boundary cooperation in flood risk management. Hence, we recommend the following:

- Public and private actors at different levels need to initiate, carry out and facilitate practical experiments and engage in knowledge exchange regarding the further stimulation of catchment-based approaches to FRM.

### *6.2.3 Design Principles for Improving Flood Risk Governance Outcomes*[1]

Specific design principles for enhancing the desired outcomes of resilience, efficiency and legitimacy have been formulated. These have been identified within Work Package 5 of STAR-FLOOD (see also: Ek et al. 2016a, b). In this Work Package, the country-specific evaluations of resilience, efficiency and legitimacy were compared and based on this a number of factors that support or constrain societal resilience to flooding amongst the STAR-FLOOD countries have been revealed.

**Resilience** should be disentangled into the capacity to resist, to absorb and recover, and to learn and innovate. Table 6.1 provides an overview of the three capacities and the related design principles (left-hand column). For each design principle, success conditions have been identified. The right-hand column provides some concrete examples of good practices that were found to increase the chance of meeting the success conditions.

Table 6.2 provides an overview of design principles and success conditions for improving **resource efficiency**. The right-hand column provides some concrete examples.

[1] This text is largely based on chapter 3 of Ek et al. (2016a).

**Table 6.1** Design principles, success conditions and examples related to enhancing societal resilience to floods (Ek et al. 2016a, b)

| Design principles for flood risk governance to enhance the capacity to resist | Conditions for success | Good practices |
|---|---|---|
| Selected flood risk management measures (e.g. defence and mitigation) should be tailored to local circumstances (e.g. risk, vulnerability, institutional and economic context) | Sufficient resources are provided (power, knowledge and financial), also for maintaining and improving existing defence structure | Partnership funding (England is a good example of where resources have been diversified to support the implementation of more defence and mitigation-based measures |
| | Legislation and decision-making allows/supports adaptability | Action Programme for Flood Prevention (France) |
| | Cooperation, in particular between defence and prevention and between defence and mitigation management, is supported | Water assessment (Belgium and the Netherlands) |
| | Long term forward planning is supported | Long-term investment strategy (England) is a good example of long-term forward planning of financial resources |
| | Actors (citizens) are incentivized to undertake risk-reducing measures | Delta Programme (the Netherlands) |
| Flood risk (prevention) should be incorporated within spatial planning decision-making to discourage development in known areas of flood risk, ensure that development in at-risk areas is adaptive, and ensure that development does not heighten risk | Sufficient resources are provided (power, knowledge and financial) | Water assessment (Belgium) |
| | Legislation and decision-making allows/supports adaptability | Water test (the Netherlands) |
| | Legislation contains mechanisms to ensure implementation of spatial planning measures (enforcement) | Building regulations (Sweden) |
| | Cooperation, in particular between defence and prevention and between defence and mitigation management, is supported | Zoning system (France) |

(continued)

**Table 6.1** (continued)

| Design principles for flood risk governance to enhance the capacity to resist | Conditions for success | Good practices |
|---|---|---|
| Systems for forecasting and warning (preparation) should be effective and warnings should be transmitted with sufficient lead time. | Sufficient resources are provided (power, knowledge and financial), also for investments in forecasting technology. | Use of new technologies (e.g. England and the Netherlands) |
| | Formal responsibilities are established for the communication of flood warnings | |
| | Multiple pathways for disseminating flood warnings are available. | |
| | Community risk-awareness and preparedness are promoted. | |
| Effective and proactive arrangements are in place to enhance emergency preparation and response to flooding | Requirements to assess and monitor local risks, to inform emergency planning are established. | Flood rehearsals (e.g. the Netherlands) |
| | Mechanisms for up-scaling and downscaling emergency response are established | Flood leaders programme (Poland) |
| | Arrangements are in place to facilitate inter-organizational working. Roles and responsibilities are clear. | Dike armies (the Netherlands) |
| Strategies to recover from flood events should be available for all citizens, and should entice flood risk prevention | Systems for compensation for flood damage (after severe floods) are in place | Large variation; solidarity principle v. beneficiary pays |
| | | Belgium: risk differentiation approach |
| | | France: CAT-NAT and Barnier Fund |
| Opportunities for social and institutional learning should be created | Mechanisms are in place to facilitate knowledge exchange, sharing experiences and best practices | Adaptive planning and programme cycles (the Netherlands) |
| | There is a clear strategy and investment in Research and Development programmes. | Independent public inquiries (e.g. England) |
| | | Learning from international experiences (Belgium, the Netherlands) |

**Table 6.2** Design principles, success conditions and examples for improving resource efficiency (Ek et al. 2016a, b)

| Design principle for resource efficient flood risk governance | Conditions for success | Good Practices |
|---|---|---|
| Flood risk management should secure the level of flood risk reduction that is found acceptable at the lowest possible societal cost | The process demonstrates due concern for matters related to resource efficiency | Well-developed practices for CBA, also for non-monetary impacts (e.g. England) |
| | Actors (citizens) are incentivized to undertake risk-reducing measures | |

Table 6.3 provides an overview of design principles and success conditions for improving **legitimacy**. The right-hand column provides some concrete examples.

### *6.2.4 Overall Recommendations on Appropriate and Resilient Flood Risk Governance Arrangements*

Social scientific and legal research, especially governance research, on FRM had received limited attention vis-à-vis natural science research. Adopting a governance perspective has been shown to provide important complementary insights that may help to improve FRM approaches in different countries. Improving societal resilience to floods implies increasing the capacity to resist, to absorb and recover and to adapt. This makes demands on the flood risk governance arrangements that are put in place to realise these desired outcomes of flood risk governance. For that reason, STAR-FLOOD's main research question was: "what are appropriate and resilient flood risk governance arrangements for dealing with flood risks in vulnerable urban agglomerations in Europe?". In response to this main research question, the following overall recommendations can be formulated:

- While we can endorse approaches aimed at diversification of flood risk management strategies based on our research, these approaches should **fit within the existing national and local context**. Countries differ in their approaches to diversification. In the Netherlands, Poland, France and Belgium, we see a desire to create a back-up layer of contingency. England has been diversified for 65 years, while Sweden is currently diversifying due to climate change concerns. These existing approaches form the starting point and need to be taken into account to provide the contextual understanding necessary for governance changes to be implemented.
- Steering at different levels of government (EU, national, regional/local and transboundary) is necessary, but with a clear division of tasks and responsibilities. Besides that, the role of citizens, NGOs and businesses should be considered. Increased experimentation with public-private partnerships is needed to demonstrate the ability and effectiveness of these partnerships within FRM.

**Table 6.3** Design principles, success conditions and examples for improving legitimacy (Ek et al. 2016a, b)

| Design principles for legitimate flood risk governance | Conditions for success | Good practices |
|---|---|---|
| The decision-making process should be characterised by a high degree of public participation, social equity and perceived accessibility | The process demonstrates due concern for matters related to social equity | Mechanisms for "pushing" warnings and "pulling" vulnerable people in advance (England) |
| | Stakeholder involvement for informed and outcome-oriented contributions to the design and implementation of flood risk management strategies and measures are guaranteed | Community engagement (England) |
| | Attention is paid to under-represented categories and newcomers, including property developers and institutional investors | Duty to inform (Belgium) |
| | The process and outcomes of stakeholder engagement are regularly evaluated in order to foster learning and improvement (also in terms of use of resources) | |
| | Information about the way in which and to what effect resources are spent on the management of flood risk is publicly available | |
| | The process for decision-making is determined by including: the expected use of stakeholders' input; plans for mitigating power imbalances between different stakeholder-groups (e.g. experts vs. non-experts) and reducing the risk that the consultation process is taken over by overly loud or over-represented groups | |

| | | |
|---|---|---|
| Mechanisms/arrangements are in place to ensure accountability | Decision-making in FRM is subject to independent reviews and public scrutiny | Independent reviews (England) |
| | Decision-makers can be held accountable | |
| Citizens are aware of their rights and responsibilities in connection with the planning and implementation of Flood Risk Management measures. | Citizens are informed of their responsibilities | Multi-layered safety (Belgium) |
| | Citizens are informed of how they can carry out their responsibility in practice | Duty to inform (Belgium) |
| The FRGA is characterised as transparent i.e. the decision-making process, outcome and impact of this process are made visible for all stakeholders | All policy and legislation relating to flood risk governance is publically available | Principle of public access (Sweden) |
| | FRM is subject to public and/or independent inquiries to evaluate its performance | |
| Mechanisms/arrangements are in place to ensure access and delivery of procedural justice | There are opportunities for stakeholders to challenge decisions made by public authorities and seek justice | Low costs for litigation (Belgium, Sweden, the Netherlands) |
| | The process of resolving disputes is considered to be just | |

- There is a need to develop connectivity between different flood risk management strategies, between governmental levels and between flood-relevant policy domains such as spatial planning and crisis management. A better coordinated and complementary (rather than undermining) suite of strategies will ensure effective flood risk management. This requires different types of bridging mechanisms: coordinating actors; procedural duties and instruments; formal rules and regulations; financial and knowledge resources and bridging concepts.
- Linked to the point above, diversification of flood risk management strategies needs to be accompanied with suitable investments in the development of these strategies. Financial investments and other resources inputted into one strategy should not lead to under-investment in other strategies. Diversification also implies investments in legal frameworks, for instance building requirements in the field of spatial planning or emergency management frameworks.
- Legitimacy is a well-established principle of good governance and seen as essential for effective governance. Establishing legitimacy requires enhancement of public participation in policy making and increased flood awareness of citizens. Greater attention in policies and legislation needs to be paid to how effective participation, rather than consultation, can be delivered.
- Flood risk governance arrangements require long-term planning (visioning) to underscore adaptive approaches and to enable the sustainable use of resources. The short-term measures should be delivered part of this longer-term perspective on flood risk management. Proactive, rather than reactive responses, to flooding are required.
- The Floods Directive has a greater role to play in stimulating the development of appropriate flood risk governance arrangements that increase societal resilience to floods. For instance, for the next implementation round of the FD, a substantive requirement regarding the content of Flood Risk Management Plans should be added to explicitly address the issue of responsibilities of actors. Bridging mechanisms could also to some extent be included in the FD, for instance the duty of property sellers to inform potential buyers of flood risks (as is currently the case in the Flemish Region). Second, it would be worthwhile to critically re-evaluate the content of the FD for enforceability by citizens and to make clear what they can ask for in the courts. Furthermore, the FD should further stimulate trans-boundary flood risk governance.

Overall, our research has shown that there are **no one size fits all solutions**. Besides physical/geographical factors, historical flood risk management, societal and cultural norms, administrative and legal frameworks are all important factors that influence flood risk management and governance. Contextual, historical and contemporary flood risk debates all have implications for how policies and legal frameworks should be shaped and the desirable scope of European policies and funding schemes.

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# Part II
# Practitioner's Guidebook

## Inspiration for Flood Risk Governance

**G. T. (Tom) Raadgever, Nikéh Booister, and Martijn K. Steenstra**

# Chapter 7
# The Relevance of Flood Risk Management and Governance

**G. T. (Tom) Raadgever, Nikéh Booister, and Martijn K. Steenstra**

**Ellen Kelder, Programme Manager Water, Municipality of Dordrecht**

As programme manager for Water in the municipality of Dordrecht, I have implemented a new approach to make the very vulnerable city, which is surrounded by major water courses, self-reliant in times of flooding. This process required not only state of the art technical insights to determine a smart combination of flood defences, evacuation routes, shelters etc. It also required insights in how to organise this

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T. Raadgever, D. Hegger (eds.), *Flood Risk Management Strategies and Governance*, https://doi.org/10.1007/978-3-319-67699-9_7

change from a governance perspective. In this process, various authorities and research institutes in the Netherlands have successfully collaborated. The Delta programme provided a good platform for this. At the same time we have been involved in a number of European projects in which we exchanged experiences. Personally I think exchange between science and policy, and between different cities and regions is essential for good flood risk management. Therefore, I am happy with this Practitioners Guidebook and hope it will inspire many people.

## 7.1 Flood Risk in Europe

Flood risk is commonly understood as the product of the probability and consequences of flooding. There are various mechanism through which floods occur: local precipitation (pluvial); rivers or seasonal snow melt (fluvial); sea (tidal, storm surge); or precipitation in steep catchments and fast runoff (flash floods). As floods are influenced by the complex and dynamic interaction between physical and human systems, flood events are highly unpredictable.

Of all the natural hazards in Europe, flooding is the most common, and accounts for the largest number of casualties and highest economic damage (Guha-Sapir et al. 2013). Unlike other natural hazards, no European country is free from the risk of flooding. Between 2000 and 2005, Europe suffered nine major flood disasters, resulting in 155 casualties and economic losses of more than € 35 billion (Barredo 2007). The 2013 floods in central Europe caused 25 casualties and $15 billion economic damage (Munich Re 2014). The winter floods in 2013 and 2014 in different parts of the UK flooded 5000 homes and caused 17 casualties and over £2 billion worth of damage.[1] In October 2015 the French Riviera was severely flooded causing at least 19 casualties and ca € 625 million damage.[2] These recent events highlight the challenge and importance of effective flood risk management.

Without additional actions, both the probability and potential consequences of floods in Europe are expected to increase. Climate change is expected to result in sea-level rise and to induce more extreme weather events, increasing the probability of flooding (IPCC 2011). On average, in Europe, flood peaks with return periods above 100 years are projected to double in frequency within three decades (Alfieri et al. 2015). Soil subsidence may aggravate flood risks, mainly in delta regions. At the same time, the potential consequences of extreme weather events are enlarged by population growth, economic growth and urbanisation in flood prone areas (Barredo 2009; Mitchell 2003).

[1] Source: http://floodlist.com/insurance/uk/cost-of-2013-2014-floods

[2] Source: www.catnat.net, Report on the events for the period 2001–2015.

**Textbox 7.1: STAR-FLOOD Research on Flood Risk Governance**
STAR-FLOOD stands for: "STrengthening And Redesigning European FLOOD risk practices: Towards appropriate and resilient flood risk governance arrangements". The project was focused on analysing, explaining, evaluating and designing policies to better deal with flood risks from rivers in urban agglomerations across Europe. Case studies have been performed in 18 vulnerable urban regions in six European countries: Belgium, England, France, The Netherlands, Poland and Sweden. The results of this ambitious project are highly relevant for developing and implementing new policies and law at the European, national and regional level and for the development of public-private partnerships. STAR-FLOOD lasted from October 1st, 2012 until March 31st, 2016.

## 7.2 Flood Risk in the STAR-FLOOD Countries

All six countries analysed in STAR-FLOOD - Belgium, England, France the Netherlands, Poland and Sweden - face the threat of flooding, but the mechanisms of flooding and the significance of the flood risk vary. The percentage of paved and built-up areas in *Belgium* is relatively high. This decreases the capacity of rainwater infiltration, resulting in a higher vulnerability to pluvial flooding. Although most recent events had predominantly a pluvial source, the most harmful events of the twentieth century were caused by storms resulting in fluvial or coastal flooding (notably in 1953 and 1976). *England* has a high flood risk, with one in six properties being susceptible to fluvial, coastal and/or surface water flooding (Environment Agency 2009). With the impact of increased climate change, urbanisation, population growth and aging drainage systems this risk is increasing. In *France* about 60% of the natural disasters are floods and about 26% of the population (17 million people) is located in flood prone areas. These flood prone areas at risk from tidal flooding and storm surges (western and northern France), pluvial and flash floods (southern France), fluvial floods along the main rivers and pluvial flooding in most of the cities. Because major flood events in the twentieth and twenty-first century have been relatively rare, risk awareness among the population is low (Fig. 7.1).

In *the Netherlands* 26% is below mean sea-level and 59% is susceptible to flooding. Fifty-five percent of the country is protected by embankments and dunes from tidal and river flooding. In 1953 a large flood disaster took place, resulting in over 1800 casualties in the Netherlands alone and also affecting Belgium and England. In reaction to this event, the Netherlands developed its Delta works, flood defences built to avoid another disaster of this scale. After the 1953 events no similar major events have occurred. There have been some threatening situations in 1993 and 1995 but no dikes were breached. Small scale pluvial flooding in urban areas also occurs as summer downpours are getting more intense due to climate change. *Poland* has a significant flood risk, with almost half of the municipalities endan-


**Fig. 7.1** Countries and cases analysed in STAR-FLOOD

gered. In 1997 the Millennium floods affected about 2% of Poland's territory inflicting a total damage of approximately €2.5 billion (1.7% of the GDP).[3] The risk of flooding increases due to urbanisation and the resulting increase of impermeable surfaces. In 2010 heavy flooding occurred again in large parts of Central Europe, where Warsaw and other areas were heavily affected.[4] Although projections of climate change in Central Europe are not clear in terms of change in mean annual precipitation, it is likely that the intensity of precipitation events will increase.

[3] Source: http://mcebrat.republika.pl/flood.htm

[4] Source: http://www.cbsnews.com/news/poland-flood-threatens-warsaw-submerges-towns/

**Table 7.1** Types of flooding, number, costs and fatalities of flood events between 2002 and 2013 in the STAR-FLOOD countries (DG Environment 2014)

| | Causes of flooding | No. of flood events 2002–2013 | Total costs over all events 2002–2013 (extrapolated) | Total no. of fatalities 2002–2013 |
|---|---|---|---|---|
| Belgium | Pluvial, fluvial, tidal, surge | 10 | € 180 million | 5 |
| France | Pluvial, fluvial, flash floods | 48 | € 8,700 million | 152 |
| Netherlands | Pluvial, fluvial, tidal, surge | 3 | € 14 million | 0 |
| Poland | Pluvial, fluvial | 10 | € 24,000 million | 24 |
| Sweden | Pluvial, fluvial, snow-melt | 1 | € 320 million | 0 |
| United Kingdom | Pluvial, fluvial, tidal, surge, flash floods | 48 | € 23,000 million | 57 |

Flood risks in *Sweden* are relatively small, although it is one of the largest countries in Europe, with a large variation in hydrological and geological conditions. Therefore, the probability and consequences of floods vary significantly. Fluvial floods are most common, which mainly occur as a result of heavy rains and snow melting. It is expected that in the Scandinavian countries temperatures will increase more than the estimated global average, and with this, the amount of intense precipitation events will rise (Table 7.1).

## 7.3 How to Use Part II as Guidebook?

### *7.3.1 Main Objective and Target Audience*

Increasing flood risks in Europe call for improved approaches for management. The main objective of this Practitioner's Guidebook is to provide inspiration on how to set up an effective flood risk management approach in a country or a specific area and how to ensure that this approach is implemented though good governance. This can concern both small incremental changes in day to day practice, as well as more structural changes. The Guidebook is based on the results of the STAR-FLOOD research. Where relevant it links to good practices and recommendations from other research and policy projects. It answers questions such as:

- How can actors find each other in a fragmented environment?
- How can a resilient mix of strategies be realised?
- How can it be ensured that strategies are implemented?
- How are specific conditions in a country/urban region accounted for?

- What instruments are available?

This Guidebook may be relevant for all stakeholders involved in flood risk management in Europe. It particularly addresses actors interested in how flood risk governance functions and what their own possibilities are to improve flood risk management practices. This includes, but is not necessarily limited to, the following groups:

- National, regional, local policymakers (authorities and NGOs) developing or implementing one or multiple flood risk management strategies at a strategic level (sectors water and flood management, spatial planning, disaster management);
- Private parties, such as consultants and insurance companies.

### *7.3.2 Set Up Part II*

Chapter 8 introduces five flood risk management strategies and three ultimate aims of flood risk management. Based on this information, it provides guidance on how to develop a good portfolio of strategies.

Chapter 9 explains why good governance is essential for the implementation of these strategies and provides practical guidance on how to assess whether change of governance is beneficial in any given situation and, if so, which steps for improvement can be taken.

Chapters 10, 11, 12 and 13 elaborate common challenges and good practices: for inspiration and to facilitate learning from other countries and cases. Chapter 10 introduces integrated planning, coordination and collaboration challenges and good practices. Chapters 11, 12 and 13 elaborate challenges and good practices for specific 'stages' in the flood risk management cycle:

- Chapter 11. Before a flood (flood defence and spatial planning);
- Chapter 12. During a flood (disaster management); and
- Chapter 13. After a flood (recovery).

The chapters can be read independently of each other, enabling easy navigation *directly to your area of interest*. Chapters 10, 11, 12 and 13 each start with an inspiring interview with a practitioner, and then describe common challenges that have been found in Belgium, England, France, the Netherlands, Poland and Sweden. Finally, for each challenge one or more good practices are introduced, describing how it has been successfully addressed in specific countries and cases. Hopefully, this will be helpful in dealing with the challenges faced in flood risk management practices.

**Textbox 7.2: Selection of Good Practices**
Good practices are projects, instruments or other practices that have proven to be effective in order to reach the goals of flood risk management in different contexts. They contribute to the ultimate aims of resilience, efficiency and/or legitimacy (see Sect. 8.3).

The good practices described in this guidebook are concrete examples from the STAR-FLOOD countries. They have been selected by the authors from the wealth of empirical material collected during the research and discussed with all project partners, and should prove inspirational to other countries and regions.

It should be noted that the selection remains to a certain extent subjective, and stress that there are many more good practices to be found in the STAR-FLOOD countries, Europe and worldwide.

Inspired by international good practices, this guidebook facilitates an understanding of essential components of flood risk management, and encourages changes. At the same time it encourages further exploration and experimentation.

Part II contains some tools that may help even quicker navigation to relevant sections. The *Quick Reference Chart* contains all good practices described in Chapters 10, 11, 12 and 13. For each good practice the chart indicates which flood risk management strategies and which governance aspects are discussed and to which ultimate aims the good practice contributes. The good practices are clustered per country. This allows searching for practices by country, strategy, governance aspect or aim. The relevant strategies, governance aspects and aims are also indicated with icons at the start of each section that describes a good practice. The *Glossary*, explains the terms and abbreviations that are of central importance in this Guidebook.

### *7.3.3 Guidebook Online*

The Guidebook can also be accessed online. The online version contains the same base content as this document but includes additional fact sheets of the analysed countries and cases, and is more interactive, as it is built up of many smaller blocks of information that are intuitively linked to each other. This allows for a quick navigation to specific topics of interest. The online version can be found at www.star-flood.eu/guidebook

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# Chapter 8
# Flood Risk Management Strategies

**G. T. (Tom) Raadgever, Nikéh Booister, and Martijn K. Steenstra**

## 8.1 Flood Risk Management Strategies

Flood risk management in European Member States has traditionally focused on structural solutions to defend against flooding, and this ethos can be described as: 'keeping the water away from people'. However, it is now widely recognised that Flood Risk Management requires a mixture of options aimed at minimising both the probability and the consequences of flood events. For example such a diversified approach is recommended in recent policy documents such as the EU Floods Directive (2007/60/EC) and the UNIDSR Hyogo Framework for Action. In the STAR-FLOOD project we have made a distinction between five flood risk management strategies, which can be combined in a diversified approach. These strategies are illustrated in Fig. 8.1.

In this Practitioners Guidebook we have clustered the five strategies by relevance to the three main occasions, before a flood, during a flood and after a flood[1]:

- Before a flood event:
  - *Flood risk prevention* aims to decrease the consequences of flooding by decreasing the exposure of people and property via measures that prohibit or discourage development in areas at risk of flooding (e.g. spatial planning,

[1] The division between before, during and after a flood is based on the risk management cycle and resilience literature. Yet, it is rather intuitive and not always clear-cut. For example, flood warning systems and evacuation plans that fall under the strategy of flood preparation and response should already be developed before a flood in order to function well. For recovery mechanism such as insurance the same is valid. Furthermore, strategies may be interlinked. For instance, a high insurance premium in a high risk area may have the effect that people will not build there (prevention), or will take measures to flood-proof their houses (mitigation).

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T. Raadgever, D. Hegger (eds.), *Flood Risk Management Strategies and Governance*, https://doi.org/10.1007/978-3-319-67699-9_8

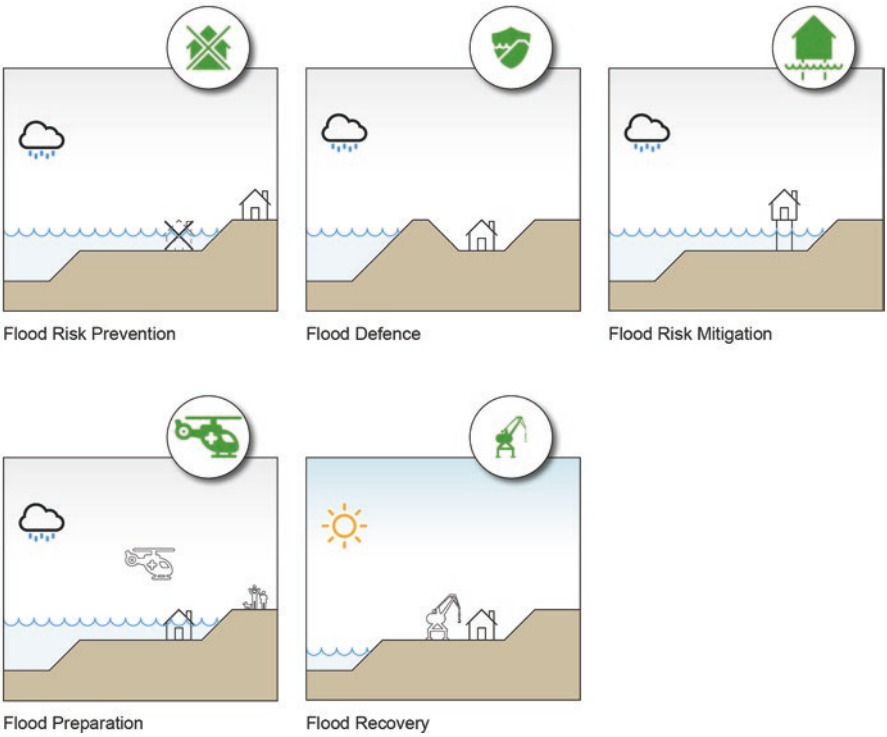


**Fig. 8.1** Flood risk management strategies

re-allotment policy, expropriation policy). The main focus of this strategy is to "keep people away from water" by building only outside flood-prone areas.
  - *Flood defence* measures aim to decrease the probability of flooding. This is accomplished using infrastructural flood defences, such as dikes and weirs; by increasing the capacity of existing channels; by increasing space for water and by creating space for upstream water retention. In other words, 'keeping water away from people'.
  - *Flood risk mitigation* focuses on decreasing the magnitude or consequences of flooding through measures inside the vulnerable area. The magnitude of flooding can be decreased by retaining or storing water in or under the flood-prone area (e.g. rain water retention). The consequences can be reduced by flood zoning or (regulations for) flood-proof building.

- During a flood event:
  - *Flood preparation and response* measures include developing flood warning systems, preparing disaster management and evacuation plans and managing a flood when it occurs.
- After a flood event:
  - *Flood recovery*, includes reconstruction and rebuilding plans as well as public compensation or private insurance systems.

**Textbox 8.1: Link with the Floods Directive (2007/60/EC)**
Directive 2007/60/EC on the assessment and management of flood risks – or in short the Floods Directive – entered into force on 26 November 2007. This Directive requires Member States to: (1) assess the risk from flooding to water courses and coast lines, (2) map the flood extent, assets and humans at risk in these areas; and (3) take adequate and coordinated measures to reduce this flood risk.

The Directive also reinforces the rights of the public to access flood risk information and to have a say in the planning process. The Floods Directive is carried out in coordination with the Water Framework Directive. Flood Risk Management Plans and River Basin Management Plans are coordinated, through the public participation procedures in the preparation of these plans.

The implementation of the Floods Directive has, and will continue to influence flood risk governance in EU Member States. For some countries it is a major driving force for change. With the finalisation of Flood Risk Management Plans in 2015, the first cycle of implementation of the Floods Directive has come to an end. STAR-FLOOD analysed the influence of the Floods Directive on flood risk management and governance and delivers lessons for improving the second cycle of implementation. These lessons are described in the deliverables "Design oriented framework (D5.2)" and the forthcoming "Policy briefs (D7.3)" (see Sect. 18.2.1.).

## 8.2 Management Strategies in the STAR-FLOOD Countries

Due to increasing flood risk, and recent flooding events, flood risk management is rising on the political agenda in many European countries. In addition, the introduction of the Floods Directive in 2007 requires all EU Member States to analyse flood risk in their country and develop integrated flood risk management plans. Yet, countries have a lot of freedom regarding the goals they strive for and the strategies and measures they employ to meet those goals. Also the STAR-FLOOD countries differ in the strategies they adopt. In Table 8.1 the relative importance of each of the five flood risk management strategies *within* the STAR-FLOOD countries is introduced.[2]

*Belgium* consists of three political regions: Flanders, Wallonia and Brussels. These regions have developed their own policy and planning independently in the last 25 years. After the 1953 and 1976 floods, flood risk governance in Belgium

[2] Dark blue designates the relatively high importance of a strategy within a country and light blue the relatively low importance of a strategy. The designations are given at the national policy scale, there may be regional and local variations. The designation is based on analysis of many scientific and policy document and many stakeholder interviews per country (see WP3 reports in Sect. 18.2.1). Still, it is somewhat arbitrary in which category a strategy falls.

**Table 8.1** Overview of relative importance of flood risk management strategies in six EU countries (in 2015)

| | Prevention | Defence | Mitigation | Preparation | Recovery |
|---|---|---|---|---|---|
| Belgium | | | | | |
| England | | | | | |
| France | | | | | |
| The Netherlands | | | | | |
| Poland | | | | | |
| Sweden | | | | | |

focussed mainly on risk prevention and flood defence. In more recent years mitigation measures were introduced. Due to the country's institutional complexity, there is a wide range of instruments available in each of the regions.

Although the discourse in *France* focusses on the prevention strategy through the implementation of the risk prevention plan, the French policy is in fact mainly dominated by two strategies: defence and recovery. In 2002 France introduced its Action Programme for flood prevention (PAPI), which introduced the principle of integrated flood risk management at the local level. Within this action programme, flood defence remains dominant in financial terms, but other strategies are taking into account.

Due to historical events and dramatic experiences, *Poland* has a preference for technical infrastructure solutions to flood risk management. Poland mainly focusses on flood defences, supported by flood preparation and risk prevention. Due to pressure from the EU in relation to the implementation of the Floods Directive, Poland has also started to look at mitigation and recovery plans although implementation of this new approach has only just begun.

In *the Netherlands* flood protection has been a precondition for settlement in low-lying areas since the Middle Ages. After the 1953 floods the protection strategy gained even more momentum by implementation of the (first) Delta programme. The coastline was shortened and the height of the dikes and dunes were increased. In recent years flood risk mitigation and flood preparation have moved higher on the agenda.

Flood risk management also has a long history in *England*. Moreover, a diversified and holistic flood risk management approach has been in place for a long time, with all five strategies established for ca. 65 years. Within this approach a variety of measures have been consistently applied and in recent years new innovations and measures have been added. Examples include the uptake of property-level measures and community flood action plans to enhance strategies of mitigation, preparation and response. Now England has a relatively encompassing flood risk management approach, which gives different strategies more or less the same level of importance.

*Sweden*, in contrast with the other countries, does not have a national adaptation or flood risk strategy. Sweden addresses flood risk management mainly through a series of environmental policies. As the effects of flooding are primarily felt at the local level, most flood risk management measures are also taken at the local level. For example, emergency management and flood prepraration are organised by municipalities. Relatively little is organised at the national level. There is flood insurance available and included in the household or building insurance, implying that flood recovery is of importance. In recent years flood defence has moved higher on the agenda.

## 8.3 Towards Resilience, Legitimacy and Efficiency

A wide variety of strategies exists and there are considerable differences between the strategies that countries apply. One may wonder in what direction the current set of strategies and measures in a country could be improved. Or in other words: What can be considered an improvement?

The answer to this question is twofold. Firstly, there are no 'one size fits all' solutions. What is considered an improvement depends on societal and political preferences and on the specific physical and societal context: Which types of floods are encountered? How significant is the risk? What flood risks are acceptable, and to whom? How far does society want to reduce flood risk? At what (societal) cost? What measures are implemented already? And what are the physical and institutional boundary conditions determining what is possible in the future?

Secondly, we can provide the reader with generally desirable outcomes that indicate possible ways forward, based on the state of the art in literature on disaster risk management and governance. This section describes three desired outcomes for flood risk management and their underlying criteria – resilience, legitimacy and efficiency (Alexander et al. 2016). They can help to determine in which direction to improve. The criteria can be applied to select strategies and measures, as well as to design improved governance arrangements (see next chapter).

Thus, the general outcomes and criteria are to be handled with care. They provide inspiration for improvement rather than judgement. The outcomes and underlying criteria are explained in more detail below.

### *8.3.1 Resilience*

Resilience can be divided into three components: the capacity to resist floods, ability to absorb and recover and adaptive capacity.*Capacity to resist* is defined as the

ability to prevent flood hazards from occurring, typically through the use of flood defences. This might be seen as 'the first line of defence'.

The next 'line of defence' and the next facet of resilience is *the ability to absorb and recover* from flood events. This ability is important, because flood events can always occur, no matter how good flood defences are. It offers the possibility for (relatively) safe failure, just like the airbag in a car. The ability can be improved by measurse that mitigate the consequences in case of a flood event and enable a good recovery. For instance, economic damage in case of a flood can be reduced by flood adapted building (before a flood); inhabitants can be evacuated according to evacuation plans (during a flood); and insurance schemes can enable a faster recovery after the flood. Indirectly, insurance schemes can also promote individual risk prevention and mitigation, for example by offering cheaper insurance policies to property owners who take measures to limit damage. This enables communities to overcome flood events and return to 'business as usual' with as little disruption as possible.

A third facet of resilience is *adaptive capacity*, or the capacity to learn, innovate and improve flood risk management.

### 8.3.2 *Efficiency*

Efficiency is a desired outcome that emphasises that flood risk management and governance should use resources (economic, human, and technological) in an efficient manner; maximising desired outputs and minimising required inputs. *Economic efficiency* focuses on the use of financial resources. The broader criterion of *resource efficiency* focuses on other types of resources such as technology, infrastructural assets and human resources (e.g. knowledge, skills and personnel).[3]

### 8.3.3 *Legitimacy*

Legitimacy can be defined as the societal acceptance of the input, process and output of flood risk management and related governance arrangements. It includes

[3] NB. Effectiveness, or achievement of the goals set, is an underlying condition for both resilience and efficiency. Therefore, it is also important to improve the effectiveness of flood risk management and governance.

many aspects: *accountability, transparency, social equity, participation, access to information, procedural justice and acceptability*. For instance, the decision-making process and relevant information should be transparent, so all affected stakeholders can see how decisions are made. Furthermore, there should be opportunities for various stakeholders to participate at relevant points in the decision-making process. All stakeholders should be able to challenge decisions made and the rule of law should be secured. Finally, cost and benefits should be distributed in a fair manner among stakeholders.

## 8.4 How to Select Flood Risk Management Strategies

One may wonder what the desired outputs of resilience, efficiency and legitimacy mean for the strategies that one should implement. The criteria that are most directly applicable for determining an optimal set of strategies are the capacity to resist, the capacity to absorb and the resource efficiency. The first two capacities reflect that regions vulnerable to flooding will be more resilient if multiple flood risk management strategies are implemented simultaneously.

In several European countries, engineers and flood defence measures dominate the flood risk management domain. Although this often appears to be an effective and economically efficient strategy, other strategies could enrich and enhance flood risk management. By combining multiple flood risk management strategies, loss of lives and social, economic, environmental and cultural losses can be decreased and recovery or smart adaptation after a flood event can be enabled. In other words: if one strategy fails, another is still in place, creating a backup.

On the other hand, it may not be efficient to implement all flood risk management strategies simultaneously. It may for example be more efficient to invest money in flood defences than to invest money in flood proofing buildings. This depends strongly on the local physical situation, on past investments, and on the governance capacity to implement certain strategies.

For instance, in countries with a dominant focus on flood defence, (Belgium, France, Poland and the Netherlands), the presence of effective flood defence infrastructure is a necessity (‘must have’) and other strategies could be viewed as add-on strategies to reduce residual risks (‘nice to have’). A country like England with more of a balanced approach to strategies experiences more floods, but at the same time performs better in terms of response and recovery. And in France (and to a lesser extent Belgium) the recovery system is well developed. This contributes to resilience, but also to the risk that citizens and companies pay less attention to prevention and mitigation. That is to say citizens and companies trust that their losses, in case of a flood, will be compensated negating the need for prevention and mitigation.

An important finding from STAR-FLOOD is that having multiple strategies in place may cause fragmentation. Actors, policies, laws and other tools and instruments that link and align strategies are therefore essential.

As there is no 'one size fits all solution', evaluation of the pros and cons of each strategy and combination of strategies, for a specific country or region is recommended. This way, one can develop an approach that is tailored to local physical, socio-economic and institutional conditions.

In the next chapter (Sect. 9.4) we describe four steps that can be taken to analyse and improve flood risk governance in a specific area. The steps concern the strategies to employ, as well as governance aspects that ensure their implementation and instruments to bridge gaps between strategies and governance arrangements. Furthermore, in Chap. 10 we present a number of concrete good practices for integrated planning. These examples may provide inspiration on how to select an optimal portfolio of strategies and measures.

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# Chapter 9
# Flood Risk Governance

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## 9.1 Flood Risk Governance Arrangements

A growing body of scientific literature (e.g., Hegger et al. 2014; Mees et al. 2014; Mostert et al. 2008) and policy documents (e.g., the EU Floods Directive (2007); UNISDR Hyogo framework for action (2005) and OECD Water governance principles (2015)) point out that flood risk management is not exclusively a technical matter. The implementation of flood risk management strategies, as well as their mutual alignment or integration, is more and more considered a governance issue. A proper embedding of strategies in *flood risk governance arrangements* is essential for their successful implementation. In general we can say that the following elements have to be in place:

- the relevant *actors,* such as spatial planners, water managers, emergency services and insurance companies, take responsibility and collaborate to implement the strategy;

- the strategy is embedded in the actors' *discourses*, e.g., in thinking, discussions and policies;

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T. Raadgever, D. Hegger (eds.), *Flood Risk Management Strategies and Governance*, https://doi.org/10.1007/978-3-319-67699-9_9

- the implementation is backed up by formal and informal *rules;* and

- the actors have the necessary *power and resources* (finances, knowledge, political and interaction skills).

These four dimensions are central in the STAR-FLOOD research. Table 9.1 illustrates the most relevant aspects within each dimension. All these governance aspects need to function together and any one missing link may hamper implementation. Basic requirements include a transparent societal debate and clear specification of normative objectives (such as acceptable protection levels), a clear division of responsibilities, structures for information, participation and collaboration of all relevant stakeholders, adequate legislation and policies, sufficient financing and transparent financing. Furthermore, as already mentioned in the previous chapter, instruments that link and align different strategies and governance arrangements should be in place to avoid fragmentation (see next chapter).

**Table 9.1** Dimensions and underlying aspects of flood risk governance arrangements

| Actors | Discourses | Rules | Power & Resources |
|---|---|---|---|
| • Public actors<br>• Private actors<br>• Citizens<br>• Coalitions and oppositions<br>• Interaction patterns | • Relevant scientific paradigms and uncertainties<br>• Policy programmes, policy objectives (perceived issues) and policy concepts<br>• Historical metaphors/ narratives<br>• Policy and legal principles | • Legislation<br>• Constitutional, procedural & substantive norms<br>• Procedural instruments<br>• Legal traditions<br>• Cross-country and cross-sector alignment of rules (integration)<br>• Policy and legal principles<br>• Informal norms, culture | • Legal authority, including the right to regulate property (expropriation)<br>• Financial power<br>• Knowledge<br>• Informal political networks<br>• Interaction skills |

## 9.2 Governance Arrangements in the STAR-FLOOD Countries

Governance arrangements for flood risk management differ strongly between the STAR-FLOOD countries. In *Belgium* competences for water management and spatial planning have been transferred to the regions (Flanders, Wallonia and Brussels). Each region has its own actors, legislation and policies. The regional water system arrangements are highly fragmented in terms of actors. Competences are divided over four categories of watercourses, which each have different water managers. In order to increase the coordination between the water managers of all levels and with the spatial planning department, the Flemish government installed a Coordination Committee on Integrated Water Policy (CIW) in 2003. In the same year, the Walloon government took a similar initiative with the Horizontal Flood Group (GTI). At basin level, integrated water management is pursued by the basin boards in Flanders and the river contracts in Wallonia. Crisis management and insurance are coordinated at the federal level.

In *England* the Risk Management Authorities are identified in the Flood and Water Management Act 2010: Environment agency, Lead Local Flood Authority, Internal Drainage Board, District Councils, Highways Agency and Water Companies. Yet, there are many more stakeholders influencing flood risk management, such as spatial planners. The English governance is built up of many sub-arrangements with separate policies, legislation and informal rules. These different arrangements are well aligned and linked. Funding for defence and mitigation mainly comes from the national level. In addition Partnership Funding allows public and privatfe funding to be sought. Furthermore, insurance companies play an important role in the recovery. The insurance system is currently in transition (see Sect. 13.2.1).

The main actors in flood risk management in *France* are central and local public authorities. A process of decentralisation has been started, but has not yet been fully realised. The State still maintains a central position through the production of legislation and policies and the control of procedures, while responsibilities for infrastructures is devolved to the municipal level. The principal resources for measures come from the National Fund for Major Natural Hazards (also known as the "Barnier Fund"), which is funded by taxes on home insurance contracts (see Sect. 13.2.3).

In *The Netherlands* water system management and flood risk management (focusing on defence) is traditionally the responsibility of the ministry and the regional water authorities. Provinces and municipalities are involved in spatial planning and sewerage and urban water management. The Safety regions are in charge of coordinating disaster management. The government is responsible for meeting legal safety standards for dikes, as stated the Water Act (2009), which are currently updated to reflect a basic safety level for each inhabitant as well as economic value and group risk. The authorities developed several relevant integrated policies, such

as the National Water Plan and Delta Programme. The national and regional authorities involved have a lot of specialised technical expertise and can count on sufficient financing though national and regional taxes.

In *Poland* the Regional Authorities of Drainage, Irrigation and Infrastructure (WZMiUW) are responsible for 94% of the flood defences. The remaining 6% fall under the responsibility of local administration or Regional Water Management Boards. WZMiUWs are supervised by the provincial governments, but have close links to the Ministry of Agriculture and Rural Development. The Water Framework Directive and the Flood Directive stimulated fast change, leading to integrated risk analysis and management. The 1997 floods also triggered legislative and organizational reforms, including the Water Act (2001), Act on State of Natural Disasters (2002) and Act on Crisis Management (2007). Flood defence measures are mainly financed by central government. The defence strategy is gradually more supported by preparation and prevention strategies.

Whereas in most countries national authorities play an important role in flood risk management, *Sweden* lacks a central overarching agency for flood risk management. It also lacks a national flood risk management strategy. Yet, it has a series of environmental objectives for 2020 in place that partially touch upon flood risk issues. This results in the scattering of flood risk issues across the policy areas of environment, spatial planning and housing, each of which have their key legislative instruments. The main actors in Swedish flood risk management are the municipalities. They are responsible for emergency management, spatial planning, water and sewerage. They are supported by regional and national authorities. Most of the financial resources come from taxes and charges at the local level. Costs are borne by the party that benefits the most from a measure. Furthermore, insurance companies play an important role in flood recovery.

## 9.3 Factors Promoting Stability or Change

Flood risk management strategies and governance arrangements change over time. Knowledge of which factors lead to stability and which factors promote change is essential to be able to promote change and to promote change in the desired direction. Through literature review and analysis of stability and change in the six countries in the past decades, we found the main factors that can explain stability and change. They are related to: (i) physical circumstances; (ii) physical and social infrastructure; (iii) structural factors; (iv) agency and (v) shock events (Matczak et al. 2016). In practice, changes can often only be explained by a set of interrelated factors. Some of these factors can be steered by stakeholders involved in flood risk management (each with their own circle of influence), others cannot. The table below presents factors that promote change and factors that promote stability in flood risk governance.

## 9.4 How to Change Flood Risk Governance in a Specific Area?

The presented information on flood risk management strategies (Chap. 8), governance arrangements and factors that promote stability and change (this chapter), can be used to analyse and improve flood risk management and governance in a specific country, region or city. In this section we present generic steps that can be used to analyse and influence flood risk management.

We recommend analyse of the current situation, its strengths, weaknesses, opportunities and threats. Next, we recommend that the desired state is determined, including what changes would be required to arrive there. Then it is time to consider what has priority and what can be changed and by whom. Finally, and the biggest challenge, is to take action in order to establish the desired changes. And then, with monitoring the results of undertaken actions, the cycle will start again.

### *9.4.1 Step 1. Analyse the Current Situation*

The first step is to analyse the type and severity of flood risks in a specific area; which strategies are in place; who is involved; what are their perspectives; what legislation and unwritten rules guide their behaviour and what financial resources, power and knowledge do they use? We advise that focusing on the strategies and governance arrangements in one's own geographic area and field of work.

We then advise performing a SWOT analysis: mapping the strengths, weaknesses, opportunities and threats of current strategies and governance arrangements. Are the right measures in place to reduce flood risk to an acceptable level, what bottlenecks exist in their implementation, and what future threats and opportunities for improvement can be identified?

### *9.4.2 Step 2. Define the Desired Situation*

With the SWOT analysis as a starting point, one can develop ideas about an ideal flood risk management situation. What future situation is desired, for instance 50 years from now? This kind of thinking may help to focus on what one really wants, instead of on current limitations. Collaborative workshops, scenario and visioning workshops for example may help to develop a joint vision with other stakeholders (see Sheppard et al. 2011; Mostert et al. 2007)[1].

[1] See also: http://participedia.net/en/methods/scenario-workshop

The evaluation criteria presented in Sect. 8.3 (resilience, efficiency and legitimacy), and the good practices presented in Chaps. 10, 11, 12, 13 of this book, may also provide inspiring directions for improvement.

### *9.4.3 Step 3. Define and Prioritise the Actions*

What steps are needed to achieve the desired situation? Which are most important? And which are most feasible? Organisational changes often require a lot of time, effort and cooperation of multiple actors. One could sketch a development path in time that shows the required changes between the current situation and the desired future. Techniques like backcasting and adaptive pathways may be useful for this. The good practices in Chaps. 10, 11, 12, 13 may suggest specific activities that can be employed to achieve specific desired changes.

As nobody wants to waste their time and energy, we advise focussing on what is most important and to focus on the change that one can really influence. Table 9.2 in Sect. 9.3 can help to make a distinction between the factors that promote change that one can and can't influence. We advise starting with the 'low hanging fruit' in order to motivate the actors involved in the improvement process, and to build further on achieved successes. Another suggestion is to analyse which processes of change are already present in the relevant area and if these processes can be influenced in such a way that new ideas can be realised.

**Table 9.2** Factors promoting stability and change

| | Promoting Stability | Promoting Change |
|---|---|---|
| • Difficult/cannot be influenced | • Large past investments in infrastructure (sunk cost)<br>• Economic development level of country/available resources<br>• General physical situation (e.g., types of flood threat)<br>• Climate change, socio-economic change | • (Near) flood events<br>• Increasing cost of maintaining flood infrastructure (past investments)<br>• Culture of learning, innovation and change |
| • Can be influenced | • Governance is centred in specific divisions of accepted responsibilities<br>• Strong body of expert knowledge and strong epistemic community on existing strategies<br>• Current legislation (formalization of rules and procedures)<br>• Political norms and codes of conduct<br>• Strong historical narratives<br>• Public trust in existing institutions and their efficiency<br>• Belief of efficiency of current strategies/arrangements | • Current implementation gap<br>• Decreasing legitimacy of current rules<br>• New ideas, problem definitions and policy concepts<br>• New knowledge and expertise (learning)<br>• New rules such as EU floods directive<br>• Entrepreneurs highlighting the sub-optimality of the current approach<br>• Strong pressure by specific interests (actor coalitions) |

### *9.4.4 Step 4. Start Change*

After determining what to do, there is no time to waste! We advise setting up joint actions in order to bundle resources and keep each other motivated.

NB. This step-wise approach may appear simpler than it is. In reality improving flood risk management is a complex challenge. It includes many actors in multiple interconnected and non-linear processes, which can be only partly influenced by individual persons or organisations. It will require ongoing effort, many iterations and sustained networking and capacity building.


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# Chapter 10
# Integrated Planning, Coordination and Collaboration

**G. T. (Tom) Raadgever, Nikéh Booister, and Martijn K. Steenstra**

**Practitioner's Interview François Mayer, Department of Agriculture, Natural Resources and Environment, Wallonia**

"I am responsible for the convergence of common themes between the regional government's Department of Agriculture, Natural resources and Environment and the Department of Spatial planning, Urban planning and Energy in Wallonia. With regard to flood risk management, we aim for a better consideration of flood risks in agricultural projects (specifically preventing mud streams due to soil erosion) and in developments close to agricultural zones. Furthermore, we developed a regional framework for rainwater management on individual parcels within building projects or allotments.

**Electronic Supplementary Material** The online version of this article (https://doi.org/10.1007/978-3-319-67699-9_10) contains supplementary material, which is available to authorized users.

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T. Raadgever, D. Hegger (eds.), *Flood Risk Management Strategies and Governance*, https://doi.org/10.1007/978-3-319-67699-9_10

I see the need for a strategy aiming at promoting the infiltration of rainwater on parcel level in the urban environment. For this we need technical guidelines adapted to the local situation (for example the local soil permeability) and adaptation of the legal framework. Urban planning and spatial planning project dossiers should contain a chapter assessing the impact on the water cycle. In the end the creation of a technical cell to support the local authorities would be beneficial.

To promote more integrated planning we need to (1) identify the key actors in spatial planning (urban and rural) and water managers (drinking water, sewerage and watercourses), (2) let them work together on a regional level; (3) develop a common vision; (4) ensure the dialogue with scientists; and (5) communicate the decisions and other information to the general public. My key advice is to organise platforms that bring together authorities and other stakeholders from multiple levels, multiple domains and multiple types of organisations.

A good example of a collaboration platform that deals with river floods is the Wallonian *Groupe Transversal Inondations* ('cross-cutting' flood group). This structure follows the plan "P.LU.I.E.S." established in 2003. It organises monthly meetings with representatives from among others the academic world, the Drinking Water Federation, watercourse managers (provincial and regional), and the regional administration (in charge of spatial planning; rural environment; roads; and the implementation of the Water Framework Directive)."

## 10.1 Common Challenges

In Chap. 8 we illustrated that resilience entails both strategies that contributes to resistance against flooding, such as flood defences, and strategies that enable absorption and recovery from floods, such as insurance. Many countries and cities have traditionally focused on flood defence and are now trying to diversify their approach, giving more attention to for instance flood proof construction and disaster management. One should make sure that such diversification does not result in conflicts between strategies: they should be complementary, linked and well-aligned in integrated plans.

In Chap. 9 we emphasised the need for a good organisation or governance – of actors, discourses, rules and resources – in order to guarantee that the selected strategies are properly implemented. In each of the analysed countries we encountered many groups of actors involved in the development and implementation of the flood risk management strategies. Actors from different types of organisations (authorities, NGOs, businesses, citizens, researchers); different sectors or domains (water management, spatial planning, disaster management, insurance, etc.); different levels and scales (EU, national, regional, local); and different locations in the river basin (upstream, downstream), all with their own sets of ideas, policies, legislation,

knowledge, finances etc. Such a complex governance system can become chaotic and dysfunctional, unless there is sufficient coordination and collaboration between the actors involved.

In this chapter we present common challenges and good practices on integrated planning, coordination and collaboration. They can be seen as *'bridging mechanisms'* that combat fragmentation and create synergies by linking strategies and (groups of) actors in a joint, integrated effort to reduce flood risk.

We organised this chapter around four common challenges that all EU Member States have to deal with to some extent. The first common challenge is the implementation of the EU Floods Directive, the second is the development of integrated plans, and the last two concern coordination and collaboration (between neighbours) within a river basins and between actors at different levels.

More common challenges and related good practices can be found in Chaps. 11, 12 and 13. These chapters specifically focus on practices before, during and after a flood event, but include also practices of integrated planning, coordination and collaboration.

A Quick Reference Chart describing the good practices per country can be found as Supplementary material x. It indicates per good practices to what Flood Risk Management Strategies, Governance aspects, and Ultimate aims it relates.

## 10.2 How to Implement the Floods Directive?

As introduced in Chap. 2, all EU Member States have to implement Directive 2007/60/EC on the assessment and management of flood risks – or in short the Floods Directive. The Floods Directive requires the identification of *areas at risk of flooding*, making *flood risk maps* indicating the type and level of risk and developing *flood risk management plans* that describe the measures that are taken to deal with flood risk. For good practices concerning flood risk assessment we refer to the FLOODsite Best practice guide on flood risk assessment and management (FLOODsite 2009).

The flood risk management plans for flood prone areas had to be finished by 22 December 2015. The plans should specify appropriate objectives for reducing the likelihood and adverse effects of flooding and measures to achieve these objectives. Strategies to be considered include prevention, protection and preparedness, as well as mitigation through sustainable land use practices, water retention and controlled flooding. This includes strategies that increase resistance against floods as well as strategies that increase the ability to absorb and recover from floods, thus promoting resilience. Furthermore, the measures should take into account the characteristics of the particular river basin. The Floods Directive offers the Member States a large amount of freedom to select the measures that fit well with their own situation (Textbox 10.1).

**Textbox 10.1: Objectives, Measures and Prioritisation Workshop**
Together with the Working Group on floods of the Common Implementation Strategy of the Water Framework Directive the STAR-FLOOD partners organised an expert workshop on setting objectives, determining measures and prioritising them. The workshop took place in Brussels at 16 October 2013.

An important finding was that existing practices are so diverse that, in general, it does not seem to be feasible or desirable to be more prescriptive at the EU level. Another finding was that the Floods Directive in several countries fulfils an agenda setting purpose, fuelling debates on new flood risk management measures. Furthermore, the workshop pointed out that the progress in drafting the flood risk management plans differed strongly between Member States, and that tools need to be developed to predict (in advance) and demonstrate (afterwards) the effects of measures on goal achievement. Exchange of this knowledge among Member States is needed, in order to learn from each other and improve the future selection of measures. More concrete examples of how the objectives are set, and measures are developed and prioritised in different Members States can be found in the workshop report (Hegger et al. 2014).

The EU Floods Directive also promotes legitimacy by reinforcing the rights of the public to access this information and to have a say in the planning process. A weak point in this respect is that it has no provision for access to justice. The implementation is carried out in strong coordination with the *Water Framework Directive*, notably by coordination of the flood risk management plans and river basin management plans and coordination of the public participation procedures.

In some countries, like the Netherlands, the impact of the Floods Directive is considered to be limited, as integrated plans were already in place before the introduction of the Directive and were also developed in parallel processes. In other countries, we found that the Floods Directive had a particularly strong and positive influence in reshaping flood risk management. Poland is good example of such a country although the process of implementation of the new approach is still at an early stage.

### *10.2.1 Floods Directive as Driver for Change: Poland*

The Floods Directive, the Water Framework Directive, and other EU regulations have become a clear reference point for flood risk management and water management policies in Poland. Moreover, accession to the EU has brought inflow of funds resulting in a significant number of infrastructure investments. EU regulations initially also caused changes towards more environmentally friendly ‘softer’ management. However, after a recent change in government the focus shifted back to ‘hard’ infrastructural measures with less concern for the environment.

The Floods Directive created a more strategic and proactive perspective on flood risk management rather than being reactive and ad hoc after an event. As a result of a lack of a national flood strategy, the practical idea arose to repeat good practices from England (in terms of institutional design etc.). However, the English approach is difficult to copy to a complete different context. The implementation of basin-based water management (implemented in 1991) and the flood risk maps (resulting from the EU Floods Directive) serve as examples.

Other countries with relatively undeveloped flood risk management policies are advised to also seize the window of opportunity that the EU Floods Directive offers to analyse flood risks, develop an integrated strategy and learn during the implementation. Exchange in the Working Group on Floods under the Common Implementation Strategy may stimulate mutual learning (Matczak et al. 2016).

## 10.3 How to Make Integrated Plans for the Future?

The Floods Directive calls for integrated plans, but we also found various other examples of integrated flood risk management planning in the analysed countries. The first thing that needs to be done is to determine the objectives of flood risk management. Objectives may be expressed in a joint vision of the future situation, minimum safety standards, or a certain risk reduction to be achieved. Questions that can be raised include: What level of risk is acceptable? To whom? And who is responsible for achieving this safety? Should the government protect citizens or should everybody protect themselves?

In all countries analysed in STAR-FLOOD public authorities have some role or responsibility in dealing with flood risk and in providing safety to their citizens. Yet, there are also large differences. One extreme is the Netherlands, with a government that is responsible for achieving high legal flood defence standards (applicable to areas that are protected by primary embankments from flooding by large rivers and sea). In most other countries citizens and businesses have more responsibilities themselves.

The challenge of selecting strategies and developing an integrated approach that avoids fragmentation is already introduced in Sect. 8.4 and the introduction of this chapter. This section provides some good practices on how to prioritise strategies and measures in integrated planning. Good practices on selecting the most effective and efficient measures for the phase before a flood are elaborated in Chap. 11.

A related challenge concerns complexity and uncertainty. We do not know the exact current flood risk nor how it will develop in the future. We also do not exactly know the effects of different measures, and their exact costs. Knowledge on these aspects is crucial for the planning process. A final dimension to consider is time. What measures should be taken when? Adaptive management (see Textbox 10.2) can help to deal with these challenges.

**Textbox 10.2: Adaptive Management as a Way to Deal with Complexity, Uncertainty and Change**

Adaptive management is a concept that has been proposed as a way of dealing with system complexity, uncertainty and change. It acknowledges that current knowledge will never be sufficient for future management. Therefore, policies are treated as hypotheses and their implementation as experiments to test them. Adaptive management requires a process of active learning by all stakeholders, and continuous improvement of management strategies by learning from the outcomes of implemented policies (Raadgever et al. 2008; and see Fig. 10.1).

Adaptive management may help in selecting and planning measures, and preventing under and over investments. It aims at developing robust and flexible management strategies that perform well under different possible futures and can be modified if necessary. This means starting with no regret measures and waiting as long as possible with measures of which the necessity and/or effects are uncertain. For more information on adaptive management, see also The Adaptive Water Resources Management Guidebook.[1]

The good examples below describe how Sweden used climate change as a way to get flood risk management on the political agenda and to incorporate change; how French regions develop their own flood risk management plans; how the Netherlands and Belgium bring the concept of adaptive management to practice in their policies and how London prepares the Thames area for the future.

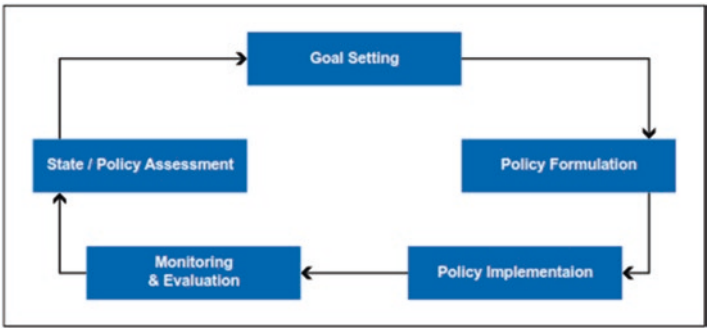


**Fig. 10.1** The adaptive management cycle (Pahl-Wostl 2007)

[1]The Adaptive Water Resource Handbook: http://www.newater.uni-osnabrueck.de/index.php?pid=1052

### *10.3.1 Climate Adaptation as a Trigger: Sweden*

Sweden is a relatively low densely populated country with a low risk of flooding, at least for flooding that causes severe impact to the society. Although in recent years no serious or high impact events have occurred, the climate change threat creates public awareness. Authorities on the national and more decentralized levels assign money and other resources to plan more sustainably and resilient.

As a consequence of expected climate change impacts, new mandatory national standards for designing housing and infrastructure related to possible flood situations with higher return periods have been implemented. The use of *BREEAM certification* triggers this even more. It is a rating-system that gives lower ratings when a building is built in a flood prone area (in an unsustainable location). Predictions of what can happen visualised on maps are enough to influence economic investments and trigger more sustainable/resilient planning in Sweden (Fig. 10.2).

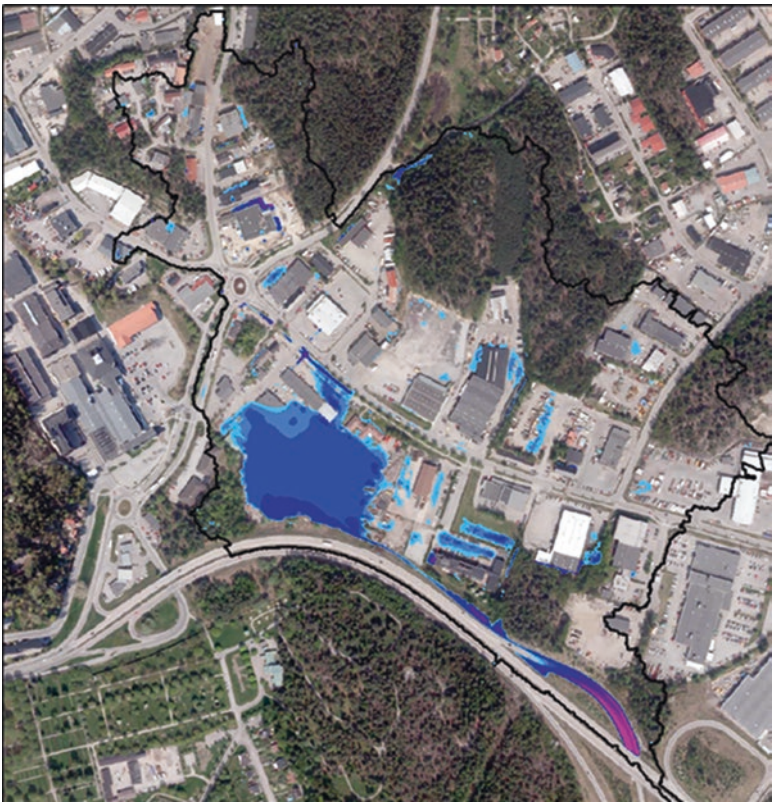

**Fig. 10.2** Flood depth at a modeled pluvial flooding before preventive measures in Södertälje at the 1/100 – year event (flood depth varies from 0 to 3 m)

Other countries can use the Swedish case as a good example. Providing information through mapping risks of climate change on a local and national level can improve awareness and trigger changes resulting in resilience through flood prevention (Ek et al. 2016).

### *10.3.2 PAPI, a Bottom-Up Approach Towards Resilience: France*

PAPIs (Programmes d'Action de Prévention des Inondations or Action plans for flood risk prevention) have been created in France since 2002 (Ministère de l'Écologie, du Développement durable, des Transports et du Logement 2003). The aim of the innovative programme is that local authorities reduce flood risks by combining structural measures, like flood retention and flood defence, and non-structural measures like mitigation and preparation. More specifically, the programme's objective is the implementation of a cross cutting flood risk strategy including the 7 following directions:

1. Improvement of knowledge and risk awareness
2. Monitoring and flood forecasting
3. Flood warning and crisis management
4. Integration of flood risk concern in urbanisation
5. Actions for assets and people vulnerability reduction
6. Flood retention actions
7. Protection infrastructures management

The programme started with a first call for projects directed at all local authorities (municipality, intercommunality, 'département', region, and river basin authority) and based on the willingness of authorities to participate. Proposals for projects were validated using a list of criteria, and when approved by the 'Mixed Flood Commission' (*Commission Mixte Inondation,* a gathering of State, local authorities and civil society representatives) received the PAPI label. This label opens up the possibility for these projects to receive funding from the National Fund for Major Natural Risk Prevention. This contribution ranges from 20 to 50% of the required investment, depending on the nature of the operation. Each labelled project can also be funded by the Ministry of Environment. Every year the PAPIs are granted 300 million Euros for flood management measures.

Each PAPI project is based on an assessment of the territory's vulnerability for flooding. The results of the assessment are shared among and agreed by the involved stakeholders. Each PAPI is developed in partnership between the State and local authorities, led by a local authority and implemented by a broad range of stakeholders (State, local authorities, representatives of companies, farmers, NGOs). The PAPIs do not cover all areas with a potential significant flood risk identified during the first round of implementation of the Floods Directive. Yet, it is likely that the

PAPI programme will be used in the future as a way to finance the measures required where possible.

Initially the approach was designed for fluvial flood risk reduction only, but the measure was renewed in 2011 and extended to marine submersion too. Since 2011, the selection of the projects is done in the frame of a permanent call for projects. Proposals are checked by the State services and validated by the 'Mixed flood commission'. Another authority (the Basin Comity) may do this validation for proposals requesting less than 3 million Euros.

Today more than 100 PAPIs are implemented in France. This demonstrates the success of this programme in encouraging additional action in a bottom-up and collaborative process. New measures are being implemented, preventing further development and preventing increase of risk in flood prone areas (Larrue et al. 2016).

### *10.3.3 Adaptive Delta Planning: The Netherlands*

Predictions of the consequences of climate change inherently contain uncertainties. To deal with such uncertainties, the Dutch Delta Programme has adopted an adaptive approach. An adaptive approach prevents over-investments and is based on no-regret measures.

Research done within the framework of the Delta Programme has shown the bandwidth of potential future peak discharges through the main river systems in the Netherlands. In the Delta Programme areas have been identified that are protected using regular spatial planning instruments. To be able to take measures in the future to deal with more extreme climate change impacts, certain areas should remain free of major developments. An example is the *Rijnstrangen* area in the east of the Netherlands that is reserved as it is possibly required after 2050 as additional retention area. Identifying these areas was done through scenario analysis.

Another example of adaptive planning can be found in the coastal village of *Petten*. Two alternatives to strengthen an existing coastal defence in Petten were possible: (1) strengthening the existing concrete dike; or (2) developing a flexible dike with loose sand. The latter option was chosen as it was more flexible compared to the concrete dike. In a scenario where sea level accelerates, additional sand can be supplemented in a cheap and easy manner. In a scenario where the sea level rises less quickly, overinvestment in a concrete dike is prevented. Another benefit of the flexible "soft" dike was the ability to create ecological habitats and opportunities for coastal recreation. Such *Building with Nature* solutions – of which the Sand Engine near The Hague is an even more knowns example – are more and more applied worldwide as flexible solutions (Kaufmann et al. 2016).

### 10.3.4 The Sigma Plan, Defence and Controlled Flooding: Belgium

Flood defence in the Scheldt estuary is mainly determined by the Sigma Plan of the Flemish government. The Sigma Plan combines three goals: accessibility of the river, flood protection and nature development. When fully implemented it is calculated that the basin will be protected against a 1/1000 up to a 1/4000 storm, depending on the location.

The plan involves a set of actions to be taken to reduce the risk of flooding. It include both local *dike elevations* (for example 90 cm in Antwerp) and *room for the river* measures. Some areas are *de-poldered* in order to give more room for the river. In addition, *flood control areas* that can be flooded in a controlled manner are developed. The measures combine flood protection with estuarine nature development. The plan makes use of existing spatial planning instruments.

The Sigma plan is based on an expected sea-level rise of 0.60 m by the year 2100. Yet, it is uncertain if this expectation will become reality. Thus, when necessary the Sigma plan will be adapted by 2050 (Mees et al. 2016).

### 10.3.5 Multi-scale and Adaptive Management for the Thames Estuary: England

Adaptive capacity in flood risk governance is necessary to ensure the continuation of effective flood risk management under uncertain environmental, climate and socio-economic conditions of the future in the scheme. In terms of flood defence, managed adaptive approaches are increasingly advocated for large-scale schemes. This requires the identification of trigger points and managing risk through predetermined interventions, whilst instilling a degree of flexibility to adjust responses according to changes in conditions; the implementation of the Thames Estuary 2100 project is a good example of such *long-term and multiscale planning*.

Future concerns are also integrated within Catchment Flood Management Plans that support strategic decision-making over a 50–100 year timescale. This decision making is separated into three time horizons with their own themes:

- The first 25 years (2010–2034), which involves the continuation of maintenance, creating new habits – with a look towards the future and safeguarding space for future developments;
- The middle 15 years (2035–2049), which includes the raising and major refurbishment of many existing embankments, walls and smaller barriers;
- To the end of the century (2050–2100). The decisions in this stage will be adapted to the actual situation and the further future, using climate projections and expectations in that time period (see Fig. 10.3).

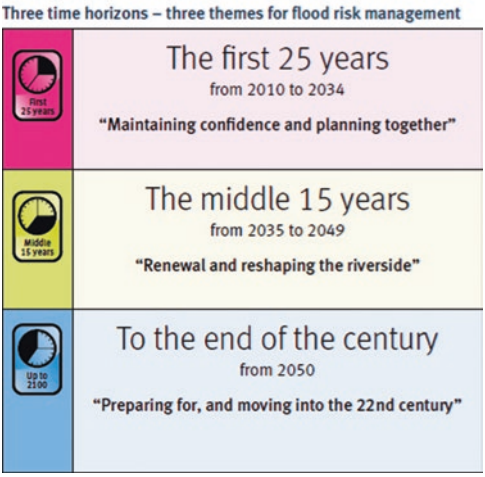


**Fig. 10.3** Time horizons and themes in the Thames 2100 Scheme (Environment Agency 2012)

## 10.4 How to Collaborate in River Basins?

Rivers do not respect manmade borders: river basins like the Danube and Rhine run through several countries and regions. Flood management measures such as the construction of flood defences or water retention upstream may influence the flood risk downstream. Floods starting in one area may lead to floods in other areas as well. This may lead to conflicts of interest between 'neighbours' in a river basin. It calls for coordination and collaboration.

In the STAR-FLOOD project we encountered various good practices in *transboundary coordination and collaboration*. The most striking example are the river contracts in Wallonia, as described below. Another example was the collaboration between Sweden and Finland in the implementation of the Floods Directive in the Haparanda basin (Ek et al. 2016).

For more tools for collaboration and public participation in water management we refer to the Harmonicop handbook.[2]

### *10.4.1 River Contracts in Wallonia: Belgium*

To increase coordination at sub-basin level and to enhance community resilience, Wallonia introduced the 'river contracts'. River contracts are meant to conciliate the different functions and uses of the river, river banks and water resources. These are regional negotiation platforms in which projects are discussed between public and private actors. The river contracts aim to remedy the high fragmentation between

[2] Harmonicop handbook: http://www.harmonicop.uni-osnabrueck.de/handbook.php

authorities involved in flood risk management and are an important driving force for community resilience as they facilitate communication between citizens and water managers.

The precise role of the river contracts varies depending on the basin. To establish a river contract the members have to agree on 3-year action programmes. In some cases the river contract takes a very proactive role in flood management. For example, in the Senne basin the river contract cooperates with local water managers and advises on the prioritisation of actions based on local knowledge.

The river contracts are non-governmental, non-profit organisations, which guarantees their independency and neutrality. They are organised around local negotiation platforms that are composed of representatives from municipalities, provinces, regional administration and non-governmental organisations. Each river contract is equipped with a permanent staff of about 3–6 people. The development of river contracts occurs bottom-up; the initiative is mostly taken by the municipality or province authority. Membership by stakeholders involved is voluntary. The Walloon Region approves the river contract's action programme and supports it financially. Apart from non-governmental organisations, every participating stakeholder contributes funding as well. For every Euro spent, the Walloon government adds 2.33 Euro.

The river contracts are structured around two general assembly's a year, an administration board to prepare the general assembly, a project coordinator and working groups (specific themes or problems). There is technical assistance from the ministerial departments.

At the time of writing, there are 13 river contracts in Wallonia with 54 fulltime equivalents of staff and a budget of 2.6 million Euro. They cover 92% of the Walloon area and include 232 out of 262 municipalities. The river contracts are involved in a total of 8000 projects (Mees et al. 2016).

## 10.5 How to Build Bridges Between Different Governmental Levels?

A multilevel governance system is characterized by activities or phases in the policy cycle that occur at different spatial levels. In a typical centralized system, strategic goals and policies are only formulated at the national level, and regional levels implement according to orders from above. Actors from the national level have a leading role. In more polycentric or decentralised systems regional authorities develop their own strategic goals and tailor made policies (Pahl-Wostl et al. 2013). Whereas current flood risk management planning in the Netherlands is for instance rather centralized, in Sweden the system is heavily decentralized. This can be explained by the fact that in the Netherlands flood risk is much larger than in Sweden, and flood events can have an impact on the whole country. In Sweden, flood risk is much lower and the impact of an event is much more local.

Both types of systems and systems in-between have their advantages and disadvantages. Centralized regimes often have more (legislative) power and resources. On the other hand, decentralized systems tend to develop more tailor-made solutions and have a higher adaptive and transformative capacity. In decentralised systems it is important to have effective coordination mechanisms in place and to find a balance between bottom-up and top-down processes (Pahl-Wostl et al. 2013). The struggle for a good balance is also visible in the STAR-FLOOD countries. In Sweden we see a call for more coordination, knowledge and financial support from the national level now climate in increasing flood risk, whereas in the Netherlands municipalities like Dordrecht (see Sect. 5.1) and Nijmegen (see Sect. 11.3.2) are more and more involved in order to develop solutions that are accepted by local stakeholders.

### *10.5.1 Multi-level Cooperation in Dordrecht: The Netherland*

The **Island of Dordrecht** in the southwestern part of the Netherlands is highly vulnerable to flooding. It is enclosed by large rivers and situated in a tidal area. If a flood occurs, it will be deep and fast. The accessibility of the island is limited: only three bridges, two tunnels and shipping connect it to mainland. Accordingly, evacuation possibilities are limited. Flood risk was to be handled by defending the whole island with primary defences, a responsibility of the national government and regional water authority.

Yet, the municipality had the idea that other *multilevel safety measures* – combining flood defences with water robust building and disaster management – could be more beneficial for the safety of the island. Dordrecht was to become a self-reliant island. The most vulnerable part of the island should be better protected, and other parts could be flooded in extreme situations, which requires among others good possibilities for evacuation *on* the island. To be able to divide the island into compartments – and protect the most vulnerable part – regional defences need to be strengthened. Yet, in order to find support for their plan, the municipality had to convince the other (responsible) authorities to change existing policy, law and funding.

The Delta Programme provided a window of opportunity to discuss and implement the new idea. Within this programme, the Island of Dordrecht became a pilot project for the multilevel safety approach. The municipality has played an important role in bringing all the actors together. It has good connections to (all) involved stakeholders and facilitates communication. The plans are based on the knowledge and experience of the local citizens as well.

At the moment of writing it appears that the desired tailor-made approach will be implemented, including the necessary changes in safety standards and funding. Factors that enabled this include a proactive and visionary policy entrepreneur supported the Municipal Council, joint fact finding with various research institutes in various projects to analyse problems and develop a strategy, joint programming and joint fact finding with other authorities and stakeholders at different levels. Such a proactive approach may also be beneficial for other municipalities striving for change (Kaufmann et al. 2016).

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# Chapter 11
# Before a Flood Event

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**Practitioner's Interview with Marie-France Beaufils**
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**Electronic Supplementary Material** The online version of this article (https://doi.org/10.1007/978-3-319-67699-9_11) contains supplementary material, which is available to authorized users.

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T. Raadgever, D. Hegger (eds.), *Flood Risk Management Strategies and Governance*, https://doi.org/10.1007/978-3-319-67699-9_11

100% of the territory of my city Saint Pierre des Corps is located in flood prone area, and exposed to dikes breaches in case of flooding of the Loire River. The last flood occurred in 1866. In the late 1990s, I analysed the potential impacts of such an event, and I decided to engage with the State services in order to think about a way to continue the development of my city while adapting it to flood risk. This collaborative work allowed for finding innovative, low-risk urban and architectural solutions for living in flood prone zones. It took more than a decade to implement them.

The project is a good example of resilient urbanisation: developing cities while taking into consideration flood risks. It is based on several relatively young initiatives in European cities like Hamburg and Rotterdam, as well as French cities like Rennes and Strasbourg. Technical, economic and regulatory aspects still need to be elaborated in order to arrive at a common understanding of how to implement such resilient urbanisation.

Rebuilding or renewing the cities in flood prone zones is a delicate matter. Many actors are involved and express different – seemingly irreconcilable – points of view: some promote the idea of preventing construction in flood prone areas; others promote the idea of adapting existing buildings and infrastructure. This multiplicity of visions generates a complex playing field in which it is difficult to reach consensus.

We also inherited a difficult legacy. 17 million persons currently live in vulnerable flood prone territories. They are more or less protected by defence infrastructure, but the condition is not always sufficient due to lack of maintenance. Furthermore, in many territories urban renewal in flood prone areas is legally allowed, or even implicitly encouraged by law. Other challenges include the uncertainties around the future of local authorities and their jurisdictions; budgetary restrictions and economic and social crises.

As a consequence, the consideration of flood risk in urban renewal projects often remains vague, remote and not a priority. We have no other choice than to build consensus about how to renew cities in flood prone areas. We have to accommodate, to bring closer, to pacify and to reconcile the different approaches. By doing so, we place ourselves in the heart of the implementation of the European Floods Directive and of the National Flood Risk Management Strategy. A promising way forward is the national project called “Territories in transformation exposed to flood risk”. It is managed under the general direction of urban planning, housing and nature and risk prevention activities of the French Ministry of Environment, and integrates insights from several local pilot projects.

## 11.1 Common Challenges

When flood risks are recognized, either by modelling or because of previous flood events, action can be taken to prepare for possible future floods. As written in Chap. 2, in the phase before a flood event it is possible to reduce flood risks by (1) keeping people away from flood prone areas; (2) decreasing exposure to floods through defence infrastructure; and (3) mitigating the risk by decreasing the magnitude of a flood using water storage or by flood proofing buildings and infrastructure (Fig. 11.1).

There is a relation between the three strategies. In case of full prevention (not living in flood prone areas), there is no need to construct defences or mitigation measures. Yet, in most countries space is scarce and it is not desired to leave the

**Fig. 11.1** Flood adapted passage way in St Pierre de Corp

fertile and attractive land close to water unused. On the contrary, there is a lot of social and economic pressure to live and work in flood prone areas. Furthermore, due to climate change new areas are facing flood risk. There is also a relation between flood defence and mitigation. Large past investments in flood defences make most mitigation measures unfeasible from a cost-benefit perspective. This is for instance the case in the Netherlands with its high dikes. If for example one lives in a deep polder and runs the risk of flooding by 5 m of water, there is little one can do to flood proof his or her house. When the expected magnitude of a flood is lower (e.g. 0.5 m water in a house), it may be more efficient to take mitigation measures than to build a dike.

This chapter is organised around the following six common challenges and questions that we found in comparing the six countries analysed in STAR-FLOOD:

- How to defend yourself against flooding (Sect. 11.2);
- How to provide sufficient space for water (Sect. 11.3);
- How to include flood risk in spatial planning (Sect. 11.4);
- How to ensure sufficient money for physical measures (Sect. 11.5);
- How to prioritise measures (Sect. 11.6); and
- How to raise awareness and actions by citizens (Sect. 11.7).

We refer the reader to more common challenges and related good practices in Chap. 10 on integrated planning, collaboration and coordination, Chap. 12 (During a flood) and Chap. 13 (After a flood).

A Quick Reference Chart describing the good practices per country can be found as Supplementary material. It indicates per good practices to what Flood Risk Management Strategies, Governance aspects, and Ultimate aims it relates.

## 11.2 How to Defend Yourself Against Flooding?

Flood defences contribute to the ultimate aim of resilience by increasing the capacity to resist flooding, thus lowering the probability of floods. Most of the countries analysed in the STAR-FLOOD project have flood defences in place.

A challenges is to create a good *knowledge base* to design a 'watertight' system of defences. State of the art knowledge on hydraulic conditions in extreme events, geotechnical knowledge on embankments and the soil below and knowledge of constructions like dams and weirs is required. A complete overview of the system is needed, as the weakest link determines the strength of the defence system. Temporary flood defences or closable weirs or dams often form the weakest link in the system and thus require specific attention. Although they provide a lot of flexibility, the risk of human or technical errors during their installation and operation is significant.

Flood defences in general have a lifetime expectancy of 50–100 years. They should not only be designed to withstand current extreme conditions, but also possible future conditions. As required *investments* in new infrastructure are often significant, there should be agreement on their necessity and functions (now and in the future). The ideas of adaptive management as introduced in Sect. 10.3 can help to set up smart designs and investment plans.

A recurring theme that affects all STAR-FLOOD countries (with the exception of the Netherlands), is the *lack of resources* for financing flood defence infrastructure. The global financial recession in 2009 seems to have aggravated this issue. Constraints on financial resources seem to have the greatest impact on *maintenance* of defences. Shortfalls in funding are reported in Belgium, England, France and Poland. This may have serious implications for maintaining standards of protection.

Flood defence is a particularly dominant strategy in Poland and the Netherlands. In the Netherlands flood risks are very high as about 60% of the total area can be flooded from large rivers and the sea. Therefore, there is a system of permanent flood defence infrastructure. In Sweden and England temporary flood defence systems are also used and are only installed when a flood event is predicted. Below we describe two extreme practices: the Dutch elaborate system of flood defences versus the Swedish system using temporary defences which are linked to disaster management.

### *11.2.1 Safety Guaranteed: The Netherlands*

Being a low-lying delta country, the Netherlands has depended on a system of dikes for its protection against floods for over 1000 years. The management of the flood defence system and protection through dikes has been highly institutionalised. The flood defence approach is characterised by a clear responsibility division, explicit standards and regulations, and secure financing.

#### 11.2.1.1 Flood Defence

One of the integral purposes of the Dutch Water Act is to prevent, and where necessary limit, floods and water logging. A legal distinction is made between primary and non-primary (also referred to as 'regional' or 'secondary') flood defence structures. For the areas protected by primary flood defence structures, legal safety standards have been established. For (most) regional flood defence structures, safety standards have been established in provincial by-laws. The competent (mostly regional) water authorities must make an effort to achieve these standards and have specific instruments at their disposal. They can strengthen or relocate dikes and designate conservation zones.

Within the Water Safety Programme, part of the recently developed Delta Programme, new legal safety standards for the primary flood defences are being developed. These are likely to be based on the maximum risk of an individual dying in a flood in a certain location, group risks and potential economic damage.

#### 11.2.1.2 Standards-Testing-Strengthening

Competent authorities have a wide margin of policy discretion to achieve the standards. Periodically they have to report the actual state of the defence system to the supervisory organs, namely the Minister of Infrastructure and the Environment and the Provincial Executives. Their reports must be based on pre-set hydraulic conditions and technical guidelines. Supervisory authorities can give legally binding instructions regarding the implementation of the duty of care for water safety, however, hierarchical steering generally takes place on a political level through strategic planning rather than on the implementation level.

#### 11.2.1.3 Efficiency and Knowledge Base

The national and regional water authorities that are endowed with the implementation of the flood defence system are highly specialised organisations with a strong knowledge base. This ensures a sound implementation and maintenance of the structural measures, an ongoing adjustment and improvement of the flood defence approach. It also produces innovative technologies that can be exported. Cost-benefit analysis, cost-sharing arrangements and efficiency-based procedures are increasingly applied to achieve particular levels of protection in the most cost-efficient way.

#### 11.2.1.4 Financing Through Taxes

Flood defences are primarily financed by national and regional taxes. Regional water authorities have their own system of taxation that entitles them to raise taxes to fulfil their obligations. They are a sectoral organisation with an elected board, but being a sectoral organisation they are relatively independent from general political whims (see also Sect. 11.5.1).

In the Netherlands the system of a highly institutionalised flood defence strategy is undeniably important, as a large part of GDP is produced in areas susceptible to flooding. The democratically organised regional water authorities have grown organically over a timescale of centuries and the high dependence of the Netherlands on flood defence systems justifies their existence as a separate democratic entity with its own tax system. The system of standards, testing and strengthening of the defence system will be applicable in other countries where a defence strategy is adopted (Kaufmann et al. 2016).

### *11.2.2 Temporary Flood Defences: Sweden*

Flooding in Sweden does not occur regularly and is relatively hard to predict. Events are often local and affect relatively few people each time. Therefore, in general, there is a lack of urgency among inhabitants, policymakers and politicians to deal with floods. The construction of permanent defence systems would in most places be too expensive to finance. Building permanent defences often also conflicts with aesthetic and economic values: people like to live close to water and see the water from their houses. Thus properties close to water have higher prices. Constructing flood defences may spoil views on the water and decrease house prices.

The temporary measures that can be taken include demountable defences and sand bags, as well as plugging storm-water pipes (to prevent the water flowing in the wrong direction) and pumping. The demountable flood defences are stored centrally at the Swedish Contingency Agency in Kristinehamn. These defences are an investment of the Swedish National Government which is more efficient as an investment has to be made only once for all 290 municipalities. The Agency has staff that are always ready to take action and work closely with the Swedish Meteorological and Hydrological Institute. At the moment of intense precipitation (80–100 mm in a few hours) there is barely time to prepare for a possible pluvial flood event, with spatial planning this risk is reduced as much as possible. Yet, in case of extreme river discharges, there is more time to take action and the demountable defences are used. Only three cities, which have a relatively high flood risk, have permanent defences in place (Kristianstad, Arvika and Göteborg in planning phase).

The approach with temporary measures can be used as a good example in sparsely populated regions in Europe in which the consequences of a flood event are low or regions in which the probability of flooding is low. A precondition for working with temporary defences is that there should be flood warning systems in

place and sufficient lead time in the case of an approaching event to install the defences (Ek et al. 2016).

## 11.3 How to Provide Sufficient Space for Water?

Land use in Europe is more and more anthropogenic, which has an influence on flood risks. Deforestation and agricultural land use leads to faster drainage of water. Urbanisation and the related increase in paved area has the same effect. As a consequence extreme rainfall leads to higher peak discharges in the rivers, as well as more pluvial and flash floods. At the same time, many rivers have been trained: their flow profiles have been constrained by dikes and groyns and their original flood plains are used for urban and other developments. As a consequence, many rivers can accommodate less water than in natural circumstances.

The STAR-FLOOD results point out that all analysed countries to some extent face the challenge to reverse these processes; to create space for water, instead of taking it. This can be done in several ways. In Sect. 11.4 we describe examples that limit developments in flood plains and flood prone areas. Below we describe sustainable urban drainage systems, local measures that are implemented to store water in England and slow down runoff. Such measures are also implemented in Belgium, France and the Netherlands. Another good example of providing more space to the water is the Room for the River programme in the Netherlands.

### *11.3.1 Sustainable Urban Drainage Systems: England*

In urban areas flash floods can occur due to excessive rainfall and runoff over the paved surface in the city. These types of floods are hard to predict, and it is hard to mitigate the effects of these floods. Sustainable Urban Drainage Systems (SuDS) are implemented in England, in order to store the water from these intense precipitation events temporary and give the water the possibility to infiltrate/percolate into the soil slowly. SuDS connect impermeable surfaces to the underground and in this way drain water from the paved surfaces in the city and prevent urban areas from flooding.

Since April 2015 SuDS are formally treated as an additional planning consideration which is required in new developments within the existing planning system in England. The developer is required to establish a maintenance regime that is best suited to the local flood risk, locality and type of development (Defra 2014a). Local Planning Authorities must ensure that developments of 10 properties or more consider options for SuDS with a statutory duty to consult Lead Local Flood Authorities (according to the National Planning Policy Framework, as amended).

In some cities there are, so called, '*local champions'*, individuals who put efforts to encourage the uptake of SuDS measures within the city. However, there are a number of barriers to implementing SuDS, such as the perceived efficacy of certain

options, conflicts in motivation between Risk Management Authorities and delays in national guidance. A useful addition to the current localized approach, would be a strategy for retro-fitting the SuDS for the wider urban areas (Alexander et al. 2016).

### *11.3.2 Room for the River Nijmegen-Lent: The Netherlands*

The traditional flood defence approach in the Netherlands uses dikes to protect the land behind it. When more safety was needed, dikes were raised. The introduction of integrated water resources management at the national level lead to new solutions: to (re)create room for the rivers to deal with higher peak discharges. Flood plains are enlarged by placing dikes further from the river, lowering flood plains and removing obstacles.

In the case of Lent, the city of Nijmegen took charge of the Room for the River project and created a project that integrates water safety and the construction of a new city district. The project entails placing the dike further from the river, excavating a new flood channel and creating an island in the river.

The Lent project does not show a change in the flood risk management strategy, as it is still meant to keep water away from people, but it does show a change to new integrated solutions involving water management and spatial planning. This change in measures correlates with a change in governance from sector-based to more integrated governance.

The decision for developing the Room for the River programme and about the water level reduction to be achieved on each location was made on the national level. This first collided with the plans of Nijmegen. Yet, the State stimulated regional and local authorities to come up with plans that would integrate local (spatial) development plans. After negotiations, Nijmegen embraced the new approach and developed it into a truly integrated plan.

Creating space for rivers can be done in many locations where this space is available and currently dikes separate the river from a part of its flood plains. Integrated projects, such as in the case study Lent, are especially useful when many different objectives are at stake: i.e. in urban areas. Municipalities are in general able to integrate various stakes and can therefore play an important role in such projects (Kaufmann et al. 2016).

## 11.4 How to Include Flood Risk in Spatial Planning?

No matter how good flood defences are, they can always fail under extreme conditions. Therefore it is recommended to also develop the capacity to absorb flood events: to minimise damage and casualties in case of a flood. Many instruments to do so can be found in the domain of spatial planning. However, there is a general tension between the economic development interest in flood prone areas, and the

interest to minimise flood risk. This tension is higher in countries with a lot of flood prone areas, like the Netherlands. In spatial planning all those *interests collide*. An often heard complaint from the flood risk management community is that too many developments in flood prone areas are allowed. Yet, in the end it should be a societal or political choice which developments in flood prone areas are accepted and which are not.

Spatial planning instruments can largely be divided in two categories. One is to *prohibit development in flood prone areas*, another is to develop planning conditions that minimise the potential damage caused by flooding by *flood-proofing buildings*.

France has a particularly strong spatial planning policy, with zoning that prohibits development of the highest risk areas. Belgium, England and Sweden have spatial planning policies that aim to direct development away from the highest risk areas, with the possibility of exceptions under certain circumstance (such as a lack of available land at lower risk). In Belgium and the Netherlands water managers are involved in spatial planning to check the impact of new developments on water and flood management and to give advice. Insurance mechanisms can also be used to discourage development in flood prone areas, e.g. by charging higher premiums for properties in flood prone areas (see Sect. 13.2).

In many countries spatial planning rules to prevent or mitigate flood risk are in place. A recurring issue is, however, the *lack of enforcement* of these rules. This may require a system with multiple checks and balances.

The good examples described below are the water assessment and signal areas in Flanders, construction and permitting in Sweden and the link between spatial planning and flood risk in Nice (France).

### *11.4.1 Spatial Planning Tools to Decrease Future Damage in Flanders: Belgium*

With increasing urbanisation, there is an increase of paved and impervious land surfaces leading to a decrease of water infiltration and storage. This increases the chance and number of flood events with the subsequent effect of more damage to residential properties. In order to decrease future damage, Flanders has two tools that influence spatial planning procedures: the Water Assessment and the Signal Areas address the decrease of room for water and the increase of imperviousness. With these instruments the Flemish government hopes to avoid a substantial increase of potential flood risk.

The *Water Assessment* tool is an obligation for authorities to ask advice from the water manager on the impact of a permit, plan or programme on the water system (applicable to all building permits). The advice is non-binding but authorities have to motivate the reasons for deviating from it in the final permit, plan or programme. This can *prevent* further decrease of room for water in places where water storage is

important and can prevent further imperviousness of the soil. With this advice, the awareness among authorities of the impact of planned developments increases.

By controlling the activities and development on undeveloped land, the Flemish government aims to avoid a substantial increase of potential risks. *Signal areas* are mainly areas with a 'construction' destination (e.g. residential) in flood-prone areas. Potential futures for these areas range from an innovative flood-proof within the current destination to a re-destination of the area with flanking measures, as arranged in the Circular LNE/2015/2 of 19 May 2015.

The Signal Area approach is connected to the Water Assessment instrument and the duty to inform that is described in Sect. 11.7.2. Together these instruments influence developments in flood prone areas. They address the lack of attention paid in the past to water issues in Flemish spatial planning and oblige planners and governmental institutions to focus more on this. Similar instruments could also be applied to prohibit or steer developments in flood prone areas in other countries (Mees et al. 2016).

### *11.4.2 Construction and Permitting: Sweden*

In the new National Guidelines (2016) from the Swedish Water Organisation, it is stated that the location of new urban developments has to be safe from both fluvial and pluvial flooding of a 1/100 year rain event. The plans have to be formally approved at many different stages in the planning process, minimizing the risk of projects that significantly increase flood risk slipping trough.

Building permits, which may involve restrictions for building in certain areas, come from the municipal level, which has a complete overview of the local situation. The municipality is also responsible for detailed area planning and has to evaluate the risk of both pluvial and fluvial flood risk. In addition, the County Administrative Boards have an important function in checking the municipalities. If the County Administrative Board does not agree with the municipality on the decision of permitting the construction of buildings because of the flood risk, they can stop the detailed plan referring to the flood risk (Ek et al. 2016).

### *11.4.3 From Regulator to Partner in Interactive Development in Nice: France*

Since the creation of the Department for Risk Prevention in the Ministry of the Environment at the end of the 1980s, risk prevention has been an independent (and multi-dimensional) field of action dominated by the State. It is part of a broader planning culture that is dominated by the principle of rigorous restrictions on construction in risk areas.

Municipalities also play an important role, as they are responsible for land planning and issuing building permits. It is worth noting that the principle of independence of the law leads to a separate implementation of risk policy and urban planning policy. The two main planning tools (the Risk Prevention Plan (PPRi) and the Local Land-Use Plan) are thus used by two independent public authorities. The Flood Risk Prevention Plan is elaborated by the State and sets overarching rules for spatial planning and construction in flood prone zones. The State imposes its vision on flood risk management on local authorities, by prohibiting construction, or by limiting or regulating it with obligations to adopt building mitigation measures. In this way, local authorities are obliged to take the flood risk into account in their land use plans.

The case of Nice illustrates the progressive evolution process that leads locally to a softening of the restrictive flood legislation and makes local development viable. It challenges the national approach and framework. The relationship between the State and local authorities has evolved over 15 years.

In 1999, the first proposal of a very restrictive flood zoning plan for the area of Nice was issued. It finally got approved in 2013, with a softening of the zoning regulations. The evolution process took place in the specific legal framework of a National Interest Operation[1] (OIN) launched in 2008 to promote the Eco-Valley project. It led to a master plan in which the State and local authorities control local land use plans. The aim of the plan is to launch four major projects (a business centre and multimodal transport hub, a technological centre called, a food and horticultural platform, and an eco-district).

Besides the Flood Risk Prevention Plan, other instruments play a role in flood management and spatial planning in Nice as well, involving several stakeholders. Among these, the public Development Organisation (Etablissement Public d'Amenagement – EPA) is the operational body for the new pro-development coalition. Gathering various public and private partners, the Development Organisation implements the Eco-Valley project.

In 2012 the Development Organisation elaborated a specific study for the planning of the Grand Arenas sector, business centre and multimodal transport hub: the SCHAE study. It assessed the possibility to build without increasing the level of risk exposure on both the Grand Arenas sector and adjacent districts, bringing to light that it can be done. This constituted an important step in the process towards softening the restrictive flood legislation in the Risk Prevention Plan.

At the same time, two Actions Plans for Flood Prevention (PAPI 1 2009–2014 and PAPI 2 2012–2018, see also Sect. 10.3.2) have been implemented, principally to guarantee the funding of the major protection works. The formal uptake of dikes in these plans opens up the way to development projects.

At the end of this process, the role of the State changes from a provider of regulations and controller to an actor involved, inter alia, in the bargaining game to attempt to combine development and flood prevention. Each with their own interests, but in

[1] The National Interest Operation status is given by the State to projects with scopes of national interest.

dialogue, the involved authorities explored which developments are still possible in the flood prone area without increasing flood risk (Larrue et al. 2016).

**Practitioner's Interview Rebecca Enroth**
**Environmental inspector, Municipality of Aneby**

Rebecca works as an environmental inspector in the relatively small local self-governing municipality of Aneby with 6525 inhabitants in the south of Sweden. As environmental inspector in a small municipality's her tasks varies a lot and covers everything from inspection of environmentally hazardous activities to flood management. Rebecca's main occupation is to carry out supervision and authority of the national legislation on companies and individuals. Rebecca has in recent years been active in the flood network SANT, which is a collaboration between several municipalities in Småland in southern Sweden.

Rebecca and the network SANT (flood mapping for the Svartån river upstream Somme, Aneby, Nässjö, Tranås) was formed when they realized that the Swedish government would not map flood-risk along their flood-prone Svartån river, but only prioritized streams and rivers that flow through larger communities and municipalities. For small municipalities, costs are far too high to finance a flood mapping ourselves. Although relatively few people live here, we in small municipalities have the same responsibility towards our citizens as the bigger municipalities with higher municipal tax base. In 2007, the area was hit by a 50 year flood. Furthermore, many floodings occurred, which mainly affected the stability of road embankments.

An obvious prerequisite when we started our work was that it would be very difficult for either of the municipalities themselves to procure and fund a mapping. In addition the mapping becomes better the larger the area covered. Therefore, we wanted to work together. We also wanted the mapping to get as many people as possible to benefit, and we wanted to be sure that we did not miss any important geographical area. In order to make contact with as many stakeholders as possible and we invited them to four information meetings on climate change, organised in cooperation with the Water Council of the river. At the end of the information meetings

we told about our plans to map and invited interested parties to participate in the process. It was after such a briefing that Länsförsäkringar insurance company offered to fund a flood mapping.

As far as I know, this is the first time an insurance company is financing a flood mapping in Sweden. However, Länsförsäkringar Jönköping has a long tradition of helping municipalities with other emergency related issues, such as materials needed in emergency situations.

Another reason for the contribution is that Länsförsäkringar is owned by the policyholders and therefore the company felt that it could lead to a better awareness among policyholders to protect themselves if flood risk facts were presented to them.

Since the flood mapping is inserted in the municipal master plans, political consideration of flood risks increases. There now is a good basis to assess measures for mitigation of flood consequences and we can set up crisis management plans for different flood scenarios. In Sweden there is no tradition of higher premiums for insuring property in flood risk areas. The insurance company funded the flood mapping with approximately 250,000 Euro, in order to minimise future damage and avoid risk related pricing of premiums in the future.

## 11.5 How to Ensure Sufficient Money for Physical Measures?

Flood defences, water retention and adapted building can be costly measures. Therefore, in all countries analysed, a lack of financial resources was reported as a factor hindering the implementation of flood risk management. This is in particular the case for flood defence measures. In the analysed countries, financial resources from various actors are invested. Mostly, measures are funded by public authorities using taxes as in the Netherlands; in England private parties (co)finance flood measures; in France the Barnier fund finances measures from a supplement to the insurance premiums (see Sect. 13.2.3); and Poland relies equally on both World Bank or EU investments and on public funds in structural measures.

### *11.5.1 Funding by Public Taxes: The Netherlands*

Flood defence in the Netherlands is characterised by a clear responsibility division, explicit standards and regulations, and secure financing. Flood risk management in the Netherlands is mostly a public concern and financed on the basis of solidarity.

Citizens pay general taxes to the State and water management taxes to their Regional Water Authorities. The latter are to some extent risk-dependent, as water authorities facing higher risks may raise higher taxes. Primary flood defences are financed from the Delta Fund, based on Chap. 7 of the Water Act. Specific projects are paid for by national funds (50%), the Union of Regional Water Authorities (40%) and the specific water authority implementing the project (10%). This provides an incentive to all to minimise total cost.

Due to the Delta fund and the fact that regional water authorities raise their own taxes, flood defence in the Netherlands is relatively *independent of political whims*. Citizens living outside the dike protected area are not part of the solidarity agreement and besides basic emergency management, they do not receive any protection or compensation.

The system of regional water authorities that raise their own taxes has historically grown in the Netherlands and due to the high dependency on dikes for safety, they have always remained a separate democratic entity. Also in other locations where a flood defence strategy is prominent, a system with clear responsibility division, explicit standards and regulations, and secure financing can be beneficial (Kaufmann et al. 2016).

### *11.5.2 Partnership Funding: England*

Partnership Funding is the government policy aiming to diversify the sources of funding for flood risk management. It is supported by a 6 year Investment Plan which gives a medium term planning horizon for grant-in-aid funding and facilitates the process of partnership funding and the raising of additional funding. The Investment Plan allocates £2.3 bn of capital spending towards over 1400 flood defence schemes, with the view that these will improve protection to 300,000 properties and reduce current flood risk by 5% by 2021 (HM Treasury 2014; Defra 2014b). The Investment Plan aims towards '*payment for outcomes'*, where those who benefit contribute more towards the cost, reflecting the *beneficiary pays* principle. The costs should be shared between State, market and civil society actors at the scale of individual projects or flood risk measures.

The implementation of Partnership Funding in 2012, aims to enable more flood defence and mitigation schemes to be developed than in the past. In contrast to the previous system which favoured high-priority schemes, this new approach marks a step-change whereby more schemes are eligible for funding (depending on the ratio of costs to benefits). The specific actions that take place are dependent on the Lead Local Flood Authority, who has to be able to allocate and use alternative funding sources to fill funding gaps.

An example of this funding by mixed resources is Nestlé,[2] which has contributed £1.65 m towards the Lower Dove Flood Alleviation Scheme in Derbyshire, which is based near its factory at Tutbury (Defra 2014b). Overall, between April 2011 and March 2015 it is estimated that 25% of financial contributions would have come from the private sector (NAO 2014). Another example is the Willerby and Derringham Flood Alleviation Scheme, whereby funding has been secured through nationally-administered Grant in Aid from Defra, local levies from Yorkshire Regional Flood and Coastal Committee and the European Regional Development Fund.

[2] Nestlé, work begins on river Dove Flood Scheme: http://www.nestle.co.uk/media/pressreleases/work-begins-on-river-dove-flood-scheme

Partnership Funding seems a promising instrument to fund more projects, and to involve more local governments and communities in the decision making process. Still, the implementation of the projects is dependent on sourcing additional revenue at the local scale. Some successes have been reported; in other cases it is still a challenge to attract local public and private funding (Alexander et al. 2016).

## 11.6 How to Prioritise Measures?

As funding and other resources for flood risk management are scarce, strategies and measures need to be prioritised. Common methods to compare measures are *multi criteria analysis* and *cost-benefit analysis.* Both methods compare costs, positive effects and negative effects of potential measures. Multi criteria analysis is often applied in a more qualitative way, whereas cost-benefit analysis is more quantitative, trying to express all costs and benefits in monetary terms.

Each methods has its strengths and limitations. For example, in cost-benefit analysis, expressing potential loss of lives or negative impacts on ecological or cultural and historical values in monetary terms often leads to difficult (ethical) discussions. And, it is often difficult to estimate indirect damages of floods. Similarly, multi criteria analysis raises questions regarding the relative weight of aspects in the assessment. For all methods the question needs to be raised of if the outcomes can directly lead to a decision or if they only form the basis for further discussion and decision-making.

In Belgium, England and Sweden cost-benefit analysis plays a crucial role in allocating budgets for defence and mitigation measures, and determining levels of protection. The available budget is distributed only over the measures with highest rate of return. In the Netherlands, where legally-established safety standards exist, the level of safety to be achieved is fixed (although for setting these standards cost and benefits have been assessed as well). Still, prioritisation tools are used to appraise alternative measures that can be used to achieve the standards.

### *11.6.1 Cost-Benefit Analysis and Whole Life Costing: England*

Although there are no fixed standards of protection in England the principle of efficiency is clearly embedded within the governance process. This includes the allocation of funding for flood defence and mitigation as well as the resulting standards of protection provided across the country. National policy encourages a portfolio of measures to be considered, including measures with direct benefits as well as indirect benefits from ‘enabling activities’ such as flood warning (Benefits Assessment Framework outlined by the Environment Agency).

To determine the allocation of Flood and Coastal Erosion Risk Management (FCERM) Grant-in-Aid, Cost-Benefit Analysis is used to ensure the greatest value

for money. To give an impression, in the recent past this decision was based on an 8:1 ratio; with £8 (€10.8) benefit achieved by every £1 (€1.35) of Government spend. According to the National Audit Office, as of March 2014 the Environment Agency had achieved a 9.5:1 cost-benefit ratio. Benefits are determined in terms of: (i) benefits for the householder; (ii) benefits for business, agricultural productivity and protection of national and local infrastructure; and (iii) benefits for the environment. This is widely regarded as a robust and appropriate means of allocating funding.

Moreover, the appraisal process is also informed by whole-life costing to determine the most cost-effective approach: by taking into account the benefits of alternatives, routine maintenance as well as capital replacement and improvement for the life of the asset (Defra 2014b). A range of assessment tools exist to support these processes, including the Multi-Coloured Manual (Penning-Rowsell et al. 2013) and FCERM-Appraisal Guidance (Environment Agency 2010).

The National Investment Plan (Defra 2014b) enables medium-term planning and opportunities for Risk Management Authorities to 'package' projects and source competitive prices from suppliers (HM Treasury 2014). In turn, it is estimated that efficiency savings will be made (ca. 10%) that can be reinvested in defence and mitigation projects (Defra 2014b), thus providing a positive feedback into efforts to enhance the capacity to resist flooding (Alexander et al. 2016).

### *11.6.2 Cost-Benefit Analysis for Flood Risk Management Plans in Flanders: Belgium*

To increase economic efficiency and societal equity, the Flemish Government has become an ardent user of cost-benefit analyses. By calculating the societally optimal resource allocation, the intention is to raise the efficiency and legitimacy of flood risk governance.

Cost-benefit analysis has been used for the development of the Sigma Plan (see also Sect. 10.3.4) and the flood risk management plans of Flanders. With the use of cost-benefit analysis in the designing of the Sigma plan, several options per location have been considered and based on this the most ideal and feasible solutions have been chosen.

Although cost-benefit analysis is an often used method, it is not always a very transparent one. Local governments stress that the method is a simplification and the results should not be used in a rigid way. They emphasise that cost-benefit analysis should remain a supportive tool instead of a decisive one. This way cost-benefit analysis can inform the competent authorities, and those authorities remain responsible and accountable for the decisions made. Furthermore, cost-benefit analysis should not hamper citizen participation. Examples of participatory cost-benefit analyses can be found in the BASE project[3] (Mees et al. 2016).

[3] Bottom-up climate adaptation strategies towards a sustainable Europe: http://base-adaptation.eu/

## 11.7 How to Raise Awareness and Action by Citizens?

The level of government involvement in flood risk management differs strongly between the analysed countries. Yet, the STAR-FLOOD research revealed that in all countries efforts are undertaken to raise risk awareness among individual citizens and companies. Raising awareness aims to promote actions by citizens and companies to (1) prevent increase of, or even decrease, risks (by limiting or adapting new developments in flood prone areas); (2) strengthen the capacity to resist floods (by contributing to flood defences); and/or (3) strengthen the capacity to absorb floods (by water retention and/or flood proofing). Public awareness and involvement are also relevant in relation to disaster management during a flood (see Sect. 12.2.2) and in relation to recovery after a flood (see Sect. 13.2.1).

The Floods Directive obliges all EU Member States to assign areas at risk of flooding and to establish flood risk maps. These maps are publicly available. It is however still a challenge to appropriately communicate the risk in to all inhabitants of flood prone areas. In general, private parties are more aware and involved when they are regularly confronted with flood events. The possibility for citizens and businesses to take measures by themselves, and communication and advice by the government in this regard, also contribute to awareness and actions. Yet, in most of the analysed countries, citizens rely on the government to protect them, even if this is not in line with the government's policy and legislation. Such misplaced expectations limit citizens in taking measures.

In the Netherlands, the government provides inhabitants with high protection levels in order to keep the land attractive to live and invest in. Awareness of individual flood risk and possible mitigation measures is low, and actions by individuals to flood proof their own properties are usually inefficient. In England and Belgium, where the potential consequences of flooding are lower and more local, and protection levels are also lower, floods are experienced more often. Furthermore, it is more efficient in those countries to take local, private measures. Below two good practices from these countries are described.

Finally, public say and involvement in the decision-making process is important to achieve the ultimate aim of legitimacy (see Sect. 8.3.3). This applies to setting objectives and standards, to selecting strategies in policy and law, as well as to selecting concrete measures to deal with flood risk in specific areas. Cost and benefits of such measures should be distributed in a fair manner, which means for instance that stakeholders that are disproportionally damaged by a defence or mitigation measure should receive adequate compensation for that.

### *11.7.1 Encouraging Local Action to Reduce Flood Risks: England*

In England flood risk maps have been publicly available online since 2000. Since then, the types and amount of information and presentation have improved significantly. The Environment Agency website shows the risk based on a postal-code search, in order to make this information easily accessible. Furthermore, the provision of flood maps from the Environment Agency to professional and public stakeholders supports a host of activities, such as spatial planning, emergency management and awareness-raising amongst at-risk communities. In this context, flood modelling and mapping can be thought of as an essential bridging mechanism.

Significant efforts are made to encourage citizens to adopt some responsibility for managing their risk to flooding and implement property-level measures. From 2009 to 2011 Defra provided £5.2 m of funding to support a property-level flood protection scheme, leading to the installation of property level measures in 1109 properties within 63 at-risk communities. Following this, the 'Flood Resilience Community Pathfinder Scheme' was launched in 2012. It is a plan that supports the communities to increase their flood resilience without just starting to build defences everywhere.

Through this scheme £5 m was made available to 13 selected local authorities for the purpose of enhancing local responses (and ownership) of flood risk. Activities ranged from voluntary monitoring of river levels (e.g. in Calderdale), establishing community resilience groups and local 'champions' (e.g. in Blackburn), to developing voluntary flood warden schemes and community flood plans (e.g. in Buckinghamshire). Such initiatives represent attempts to prompt bottom-up activities and ownership of flood risk amongst at-risk communities.

At the individual, household and community scale, self-governance is observed in England in a number of forms. These include;

- Installation of property-level resistance and resilience measures;
- Purchasing insurance products or opting to 'self-insure';
- Formation of local community groups; these may be involved in campaigning and lobbying for structural defences or other flood management measures; whereas others are involved more actively in undertaking flood management;
- Community flood warning systems; Due to dissatisfaction with the official flood warnings in Thames Ditton (River Thames, West of London) the community has developed its own processes of observing the river and a communication system which inputs the advice of trusted local lock-keepers; they then work together to decide upon and activate a collective community response.

There are a number of barriers to developing consistency. For instance, the uptake of property-level measures and development of community flood action plans is understandably greater in areas that have recently experienced flooding. Another challenge is how to sustain these efforts as the frequency between flood

events increases or people move away from an area. There is also a lack of resources to support community engagement officers. Furthermore there is no standard fund through which households/communities can apply in order to purchase property-level measures; often this is a private investment on behalf of the householder (Alexander et al. 2016).

### *11.7.2 Informing House Buyers and Tenants on Flood Risks: Belgium*

To increase their risk awareness, property owners in Belgium that want to sell their property have to state the property's flood vulnerability in real estate advertisements, in order to inform the would-be buyers and/or tenants of a real estate. This *duty to inform* is an obligation to inform the would-be buyer or tenant that the real estate is situated in a flood prone area. As properties with such a bad advertisement sell worse, the duty to inform may encourage property owners to take mitigation measures to be able to sell their properties better. In the advertisement certain icons have to be used, based on the flood risk:

- 'Effectively flood prone' (recent flooding or frequency <100 years)
- 'Potentially flood prone' in case of extreme conditions or failure of dyke infrastructure

This instrument will be reviewed shortly, as property owner's claim that property prices in flood prone areas decrease disproportionally to the risk. A website is available with detailed information.[4]

In order to be able to reduce damage a *guidebook on protection measures* is available. It is a brochure and animation film, produced by the Flemish Environmental Agency (VMM), called 'Floodsafe Buildings and living safely in flood areas'.[5] It gives information and advice about; what to do, where to obtain information on insurance, and procedures to follow in case of a new design and possible measures to take to protect a building in case of flood risk (Mees et al. 2016).

[4] More information (in Dutch), Overstromingsgevoelig vastgoed: http://www.integraalwaterbeleid.be/nl/beleidsinstrumenten/informatieplicht/informatieplicht-overstromingsgevoelig-vastgoed#richtlijnen voor publicatie.

[5] More information (in Dutch), Built and live safely in flood prone areas: http://www.integraalwaterbeleid.be/nl/publicaties/brochure-overstromingsveilig-bouwen-en-wonen

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# Chapter 12
# During a Flood Event

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**Practitioner's Interview with Jerzy Weraksa, Department of Security and Crisis Management Office of the City of Wroclaw, Section for Wroclaw Floodway System (WFS) and Flood Protection**

**Electronic Supplementary Material** The online version of this article (https://doi.org/10.1007/978-3-319-67699-9_12) contains supplementary material, which is available to authorized users.

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T. Raadgever, D. Hegger (eds.), *Flood Risk Management Strategies and Governance*, https://doi.org/10.1007/978-3-319-67699-9_12

I am leading a team coordinating the activities of flood protection of the city of Wroclaw. Before a flood we prepare by developing a solid basis for the activities of the Crisis Management Team during the flood. It is essential to have a good Operational Plan of Flood Protection. Our plan needs to be updated.

Within the Wroclaw Flood Leaders programme, we organise training courses and meetings with Flood Leaders. They are local community leaders (members of the council of city districts) leading the response during flood events at the local level. Flood leaders organise and supervise volunteers, which for instance monitor the condition of dikes and place sandbags where needed. They cooperate with the Crisis Management Board and firefighters.

We also organise daily cooperation with the administrators of the existing flood defence infrastructure and other units related to the Wroclaw Floodway System. Another important task is the supervision of the flood warehouses. We store the necessary amount of material and equipment (bags, film, geotextile, wheelbarrows, etc.) and have six local, innovative sand repositories. We store ca 20.000 $m^3$ of sand in the form of stocks piles covered with soil and integrated into the area. During a flood we prepare and coordinate the actions of the Crisis Management Team. During major floods our Section operates 24 h per day.

An important issue in Poland is the fragmentation in competences and lack of supervision of institutions in the field of flood defence. As local authorities we cannot change this system. Therefore our actions are directed mainly toward good cooperation and agreement with these various stakeholders before and during the flood. Currently the modernization of the whole Wroclaw Floodway System is about to finish. The modernization has changed extreme discharges, inundations patterns and the condition and functioning of flood defences. Hence there is a need to adjust our operations: this must be reflected in our Operational Plan.

The other crucial issue is increasing societal awareness of what to do in case of a flood, by improving the work of Local Flood Leaders and by training a broader range of residents, e.g. by educating students. The daily conscientious work of my section staff allows us to achieve our goals despite the challenges we are facing.

It is difficult to give good advice to others responsible for flood protection, because each country and each region has a different hydrological situation. Wroclaw is a specific city with a very high flood risk. This is because the position of the city where the Oder is affected by four smaller but equally dangerous rivers. Still, I would suggest to others to develop partnerships with society. We did this by in a successful way by creating a group of Flood Leaders. Moreover, we are very willing to share our experiences with everyone who cares about the flood safety of their city.

## 12.1 Common Challenges

This chapter addresses the *flood preparation and response* measures that enable good disaster management during a flood. These measures include developing flood forecasting and warning systems, preparing disaster management and evacuation plans and disaster management when a flood occurs. Thus, even though the chapter is called ‘during a flood event’, several measures have to be developed already before the flood takes place.

*Flood forecasting* is established in all analysed countries: Belgium, England, France, the Netherlands, Poland and Sweden. Technological advancements have

played a pivotal role in improving the provision of timely flood warnings. Timely warning is essential to create sufficient lead time to prompt action. All countries also have a system of communicating *flood warnings* to at-risk citizens and emergency responders in place. England has an advanced system with multiple pathways for disseminating flood warnings, including an opt-out service to maximise the reach of formal warnings. Voluntary community-based warning schemes that facilitate the communication of formal flood warnings are in place in England and Poland.

*Emergency or disaster management* is changing in several ways in the analysed countries; from (i) civil defence to holistic risk-based approaches, (ii) from reactive to proactive strategies, and (iii) from command-and-control structures to more collaborative forms of multi-actor decision-making. Clarity of roles and responsibilities appears to be a fundamental condition for success.

All countries work with *multi-hazard approaches* to emergency management. This means that provisions for flood event management are embedded in broader constructs of 'emergency' and 'crisis' management. In order to clarify roles and responsibilities, and to respond to contemporary risks, emergency management has been significantly re-organised in the 2000s in all analysed countries. For example, the Security Regions Act 2010 in the Netherlands establishes Security Regions (i.e. specialized emergency management authorities) and provides a comprehensive organizational basis for integrated multi-actor emergency management. Besides clear roles and responsibilities, mechanisms are required to facilitate integrated, multi-actor collaboration. A final condition for success is the performance of periodic exercising to test emergency plans.

The research also revealed three issues related to emergency management that are to varying degrees in place in the analysed countries. In all countries there tends to be a lack of risk awareness amongst the public. Furthermore, the public has a tendency to depend on State intervention instead of helping themselves. Finally, in Belgium and Poland there is evidence of a lack of resources for emergency management activities especially at the lowest levels of management (Ek et al. 2016a).

In this chapter we describe good practices on how authorities can divide roles and responsibilities, on measures to increase risk awareness and involvement of the public in times of flooding, and on keeping awareness about what to do in case of a flood alive.

More common challenges and related good practices can be found in Chap. 10 on Integrated planning, collaboration and coordination, Chap. 11 (Before a flood) and Chap. 13 (After a flood).

A Quick Reference Chart describing the good practices per country can be found as Supplementary material. It indicates per good practice to what Flood Risk Management Strategies, Governance aspects, and Ultimate aims it relates.

## 12.2 How Can Authorities Organise Themselves in Times of Flooding?

In times of crisis it is particularly important to know who can make what decisions, who needs to do what, and who communicates to whom. For instance, it should be clear who decides that an area will be evacuated, who communicates this decision, and whether or not citizens are obliged to leave. A challenge is to coordinate and collaborate in an environment with many stakeholders, including; the domains of water management, public safety, etc. In particular cross-country comparisons reveals the importance of established mechanisms for upscaling and downscaling emergency responses when relevant. This should follow the principle of *subsidiarity*, meaning that a more central authority should only perform those tasks that cannot be performed at a decentralised level (Ek et al. 2016a).

Examples of good practice are the organisation of flood forecasting and warning and the multilevel organisation of emergency management in England. Other interesting coordination mechanisms can be found in Sweden as well, where intra-agency collaboration areas have been established (Ek et al. 2016b).

### *12.2.1 Organising Flood Forecasting and Warning: England*

The Met Office provides a Public Weather Service (PWS) for England, offering forecasts free-of-charge to the public. Also provided is a National Severe Weather Warning Service to give advance notice of weather with the potential to effect public safety (either because it may lead to flooding or some other risk). Although the Met Office provides a public service, it is also a 'Trading Fund' within the Department for Business Innovation and Skills (a ministry of central government) and operates on a commercial basis under set targets.

Combining forecast capabilities within the Met Office and the Environment Agency, the Flood Forecasting Centre is a joint venture established in 2009 to provide forecasting for all types of flooding. The Flood Forecasting Centre also has a Stakeholder User Group, consisting of representatives from key partners in government, business, the scientific community and emergency responders. A key objective of the Stakeholder User Group is to provide feedback to the Centre's management team to help shape their future direction.

Within the Flood Forecasting Centre is the UK Coastal Monitoring and Forecasting Service. This also has a number of partners and stakeholders. Partners include the Proudman Oceanographic Laboratory which provides data inputs (notably tide predictions and surge modelling). Stakeholders include international organisations (e.g. the Dutch organisation *Rijkswaterstaat* responsible for flood crisis management coordination on the other side of the North Sea from England),

shipping companies, port agencies, energy companies etc. Flood forecast recipients include some of these stakeholders together with members of the public, professional responders, infrastructure providers and other public and government services.

The importance and influence of the scientific research community working in flood forecasting and related science should not be underestimated. Both the Met Office and to some extent the Environment Agency have scientific research functions and researchers working within them. Furthermore, both organisations commission other organisations to undertake research. For instance, as part of the Met Office, the Hadley Centre was established in 1990 and is a dedicated climate change research centre. This is co-funded by Department of Energy and Climate Change and the Department for Environment, Food and Rural Affairs and advises the Government on climate science issues. Another feature to mention is that the UK is playing its part in the development of the European Flood Alert System (EFAS) particularly through the medium term weather forecast centre based at Reading in England (Alexander et al. 2016) (Table 12.1).

**Table 12.1** Flood warning products available to the public, professional emergency responders and other stakeholders in England in early 2014

| Type of warning | Description | Provider |
|---|---|---|
| Public flood warning service | Warning for areas at risk of flooding from rivers or the sea, under the categories of flood alert, flood warning and severe flood warning. | Environment Agency |
| Flood guidance statements | Guidance for river and coastal flooding available from the FFC. 3–5 day forecasts issued daily for very low and low risk; medium risk; and high risk. | Flood Forecasting Centre |
| Extreme rainfall alerts | Issued by FFC when probability of extreme rainfall is >20%. Alerts issued daily in the form of guidance and update statements. These warnings may indicate potential for surface water flooding | Flood Forecasting Centre |
| Severe weather warning | Met Office will issue warnings for severe weather events with the potential to cause disruption (based on the National Severe Weather Warning Service). | Met. Office |
| Advisories | Issued daily to indicate 20–60% confidence of expected severe or extreme weather. Early warnings: Issued up to 5 days in advance of an event and indicate 60–80% confidence of expected severe or extreme weather. Flash warnings: Issued when confidence exceeds 80% and gives a minimum of 2 h notice. | Met. Office |
| Groundwater flood warnings | Data on the status of groundwater in areas of England are provided on-line and for some areas groundwater flood warning alerts are available | Environment Agency |

### 12.2.2 Framework to Coordinate Local Emergency Response: England

As long as several decades ago, the basics of governance arrangements around emergency management were established in England. Flooding should not be isolated in civil protection legislation as a distinct problem, but rather enveloped within the broader concept of '*emergency*' (as defined in the Civil Contingencies Act 2004). Still, there is a specific strategic policy framework called the *National Flood Emergency Framework for England 2013*, which is maintained by Defra.

England is organised through a single statutory framework for local civil protection, called the Civil Contingencies Act 2004 and the Civil Contingencies Act (Contingency Planning) Regulations 2005 (as amended). Two core groups of actors are distinguished in the legislation; namely Category 1 and 2 Responders (as listed in the Civil Contingencies Act). Category 1 responders (local authorities and the Environment Agency) are central to 'front line' emergency response and are subject to the full set of civil protection duties to *assess, plan and advise* the public and other responders about potential and emerging risks. In addition, Category 1 Responders have the duty to establish and maintain arrangements for sharing information, both with the public and other emergency responders. Also imposed on emergency responders is the duty to promote business continuity management and encourage businesses to develop recovery plans. Category 2 responders, mostly utility companies and transport organisations, essentially function as '*cooperating bodies*' to the Category 1 response and have a duty to cooperate and share information and advice with all necessary responders involved. Also obliged through the legislation is the need for responders to have due regard for the voluntary sector, although specific mechanisms for this are not outlined.

Emergency planning is underpinned by periodic assessments of local risks recorded in Community Risk Registers. This task is a statutory requirement for Category 1 Responders functioning within Local Resilience Forums. Local Resilience Forums are established for every police district in England and consist of both Category 1 and 2 Responders (as required by the Civil Contingencies (Contingency Planning) Regulations 2005). This ensures that the wide range of emergency actors have a shared understanding of local risks. Local Resilience Forums produce a range of generic and hazard-specific planning documents. With regards to flooding, they produce Multi-Agency Flood Plans to support strategic and tactical decision-making.

Overall, emergency management is guided by the legal principle of *subsidiarity*, which advocates the devolution of decision making to the lowest appropriate scale, with collaboration and coordination at the highest level necessary (Defra 2013; Cabinet Office 2011). This means that in the context of Flood Incident Management a range of different actors may become involved, depending on the scale of the flood event. Ultimately, emergency management is under the authority of the Cabinet Office and the Civil Contingencies Secretariat (Alexander et al. 2016).

### *12.2.3 SEQUANA Flood Event Management Exercise: France*

SEQUANA is a large-scale flood crisis management exercise, which takes place under the direction of the Secretary General of the Defence and Safety Zone of Paris, from 7th to 18th of March 2016. This project is partly funded by the European Commission.

For around the last 10 years, the risk of a major flood in Ile-de-France has become a matter of real concern for both public and private stakeholders. This scenario is a major risk that the region will have to deal with one day. The Paris region is home to one-third of French economic activity. It is the second largest economic zone in Europe. All the central administrations are located here, as well as many major company headquarters. A major flood in Paris could directly or indirectly affect nearly 5 million inhabitants and impact a large number of activities, with considerable repercussions on a human, economic and social scale. 850,000 people currently live directly in a flood-risk zone. Over one million people would be deprived of electricity if such a major event occurred.

This exercise aims to test the capacity of all involved actors to manage a major rise in the levels of the Seine river, to coordinate the actions of everyone involved at flood zonal level, and to assess the relevance of the plans drawn up by the services and operators concerned. It must also lead to an improvement in the civil security services response capacity, and test civil-military cooperation with the use of Force Neptune. 1500 military personnel out of the 10,000 provided for in the armed forces' operational contract will be involved for the first time in a real exercise on the ground.

SEQUANA is also an opportunity to measure the scope of information issued to Ile-de-France residents, and raise awareness of the major role of citizens alongside the public authorities and other parties involved in crisis management. The participation of over 90 partners in the project allows for the communication to these partners and to the public about how to prepare and what to do in case of a flood, within their own area of competence.

To prepare this exercise in a collaborative way, a collaborative platform has been set up, allowing stakeholders to exchange ideas more easily. Participants have been provided with the tools to jointly develop a coherent strategy. The coordination is done by the Secretary General of the Defence and Safety Zone. The project began in early 2014 and will continue beyond March 2016 with the review providing the results.

A flood on this scale would exceed the zonal and national capacities in terms of human and material resources. Consequently, the exercise will also involve the European Civil Security Mechanism. The Préfecture de Police will benefit from the civil security resources of four countries: Belgium, Spain, Italy and the Czech Republic.

These type of flood event exercises can be very valuable in order to be prepared when a major flood really happens. Regular exercises are advisable to all flood prone regions (Larrue et al. 2016).

## 12.3 How to Involve the Public in Times of Flooding?

Citizens and companies are often insufficiently prepared for floods. They often do not know what to do which sometimes leads to wrong decisions with potentially fatal consequences. For example, in the French Riviera flooding in October 2015, citizens died trying to save their cars from their subterranean garages. People need to know if they should stay in their homes, should leave the area (*horizontal evacuation*), or go to a local safe zone such as a high shelter (*vertical evacuation*). This can be communicated during an event, but this communication is far more effective when people already have a general *awareness of what to do* in case of a flood. It is a common challenge to keep awareness levels high, also in long periods without a flood event. Such periods occur more often in countries with defence systems designed according to high safety standards.

Mobilisation of citizens requires clear communication of the event that is taking place, its impact and what options to take action citizens and companies have. Another challenge that came out of the research is that government need to be careful in how they present information on what to do, as they may be held accountable for giving wrong information to citizens.

Recently, the Dutch government has placed more effort in risk communication. The message to citizens is that even though there is good flood protection in place, there is also a small residual risk and people should know what to do in case of a flood. This is facilitated through national, regional and local awareness raising campaigns, informative websites (www.overstroomik.nl, see Sect. 12.3.4) and training exercises (as required under the Water Act). Similar arrangements exist in the other STAR-FLOOD countries.

*Volunteers* may also help to save others by executing emergency measures like placing sand bags or assisting in the evacuation. In England public participation is highly formalised and embedded within flood risk management, as described in Sect. 12.3.1. Also in Poland community preparedness activities are emerging. Public participation takes place via the voluntary fire brigades and the Flood Leaders programme in the city of Wroclaw (see Sect. 12.3.2). In the Netherlands, so-called ‘dike armies’ (comprised of citizens) have a long tradition and are growing in importance. Also in France citizens in the Fire Brigade play an important role in disaster management, as the majority of the personnel are volunteers.

### *12.3.1 Community Flood Action Plans and Flood Wardens: England*

Community engagement is highly established in England. For example, community flood action groups are established by members of the public. They typically work in partnership with local authorities and the Environment Agency, as well as the National Flood Forum (a registered charity) (see also Sect. 12.2.1). In an effort to

enhance preparedness at the community scale, *community flood action plans* are developed, with supporting guidance provided by the Environment Agency (2012) and Cabinet Office (2011). Voluntary-based community flood wardens are established in some areas to facilitate communication of official warning messages.

An opt-out flood warning service also exists between the Environment Agency and telecommunication providers. At the local scale, members of the community may act as *flood wardens* (in agreement with the Environment Agency and community itself), providing a local source of flood information, ensuring warnings reach vulnerable groups and assisting in response efforts (Alexander et al. 2016).

### *12.3.2 Firefighters, Volunteers and Local Leaders: Poland*

In Poland a lot of voluntary and non-voluntary firefighters are active in times of flooding. The *Voluntary Fire Brigade* has a ca. 100 year-long tradition and currently consists of 4000 operational bodies and 16.000 voluntary fire fighters brigades recruited from local inhabitants and financed on the local level from municipal budgets.

The professional and voluntary fire-fighters carry out regular flood event *exercises* in order to prepare for possible flood events and to optimise their response. They do both on-field and desktop exercises, covering different types of responses to different flood scenarios. These exercises also involve local crisis management authorities, representatives of local communities and municipal authorities. They are organized on regional and local level. As a consequence of these exercises, all involved actors are well prepared in case a real flood event.

Local and regional crisis management boards utilize volunteers in order to minimize flood damage and efficiently involve the local community. Among the organisations involved on local level are; Scouts, voluntary water rescue patrols etc. The local and regional crisis management boards supervise volunteers during the flood events.

There are also sporadic examples of good practice at the sub-national scale. For example, the City of Wroclaw established a *Flood Leaders programme* in 2007, as a means of accessing the local knowledge held by key individuals within the community, and facilitating effective response during flood events (Matczak et al. 2016).

### *12.3.3 Booklet to Inform on Flood Risks and Evacuation Perspectives: Sweden*

The big electricity dams of the Luleå River were built around the 1960s. In case of a dam failure the river would flood hundreds of kilometres downstream of the dam and large areas of the cities Boden and Luleå would lie several meters under water.

Flood risks associated with a dam failure are among the most known risks in Sweden. They have been addressed in policies for a long time. Still, in the perspective of many citizens, hydropower dams are considered to be safe and any improbable failure would happen slowly.

In order to improve the risk perception of citizens, in 2012 a booklet was provided to every household in Luleå and Boden (53,000). The booklet informs about the risks of dam failure, evacuation routes, and meeting points in different cities. It also gives information on the time between a dam breach and the moment that the water will reach the place of interest.

However, providing a booklet once is not generally sufficient. In order to make sure the message will be received, it has to be distributed over and over again with certain intervals, and should preferably be combined with communication via other means such as television, social networks, internet, newspapers and street promotion. This increases the awareness of people of the risk of flooding and other natural disasters and what to do in case of a disaster (Ek et al. 2016b).

### *12.3.4 Website 'Should I Stay or Should I Go': The Netherlands*

Until recently, in the Netherlands very little information was provided to citizens regarding flood risks and actions that people can take. Research shows that citizens have very low levels of awareness regarding floods as protection levels are high. General perception is that the government will take care of people, while in fact the government has limited powers in case of an emergency situation. Recently, especially after Hurricane Katrina in New Orleans, more attention has been given to consequence-managing measures. A publicity campaign was started to better inform citizens on their local situation regarding possible floods.

To inform citizens on what actions they can take in case of a flood, a webpage has been designed. The website, www.overstroomik.nl, provides specific information per postal code area on the risk of flooding, consequences of flooding (e.g. maximum water depths) and advice on what to do in case of a flood and how to prepare (e.g., take blankets, drinking water, food, radio and medication). The question 'should I stay, or should I go' is prominent on many locations in the Netherlands. Vertical evacuation – such as moving to the higher floors of buildings – can result in less casualties than horizontal evacuation in certain circumstances. This is also a relevant option in many other low-lying countries and regions, where the road network is also at risk of flooding (Kaufmann et al. 2016).


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# Chapter 13
# After a Flood Event

**G. T. (Tom) Raadgever, Nikéh Booister, and Martijn K. Steenstra**

**Practitioner's Interview with Adrian Kerr**
**Director of Operations for Flood Re, a flood re-insurance scheme administered on behalf of the UK Government. Previously, Aiden was Head of Investment and Funding at the Environment Agency and responsible for delivering their Long Term Strategy for Flood Risk Management.**

Adrian is responsible for ensuring Flood Re's operations are designed and implemented to deliver their targets and objectives. It is estimated that 350,000 flood prone UK households would struggle to obtain affordably priced flood insurance without a scheme like Flood Re.

**Electronic Supplementary Material** The online version of this article (https://doi.org/10.1007/978-3-319-67699-9_13) contains supplementary material, which is available to authorized users.

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T. Raadgever, D. Hegger (eds.), *Flood Risk Management Strategies and Governance*, https://doi.org/10.1007/978-3-319-67699-9_13

From April 2016 the scheme will go live, and a wider number of insurers will be able to offer the general public flood insurance as they will be using the Flood Re scheme. Insurance companies will pass on the flood risk element of eligible home insurance policies to Flood Re, and we will charge the insurers a premium for each policy, based on the property's council tax band. To cover the shortfall between the estimated cost of flood damage and the new, lower premiums and excesses, insurers will pay Flood Re a levy of around £180 m per year. As a result, there should be greater choice of home insurance policies for customers at risk of flooding and those policies should then be more affordable.

Essentially Flood Re is a fund established for insuring household properties, and as with all funds it will grow when there is little call-down on the funds and decrease when there is a large flood. If this occurs in the early years, Flood Re will be covered, as we will purchase our own reinsurance and hold reserves and capital so that we can fully cover all claims in at least 99.5% of years.

Part of the Flood Re scheme includes offering help to people to increase their understanding of their level of flood risk and explain how they can take action to reduce their risk, where possible. Flood Re will only operate for 25 years, allowing time for the Government, local authorities, insures and communities to become better prepared for flooding. This could mean, for example, making use of effective land planning, sustainable drainage, sustainable development and effective flood risk management.

When Flood Re ends, we should be able to return to a system for home insurance prices that will be based more accurately on the kind of flood risks each household actually faces (risk reflective pricing).Therefore there will be an incentive for homeowners, local authorities and the government to take action to try and mitigate the effects of flooding.

## 13.1 Common Challenges

After a flood event the recovery phase starts. Initially, all the water needs to be removed, either by flowing away naturally or through pumping out of the area. The area then requires to be cleaned, with any damaged buildings and infrastructure restored. This process should be carefully planned, and be based primarily on the damage done by the storm event. Some basic infrastructure like roads, electricity supply, water supply and sewerage should be restored before individual properties can be restored and normal living and working functions can start again (see Sect. 3).

A common challenge is to make sure that there is sufficient money for recovery, either by private insurance, public compensation or a mix of both (see Sect. 2). If such instruments are not in place, there is a risk that restoration of certain areas will take a significant time or will not be possible at all. An example of such a problematic situation is the recovery in New Orleans after hurricane Katrina which took up to 4 years to recover the principal areas, but with individual residences requiring up to double that time.

A final challenge is how to use the experiences and lessons from past flood events to improve future flood risk management (see Sect. 4).

Other common challenges and related good practices can be found in Chap. 10 on integrated planning, collaboration and coordination, Chap. 11 (before a flood) and Chap. 12 (during a flood).

A Quick Reference Chart describing the good practices per country can be found as Supplementary material. It indicates per good practices to what Flood Risk Management Strategies, Governance aspects, and Ultimate aims it relates.

## 13.2 How to Provide Sufficient Money for Recovery?

Two main approaches to funding flood recovery in the STAR-FLOOD countries are private insurance and State-funded compensation. Yet, there are large differences in how these schemes function in each country. These differences reflect the different perspectives on flood risk responsibilities. In England and Sweden, flood protection and recovery are, legally speaking, the responsibility of individuals. Therefore, flood recovery is often funded through private insurance mechanisms. In France, the principle of solidarity is established in the constitution, which may account for the presence of both public and private arrangements. In the Netherlands, the limited availability of insurance can be attributed to the high standards of protection and the duty the State has in protecting its citizens. As flood risks increase due to climate change, countries are encouraged to reconsider and improve their insurance systems. The call for risk-based approaches is becoming more pressing in all countries.

*Insurance mechanisms* vary in terms of their level of cooperation with the State. The spectrum ranges from the English insurance system with little State intervention to the French system that is largely State governed. In most countries flood insurance is tied to general household insurance and/or linked to fire insurance. This bundling provides the advantage of spreading the risks and costs between all policyholders and contributing to a high penetration rate. On the other hand, this approach can limit the extent to which property owners are encouraged to stay away from flood prone areas or to adapt their own properties. In addition, it raises premiums for people living outside of flood prone areas.

In Belgium, private flood insurance has been introduced to shift the responsibility for recovery from the State towards the individuals affected (and hence the market). This system of risk-differentiated premiums is used to discourage individuals from building in high-risk areas. A premium cap was set by the government for floods, but this does not apply to buildings built in those areas after 23 September 2008, and there is a disaster fund to back-up the private insurance (see Sect 2.2). In France, private insurance is provided in partnership with the State, which guarantees reinsurance covering extreme events. Reinsurance enables lower premiums and makes country-wide coverage possible, regardless of the degree of risk (see Sect. 2.3).In the UK the English insurance system is currently under reform, with the short term

aim that cross-subsidies for high risk properties are to be pooled across the industry to maintain affordability. The longer term aim is for the cross-subsidies to be slowly removed in an attempt to encourage home owners to take risk reduction action (see Sect. 2.1).

In the Netherlands and Poland, *compensation* for flood damage remains in the public, rather than the private domain. In the Netherlands the system of high safety standards and compensation mechanism (see Sect. 2.4) does not encourage citizens to insure themselves. Only one company offers flood insurance for major flood events. In Poland citizens and companies are responsible to fund their own recovery. Yet, state aid and compensation are expected in the event of a flood, and have been provided by the State in the past. However, this is not a formalised and uniform approach and is therefore not a secure source of compensation. Even for France and the Netherlands - where public compensation mechanisms are established by law - critics have pointed to the fact that compensation is influenced by political will and public pressure.

Beyond citizen-based recovery, *financial recovery mechanisms to support local authorities* in their recovery efforts also exist in England, Sweden and the Netherlands. In England this arrangement takes place through the Bellwin Scheme (see Sect. 2.5). In Sweden and the Netherlands, government grants may be provided after severe events. These grants are decided on a case by case basis (Ek et al. 2016).

### *13.2.1 Flood Insurance and Reinsurance: England*

Flood insurance in England is provided as part of general household insurance (buildings and contents) and therefore sits within a broader policy domain of household insurance and reinsurance provision. It has a *high penetration* rate. Flood insurance is the primary mechanism by which individuals and businesses are able to ensure financial assistance following flooding.

From 2016 a not-for-profit reinsurance fund, *Flood Re*, will be introduced. The introduction of Flood Re aims to ensure that in the medium term flood insurance is accessible and affordable to all (under the Water Act 2014). Flood Re will be a pool-backed system whereby the premiums of properties at high risk will be capped and subsidised by the pool. Although the majority of households will not be affected, the new approach enables the formal cross-subsidisation of those properties at higher risk of flooding and the provision of a premium cap, thereby limiting the cost of insurance to those households.

Flood Re will introduce additional complexity within the domestic market, with a company set up by the industry to manage the reinsurance fund and an increased regulatory role for government. Those companies providing flood insurance remain subject to the same general national and EU rules about financial service provision; however Flood Re has necessitated the introduction of additional legislation. Importantly, the adoption of this new approach aims to ensure the universality and

affordability of insurance for the majority of domestic properties (there are some notable exceptions) and manage the transition in the long term towards risk-reflective pricing of flood insurance. However, there are some concerns about how this will be implemented in practice and whether this new insurance/reinsurance scheme is doing enough to encourage adaptation at the household scale.

Flood insurance has always been provided via private insurance companies, operating purely on a market basis. However, the new scheme, Flood-Re, suggests a higher degree of Government involvement and regulation, indicating a potential shift in the distribution of power between the State and the market (Defra 2013). The English system is an example of good practice primarily because of the high penetration rate of flood insurance as part of the general household insurance, the prolonged affordability via reinsurance and the intention for more risk-reflective pricing encouraging adaptation at the household scale (Alexander et al. 2016).

### *13.2.2 Insurance with Differentiated Premiums: Belgium*

As of the 2nd of March 2006, insurance against damage caused by floods has to be included in the 'simple risk-fire insurance policy'. The insurance is generalised to all natural disasters (i.e. earthquakes, landslides, dike breakings etc.). This generalisation is done because all Belgian citizen runs the risk of being confronted with natural catastrophes. Although this insurance is not obligatory, 95% of owners and 89% of renters in Belgium have subscribed to this insurance.

Because not everyone has the same risk of flooding, policy makers had a lot of discussion about whether to prevent flood risk (by *risk awareness*-raising) or to offer affordable flood insurance for everyone (*solidarity*). The final Act of 17 September 2005 of the Land Insurance Contract Act balances between these two discourses. Flood risks are integrated into the widely applied fire insurance. The Act determines that the following damages should be compensated:

- Direct damage from flooding;
- Indirect damage, also related to measures taken by a competent authority;
- Cleaning and demolition costs related to reconstruction and reinstatement;
- Housing costs in a period of 3 months, in case residential premises have become unfit for habitation.

Yet, insurers are not obliged to cover buildings and their contents when they have been built after 23rd of September 2008 in high-risk areas.

In principle insurers have the freedom to determine themselves the premium rate they wish to apply. They make use of flood risk maps to calculate the correct tariff for a certain location, updated with damage claims. However, the Tarification Bureau defined the maximum tariff that can be asked for the policy, regardless of the location of relevant buildings and the associated (flood) risk. The only exception is again that the maximum tariffs are not applicable to buildings and their contents when they have been built after 23rd of September 2008 in high-risk areas (see also

Sect. 11.4.1 for discouragements for building in flood prone areas). This mechanism thus aims at keeping people away from the water, by discouraging further construction in flood prone areas.

Also for the reimbursement of claims after a disaster an interesting mechanism is in place. An intervention threshold has been set per disaster. When more money is applied for, the excess will be reimbursed by the disaster fund (CANARA – compensation mechanism). This mechanism spreads the losses in case of major disasters between all of the fire insurers active in Belgium. Good practices are evident through the high penetration rate via integration into fire insurance, the redistribution of claims among insurers and the mechanism that discourage development in flood prone areas (Mees et al. 2016).

### *13.2.3 Cat Nat Public-Private Insurance System: France*

Following different natural catastrophes with severe impact in the early 80's, the French Parliament voted the 13th July 1982 for a law for the compensation of victims of natural catastrophic events. This law forms the basis for what is usually called the Cat Nat system.

The Cat Nat system is a mixed insurance system, a sort of public-private partnership. It associates insurance companies, the "Caisse Centrale de Réassurance" (CCR),[1] other reinsurance companies and the State. The State ultimately guarantees the solvency of the system.

The Cat Nat system rests upon the principle of *national solidarity*. Each policyholder pays the same standardised premium rate for the insurance cover against natural hazards, whatever his exposure to the risks. An additional premium "natural hazard" is taken from all insurance contracts covering damages to properties (12% is taken and saved by the National Government in a special fund). These contracts are called "baseline contracts"[2] and are mandatory in France. Thus the penetration rate of the Cat Nat insurance is very high. Furthermore, the costs for each policyholder are considered as being modest.

Insurance companies can reinsure themselves, particularly by choosing the CCR, the only reinsurance company with a solvency guaranteed by the State.

For property owner's to benefit from the Cat Nat guarantee, the required conditions are:

- Properties have to be insured through the 'baseline contracts'
- The impacted city and event has to be recognised as being a 'natural catastrophe' through a joint ministerial decision based on the 'exceptional intensity' of the

[1] National Reinsurance Company, CCR is a reinsurance company tasked with designing, implementing and managing efficient instruments providing reinsurance cover for exceptional perils to meet the needs of its clients as well as serve the general interest.

[2] "Contrats socles" in French.

event. For flooding the threshold of this 'exceptional intensity' correspond to a flood or a rain event with a return period of 10 years minimum. It is one of the lowest thresholds worldwide.

A further requirement is that a part of these additional premiums is taken to finance a fund for the prevention of major natural hazards (known as the "*Barnier Fund*" or National Fund for Major Natural Risk Prevention (FNPRNM)). This fund finances one third of the national policy for flood risk management in France. So this fund forms an interesting link with measures *before* a flood (Chap. 11).

This system has proven to be very effective in the recovery period after a flood event, but is criticised at the same time. Although the Barnier fund is used to pay for flood risk management *before* a flood (see Chap. 11), the guaranteed availability of funds for recovery is generally considered as limiting prevention and mitigation actions. The perspective of being covered in case of an event does not encourage the population to take actions to limit the consequences of the catastrophes. This is the reason why potential reforms of the Cat Nat system are frequently on the political agenda (Larrue et al. 2016).

### *13.2.4 Public Compensation Fund: The Netherlands*

In case of a flood in the Netherlands, victims can be compensated through the 1998 Calamities Compensation Act. This Act compensates victims of floods and earthquakes, or calamities of a similar magnitude. The law only applies when the victim is not culpable for the damage, the damage cannot be insured and when it cannot be claimed elsewhere. In addition, it currently applies to physical damage to goods and not damage to people.

Victims are compensated for specific categories of damage designated by law, in areas that are designated as 'disaster area' by the national government. Damages are assessed by experts and laid down in damage reports that form the basis for compensation. By ministerial decree, specific arrangements are made regarding the compensation for each individual calamity. Provisions for damage compensation by law can be made especially for exceptional situations where no other means of compensation is available and risks cannot be insured.

This system is presented as good practice, and it illustrates a well arranged alternative to an insurance based system. However, it is noted that there is limited experience with how the compensation mechanism functions, in particular for really devastating flood (Kaufmann et al. 2016).

### *13.2.5 Bellwin Scheme Compensating Local Authorities: England*

The Bellwin Scheme is a central government-funded and organised system which provides funding for unexpected losses to local authority functions. The scheme is not only designed to provide financial assistance from flooding but from a range of different types of incidents which require emergency expenditure.

Examples of the types of circumstances whereby local authorities might seek assistance under the Bellwin approach include the costs of evacuation and temporary accommodation of residents or the costs of initial highway repairs where a tree has fallen.

At a central government level the scheme is administered by the ministerial Department for Communities and Local Government. Those seeking funds at the local level are required to submit an application detailing eligible expenditure to this department.

The Bellwin scheme is a good practice as it enables local authorities to recover from floods, but one may argue that the scheme could do more to ensure that these authorities take preventive actions before a flood (Alexander et al. 2016).

## 13.3 How to Maintain and Restore Critical Infrastructure, Healthcare and Other Functions?

In research and policy great attention is paid to maintaining critical or vital infrastructure during a flood, and to restoring this infrastructure quickly after a flood. This includes transportation infrastructure such as roads, railways, airports, hospitals (in particular during a flood), as well as utilities such as electricity supply, water supply and sewerage. Furthermore, special attention is needed for industries and facilities that can severely aggravate the consequences of a flood, such as nuclear power plants and chemical industries.

In the Netherlands the importance of ‘vital and vulnerable’ infrastructure has been reinvigorated in recent years. In the Delta programme it was agreed that the vulnerability to floods of 13 ‘vital and vulnerable’ is to be addressed. This includes functions such as energy production and distribution, telecom, healthcare, transport and chemical and nuclear industries. The effort regarding vital and vulnerable functions is part of the broader aim to make the Netherlands more water robust by 2050. In the coming years, studies into all 13 functions will provide greater insight into actual risks. These studies are interrelated, as many causes and effects connect the various networks. For example, if the energy network fails, this could have a large effect on the functioning of pumps, resulting in severe flooding. When the transport systems fail, this will have a large effect on the functioning of medical facilities. These type of interrelations are investigated using pilot projects. It is expected that realistic goals will be established for the selected functions, with the period to 2050 being required

to adapt infrastructure. By connecting investments to the existing cycle of maintenance and renewal of the networks, it is hoped that costs will be saved.

A good practice that is already more developed than the debate in the Netherlands is found in England, which is described below.

### *13.3.1 National Infrastructure Resilience Programme: England*

The critical infrastructure system in England is a complex and interconnected system. Building resilience in this infrastructure is important to reduce the vulnerability to natural hazards. The National Infrastructure Resilience Programme promotes the integration of resilience within the infrastructure, supply and distribution systems and business planning. The programme is led by the Civil Contingencies Secretariat and was established in March 2011. It encourages organisations to build resilience in their networks and for systems to be able to absorb shocks and recover after an event.

Resilience is described in terms of 'resistance', 'reliability', 'redundancy' and 'response & recovery'. Where resistance is focussed on providing protection in order to prevent damage or disruption. The reliability component ensures that the infrastructure (elements) are inherently designed to operate under a range of conditions and mitigate damage or losses from an event. The availability of backup installations and spare capacity describes the element of redundancy and enables operations to be diverted or switched to other parts of the network during the event to ensure continuity. The response and recovery element describes planning, preparation and exercises in advance of events to enable a fast and effective response to and recovery from disruptive events.

A guide has been written that elaborate this model of resilience (Cabinet office 2011). It shares good practice and advice for owners and operators of critical infrastructure in England (and the UK) to improve security and resilience of their assets. The regulators give support where relevant and needed, but the guide is not embedded in additional regulation or standards (Alexander et al. 2016).

## 13.4 How to Learn from the Past…?

The concept of adaptive planning was already introduced in Chap. 10. Policies are considered hypotheses that need to be tested in practice, and changed based on new insights. No matter how devastating flood events can be, they also provide an opportunity to evaluate and improve current flood risk management. Good practices in this respect are the independent reviews in England and the use of momentum after flood events for stimulating change in Poland.

### 13.4.1 Independent Flood Management and Response Reviews: England

In order to enhance transparency and accountability in flood risk governance, and to promote learning, independent reviews and public scrutiny of flood risk management and responses to significant events are organized. The idea lies in contributing positively to the evaluation of legitimacy and not to create a 'scrutinising culture' which attributes blame. Frequent reviews by Parliamentary Committees and the National Audit Office, as well as external reviews such as the Pitt Review help to enhance transparency and accountability. These independent reviews and select committees have in the past highlighted inefficiencies and ineffectiveness of warning arrangements. One example is the Pitt Review which led to the formation of the Environment Agency / Meteorological Office joint Flood Forecasting Centre in 2009 (see Sect. 12.2.1). Another example from the Pitt review is the formalisation of responsibilities related to surface water flooding; more consistent legislation, namely the Flood and Water Management Act 2010, has also been established.

Local scrutiny boards are also established under the Flood and Water Management Act 2010 to evaluate local flood risk management strategies; although, there is evidence to suggest that this is lacking in some parts of the country. Ultimately, these mechanisms create pathways for institutional learning and improving current flood risk governance and practice (Alexander et al. 2016).

### 13.4.2 Flood Events as a Trigger for Change: Poland

The 1997 Millennium-flood in Poland triggered various changes. Before this flood event the focus in the country was mainly on social and economic issues. The flooding of 1997 brought flood issues back into the centre of cities' agendas. Significant changes in planning and organisation were brought to life through governance instruments such as the Water Act of 2001 and the Programme for the Odra 2006 (which started to be developed in 1999). The city of Wroclaw was especially affected by the 1997 flood, with over 30% of the city flooded. Following the flood Wroclaw put greater effort into flood management. The degradation of dikes and drainage systems in Poland and mainly in the Wroclaw region provided a rational for applying more comprehensive measures against flooding, as part of a holistic flood protection scheme for the whole region. Following the structural changes after 1997, crisis management was much improved for the 2010 flood event.

Reviews of significant flood events have been used at the local and national level. These normally include an overview of the causes of flooding and the performance of defence and drainage infrastructure, as well as the performance of actors involved in flood incident response. Such learning from past events has proven to be very useful. However, it should be stressed that to develop a good adaptive flood capacity, learning should not be ad hoc, but a continuous, proactive and forward looking process (Matczak et al. 2016).


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# Glossary[1]

**Actor** An individual or organisation who has the pindividual or organisation ower to act (or conversely to prevent others from acting), within a certain domain and certain rules of the game. Actors have an interest in the outcome of a decision process or will be affected by the consequences of a decision taken by other actors and the resulting actions.

**Adaptive capacity** The ability to learn and adjust natural or human systems in response to actual or expected external changes in order to moderate harm or to exploit beneficial opportunities.

**Bridging mechanisms** Tools and instruments that combat fragmentation and create synergies by linking and aligning flood risk management strategies, public and private actors from various domains and levels of decision-making, and/or other governance aspects.

**Capacity to resist** The ability of the natural and human system in a specific region in terms of reducing the likelihood or magnitude of flood hazard.

**Capacity to absorb and recover** The ability of the natural and human system in a specific region in terms of reducing the consequences of a flood, enabling the system to absorb a flood and/or quickly recover form a flood.

**Consequences of flooding** Economic, social or environmental damage (or benefits) resulting from a flood, including causalities and harm to individuals.

**Disaster management or Emergency management** *T*he *management* of resources and responsibilities for dealing with all humanitarian aspects of emergencies, in particular preparedness, response and recovery in order to lessen the impact of disasters.

**Discourse** A connected set of statements, ideas, concepts, categories and stories through which meaning is given to social and physical phenomena, and which is produced and reproduced through an identifiable set of practices.

[1] In this glossary, the often used terms in this book are described in alphabetical order. The glossary explains how the authors used the term in the context of this book on flood risk management and governance, without scientific justification and reference.



T. Raadgever, D. Hegger (eds.), *Flood Risk Management Strategies and Governance*, https://doi.org/10.1007/978-3-319-67699-9

**Economic efficiency** The use of financial resources in an efficient way, based on the ratio of desired outputs(s) to input(s).

**Efficiency or Resource efficiency** The use of resources, including financial, technological and human resources, in an efficient way, based the ratio of desired outputs(s) to input(s).

**Emergency management** See Disaster management.

**Exposure to floods** People, economic, social or cultural assets and activities, livelihoods, environmental services and resources, and other elements of social or natural systems present in places that could be adversely affected by a flood.

**EU Floods Directive** Directive 2007/60/EC of the European Parliament and of the Council on the assessment and management of flood risks, which entered into force on 26 November 2007.

**EU Water Framework Directive** Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy, which entered into force on 22 December 2000.

**Flash flood** Flooding via precipitation in steep catchments with fast runoff. Floods occur fast and the response time is short.

**Flood defence** Strategy aiming to decrease the probability of flooding, by infrastructural flood defences, such as dikes and weirs, as well as by increasing the capacity of existing channels, increasing space for water and by creating space for upstream water retention.

**Flood preparation and response** Strategy aimed at decreasing the consequences in time of flooding, by flood warning, disaster management and evacuation.

**Flood recovery** Strategy aimed at a quick recovery after a flood, including reconstruction and rebuilding plans as well as compensation and insurance systems.

**Flood risk** A function of the probability of a flood event and its consequences. Similarly, it can be specified as a function of three flood hazard, vulnerability and exposure.

**Flood risk management** Activity involving risk analysis, assessment of risks, and identification and implementation of measures to reduce flood risks or to deal with flood risks otherwise.

**Flood risk management strategy** Specific goal-oriented way of reducing flood risks or dealing with floods in another way. The five flood risk management strategies distinguished in this Guidebook are (1) Flood prevention, (2) Flood defence, (3) Flood risk mitigation, (4) Flood preparation and response and (5) Flood recovery.

**Flood risk governance arrangement** Interplay (practices and processes) between the actors involved in all policy domains relevant for flood risk management; their dominant discourses; formal and informal rules of the game; and their power and resource base.

**Flood risk mitigation** Strategy focusing on decreasing the magnitude or consequences of flooding through measures inside the vulnerable area, such as retaining or storing water in or under the flood-prone area, flood zoning or (regulations for) flood-proof building.

**Flood risk prevention** Strategy aiming to decrease the consequences of flooding by decreasing the exposure of people and property via measures that prohibit or discourage development in areas at risk of flooding (e.g. spatial planning, re-allotment policy, expropriation policy).

**Floods Directive** See EU Floods Directive.

**Fluvial flooding** Flooding by rivers or seasonal snow melt.

**Good practice** Good practices are projects, instruments or other practices that have proven to be effective in order to reach the goals of flood risk management in different contexts.

**Governance** Set of steering processes and practices through which decisions are taken and implemented, and decision-makers are held accountable. See also Flood risk governance arrangements (more specific).

**Hazard** A physical event or human activity with the potential to result in harm (e.g. the loss of life, injury, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage).

**Legitimacy** A claim to some form of power in some domain which is accepted by those over whom it is used. Legitimacy encompasses accountability, transparency, social equity, participation, access to information, procedural justice and acceptability.

**Pluvial flooding** Flooding by local precipitation.

**Probability of flooding** The likelihood of glossary, the often used terms in period. For instance, a 1:100 flood has a yearly likelihood of 1/100 to occur.

**Resilience to flooding** The ability of the natural and human system in a specific region to deal with disturbances while retaining the same basic structure and ways of functioning. It consists of the capacity to resist flooding, the Capacity to absorb floods and to recover from floods, and Adaptive capacity.

**Resource** A stock or supply of money, materials, human capacity, knowledge and other assets that can be drawn on by a person or organisation to exercise power and manage flood risks.

**Resource efficiency** See efficiency.

**Risk** See Flood risk.

**Rules** Formal or informal prescriptions or restrictions on what may be done or is required to be done or may not be done, including social norms, (in)formal agreements, legislation and enforcement mechanisms.

**Solidarity** Unity (as of a group) that produces, or is based, on community of interests, objectives, and standards. In terms of flood risk management, solidarity may mean equal safety standards or equal sharing of the cost for measures or recovery among citizens.

**Subsidiarity** Principle advocating the devolution of decision making to the lowest appropriate scale, with collaboration and coordination at the highest level necessary.

**SuDS** Sustainable urban Drainage System. A natural approach to slow down or hold-back water that runs of from a property or other development.

**Tidal flooding** Flooding by storm surges from the sea.

**Ultimate aim** The objective to achieve with flood risk management. In this Guidebook we distinguish Resilience, Efficiency and Legitimacy.

**Vulnerability to floods** Degree to which a natural and human system in a specific region is susceptible to, and unable to cope with, adverse effects of flood events.

**Water Framework Directive** See EU Water Framework Directive.