Strengthening and Redesigning European Flood Risk Practices
Towards Appropriate and Resilient Flood Risk Governance Arrangements

Design principles for resilient, efficient and legitimate flood risk governance; Lessons from cross-country comparisons

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Preface

This report is a deliverable of Work Package 5 of the EU 7th Framework Project STAR-FLOOD (www.starflood.eu). STAR-FLOOD focusses on flood risk governance. The project investigates strategies for dealing with flood risks in 18 vulnerable urban regions in six European countries: Belgium, England (UK), France, The Netherlands, Poland and Sweden. The project assesses Flood Risk Governance Arrangements from a combined public administration and legal perspective, with the aim of identifying means of strengthening or redesigning flood risk governance to better support goals of enhancing societal resilience to flooding.

Work Package 1 provided an extended problem analysis related to Flood Risk Governance in Europe and Work Package 2 focussed on how Flood Risk Governance in Europe can be researched. Work Package 3 forms the empirical core of the project, in which analysis, explanations and evaluations of each country, including three case studies, have been performed. Work Package 4 provided a systematic comparison between the STAR-FLOOD consortium countries that has informed the research in Work Package 5, and lead to the identification of design principles for resilient, efficient and legitimate flood risk governance.

We trust that the current report is of interest to a broad readership with an interest in Flood Risk Management.

Yours sincerely,

Dr. Maria Pettersson
Leader of WP5

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Key findings

This report is the result of cross-disciplinary research conducted within the EU 7th Framework Project STAR-FLOOD (www.starflood.eu). The STAR-FLOOD project focusses on Flood Risk Management (FRM) and investigates how current flood risk governance arrangements (FRGAs) can be strengthened or redesigned to enhance societal resilience to flooding. Drawing on public administration and legal disciplines, the FRGAs in six selected EU Member States (Belgium, England, France, the Netherlands, Poland and Sweden) are examined and evaluated.

The aim of the 5th work package (WP5) of the STAR-FLOOD project, and hence this report, is to develop design principles for flood risk governance. Design principles are here understood as sub-objectives which are supposed to contribute to the achievement of more overarching goals, which in this context means flood risk governance arrangements that enhance societal resilience to flooding, and do so in a resource efficient and legitimate manner. The basis for the development of the design principles is a comparison of the results obtained from the evaluation of FRGAs in each STAR-FLOOD country. Flood risk governance has been evaluated on the basis of the extent to which it enhances or constrains societal resilience, resource efficiency and legitimacy. Based on the comparative and evaluative analyses of the empirical studies, good practices and success conditions were identified and synthesized into design principles.

As a result of the substantial variation between countries in terms of physical conditions, administrative and legal context, as well as in normative values, the level of acceptable flood risk will differ. The appropriateness of flood risk governance arrangements should therefore be evaluated in relation to the goals set in each country and the recommendations and design principles that we present should be interpreted within the context of the country.

Design principles for flood risk governance to enhance societal resilience to flooding

- Selected flood risk management measures (*e.g.* defence and mitigation) should be tailored to local circumstances (*e.g.* risk, vulnerability, institutional and economic context).
- Flood risk (prevention) should be incorporated within spatial planning decision-making to: (i) discourage development in known areas of flood risk, (ii) ensure that development in at-risk areas is adaptive, and (iii) ensure that development does not heighten risk.
- Systems for forecasting and warning (preparation) should be effective and warnings should be transmitted with sufficient lead time.
- Effective and proactive arrangements are in place to enhance emergency preparation and response to flooding.
- Strategies to recover from flood events should be available for all citizens.
- Opportunities for social and institutional learning should be created.
- Climate change and future uncertainties are accounted for in the development of law, policy and planning.

Design principles for resource efficient flood risk governance

- Flood risk management should secure the level of flood risk reduction that is found acceptable at the lowest possible societal cost.

Design principles for legitimate flood risk governance

- The decision-making process should be characterised by a high degree of public participation, fairness and perceived accessibility.
- Mechanisms/arrangements are in place to ensure accountability.
- Citizens are aware of their rights and responsibilities in connection with the planning and implementation of Flood Risk Management measures.
- The FRGA is characterised as transparent i.e. the decision-making process, outcome and impact of this process are made visible for all stakeholders.
- Mechanisms/arrangements are in place to ensure access and delivery of procedural justice.

1. Introduction

Anthropogenically induced climate change poses great challenges to society. Phenomenon like flooding is expected to increase and fundamentally alter the living conditions for a large number of people (IPPC 2014). The actual consequences of climate change, especially at local level, are moreover difficult to predict, making it increasingly important to assess risk and vulnerability on the basis of context specific characteristics in order to appropriately address the challenges.

WP5 aims to develop design principles for resilient, resource efficient and legitimate flood risk governance and provide implications for EU policies and directives. This document provides a specification of the process, content and general findings of WP5. The document is consistent with other, approved, project documents, including the STAR-FLOOD Grant Agreement, the Description of Work, the Consortium Agreement and the Project Management Plan. The formulation of the design principles constitutes the last step of the STAR-FLOOD research program. All partners have contributed to the report.

The design-principles for resilient, resource efficient and legitimate flood risk governance need to be based on empirical evidence from a variety of empirical contexts. For that reason, the national level analyses and evaluations from the six countries (Belgium, England, France, The Netherlands, Poland and Sweden) and the 18 case studies conducted during WP3 as well as the comparisons thereof, will serve as the basis for deriving design principles that can be applicable in several contexts. The experience from the expert panel that was organised as part of WP5 has also provided valuable insights to the formulation of the design principles. The analysis includes a comprehensive overview of the national and case study evaluations of relevant aspects of governance, including discourses, actors, rules and resources in relation to flood risks in the examined countries. Flood risk governance has been evaluated on the basis of the extent to which it enhances or constrains societal resilience, resource efficiency and legitimacy. Based on the comparative and evaluative analysis of the empirical studies, important success conditions for resilient, efficient and legitimate flood risk governance will be identified in this report.

1.1 Overview of the STAR-FLOOD project and methodology

This report is the result of cross-disciplinary research conducted within the EU 7th Framework Project STAR-FLOOD (www.starflood.eu). The STAR-FLOOD project examines how current Flood Risk Governance Arrangements (FRGA), and sub arrangements therein (as defined in Box 2.1), can be strengthened or redesigned to enhance societal resilience to flooding in urban areas. Drawing from public administration and legal disciplines, flood risk governance was examined in six selected EU Member States; namely Belgium, England (UK), France, the Netherlands, Poland and Sweden.

Box 1.1: Key terms (Hegger *et al.*, 2014)

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.

sub-Flood Risk Governance Arrangement (sub-FRGA) – The distinct arrangements of actors, rules, resources and discourses directed towards a distinct goal of FRM, embedded within an overarching 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. These can be identified because they have to some extent separate actors, discourses, rules and resources than other sub-FRGAs

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

The project adopted the starting assumption that the diversification of FRM Strategies (FRMSs) is a necessary condition for societal resilience. The notion of FRMSs was introduced as a heuristic device to help identify (sub)-Flood Risk Governance Arrangements, but have also provided a pragmatic way of organising the array of FRM Measures employed by different EU Member States. The extent to which governance arrangements support or constrain the diversification of Flood Risk Management Strategies (FRMSs) was assessed in each STAR-FLOOD country, according to the categories of *prevention, defence, mitigation, preparation and response*, and *recovery* (Hegger *et al*., 2014; Figure 1.1).

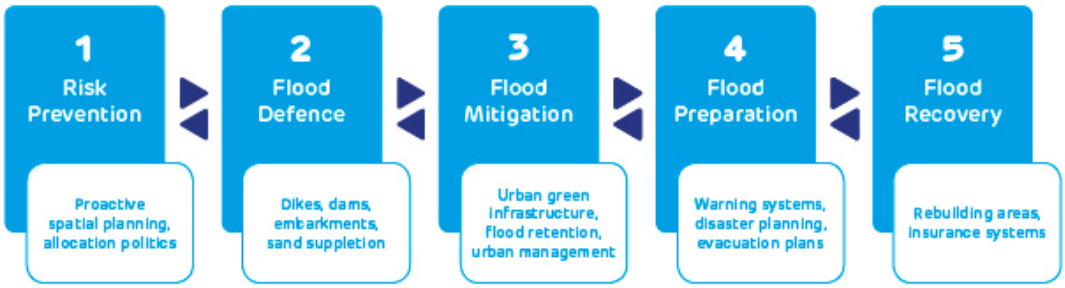

Figure 1.1: Overview of the five Flood Risk Management Strategies identified within STAR-FLOOD

Flood Risk Governance Arrangements and implementation of FRM strategies were examined in each STAR-FLOOD country through in-depth policy and legal analysis, accompanied by semi-structured interviews with key actors involved in FRM. This empirical research formed the basis of Work Package 3 and is reported in a series of country-specific reports (Alexander *et al*. 2015, Ek *et al*. 2015, Kaufmann *et al*. 2015, Larrue *et al*. 2015, Matczak *et al*. 2015 and Mees *et al*. 2015). Research was conducted at national and case study scales and comprised a series of stages (illustrated in Figure 2.2) and summarised as follows;

1. **Identification** of the national Flood Risk Governance Arrangement (FRGA) and sub-FRGAs, according to the arrangement of actors, rules, resources, discourses in relation to functionality (adopting the Policy Arrangement Approach[1], 'PAA');
2. **Explanation** of governance dynamics, including explanatory factors for stability and change (Larrue *et al.,* 2013);
3. **Evaluation** of flood risk governance according to the desired outcomes of *resilience, efficiency* and *legitimacy* (based on the framework presented by Alexander *et al*., 2015);
4. **SWOT analysis** – including an assessment of the strengths and weaknesses in current flood risk governance, as well as the opportunities and threats to strengthening flood risk governance.

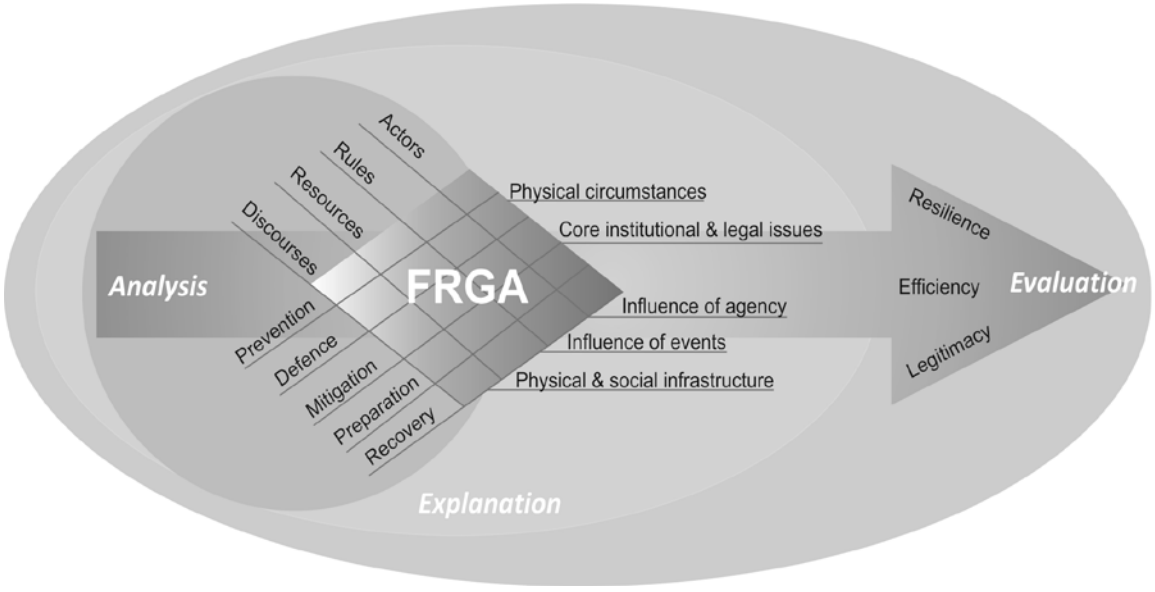

Figure 1.2: Research steps in STAR-FLOOD

1.2 Methodology

The purpose of this report and goal of Work Package 5 was to compare the results obtained from the evaluation of FRGAs in each STAR-FLOOD country; for a comparison of other cross-country comparisons the reader is referred to Matczak *et al.* (2016). As a project, we adopted the normative stance that flood risk governance arrangements should enhance societal resilience to flooding and do so in an efficient and legitimate way (Hegger *et al.,* 2014).

In order to determine the extent to which current arrangements of flood risk governance are achieving the desired outcomes of societal resilience, efficiency and legitimacy, an evaluation framework was developed in Work Package 2, based on a number of criteria and indicators (or 'benchmarks') to evaluate current conditions against a desired optimum (Priest *et al*., 2013; Alexander *et al*., 2015). These are summarised in Table 1.1.

[1] The Policy Arrangements Approach (PAA) represents an analytical framework, based on the four interdependent dimensions of *actors, rules, resources* and *discourses* (Arts *et al*., 2006; Liefferink, 2006). Each dimension essentially provides a different analytical perspective and, by combining these perspectives, the regime can be fully understood (Larrue *et al*., 2013).

Table 1.1: Evaluation Framework – Outcomes, criteria and indicators for evaluating flood risk governance

Desired outcomes of governance	Evaluation criteria	Indicators ('benchmarks') of success
Societal resilience	Capacity to resist	▪ The assembly of measures/projects/or governance arrangements is shown to have enhanced the capacity of the social-environmental system to reduce the likelihood and/or magnitude of flood hazard
	Capacity to absorb and recover	▪ Diversity of measures/projects/or FRM strategies to address risk in a holistic way (i.e. from the likelihood of occurrence (resistance) to the potential range of consequences) ▪ Bridging mechanisms exist which support integration and coordination between different levels of governance and sub-governance arrangements ▪ Assembly of measures/projects/FRM strategies is multi-layered to address risk at different spatial and temporal scales ▪ 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 ▪ Opportunities are created for innovation and experimentation ▪ The legal framework or legal instruments / plans and programmes are subject to periodic review proceedings in order to incorporate new information about climate change and floods ▪ There is a balance between adequate flexibility in the legal framework in order to allow adjustments and legal certainty ▪ Future risks and uncertainty (*e.g.* climate change) are factored into the decision-making process
Resource efficiency	Resource efficiency (Including **economic** resources, **human** resources (personnel, skills and knowledge) and **technological** resources	▪ The flood risk governance arrangement or sub-entities of governance (*e.g.* FRM measures, projects or sub-arrangements) use resources in an efficient manner, based on the ratio of desired output(s) to input(s) ▪ 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 ▪ FRM measures deliver multiple benefits, for example economic, social and / or environmental benefits or address multiple problems (thus reducing the need for multiple schemes/projects at added cost) ▪ The legal and institutional framework favour good cooperation between the different actors involved in FRM (ensuring timely exchange of information and minimising the overlap of tasks completed by different actors) ▪ Resource efficiency is allied to goals of sustainable FRM (thus demonstrating concerns with long-term efficiency) ▪ The legal framework, the overall process of decision-making and

Desired outcomes of governance	Evaluation criteria	Indicators ('benchmarks') of success
		delivered-activities are described as efficient by relevant actors and stakeholders
Legitimacy	Social equity	▪ The distribution of costs and benefits are fully considered within the decision-making process and communicated to those affected ▪ The process of decision-making is perceived to be fair ▪ The outcome of decision-making is perceived to be fair
	Accountability	▪ There are opportunities for stakeholders to challenge decisions that have been made
	Transparency	▪ The decision-making process is transparent so all can see how decisions were made (*e.g.* public inquiries)
	Participation	▪ Stakeholder participation has been sought through various stages in the decision-making process, based on a model of knowledge exchange ▪ A range of stakeholders have been involved in stakeholder participation ▪ The views of stakeholders have been considered and integrated within decision-making
	Access to information	▪ Stakeholders have equal access to relevant information about the problem and how it will be managed
	Procedural justice	▪ There are opportunities for stakeholders to challenge decisions that have been made ▪ Stakeholder have equal access to the appeal process ▪ The process of resolving disputes is considered to be fair
	Acceptability	▪ The processes involved in decision-making are accepted by stakeholders ▪ Decisions are accepted by stakeholders

Insights into national flood risk governance were further accompanied by critical evaluation performed at the case study scale. Three case studies were selected in each country. This provided an opportunity to identify differences between the two scales (*e.g.* observe where innovation has emerged at the local scale or where the national FRGA may have constrained innovation). Drawing both this information together, this report essentially compares the results from these evaluations and observes the similarities and differences between the STAR-FLOOD countries. Whilst the national scale is the key unit of analysis, findings obtained through case study research are also used as illustrative examples or to demonstrate where local flood risk governance differs from national FRGAs.

This comparative study was facilitated through cross-country dialogue and knowledge exchange within the STAR-FLOOD consortium, alongside in-depth study of the evaluation findings reported by each country (Alexander *et al*. 2015; Ek *et al*. 2015; Kaufmann *et al*. 2015; Larrue *et al*. 2015; Matczak *et al*. 2015; and Mees *et al*. 2015). To assist this task, STAR-FLOOD researchers from each partner country were requested to complete a qualitative matrix to centralize the key findings from national and case study evaluations performed in their respective countries. The matrix requested

researchers to enter information relating to the features of governance that enhance or constrain goals to enhance societal resilience to flooding and the efficiency and legitimacy of flood risk governance. Moreover researchers were asked to reflect on the conditions for success as well as the barriers and constraints to achieving these goals, taking into account the four dimensions of the Policy Arrangement Approach (i.e. actors, rules, resources and discourses). The matrix framework is illustrated in the appendix to this report.

This report is guided by a series of Research Questions (RQ):

1. What factors appear to support or constrain efforts to enhance societal resilience to flooding? The efficient use of resources? Legitimate flood risk governance?
2. What are the conditions for successful flood risk governance (i.e. 'success conditions')?
3. To what extent can 'success conditions' be translated into design-principles?
4. What are the implications of these success conditions for flood risk governance at European, national and local scales?

This report begins by comparing the results from each country's evaluation of flood risk governance, with a particular focus on the factors that support or constrain efforts to enhance societal resilience, the efficient use of resources and legitimacy of flood risk governance (RQ1). The extent to which these factors are influential in the STAR-FLOOD countries is scored as *high, medium* or *low* (or combination thereof) and presented in Tables 2.1 to 2.16. These assessments were determined by the academic research team of each country on the basis of empirical research. This information is used to discern the conditions for 'successful' flood risk governance, i.e. governance that achieves the desired outcomes of resilience, efficiency and legitimacy (RQ2). We adopt the term **'success conditions'** in reference to the social structures, procedures, rule-types, resources etc. that need to be in place in order to successfully deliver different aspects of flood risk governance. Section 3 considers the extent to which these success conditions can be translated into design principles and recommendations for strengthening flood risk governance in the selected STAR-FLOOD countries, and more broadly across the EU (RQ 3 and 4). **Design principles** are here understood as sub-objectives which are supposed to contribute to the achievement of more overarching goals (see further Section 3). Section 4 concludes and discusses the results.

2 Evaluating flood risk governance arrangements – A cross-country comparison

Drawing from the critical evaluations of flood risk governance in each of the STAR-FLOOD countries, this section presents the results of a cross-country comparison. Following the evaluation framework, comparisons are made in terms of the three desired outcomes of flood risk governance; namely the pursuit of societal resilience to flooding (Section 2.1), efficient use of resources (Section 2.2) and legitimate governance (Section 2.3). This section observes the similarities and differences between the STAR-FLOOD countries and outlines the factors that seem to support or constrain the achievement of societal resilience, efficiency and legitimacy. Thus this section provides important insights into success conditions (discussed further in Section 3) and reveals a number of examples of good practice. Below, the three capacities of resilience are analysed in separate sub-sections although there are clear overlaps (and even causal links) between these capacities. We argue for instance that the capacity to adapt is in itself an enhancing factor for the capacities to resist, recover and respond from floods.

The flood risk governance arrangements in the STAR-FLOOD countries are also affected by the EU Floods Directive. The impact of the Directive however varies across the countries. In Poland and Sweden the Directive arguably has had an agenda-setting function in terms of discussing measures belonging to several Flood Risk Management Strategies, and stipulating a shift from reactive towards preventive strategies, whereas in countries such as the Netherlands and England, where a solid package of legal instruments and measures was already in place, impact appears to be limited.

It follows from Art. 288 in the Treaty of the Functioning of the European Union (TFEU) that using the Directive-form of legislation entails that the legislation is binding primarily with respect to the result to be achieved. It is thus, in principle, up to the member states to decide by which means to accomplish the objectives of the Floods Directive. In combination with the relatively open and flexible goal formulation of this Directive, this also implies that the effectiveness of the Directive will depend on the level of ambition in the individual member states, thus also reflecting the principle of subsidiarity.

2.1 Evaluation of societal resilience

Flood risk governance underscores the delivery of Flood Risk Management (FRM), from policy and legislation through to its implementation, and the assembly of strategies and measures to manage flood risk (including exposure, the hazard potential and consequences). Governance therefore plays a pivotal role in supporting (or potentially constraining) societal resilience to flooding. This project has 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).

This section reports the findings from a cross-country comparison and reflects on the similarities and differences between STAR-FLOOD countries in terms of the factors that support, or alternatively constrain, efforts to enhance societal resilience to flooding. Although the three facets of resilience

are analysed in sub-sections, we acknowledge the considerable connectivity and feedback mechanisms that exist between these, and in turn influence the overall resilience of societies. For an in-depth appraisal of each country, the reader is referred to Deliverable Reports 3.2 to 3.7. The purpose of this section is not to determine which countries are more or less resilient, but rather to illustrate how societal resilience is supported through the Flood Risk Governance Arrangements (FRGAs), and observe and account for similarities and differences.

2.1.1 Factors that support and constrain capacities to resist flooding

The capacity to resist can be defined as the ability to minimise the likelihood and magnitude of flood hazards. This is supported through the implementation of defence and mitigation strategies, which include a range of measures that act to resist (*e.g.* dikes) or accommodate (*e.g.* flood storage and forms of sustainable drainage) water, respectively. The latter, may be implemented through preventative-based measures related to spatial planning. On the basis of intra- and inter-country analysis it is clear that capacities to resist flooding vary between STAR-FLOOD countries. Moreover, there is significant variability within these countries, depending on the type of flood risk under study and the scale at which resistance is assessed. Table 2.1 considers the degree to which certain features of flood risk governance support capacities to resist flooding.

In all STAR-FLOOD countries, investment in new defence infrastructure and maintenance of existing assets enhances the capacity to resist fluvial and coastal flooding. Unsurprisingly, the Netherlands is a leading example of this. Indeed, flood defence is considered to be the cornerstone of Dutch FRM, with high standards of protection legally established and largely funded through the State and Regional Water Authorities. Moreover, a safety culture is embedded in society. In contrast in Sweden, where floods vary significantly in time and space, it is considered to be more resource efficient to deal with flood incidents through the use of temporary defences and evacuation of people, rather than constructing permanent defence structures (Fiselier and Oosterberg, 2004). In stark contrast to the Netherlands, where permanent defence measures are developed, in Sweden they are principally initiated and financed at the local scale. In Poland, flood defence is also not regarded as a national priority and was under-developed for a considerable period of time. However, the impact of significant flood events (*e.g.* 1997, 2001 and 2010) has prompted more recent investment in defence infrastructure (as illustrated in the Slubice and Wroclaw case studies; Matczak *et al*. 2015). Arguably, this has been facilitated by shifts in political ideology, accession to the EU (and access to EU funding) and economic development, which have made this investment in FRM possible.

In Belgium, Sweden and England cost-benefit analysis plays a crucial role in allocating budgets for defence and mitigation measures, and determining standards of protection. This is less important in the Netherlands and France where legally-established safety standards exist. As a result, it is not possible to infer which countries are relatively more or less resistant without taking into account the influence of spatial scale upon this interpretation. Whilst the Netherlands is clearly the most resistant against fluvial and coastal flooding at the national scale, high levels of resistance are also evident at the sub-national scale within the other STAR-FLOOD countries. Furthermore, it should be borne in mind that what is regarded as an appropriate level of defence is highly context-dependent. For instance, in a relatively small and densely populated country exposed to high flood risk, such as the Netherlands, significant investment in permanent defence seems adequate while this is not

necessarily the case in a larger country with more limited and highly dispersed flood risk, such as Sweden.

Table 2.1: Comparing the degree to which certain features of flood risk governance support capacities to resist flooding in STAR-FLOOD countries

Degree to which […]* *support(s)* capacities to resist flooding	**Belgium**	**England**	**France**	**The Nether-lands**	**Poland**	**Sweden**
the level of investment in fluvial/coastal flood defence infrastructure (new projects and maintenance of existing defence assets)	Medium	Medium	Medium/ low	High	Medium/ high	Medium
Efforts to encourage the uptake of property-level measures to mitigate all flood types	Low/Medi um	Medium/ high	Low/medi um	Low	Low	Low/ medium
Long-term, forward planning for defence infrastructure, taking into account the potential effects of climate change upon all flood types	High	Medium/ high	Medium	High	Low	Low
Mitigation-based measures (*e.g.* SUDS), are encouraged through national policy or legislation	Medium/ high	Medium	Medium/l ow	High/medi um	Low	Medium

*Insert factor listed in each row

As one might expect, whereas investment in defence infrastructure supports the capacities to resist flooding, a lack of financial resources limits this. This is a recurring theme that affects all STAR-FLOOD countries (with the exception of the Netherlands). Moreover, this appears to have been exacerbated by the impact of the global financial recession in 2009. Constraints on financial resources seem to have the greatest impact in terms of maintaining existing defence assets; indeed, shortfalls in funding for defence maintenance at national and case study scales are reported in Belgium, England, France and Poland. This has implications for maintaining standards of protection and could result in existing lines of defence falling into disrepair. This is not the case in the Netherlands due to the fact that funding for defence maintenance is sourced from taxes raised by Regional Water Authorities and there is societal willingness to pay for flood safety. In the other STAR-FLOOD countries, different social norms and administrative structures exist; therefore, different approaches must be sought to secure money for defence assets.

One way of addressing this, and alleviating pressure on state money, has been to look to alternative sources of funding and develop public-private partnerships. In England, Partnership Funding was formally implemented in 2012 and requires a proportion of financing for defence and mitigation measures to be sourced at the local scale through local tiers of government, the private sector and/or civil society actors (Defra, 2011). Early assessments of this new funding arrangement appear to be favourable and have documented an increase in external funding (Efra Committee, 2015); although the difficulties of securing contributions at the local scale and from the private sector is still an express concern. Public-private partnerships are also evident in France and there are examples of efforts to integrate the private sector in the design of defence and mitigation measures. However,

there is scope to develop this further, Currently, the Action Programme for Flood Prevention (PAPI) defines the investments of all actors, but largely formulates partnerships between the State and local public actors (*e.g.* municipalities, inter-municipal bodies and water agencies), although it has the potential to involve private partners (i.e. dike owners). This is particularly important given the emergence of so-called 'orphan dikes' in France, created by the fragmentation of responsibilities and corresponding confusion about ownership. Thus, clearly-defined responsibilities are a clear condition for success.

In light of future uncertainties, and given projections for climate change, long-term forward planning for flood defence is desirable. It is argued that this is necessary for maintaining capacities to resist flooding in the future; thus this aspect of flood risk governance is also relevant for supporting adaptive capacity (Section 2.1.3). For example, an important step forward in England has been the recent introduction of a six year spending programme (Defra, 2014). The Investment Plan is designed to reduce current flood risk by 2021 (HM Treasury, 2014; Defra, 2014). This is seen as a necessary step in securing and adequately planning for defence and mitigation measures in the medium-term. Over longer timeframes, the Environment Agency has developed a Long-Term Investment Strategy (Environment Agency, 2014), as well as taking the lead in the development of Catchment Flood Management Plans to support strategic decision-making over a 50 to 100 year timescale (Environment Agency, 2012). In the Netherlands, the Delta Programme is a water-related adaptation plan (as requested under the Water Act) and situated within a 50 year time horizon. Likewise in France, there exists a national climate change adaptation programme and areas exposed to tidal flooding must take into account the risk of sea level rise in Flood Risk Prevention Plans. In contrast, there is no formalised approach to climate change adaptation in Poland and limited integration of climate change and future uncertainties within FRM (Matczak *et al.* 2015).

To ensure capacities to resist in the future, future uncertainties should be factored into the design of defence and mitigation projects, as well as in spatial planning in general. For instance, a range of measures will be developed within the Scheldt estuary with the implementation of the Sigma Plan in Flanders to enhance standards of protection for tidal flooding from a 1 in 75 year to 1 in 4000 year safety standard. The Sigma Plan assumes a rise in sea level by 60 cm by 2100 (selected from the estimated range proposed by the IPCC, 2001) and uses this figure to inform the selection of measures and safety standards. Importantly, this will be re-evaluated by 2050 to take into account new projections for sea-level rise and adapted accordingly. In fact, 656 hectares of land has already been marked as a reserve area, which can be developed as additional flood control areas in the course of time (Gauderis *et al.*, 2005). Similar forms of adaptive management are found elsewhere in England (*e.g.* River Thames 2100 project) and the Netherlands (*e.g.* Delta Programme). This approach requires the identification of trigger points and strategies for managing risk through pre-determined interventions, whilst instilling a degree of flexibility to adjust responses according to changes in conditions. Adaptive management is thus a crucial step-forward in terms of sustaining capacities to resist flooding in the future and supporting adaptive capacity.

As a result of changing land use, increasing urbanisation, aging drainage infrastructure and soil subsidence, surface water (or pluvial) flooding has emerged (albeit to varying degrees) as a distinct source of risk in these countries. Mitigation for surface water FRM is necessary for supporting capacities to resist this type of flooding; where mitigation can be delivered in its own right or

delivered through spatial planning arrangements. The Kingston-upon-Hull case study in England provides a large-scale example where several flood storage areas (currently at varying stages of completion) are being developed to mitigate surface water flood risk (Alexander *et al.*, 2015). Nationally, Sustainable Urban Drainage Systems (SUDS) have recently been introduced as a planning consideration for developments of 10 properties or more. Although it is too soon to evaluate the effectiveness of this approach, it reflects for the first time established protocols for considering SUDS and surface water management, thus strengthening the alignment between spatial planning and FRM governance. However, whilst certain mitigation measures can be delivered through spatial planning rules, a recurring theme discussed by all countries is the issue of enforcement in spatial planning (Table 2.2). Effective mechanisms for enforcing planning policy are a clear condition for success.

Related to this are the conflicting interests for local authorities (or governments) for providing more housing for their population; economic reasons (attractive waterfront living) and lack of space elsewhere implies that buildings, despite the increased flood risk, are often located in floodplains, or other flood prone areas. In Belgium, the water assessment, signal areas and flood risk zones help to limit further construction in flood prone areas.

Amongst STAR-FLOOD countries we see efforts to diversify the types of measures used to minimise the likelihood and magnitude of flooding. Beyond defence structures, sustainable urban drainage is promoted in England, the Netherlands, Belgium and France. In addition, the use of property-level measures is widely encouraged in England and evident in the Netherlands and Belgium. Natural Flood Management is also strengthening across the STAR-FLOOD countries. For instance, in the Netherlands the use of water storage (or retention basins) has increased over the past decade, alongside wider efforts to make 'Room for the River'. Whilst minimising the likelihood of flooding, this approach simultaneously helps countries to improve the ecological status of water bodies, as required by the EU Water Framework Directive[2].

An important finding from our cross-country comparison is that capacities to resist are threatened by societal dependence on flood defences. This has resulted in the under-development of other FRMSs in certain countries. Although this does not undermine the capacity to resist flooding, this does have a significant impact upon the other facets of societal resilience (i.e. the capacity to absorb, recover and adapt). Addressing this, efforts to diversify and develop FRMSs are evident in all STAR-FLOOD countries, with the exception of England where a diversified approach has been established for ca. 65 years. The legacy and dependency on flood defences has influenced societal perceptions and seems to have instilled the perception amongst certain members of civil society that floods can and should be prevented by the State (Table 2.2). Whilst this societal expectation is arguably justified in the Netherlands, where rights to flood protection are established in the constitution, this is not the case in the other STAR-FLOOD countries. At the same time, there is a clear discursive shift

[2] The overall aim of the EU Water Framework Directive (WFD) is for all EU bodies of water to achieve and retain 'good ecological status' in terms of the quality of the biological community, the hydrological characteristics and the chemical characteristics of the water resources (Art. 1, WFD). The focal points in connection with the implementation of the Directive are the designation of river basin districts and the establishment of water authorities. The implementation method involves a combination of legal instruments (a so called combined approach) for point and spread out sources, which entails both emission requirements, such as best available technology (BAT), and environmental quality standards (Art. 10, WFD).

in FRM policy in Belgium, England and France, where individuals, households and communities are expected to adopt partial responsibility for managing their own flood risks, thus encouraging efforts to engage and encourage citizens to participate in FRM. Of relevance to this section, we see efforts to enhance capacities to resist at the local scale (*e.g.* through the installation of property-level measures). However, citizen engagement can be challenged by misaligned expectations. Similarly, research conducted within Poland also uncovered perceptions of 'safety' and a passive attitude towards FRM amongst citizens. Such attitudes can undermine citizens' willingness and motivation to adopt resilient behaviours. Furthermore, high degrees of trust in defence measures and perceptions of infallibility are also potentially detrimental to societal resilience. Fuelled by this perception of safety, significant development has occurred behind (and even on) dikes in the Netherlands and other STAR-FLOOD countries. Indeed in the Netherlands, the high level of protection seems to have created an 'awareness gap' towards flood risk (OECD, 2014). This heightens the consequences should these defences become overwhelmed or fail.

In summary, this cross-country comparison reveals a number of factors that seem to support or constrain capacities to resist flooding in the STAR-FLOOD countries. These factors indicate potential conditions for success as well as aspects of flood risk governance that require improvement.

Table 2.2: Comparing the degree to which certain features of flood risk governance constrain capacities to resist flooding in STAR-FLOOD countries

Degree to which […]* *constrain(s)* capacities to resist flooding	**Belgium**	**England**	**France**	**The Nether-lands**	**Poland**	**Sweden**
Enforcement challenges encountered in spatial planning	Low	Medium	Medium/ low	Medium/ low	Medium	Medium
A lack of clarity over ownership and responsibility of fluvial and coastal defence assets	Low	Low/ medium	Medium/ high	Low	Medium	Low
Societal dependency on flood defences and citizens' expectations that these will suffice	Medium/ high	Medium	Medium	High	High	n.a.
the challenge of changing societal attitudes towards property-level measures	Medium/ high	Medium	n.a.	High	Medium/ high	Medium/ high

*Insert factor listed in each row

2.1.2 Factors that support and constrain capacities to absorb and recover from flooding

The next facet of resilience relates to the *capacity to absorb and recover* from flood events. Table 2.3 and Table 2.3 respectively summarise the different degrees to which certain features of flood risk governance support and constrain capacities to absorb and recover. Supporting this, **spatial planning is an essential strategy for minimising the exposure of people and property,** and therefore plays a focal role in **minimising consequences** if flooding occurs. This can be achieved by prohibiting development on the floodplain or through planning conditions that minimise the potential damage caused by flooding and therefore speed-up the recovery process. France has a particularly strong spatial planning policy, with zoning that prohibits development of the highest risk areas. Furthermore, Belgium, England, the Netherlands 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 no other available land at lower risk). In Poland, recent amendments in the Water Law (2015) have reduced the possible impact of flood hazard maps in spatial planning decisions. As a result of the amendment, local authorities 'may', rather than 'shall' (as was the case prior to the legislative changes), consider flood hazards in spatial planning, and they are not obliged to reduce flood risks through such measures. **Insurance mechanisms** can also be used to discourage development in flood risk areas.

A central aspect of flood risk governance supporting capacities to absorb and recover is well-functioning preparatory systems in the form of flood forecasting, warning and emergency response (Table 2.3). **Flood forecasting** is established across all STAR-FLOOD countries and technological advancements have played a pivotal role in improving the provision of timely flood warnings (i.e. with sufficient lead times to prompt action).

Across the STAR-FLOOD countries, different arrangements are established for communicating **flood warnings** to at-risk citizens and emergency responders. In England, multiple pathways for disseminating flood warnings exist, including an opt-out service to maximise the reach of formal warnings. Facilitating the communication of formal flood warnings, voluntary community-based warning schemes are also evident in England and Poland.

Table 2.3: Comparing the degree to which certain features of flood risk governance support capacities to absorb and recover from flooding in STAR-FLOOD countries

Degree to which […]* *support(s)* capacities to absorb and recover from flooding	**Belgium**	**England**	**France**	**The Nether-lands**	**Poland**	**Sweden**
Forecasting capabilities for timely flood warnings	High	High	High	High	Low/med	High/ medium
Established and diversified pathways for disseminating flood warnings (including local citizens actively involved in dissemination processes)	Medium/ high	High	Medium/ low	High	Low	Medium/ high
Regular assessment and proactive planning for flood risk	Medium	High	Medium	Medium/ high	Low	High/ medium
Requirements to periodically exercise emergency arrangements	Medium	High	Medium	Medium/ high	High	High/ medium
Mechanisms for facilitating multi-actor working within emergency management	Medium	High	Medium	Medium/ high	Low/ medium	High/ medium
Mechanisms for targeting hard-to-reach and vulnerable groups in society	Medium	High		Low/ medium		Medium/ high
Initiatives to improve community preparedness (*e.g.* formation of community flood action plans)	Low/ medium	High/ medium	n.a	Low	Medium	Medium/ high
Clearly defined roles and responsibilities of emergency responders, alongside clear mechanisms for	High	High	High	Medium/ high	High	Medium/ high

upscaling/downscaling emergency response						
The availability of flood insurance and/or compensation mechanisms	High	High	High	Low	Low/ medium	High/ medium

*Insert factor listed in each row

Flood emergency management plays a crucial role in efforts to enhance societal resilience to flooding by enhancing the capacity to respond and recover from flood events. As an umbrella term, emergency management is often conceptualised as a cycle of activities, from (pre-event) preparedness, to emergency response and recovery. In general, emergency management has been evolving and shifting in these 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. It should be borne in mind that multi-hazard approaches to emergency management are adopted in each STAR-FLOOD country; thus provisions for flood incident management are embedded within broader constructs of 'emergency' and 'crisis' management. Significant re-organisation of emergency management has occurred in all STAR-FLOOD countries in the 2000s in an attempt to clarify roles and responsibilities, and respond to contemporary risks. 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.

Clarity of roles and responsibilities is a fundamental condition for success. Moreover, mechanisms are required to facilitate integrated, multi-actor working. An example of good practice is evident in England, where Local Resilience Fora (LRF) are established and comprise of Category 1 and 2 Responders. It is a statutory requirement for LRFs to meet frequently, develop Community Risk Registers and perform multi-agency planning (such as Multi-Agency Flood Plans). Similar mechanisms are found in Sweden, where intra-agency collaboration areas have been established.

Such mechanisms for integrated-working are essential for **facilitating the exchange of information and helping to target vulnerable people** (such as the elderly, mobility impaired and minority language speakers etc.). This is institutionalised in England where *e.g.* emergency planners are required to build inclusive lists of the appropriate agencies responsible for certain vulnerable groups and establish pathways for accessing these lists when required. Such networks are also employed as a means of 'pushing' warning messages and 'pulling' potentially vulnerable individuals towards the authorities in advance of an emergency or major incident (HM Government, 2008). Similar mechanisms are present in Sweden, where the issue of vulnerable groups has been particularly highlighted in the context of climate change related threats, such as heat waves, storms and floods (*e.g.* Statens Folkhälsoinstitut, 2010). Specific challenges in this context however relate to dealing with temporary settlements resulting *e.g.* from a sudden influx of migrating people.

Cross-country comparisons also reveal the importance of established mechanisms for upscaling/downscaling emergency response according to the principle of subsidiarity, as well as periodic exercising to test emergency plans. In the Netherlands for instance, flood rehearsals are integrated within the Water Act 2009 (Gilissen *et al*., submitted *paper*). However, it is also necessary

to highlight the factors that appear to constrain effective flood emergency management in STAR-FLOOD countries (Table 2.4). These can be summarized as follows:

- **Lack of resources** to support emergency management activities – evident in Belgium and Poland
- **Tendency to depend on State intervention** and therefore lack of agency for people to help themselves – evident to varying degrees in all STAR-FLOOD countries
- **Lack of risk awareness amongst the public** – evident to varying degrees in all STAR-FLOOD countries

The relationship between public authorities and citizens in preparedness and response activities has been studied within the STAR-FLOOD consortium (Mees *et al. submitted* and Gilissen *et al. submitted*). **Citizen involvement** is widely regarded as an important means of raising risk awareness and encouraging resilient behaviours amongst those at risk of flooding. Therefore, activities and initiatives which engage citizens in FRM have the potential to strengthen capacities to absorb and recover, as well as adapt to flood risk at the household and community scale. In contrast to other EU countries, public participation in England is highly formalised and embedded within FRM. In an effort to enhance preparedness at the community scale, *community flood action plans* are encouraged alongside the formation of voluntary flood warden networks to facilitate the dissemination of official flood warnings within the local community. Such activities are often initiated through citizen-based Community Flood Action Groups and supported by Local Authorities, the Environment Agency and the National Flood Forum (a registered national charity).

In the Netherlands, so-called 'dike armies' (comprised of citizens) have a long tradition. Other attempts to actively engage citizens are also evident; for instance, in the Overdiepse Polder farmers have co-developed plans with public authorities to increase the height of their houses so that the polder might flood in the case of an emergency situation. However, the general lack of flood risk awareness amongst citizens, and the expectation that the State and Regional Water Authorities will prevent flooding, seems to limit the desire amongst citizens to engage in flood risk governance (Kaufmann *et al.*, 2015).

Community preparedness activities can be thought of as emerging in Poland. Public participation can be seen with the Voluntary Fire Brigades (VFBs) which have a ca. 100 year-long tradition and currently consist of 4000 operational bodies recruited from local inhabitants and are financed at the local level from municipal budgets. 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.* 2015).

Similar to Belgium, the Netherlands, Poland and Sweden, the integration of citizens in the Fire Brigade has become very important in France and the majority of Fire Brigade personnel are volunteers. However, other attempts to engage citizens in FRM are limited (Larrue *et al.* 2015). In Belgium, citizen engagement in FRM is relatively new, following the implementation of the Floods Directive and corresponding emphasis on *prevention, protection* and *preparedness* measures within a holistic, risk-based approach to flood management. This prompted a wider debate within the

Flemish government about how flood risk responsibilities should be shared, including the role of Flemish citizens. Increasingly, property-level protection and preparedness measures are encouraged in households located in high-risk areas (Mees *et al.* 2015).

Raising community awareness of flood risk is one of the cornerstones for efforts to enhance societal resilience, but is pursued to different degrees amongst STAR-FLOOD countries. For instance, in the Netherlands this is facilitated through national and regional/local awareness raising campaigns, informative websites (www.overstroomik.nl) and training exercises (as required under the Water Act). Similar arrangements exist in the other STAR-FLOOD countries.

In terms of enhancing the **capacity to recover** from flooding, the selected countries rely on a range of measures. Two main approaches to funding flood recovery in the STAR-FLOOD countries are private insurance and state-funded compensation mechanisms, although there are large differences in how the schemes function and how effectively they facilitate resilience to flooding. **Insurance mechanisms** vary in terms of their level of cooperation with the State with, on the one hand, England having little state intervention but with France, at the other end of the spectrum, being largely State governed. In many countries (England, France, Sweden, Poland and Belgium) flood insurance is tied to general household insurance, whether as a standard peril or compulsorily linked to fire insurance. This bundling provides the advantage of spreading the risks and costs between all policyholders as well as contributing to the high penetration rates in these countries. On the other hand, this approach can limit the extent to which property owners are encouraged (or incentivised) to adapt their own properties. For instance, only Belgium has risk-differentiated premiums, which can act to incentivise adaptation, although England is moving towards this with the implementation of the Flood Reinsurance scheme. In France, private insurance is provided in partnership with the State who guarantees reinsurance to cover extreme events (similar to Flood Re in England). Reinsurance enables lower premiums and cover to be made available across the country, regardless of the degree of risk. In Belgium, there has been a concerted effort, through the introduction of private flood insurance, to move responsibility for recovery towards individuals affected (and the market), rather than relying on government compensation, although there remains a Disaster Fund as a back-up to private market insurance.

In the Netherlands, **compensation** for flood damage remains in the public rather than private domain through the Calamities Compensation Act of 1998. This Act can provide compensation to flood-affected members of the public; however, as the Act is designed to provide compensation for a broad range of hazards, in extreme circumstances, a large scale event combined with demands from other hazards might place too high demand on the compensation facility. Whilst an important cornerstone of financial recovery, the Calamities Compensation Act (1998) cannot be expected to fully compensate for a large number of victims. However, due to the Dutch focus on flood resistance measures, and arguably the presence of the Calamities Compensation Act, the Netherlands lacks comprehensive insurance mechanisms to facilitate financial recovery from varied types of flooding. With generally high levels of protection, the need for insurance mechanisms is diminished and thus neglected. Whilst alternative forms of insurance would not necessarily provide full compensation (indeed several insurance companies have already stated that they would not be able to fully compensate losses from flooding), with a trend towards increasing resilience rather than resistance approaches, interest in insurance mechanisms is growing. In Poland flood risk management is largely

seen as the responsibility of the state. Despite the legal responsibility lying with the public, **state aid and compensation** are expected in the event of a flood. In Poland, funding for flood recovery has been provided by the state in the past but this is not a formalised and uniform approach and is therefore not a secure source of compensation.

Beyond citizen-based recovery, **financial recovery mechanisms to support local authorities** in their recovery efforts also exist in England and Sweden. In England this arrangement takes place through the Bellwin Scheme which is designed to encourage authorities to take action to mitigate losses accrued through the response to a flood event (amongst other types of hazards), with the safeguard that some of these costs will be refunded, and further support the repair and reinstatement of damaged property (Alexander *et al.*, 2015). In Sweden and the Netherlands, government grants may be provided after severe events. These grants are decided on a case by case basis. In addition, municipalities can receive compensation from the state if a rescue operation in case of, *e.g.* a flood event, has resulted in significant costs. In terms of compensation for local authorities, the Netherlands does have arrangements in place but there appears to be a low chance of success in claiming compensation through these arrangements and they are hardly ever implemented (Kaufmann *et al.*, 2015). Indeed, even after the floods of 1953 state aid was required to provide assistance to authorities. Criticisms have been made that compensation is tied to political will and public pressure. Indeed, this can also be seen to be true for the public compensation mechanisms that are reliant on a decree in order to be enacted (*e.g.* France, the Netherlands) as well as those where no formalised system of compensation exists (Poland).

The range of insurance and compensation mechanisms visible across the countries is partly **reflective of different perspectives on flood risk responsibilities**. In England and Sweden, flood protection and recovery are legally the responsibility of individuals. As such, flood recovery is often funded through private insurance mechanisms. However, 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 fact that insurance is limited to urban (sewage system) flooding, can be attributed to the high standards of protection and duty to protect obligated to the State.

Financial pressures and concerns of increased flooding, particularly under climate change, are leading STAR-FLOOD countries to develop flood insurance mechanisms to strengthen capacities to recover. In countries where flood insurance is already a key part of the post-flood recovery process (i.e. Belgium, England, France and Sweden), **the case for risk-based insurance is becoming more pressing**. England has already taken steps to secure available and affordable flood insurance through FloodRe, recognising the increasing pressure on the insurance sector. In Belgium, flood insurance provided through standard household fire insurance is no longer capped for high risk properties constructed after September 2008. In contrast, where flood insurance is not a key element of flood recovery processes, such as the Netherlands, this area is beginning to be explored for future management of recovery costs. This also seems to be linked to efforts to encourage greater personal responsibility for flood risk management, as is the case of Poland.

Table 2.4: Comparing the degree to which certain features of flood risk governance constrain capacities to absorb and recover from flooding in STAR-FLOOD countries

Degree to which […]* *constrain(s)* capacities to absorb and recover from flooding	Belgium	England	France	The Nether-lands	Poland	Sweden
A lack of resources to support emergency management activities	Medium/ high	Low	Low	Low	Low	Low
The tendency for citizens to depend on State intervention	High	Low/ medium	High	Medium/ high	High	Medium
The lack of flood risk awareness amongst the public (meaning that proactive measures have not been taken)	High	Low/med	Medium/ high	High	Medium/ high	Medium/ high
The lack of interest or support for citizen engagement activities	Medium/ high	Low	Medium	High	High	Medium/ high

*Insert factor listed in each row

In summary, this cross-country comparison reveals a number of factors that seem to support or constrain capacities to absorb and recover from flooding; albeit these vary between the STAR-FLOOD countries and are summarised in Table 2.4. Put simply, these factors appear to relate to two central aspects of governance: (1) the 'rules' and mechanisms in place to deliver effective measures and (2) normative perspectives related to the role of the State and citizen involvement in FRM. These factors indicate potential conditions for success as well as aspects of flood risk governance that require improvement and are discussed further in Section 3.

2.1.3 Factors that support and constrain capacities to adapt

Risk is an inherently futuristic concept and subject to considerable uncertainty. It is anticipated that flood risk will increase in Europe as the result of climate change, land use change (including urbanisation and soil subsidence), population growth and aging defence and sewage infrastructure (Feyen *et al.*, 2012). Given the complexity of socio-environmental systems and considerable uncertainty attached, adaptive forms of governance and FRM are seen as desirable (Chaffin *et al.*, 2014). **Key features of adaptation are the capacity to learn, innovate and improve current practices in order to enhance capacities to resist, respond and recover in the future.** The need for adaptive governance also includes the legal system; the law influences society's capacity to deal with change and uncertainty, not least in its function as a policy instrument to achieve *e.g.* environmental objectives. While there is a clear tension between requirements of legal certainty on the one hand and the need for flexibility and adaptability on the other, there is no absolute incompatibility that prevents the legal system fulfilling both principles. The challenge is to find the appropriate balance between them (Goytia *et al.* under revision).

Cultures of learning are highly established in certain STAR-FLOOD countries. In England this is actively prompted following the occurrence of significant flood events through independent and public inquiries (*e.g.* Pitt, 2008, Efra Committee 2014). Learning also occurs habitually even after smaller flood events, with responsible agencies reviewing the effectiveness of their processes and procedures. In Sweden, a similar approach to learning from past events occurs, with reviews after particularly large events. However, the limited experiences and relatively lower profile of flooding as a national priority naturally limits these opportunities (Ek *et al.*, 2015). The Netherlands similarly

lacks flood experience given its high safety standards, but analysis of Dutch flood risk governance reveals the influence of external events. For example, the impact of Hurricane Katrina in New Orleans highlighted the fallibility of flood defences and provided further momentum to efforts to diversify FRM strategies. In addition, Dutch FRM has benefited from adaptive planning and programme cycles, which promote periodic learning. Simultaneously, there has been considerable investment in research programmes and the exportation of knowledge to other countries (Kaufmann *et al.*, 2015). Analysis of Belgian flood risk governance also demonstrated learning from international experiences (Mees *et al.*, 2015); *e.g.* spatial planning in Antwerp and the integrated water management and water test in the Netherlands reflects similar approaches adopted in other countries such as England and France.

Opportunities for innovation are also identified in the literature as a means of cultivating adaptive capacity (Termeer *et al.*, 2011). As part of STAR-FLOOD research, each partner country examined the extent to which national flood risk governance arrangements support opportunities for innovation, especially at the case study scale. Technical innovation is particularly evident in the Netherlands in defence and mitigation measures, such as floatable storm barriers and dikes built within dunes, supported through technical universities, institutes and specialist consultancies. Furthermore, innovations in multiple land use, combing water retention with ecological improvement and combining flood defence works with renewable energy supply can be seen. As an example of a private initiative we see the agricultural sector taking more responsibility by developing new methods to store water on land that is fully covered with greenhouses. Examples of innovation are also evident in England, in particular the Leeds case study and the implementation of the River Aire Flood Alleviation Scheme (RAFAS), represents the first time that moveable weirs have been installed in England to reduce flood risk. Analysis of this case study revealed how shifts in funding policy helped prompt this innovative approach (Alexander *et al.*, 2015). In contrast to the other case studies, Poland demonstrates a relatively low degree of learning and innovation. This stems from a conservative perspective that preferences traditional approaches and strategies towards flood risk management (Matczak *et al.* 2015). Our cross-country analysis highlights the important role played by political will and 'champions' to advocate new initiatives. Nonetheless, financial resources must also be available to invest in new approaches and implement improvements in FRM; something, which is constrained in several STAR-FLOOD countries (Table 2.5).

Table 2.5: Comparing the degree to which certain features of flood risk governance support capacities to adapt in STAR-FLOOD countries

Degree to which […]* *support(s)* capacities to adapt	**Belgium**	**England**	**France**	**The Nether-lands**	**Poland**	**Sweden**
Opportunities for learning (*e.g.* post-flood inquiries, investment in research initiatives etc.)	High	High	Medium	High	Medium	Medium
Opportunities for innovation	High	High	Medium	High	Low	Low
Spatial planning mechanisms for incentivising adaptive development (*e.g.* raised floor heights)	Medium	Medium/ high	Medium/ high	Low/ medium	Very low	Medium/ high
Forward-planning and anticipating future risks	High	High	Medium/ high	High	Very Low	High

*Insert factor listed in each row

Evidence of **forward-planning and anticipating future risk** also constitutes a key criterion for the evaluation of adaptive capacity. Examples can be seen in the Flanders Sigma Plan and the Netherlands Delta Programme which is anticipated based on the new risk approach following on from the Floods Directive. Climate change is a prime concern that is addressed at the national level in most of the STAR-FLOOD countries. It follows from the Floods Directive that the flood risk assessments shall be based on 'available and readily derivable information […] in particular impacts of climate change' and include assessments of 'potential adverse consequences of future floods […] taking into account as far as possible issues such as […] impacts of climate change on the occurrence of floods.' (Art. 4, 2., Directive 2007/60/EC). Climate change thus needs to be considered throughout the full cycle of the Directive; from the preliminary flood risk assessments to the flood risk management plans. Whereas climate change is embedded in flood risk governance at multi-levels in The Netherlands, England and France, the opposite is the case in Sweden; here FRM is embedded in the national climate change discourse, but enacted at local level. Our analysis highlights the importance of bridging policy domains for climate change adaptation and FRM. This is less developed in France and non-existent in Poland (Table 2.5).

Spatial planning is an essential strategy through which adaptive capacity is strengthened. Of interest to the evaluation of adaptive capacity is how spatial planning arrangements promote adaptive development. There are examples of this in England, Belgium and the Netherlands where planning conditions, such as designated floor heights or considerations of SUDS, are integrated into urban development. In the Netherlands there is formal coordination between spatial planning and water management at the national level and most of the large Room for the river projects is based on spatial planning legislation instead of water management. Allied with this, **insurance** is another means through which adaptive development may be encouraged, providing that premiums have been or can be differentiated according to the actual risk. In England, there is an assumption that the transition to risk-reflective pricing through the implementation of Flood Re will incentivise homeowners to invest in property-level measures. However this is poorly developed at this stage (Surminski and Eldridge, 2014). Improving connectivity between the insurance sector and spatial planning is a necessary step forward in all STAR-FLOOD countries.

In summary, this cross-country comparison reveals a number of factors that seem to support or constrain capacities to learn, innovate and improve response to flooding, summarised in Table 2.5. These factors indicate potential conditions for success as well as aspects of flood risk governance that require improvement and are discussed further in Section 3.

2.1.4 Are diverse FRMS Strategies a prerequisite for societal resilience to flooding?

STAR-FLOOD adopted the starting assumption that diverse and aligned Flood Risk Management Strategies (FRMSs) are a prerequisite for societal resilience. *Diversity* in the arrangement of measures and strategies is often seen as advantageous in resilience literature, because it creates a series of 'back-ups' and/or addresses the problem at multiple scales (Folke, 2006; Priest *et al.*, 2013). Across STAR-FLOOD countries there is clear evidence of efforts to diversify and develop FRMSs beyond defence-orientated approaches (with the exception of England, which has been diversified for some time). However, the extent to which this has been achieved varies in these countries (as discussed in Matczak *et al*. 2016).

A 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. 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.

By looking at how FRMSs (and measures therein) have been established and embedded within flood risk governance arrangements, we can see how each country varies in their commitment to the different facets of resilience. In the Netherlands, the legal establishment of high safety standards and dominance of the defence strategy reflects a commitment to strengthen capacities to resist fluvial and coastal flooding. Although the other strategies have existed in the background for a long time and appear to be growing in importance, it is likely that the resistance model of resilience will continue to dominate in the Netherlands, given its physical setting, high exposure to risk and path dependencies. However, this does not mean that the Netherlands are more or less resilient than other countries. It is necessary to evaluate flood risk governance within the physical, socio-economic, cultural and legal contexts through which it has emerged. In England, each facet of resilience is addressed through a range of FRMSs and practices; in fact, all FRMSs are regarded as equally important. However, this does not necessarily mean that societal resilience is guaranteed in England. 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 (as discussed in Matczak *et al*. 2016). Therefore, returning to the project's starting assumption, it is clear that diversification of FRMSs is only a partial prerequisite for societal resilience.

2.2 Evaluation of resource efficiency

Resource efficiency is highly prioritized by policymakers across Europe. In the STAR-FLOOD project resource efficiency is a desired outcome of flood risk governance; i.e. flood risk management should use resources (natural, human and technological) so that the ratio of inputs in relation to a certain level of outputs should thus be kept as low as possible, which is equivalent to reaching a certain level of flood protection at lowest possible societal cost. In this section the resource analysis of flood risk management is discussed separately although it is linked both to aspects of resilience and legitimacy. A positive relationship is, for instance, likely to prevail between resource efficiency and investments in innovations and knowledge development. The relationship between resource efficiency and legitimacy can be positive as well as negative (see below).

For flood risk managers the policy relevant question related to resource efficiency is how to choose across different flood risk strategies and their corresponding instruments/measures so as to maximize the monetary and non-monetary benefits in relation to the monetary and non-monetary costs. For specific projects this can be done by applying **cost benefit analyses** (CBA), in which all the expected benefits (*e.g.* reduced flood risk) and costs are summarised and transformed to monetary values. In cost benefit analysis CBA benefits and costs for all affected parties in the society should be

included; it has thus a broader objective than an investment analysis for a firm or a public authority. A project is considered to be a profitable investment for society if the expected benefits are at least as high as the expected costs. It is important to note that resource efficiency does not imply that measures or instruments are cheap; it is the resource use in relation to the associated benefits or to a certain level of output that should be assessed. Furthermore, although different cost sharing arrangements may be considered as more or less desirable from an income distribution and equity perspective, resource efficiency is not dependent on how flood risk strategies are financed.[3] The degree to which resource efficiency is enabled and constrained by certain features of flood risk governance in the different countries are illustrated in table 2.6 and 2.7.

In the analyses performed within the STAR-FLOOD project, we have focused on whether there is empirical evidence indicating that resource 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 of 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 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 STAR-FLOOD 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 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 (this is discussed further in Section 2.3 in the context of legitimacy). 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 for conducting comprehensive and independent evaluations of the resource efficiency of flood risk management. In

[3] If there is more than one instrument available that would generate the same level of output (*e.g.*, the same level of flood risk reduction) the instrument or measure associated with the lowest cost is considered cost-effective.

France, for instance, there are no elements that allow an assessment of the use of financial resources. The French administrative culture is under-developed in this area (Larrue *et al.* 2016)

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.

Table 2.6: Comparing the degree to which certain features of flood risk governance enable resource efficiency in selected EU Member States

Degree to which […]* *support(s)* resource efficiency	**Belgium**	**England**	**France**	**The Nether-lands**	**Poland**	**Sweden**
Cost-benefit analysis	Medium/ high	High	Low/ medium	High	Low/ medium	Medium/ high

*Insert factor listed in each row

Table 2.7: Comparing the degree to which certain features of flood risk governance constrain resource efficiency in selected EU Member States

Degree to which […]* *constrain(s)* resource efficiency	**Belgium**	**England**	**France**	**The Nether-lands**	**Poland**	**Sweden**
A lack of incentives for property based/ small scale measures	Medium/ high	Medium	High	High	High	High
A lack of adequate, consistent and reliable data	Low	Low	High	Low	Medium/ high	Medium/ low

*Insert factor listed in each row

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, like so-called check valves, are currently underutilized 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).

2.3 Evaluating the legitimacy of flood risk governance

Flood risk governance should be conducted in a way that is perceived as legitimate. As illustrated in Work Package 2 of the STAR-FLOOD research (Priest *et al.*, 2013), the concept of legitimacy and its meaning has been subject to a number of studies (STAR-FLOOD deliverable report No's. D2.2.1 and D2.2.2). For evaluating flood risk governance arrangements in terms of legitimacy, the STAR-FLOOD project drew from the conceptualisation of legitimacy and participation as expressed by the 1998 Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (hereinafter referred to as the "Aarhus Convention"). The principles expressed in the Aarhus Convention are common norms, agreed by both the European Union and the various national parliaments of the STAR-FLOOD countries, and reflect principles of procedural justice. The principles expressed in the Aarhus Convention also constitute testable criteria.

The Aarhus Convention sets out a number of rights for the public with regard to the environment, accompanied by requirements for the Parties to implement the necessary rules for these rights to be enforceable. More concretely, the Convention is based on three closely connected pillars: access to environmental information (*pillar 1*), public participation in environmental decision-making (*pillar 2*), and access to justice (*pillar 3*) (see also Fitzmaurice, 2010).

The Aarhus Convention's focus on access to information and participation in matters related to the environment has been further defined in EC regulation. The European Union signed the Convention in 1998 and committed itself to adapt its legislation to the requirements of the Convention in 2005 (Council Decision 2005/370/EC). A large number of decisions and legal acts have subsequently been adopted for this purpose. Thus, in 2003, two Directives were adopted concerning the first and second pillars of the Aarhus Convention, namely Directive 2003/4/EC on public access to environmental information and Directive 2003/35/EC providing for public participation. The third pillar has however not yet been implemented in EU law.

Specific provisions on public information and consultation can moreover also be found in article 14 of the Water Framework Directive and articles 9 and 10 of the Floods Directive. These provisions state, *e.g.* that Member States shall allow at least six months for commenting in writing on the publically available documents in order to allow active involvement and consultation.

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 thus play an important role.

Within the STAR-FLOOD project, the multi-faceted concept of legitimacy was interpreted from both a legal and public administrative perspective. 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 (see Alexander *et al.*, 2015). Table 2.8 lists a number of evaluation criteria to assess different facets of legitimacy and determine the extent to which flood risk governance arrangements can be characterised as legitimate. Logically, these criteria are in line with the Aarhus Convention and the applicable European legislation.

Table 2.8: Criteria for evaluating the legitimacy of flood risk governance

Evaluation criteria	Some example indicators to assess criteria
Social equity	▪ The distribution of costs and benefits are fully considered within the decision-making process and communicated to those affected ▪ The process of decision-making is perceived to be fair ▪ The outcome of decision-making is perceived to be fair
Accountability	▪ There are opportunities for stakeholders to challenge decisions that have been made
Transparency	▪ The decision-making process is transparent so all can see how decisions were made (*e.g.* public inquiries)

Participation	▪ Stakeholder participation has been sought through various stages in the decision-making process, based on a model of knowledge exchange ▪ A range of stakeholders have been involved in stakeholder participation ▪ The views of stakeholders have been considered and integrated within decision-making
Access to information	▪ Stakeholders have equal access to relevant information about the problem and how it will be managed
Procedural justice	▪ There are opportunities for stakeholders to challenge decisions that have been made ▪ Stakeholders have equal access to the appeal process ▪ The process of resolving disputes is considered to be fair
Acceptability	▪ The processes involved in decision-making are accepted by stakeholders ▪ Decisions are accepted by stakeholders

2.3.1 Factors that support and constrain social equity

Social equity is attached to discussions on whether the process and the outcome of decision-making in flood risk governance are considered to be fair. Because of its inherent natural spatial inequality, together with the legacy of different systems to manage floods and flood risks, "flooding is not fair *per se*" (Johnson *et al.* 2007:374). What is perceived as fair thus depends on which normative system which is adhered to. From a solidary point of view it is considered fair that people in low risk areas also contribute to *e.g.* flood protection measures, whereas if social equity is interpreted as 'beneficiary pays', the situation will be perceived as fair when payments are based on risks (*e.g.* that people in high risk areas should take additional insurance).

In the STAR-FLOOD countries alone, the systems range from a strongly prevailing solidarity principle in France, to a market based insurance system in 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 the Belgian flood insurance scheme is an example. In general, Belgian flood risk management is based on solidarity, whereby public funds (*e.g.* tax income) fund flood risk measures. The solidarity principle also underpins the insurance scheme, so flood policies are automatically included in the insurance coverage for fire risks. This implies that all citizens, even those living on the top floor of an apartment building in an area where there is no risk of flooding, contribute to the system. However, in an effort to address this issue the Belgian legislator has stipulated that buildings located in high-risk areas and constructed after 23 September 2008 are excluded from the protection of maximum tariffs that insurers can impose, and insurers are not obligated to insure these houses (Insurance Act of 17 September 2005, Insurance Act of 4 April 2014).

Another tension concerns the beneficiaries of defensive measures. For instance, in the Netherlands, structural defensive measures only provide a basic safety level within the dike rings. Areas outside the dike ring must necessarily rely on other measures/strategies. The Calamities Compensation Act does also not apply in these areas, which generally have a higher flood risk. Since defensive measures moreover tend to encourage development in high-risk areas the risk increases even further (OECD 2014). However, also citizens outside the dike rings benefit from the fact that the part of the country with the highest economic activity is protected from floods. Many who live outside the dike rings also work inside the area. Social equity in connection with funding arrangements and

location of defence/mitigation measures is also the subject of debate in other STAR-FLOOD countries. In England for instance, the allocation of capital and revenue spending via Cost-Benefit Analysis (CBA), whole-life costing and risk-based prioritisation is regarded as a robust and appropriate means of allocating funding. Social deprivation is factored-into the funding calculator. Households within different deprivation bands will qualify for funding on a sliding scale; i.e. the top 20% and 21-40% deprivation bands will qualify for 2.25 and 1.5 times higher (respectively) than the amount available to non-deprived households (Defra, 2011b). This means that schemes initiated in areas of high deprivation have a greater likelihood of Government funding. So there are mechanisms in place to try to minimise inequalities. Yet, recent floods raised public concerns of a north-south divide in the country; albeit there is no evidence to substantiate this claim. Nonetheless, perceptions of inequities can impact upon the societal *acceptance* of flood risk governance (discussed further in Section 2.3.5).

Table 2.9: Comparing the degree to which certain features of flood risk governance enable social equity in STAR-FLOOD countries

Degree to which […]* *support(s)* social equity in flood risk governance	**Belgium**	**England**	**The Netherlands**	**France**	**Sweden**	**Poland**
Policy makers strive for social equity in FRM decision-making processes	Low	Medium/ high	High	Medium/ high	Low	Low
FRM protects vulnerable and financially deprived groups	Medium/ high	Medium/ high	High	High	n.a.	Low

*Insert factor listed in each row

2.3.2 Factors that support and constrain access to information and transparency

The first pillar of the Aarhus Convention concerns the right of the public to environmental information from public authorities. This includes both a passive and an active element; while public authorities are permitted to remain passive until someone exercises the right to access the information, they have a duty to actively collect and disseminate information. The Aarhus Convention thus grants the public a right to request information (art. 4), but also imposes an obligation on public authorities to collect and disseminate it (art. 5). However, the right to information is also subject to limitations. A request for environmental information can for instance be refused if the disclosure of the information would adversely affect international relations, national defence or public security (art. 4, 3.) (Fitzmaurice, 2010).

In the STAR-FLOOD project, the criterion of access to information is operationalized as the condition that stakeholders must have equal access to relevant information about flood related issues and how they will be managed. To fulfil the criterion, equal opportunities to be properly informed must be provided by law. The decision-making process in FRM must also be transparent; it must be clear to the public what is happening and how decisions are made (*e.g.* via public inquiries).

In general, access to information and transparency do not seem to be problematic in the STAR-FLOOD countries. 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 with the introduction of the 2004 Environmental Information Regulations, which apply to all environmentally related issues, including planning. 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.

The access to information and transparency guarantees are often not specifically included in the legal frameworks for flood risk management, but in the general administrative law realm, which is applicable to the flood risk management domain. For example, in the Netherlands, the General Administrative Law Act and the Access to Information Act provides for appropriate provisions to guarantee access to the extensive body of information about flood risk management, and to active knowledge sharing by the Government. Similar legal instruments are available in *e.g.* England. The degree to which access to information and transparency are enabled and constrained by certain features of flood risk governance are illustrated in table 2.10 and 2.11.

Table 2.10: Comparing the degree to which certain features of flood risk governance enable access to information and transparency in STAR-FLOOD countries

Degree to which […]* support(s) access to information and transparency	Belgium	England	The Nether-lands	France	Sweden	Poland
Legislation and policy documents are made available to the wider public in a timely manner	High	High	High	High	High	Medium
Public inquiries and independent reviews are implemented	Medium	High	Medium	Medium	High	Low

*Insert factor listed in each row

Table 2.11: Comparing the degree to which certain features of flood risk governance constrain access to information and transparency in STAR-FLOOD countries

Degree to which […]* constrain(s) access to information and transparency	Belgium	England	The Nether-lands	France	Sweden	Poland
Access to relevant documents	Medium	Low	Low/ medium	Medium	Medium	Medium
The lack of clarity about how decisions are made	Medium	Medium	Low	High	Medium	Medium

*Insert factor listed in each row

2.3.3 Factors that support and constrain procedural justice and accountability

The third pillar of the Aarhus Convention concerns the right of access to justice (art. 9). This entails access to: (1) a review procedure for any person whose request for environmental information has been ignored, wrongfully refused or inadequately answered, (2) a review procedure for members of the public to challenge the substantive or procedural legality of any decision, act or omission subject to the (above mentioned) public participation provisions and (3) administrative or judicial procedures for members of the public to challenge acts and omissions by private persons and public authorities which contravene provisions of national law relating to the environment. Moreover, it

must be ensured that these procedures provide adequate and effective remedies and that they are fair, equitable, timely and not prohibitively expensive. Appropriate assistance mechanisms to remove or reduce financial and other barriers to access to justice must also be established (Fitzmaurice, 2010). As mentioned, the third pillar of the Aarhus Convention has not been implemented in EU law, and member states thus rely on national statutory and common law provisions in relation to matters concerning access to justice. The incorporation of the third pillar of the Aarhus Convention into national law has also been subject to critique in several member states, including Sweden and England (Darpö, 2013).

In the STAR-FLOOD project, access to justice is translated into the concept of 'procedural justice', which implies that all stakeholders must have equal access to the appeal process and must thus have the opportunity to challenge decisions that have been made. In general, procedural justice does not seem to be particularly problematic. In all countries, the law foresees provisions that grant access to justice. For example, in the Netherlands and Belgium, proceedings are available for the interested parties to challenge the decisions made by the authorities through administrative law, i.e. recourse within the administrative realm such as with the supervising entity, and civil law, i.e. through the judicial system. Logically, the opportunities for stakeholders to challenge decisions before the courts are subject to rules and strict conditions, *e.g.* conditions concerning the period wherein one can challenge a decision.

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 that Flood Risk Management Plans are actually established and not that the Flood Risk Management is appropriate (see case ECJ C-237/07 Janecek (2008)). Citizens do not have other recourses with respect to substantive issues stemming from the FD (Keessen and Van Rijswick, 2012). Also in relation to the Floods Directive, each country relies on national rules for matters concerning access to justice.

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 relative short time span. For instance, for the Council of State in Belgium, per claimant a duty of € 200 must be paid and the average handling time of a case is 146 days (Council of State, Activities report 2013-2014). Yet, 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 (Gray 2013). The degree to which procedural justice and accountability is enabled or constrained by certain features of flood risk governance are illustrated by table 2.12 and 2.13.

In the context of access to justice it is also important that information is provided to the public on their possibilities of access to administrative and judicial review procedures (art. 9, 5, Aarhus Convention). However, the lack of knowledge on the judicial system can be in contrast with an

increasing 'judicialisation' of society, whereby consensus is not sought in the political arena but in the judicial sphere. This phenomenon manifests itself particularly in France, where not only interest groups and citizens but also local authorities are increasingly going to court in the context of Flood Risk Governance, *e.g.* to challenge the flood zoning tool. One possible explanation for this increasing judicialisation is the de-legitimisation of the traditional political arena and methods of solving disputes (Kaluszynski, 2006). On the other hand, the increasing focus, stemming from the Floods Directive, on the issuance of plans of programmes instead of substantive requirements can also be considered to lead toward more "policy" than "law". Indeed, the fact that flood risk management measures are included in Flood Risk Management Plans instead of in the applicable legal framework, diminishes the possibility for citizens to have recourse in court, despite the fact that their civil rights might be harmed. This is for example the case in the Netherlands. Overall, this is a consequence of an increased proceduralization at both European and national levels, which can be considered as an evolution from "government" toward "governance" (Van Rijswick, 2012). In this line of reasoning, citizens must rely more upon political accountability and on public participation mechanisms, which raises doubts with regard to the "goodness of fit" within the existing democratic system. However, it also shows the importance of well-developed public participation mechanisms.

For FRGAs to be legitimate there must also be opportunities for stakeholders to hold decision-makers accountable. However, this should not lead to a 'blame culture', in which all accountability is shifted onto one person. Accountability mechanisms are present in all STAR-FLOOD countries. For example, in England, accountability is enhanced through independent reviews and public scrutiny of Flood Risk Management. In France, the judicialisation process has also corresponded with an increase to assert the liability of politicians and public officials before (criminal) courts.

Table 2.12: Comparing the degree to which certain features of flood risk governance enable procedural justice and accountability in STAR-FLOOD countries

Degree to which […]* support(s) procedural justice	Belgium	England	The Nether-lands	France	Sweden	Poland
Stakeholders have equal access to the appeal process and have the opportunity to challenge decisions made	Medium/ high	Medium	High	High	Medium	Low/ medium
Access to the relevant courts is available at a reasonable cost and court decisions are available within a reasonable time span	Medium	Low	High	Medium	Medium	Low/ medium
The public is informed on their possibilities of access to administrative and judicial review procedures	Medium	High	High	High	High	Medium/ high
The competent authorities in FRM are subject to independent reviews and public scrutiny	Medium	High	High	Medium	High	Medium

*Insert factor listed in each row

Table 2.13: Comparing the degree to which certain features of flood risk governance constrain procedural justice and accountability in STAR-FLOOD countries

Degree to which […]* constrain(s) procedural justice	Belgium	England	The Nether-lands	France	Sweden	Poland
Litigation costs and unreasonable costs related to the access to the courts constrain procedural justice and accountability	Low/ medium	Low	Low	Low	Low	Low
Judicial proceedings are extended over longer periods of time, *e.g.* due to judicial backlog	High/ medium	Medium	Low	Medium /high	Low	High
There is a lack of knowledge of the justice system (both administrative and judicial)	Medium	Low	Low/ medium	Medium	Medium	Medium
Participation proceedings extend over an exceedingly long period of time and are used to slow down the decision-making	Medium	Low	Medium	Low	Medium	Medium

*Insert factor listed in each row

2.3.4 Factors that support and constrain participation

The second pillar of the Aarhus Convention concerns the right to 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 in the decision due account is taken of the outcome of the public participation (article 6, 8) (Fitzmaurice, 2010).

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.

In the STAR-FLOOD project, the criteria of participation entails that stakeholder participation has been sought through various stages in the decision-making process, based on a model of knowledge exchange. The views of stakeholders must have been considered and integrated within decision-making. Participation also requires that a range of stakeholders have been involved in stakeholder participation.

In accordance with international and EU legislation, public participation is organised in the context of FRM, *e.g.* the public is consulted on the Flood Risk Management Plans. This is in keeping with the EU Water Framework Directive and the Floods Directive. However, while public participation indeed is formally embedded in the institutional framework of the STAR-FLOOD countries, it seems as if in practice participation is often low and limited to a formal inquiry and dissemination of information, i.e. a consultation exercise rather than a participatory exercise. This is the case, for example, in

France where participation of the main stakeholders is often limited to actors from the public sector. Although specific tools for participation, such as the public debate, were developed, the actual impact on the decision-making of the public in France is rather small, especially when it concerns projects with a high economic impact (Terpstra and Gutteling, 2008; OECD, 2014). At local levels, public participation depends on the organisation of the municipalities in question. For example, in Geraardsbergen, in the Flemish Region, according to interviewees, citizens in affected neighbourhoods feel they are left out of the decision-making process on flood risk management. In the Netherlands, participation at local level is rather high and can sometimes lead to other solutions and measures than those proposed by the Government. However, voter turnout in the context of elections for regional water authorities is relatively low (Terpstra and Gutteling, 2008; OECD, 2014).

In England, a great deal of emphasis is put on community engagement and the raising of flood risk awareness. Several measures and activities are being developed to enhance involvement of the public in flood risk management. For example, resources are allocated to supporting community-based action, through *e.g.* community engagement officers and the community resilience programme. The 'Flood Resilience Community Pathfinder Scheme', launched in 2012, awarded £5m to 13 local authorities to enhance local responsiveness (and ownership) of flood risk at a variety of different scales *e.g.* from two streets in one project to county-wide. This included efforts to increase the uptake of property-level protection measures and development of community flood action plans. Common constraining factors in the enduring success of these initiatives are the dependence on the dynamism of the people involved ("local champions"), and the fact that motivation decreases the more time passes following a flood event. Other common constraints include misperceptions amongst communities that they are not at risk, or that it is not their responsibility, and/or that the state should intervene. Moreover, since legal provisions are often non-prescriptive and often only refer to duties to consult the public, participatory forms of engagement are not encouraged.

More participation is however not necessarily more democratic, as it may reinforce the interests of the already powerful. It may also raise questions about representativeness since in the end, only a selection of stakeholders can be involved (Van de Kerkhof and Wieczorek, 2003). Moreover, since participation is also likely to involve a cost to the individual, resourceful (and often adversarial) groups are more likely to commit to the process, and it is not uncommon that various interest groups take over the agenda (Spyke, 1999). **Well-functioning participation processes thus require that considerable attention is paid to matters of how to attract different groups and how to utilize their knowledge** (Keskitalo *et al.* manuscript).

A recurring issue also relates to the consideration that consultation of the relevant stakeholders and citizens take place at a time when actual influence of the final decision is no longer feasible, i.e. too late in the process. This is for example, at times, an issue in Sweden and in Belgium, where the legitimacy is more focused on output legitimacy rather than input legitimacy. Formal input is asked when the plans have already been drafted, although actors of sectors other than water management, *e.g.* fisheries, are involved in earlier phases. In France, public enquiries are also believed to be held too late in the process, with no legal obligation for flood risk management authorities to duly take into account the comments provided. Thus, although the right of access to environmental information is fairly well developed, the participatory rules are weak (Larrue *et al*. 2016:43).

Moreover, traditionally, FRM was considered to be an exclusive government responsibility, making the interest of citizens to participate in the decision-making process limited. This is for instance the case in the Netherlands, Belgium and Poland. The perception amongst communities that they are not at risk or that it is not their responsibility, because the state should intervene, is thus a common constraining factor in the STAR-FLOOD countries. As will be discussed further on, a shift can be marked away from this exclusive governmental responsibility, toward a greater degree of shared responsibilities as a result of discourses such as multi-layered safety and the diversification of flood risk management strategies. In order to increase acceptability and avoid legitimacy crises in the future, the issue of limited participation, interest and awareness needs to be remediated.

Citizens' Juries have been proposed by the Common Implementation Strategy Working Group on Public Participation as a way forward in this context (*e.g.* in implementing the WFD and FD). The difference between general participation and Citizens' Juries is that the latter are specifically selected to provide recommendations on specific policy issues. These then represent different echelons of population, and thus provide a bridge between the general population and decision-makers.

Table 2.14: Comparing the degree to which certain features of flood risk governance enable participation in STAR-FLOOD countries

Degree to which […]* support(s) public participation	Belgium	England	The Nether-lands	France	Sweden	Poland
Stakeholder participation is sought through various stages of the decision-making process to enable actual influence	Low/ medium	Medium/ high	Medium	Medium	Medium	Low
Time and resources are spent on community engagement and on enhancing involvement of the public	Low/ medium	High	Low	n.a.	Medium/ low	Low/ medium
Efforts are made to inform and sensitize citizens of their responsibilities in FRM	Medium	Medium/ high	Medium/ low	Medium/ high	Medium	Low
There is a legal duty to take into account the outcome of the participation procedure	Medium/ low	Medium/ high	High	Low	Low	Low

*Insert factor listed in each row

Table 2.15: Comparing the degree to which certain features of flood risk governance constrain participation in STAR-FLOOD countries

Degree to which […]* constrain(s) public participation	Belgium	England	The Netherlands	France	Sweden	Poland
Participation is limited to certain categories of actors, for example public actors	Medium	Low	Low	Medium	Medium	Medium
The process reinforce the interests of the already powerful	Medium	Low/medium	Medium	Medium/ high	Medium	Medium /high
There is a perception amongst citizens that FRM is an exclusive government responsibility, which decreases the interest of citizens	High	Medium	High	High	Medium	High

*Insert factor listed in each row

2.3.5 Factors that support and constrain 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 FRGA. 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.

The evolution toward diversification of flood risk management and a shift toward a risk-based approach (Rohstein *et al.* 2013) implies a higher degree of involvement of the citizens, as more actors are supposed to share responsibilities (Mees *et al* 2014). Whereas flood risk management in many of the STAR-FLOOD countries has traditionally been regarded as an exclusive governmental responsibility, a diversification of strategies, and thus a move away from the exclusive focus on protection, implies the involvement of the population as a whole. For example, the evolution in the Flemish Region in Belgium toward multi-layered safety puts greater responsibility on citizens to share in the burden of protecting themselves against flood risks. In this regard, governmental authorities should also increase awareness of citizens of flood risks, and increase opportunities for citizens to participate in the decision-making process in order to avoid a legitimacy crisis in the future. More awareness might indeed lead to a better insight in who gets what, when and how from flood management. However, the outcomes of these insights will not be favourable and thus acceptable for all involved, especially those people facing the highest risks. **It is thus pivotal that governments (i) properly inform citizens of their responsibilities and of the precise scope thereof and (ii) show citizens the manners in which they can actually and effectively contribute and carry out their responsibilities in practice**.

One can also question whether citizens should have a say in case of a shift toward more emphasis on private responsibilities, *e.g.* in the context of elections that are being organised, but in the context of

which FRM is often not an important topic in terms of voting purposes. Recent public enquiries conducted in England, emphasized the importance of a transparent public debate related to the "living with water" discourse, public understanding of flood risks and the division of responsibilities (House of Commons, 2015). It was found that instruments to raise awareness may contribute to the acceptability of flood risk management measures. The "duty to inform" instrument, which has been introduced in the Flemish Region in Belgium through a legislative reform in 2013, requires the dissemination of information regarding the vulnerability to flooding in every real estate transaction that involves buying or renting for a period exceeding nine years. This is quite a versatile instrument that would lend itself to smooth implementation in other countries as well. Including a requirement of implementation of an instrument such as the duty to inform in EU legislation would constitute a useful substantive addition to the EU flood risk management realm.

Table 2.16: Comparing the degree to which certain features of flood risk governance enable acceptability in STAR-FLOOD countries

Degree to which […]* support(s) the acceptability of flood risk governance	**Belgium**	**England**	**The Netherlands**	**France**	**Sweden**	**Poland**
Citizens consider the output of the FRM decision-making as effective and legitimate	Medium	Low/ medium	High	n.a.	Medium/ high	Low/ medium
There is clarity with regard to the division of responsibilities between the public and the private actors in FRM	Low/ medium	Medium	Low/medium	Medium	Medium	Low
Public actors enable citizens to effectively carry out their responsibilities in practice (*e.g.* in terms of adaptive building)	Low/ medium	Medium/ high	Low/medium	Low/ medium	n.a.	Low/ medium
Specific instruments to inform citizens of flood risks in purchasing property are in place	F: High W: Medium	Medium	Low	High	Low	Medium
There is clarity for the citizens on the scope of their possibilities to influence decision-making	Low/ medium	Medium	Low	Low	Medium/ high	Low/ medium

*Insert factor listed in each row

3. Design principles for resilient, efficient and legitimate flood risk management

The comparative analysis of the results of the empirical studies points towards a number of important conditions for resilient, efficient and legitimate flood risk governance. In this section, these research results are consolidated into design principles, i.e. results that are sufficiently universal to apply to numerous situations. Design principles are thus here understood as sub-objectives, which are supposed to influence/contribute to the achievement of higher, more overarching objectives. Since the management of flood risks has multiple objectives, the design principles are connected to the desired outcomes of a flood risk governance arrangement, i.e. the capacity to resist, to absorb and recover, and to adapt, as well as to the efficiency and legitimacy of the arrangement.

3.1 Design principles in the literature

Design principles for social systems have primarily been formulated by Ostrom (Ostrom 1990). Ostrom's principles were posited as characterising robust institutions for the management of natural resources in the context of common pool resource systems. Although the principles developed by Ostrom have largely been supported in later evaluations and studies (Cox *et al.* 2010), their applicability in the context of flood risk management is limited, not least because they were developed to address a specific issue, i.e. 'the tragedy of the commons', in a specific context.

In terms of principles for managing water resources and flood risks more specifically, Iain White suggests that, in relation to flood risk management, the dominance of economic issues "has created a legacy of exposure and vulnerability to flood risk" (White 2008:151) that cannot be fully overcome by technological advances. He identifies reflexivity, knowledge and adaptation as the three underlying principles of a theoretically 'absorbent city' adapted to geographical and climatic constraints, and stresses the importance of a well-functioning planning system to influence long-term land-use and to govern future developments towards more resilient cities.

Characteristics of "good flood risk management" based on the primary goals of strategic flood risk management are also presented by Sayers *et al.* (Sayers *et al.* 2012). The goals are formulated in terms of how to appropriately balance the risk of flooding and the need to protect society and the environment, i.e. how to utilise limited resources. The goals are accordingly to: a) reduce risk to people and communities; b) reduce risk to, and promote economies; c) promote ecosystem goods and services; and d) promote social well-being (Sayers *et al.* 2012, figure 3). Good flood risk management is then "implemented through a process of management that continually **adapts** in response to new development" and "strategies, infrastructures and operational practice have **capacity** for modification based on new information". In addition, "**risk** and **uncertainty** are used to inform prioritization of effort" and measures to reduce the flood hazard and associated consequences, including **vulnerability**, are implemented, and "pre, during and post event measures are strategically planned and implemented" (Sayers *et al.* 2012, figure 4).

In 2015, the OECD presented principles on water governance with the intention to "contribute to tangible and outcome-oriented public policies". The policies are based on three dimensions of water

governance: effectiveness, efficiency and trust and engagement, and are expected to improve the "Water Governance Cycle" both in terms of design and implementation (OECD 2015). Although the OECD principles express very important starting points for matters relating to water governance, including some regarding flood risks, they are intended to apply on a global scale, and are hence relatively generally formulated.

3.2 Design principles, success conditions and good practices

Inspired by this literature review, and on the basis of the cross-country comparison in Section 2.1, a number of factors that support or constrain societal resilience to flooding amongst the STAR-FLOOD countries have been revealed. For the design principles certain contextual factors (and combinations thereof) are highly important. These can be summarised as follows (the reader is also referred to STAR-FLOOD Deliverable 4.1: Matczak *et al*. 2016).

Differences in exposure to flood risk – The contrast between low probability-high consequences vs. high probability-low consequence systems clearly influences the amount of investment towards defence measures. For instance, considerable investment in flood defence and resistance measures in the Netherlands reflects its geographical location and exceptionally high exposure to flooding given that almost 60% of the country is susceptible to flooding (with 26% of the land situated below sea level). This contrasts significantly with Sweden where exposure to flooding on a national scale is generally low, but is spatially varied across the country.

Differences in flood experience – Flood events can act as important catalysts for change and prompt different reactions within the STAR-FLOOD countries. For example, the 1953 storm surge affected the Dutch, Belgian and English coastlines and triggered different responses. In the Netherlands, the extensive loss of life reinforced the probability-reducing approach already underway and established a 'never again' societal stance. This accounts for the strong commitment towards the resistance facet of the resilience. In England, the same flood led to the development of a national Storm Tide Forecasting Service for the first time, soon to be followed by better arrangements for warning; thus demonstrating a commitment to improve societal capacity to respond to flood events. In contrast, limited flood experience and low exposure to flooding in Sweden can be attributed to the absence of a distinct flood policy domain and lack of targeted efforts to enhance resilience to flooding explicitly at the national scale; instead, FRM is embedded within other policy domains or the secondary outcome of other activities.

Differences in normative values – Between the STAR-FLOOD countries there are important differences in social norms relating to ideas of safety, resistance vs resilience more broadly, as well as the best way to allocate financial resources. With regards to the latter, there is a sliding scale ranging from the principle of *solidarity* to *beneficiary pays*. For example, national solidarity is an important feature in Dutch flood risk governance, where civil society is willing to pay for high standards of protection to guarantee safety. Solidarity is also a crucial feature of the French system. In contrast, the introduction of Partnership Funding in England signifies a transition whereby beneficiaries of flood defence and mitigation measures are expected to partially-contribute towards local schemes. Social norms also play a crucial role in shaping societal expectations and attitudes towards State intervention and citizen involvement in FRM. This has implications for encouraging citizens to accept some responsibility for managing their own risk and adopt resilient behaviours.

The legal rules governing the distribution of responsibilities and rights to flood protection - The legal framework governing FRM has a clear influence on how different FRMSs (and measures therein) are pursued. For instance, the fact that there is no statutory right to flood protection in England and Sweden reflects a normative perception of floods as natural phenomena here in place that cannot always be prevented (Scrase and Sheate, 2005).

Investment in new defence infrastructure and maintenance of existing assets enhances the capacity to resist fluvial and coastal flooding, and flood defence is the most important flood risk strategy in each STAR-FLOOD country (except Sweden). While the Netherlands is likely to be most resistant against fluvial and coastal flooding at the national scale, high levels of resistance are also evident at the regional or local scale in other STAR-FLOOD countries. Inferences about which country is more or less resistant should not be drawn without taking the influence of spatial scale into account. What is regarded the appropriate level of defence is highly context-dependent. For instance, in a relatively small, densely populated country exposed to high flood risk, such as the Netherlands, significant investment in permanent defence seems adequate while this is not necessarily the case in a larger country, relatively sparsely populated country with more limited and highly dispersed flood risk, such as Sweden.

Tables 3.1-3 show the consolidated results of the analysis in the form of 1) design principles for flood risk governance to enhance societal resilience to flooding, 2) design principles for resource efficient flood risk governance, and 3) design principles for legitimate flood risk governance.

Table 3.1 Design principles for flood risk governance to enhance societal resilience to flooding

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 - Legislation and decision making allows/supports adaptability - Cooperation, in particular between defence and prevention and between defence and mitigation management, is supported - Long term forward planning is supported - Actors (citizens) are incentivized to undertake risk-reducing measures	- Water assessment (Belgium) - Water test (the Netherlands) - Long-term investment strategy (England), Delta Programme (the Netherlands)
Design principles for flood risk governance to enhance the capacity to absorb and recover	**Conditions for success**	
Flood risk (prevention) should be	- Sufficient resources are	- Water assessment (Belgium)

Design principles for flood risk governance to enhance the capacity to resist	Conditions for success	Good practices
incorporated within spatial planning decision-making to i. discourage development in known areas of flood risk, ii. ensure that development in at-risk areas is adaptive, and iii. ensure that development does not heighten risk	provided (power, knowledge and financial) - Legislation and decision making allows/supports adaptability - Legislation contains mechanisms to ensure implementation of spatial planning measures (enforcement) - Cooperation, in particular between defence and prevention and between defence and mitigation management, is supported	- Water test (the Netherlands) - Building regulations (Sweden) - Zoning system (France) - Sequential and Exception tests in England, as well as designated floor heights via the EA's Flood Risk Standing Advice or Bye Laws
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. - 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.	- Use of new technologies (*e.g.* England and the Netherlands) - An opt-out flood warning service is established between the Environmental Agency and telecommunication providers (England).
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. - Mechanisms for up-scaling and downscaling emergency response are established - Arrangements are in place to facilitate inter-organizational working. Roles and responsibilities are clear.	- Flood rehearsals (*e.g.* the Netherlands) - Flood leaders programme (Poland) - Dike armies (the Netherlands) - Local Resilience Forums are established nation-wide and plan and train for risks. This is a statutory duty (England).
Strategies to recover from flood events should be available for all citizens	- Systems for compensation for flood damage (after severe floods) are in place	- Large variation; solidarity principle v. beneficiary pays
Design principles for flood risk governance to enhance the capacity to adapt to flooding	**Conditions for success**	
Opportunities for social and institutional learning should be	- Mechanisms are in place to facilitate knowledge exchange,	- Adaptive planning and programme cycles (the

Design principles for flood risk governance to enhance the capacity to resist	Conditions for success	Good practices
created	sharing experiences and best practices - There is a clear strategy and investment in Research and Development programmes.	Netherlands) - Independent and public inquiries (*e.g.* England) - Learning from international experiences (Belgium, the Netherlands)
Climate change and future uncertainties are accounted for in the development of law, policy and planning	- Forward-planning for climate change and uncertain futures are in place	- Catchment Flood Management Plans in England outline a strategic approach to FRM on a 50-100 year timescale

The cross-country comparison of the evaluations of flood risk governance in each of the STAR-FLOOD countries (see Section 2) revealed that although investment in permanent flood defence have generally been considered appropriate, lack of **financial resources** (in particular for maintaining existing defence assets) is mentioned as a constraining factor in Belgium, England, France and Poland. Financial shortages appear to have been exacerbated after the financial crisis in 2009. One way of reducing financial constraints is to look to alternative sources of funding and develop **public-private partnerships**; interesting examples in this area can be found in England (Partnership Funding) and France (the Action Programme for Flood Prevention, PAPI).

Another factor constraining flood resistance in all STAR-FLOOD countries is under-utilization of **property-level measures**, which to some extent can be explained by lack flood risk awareness and few incentives for such investments. Moreover, under-development of other FRMSs than flood defence is considered a constraining factor for the capacity to resist in all STAR-FLOOD countries, in particular **flood prevention** (spatial-planning) and **mitigation-based measures should be supported**.

The under-development of **flood prevention** through proactive spatial planning can at least partly be explained by enforcement challenges and conflicting interests for local authorities or government in their strive for economic development and for providing more housing for their populations, which is often located (for lack of space elsewhere or for citizens' preferences for waterfront properties) in flood prone areas.

Flood preparation, including **flood forecasting, warning, emergency preparation and response**, supports capacities to absorb and recover. Flood preparation practices have developed during the last decade and several good practices are identified in the STAR-FLOOD countries. Technological innovations have played an important role in improving timely flood warnings, and in Poland where there still is a need to improve the provision and dissemination of timely flood warnings, examples from *e.g.* England can be used to inspire future development. Flood emergency management has evolved and shifted towards holistic risk-based, proactive approaches with collaborative forms of multi-actor decision-making. Important conditions for effective and proactive flood emergency management such as requirements to assess and monitor local risks, periodical exercises, mechanisms to facilitate multi-actor working are present in most countries, although there are some

uncertainties regarding the situation in Poland. Roles and responsibilities are found to be clearly distinctive in the STAR-FLOOD countries, which is another fundamental condition for effective emergency flood management.

Lack of flood risk awareness amongst the public and a tendency of citizens to have too high expectations on State intervention and support in case of flooding is a key factor limiting societal resilience that has been identified in all STAR-FLOOD countries. The lack of flood risk awareness reduces citizens' incentives to take measures to protect and help themselves in case of a severe flood. In all STAR-FLOOD countries, and probably also in other Member States, it is important to take action to raise citizens risk awareness.

Although the organisation of flood recovery differs across the STAR-FLOOD countries, reflecting different perspectives on flood risk responsibilities. In England and Sweden flood recovery is often funded through private insurance mechanisms, as individual responsibilities for flood protection and recovery are emphasised. In contrast, in France and the Netherlands the principle of solidarity and the duty of the State to protect its citizens are dominating.

Key features of adaptation are the capacity to learn, innovate and improve practices in order to enhance capacities to resist, respond and recover in the future. In general, most of the factors considered to enhance adaptive capacity are present, while the impact of constraining factors is relatively limited, in most of the STAR-FLOOD countries. Cultures of learning are for instance found to be established in all countries, examples of good practices in these areas can be found *e.g.* in Belgium, England and the Netherlands. The adaptive capacity in Poland however needs to be strengthened; the degree of institutional learning and innovation is found to be limited, and constraints caused by sunk costs maintaining dependence on flood defence and limiting the development in alternative strategies in Poland (in particular in preventative measures).

Table 3.2 Design principles for resource efficient flood risk governance

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 - Actors (citizens) are incentivized to undertake risk-reducing measures	- Well-developed practices for CBA, also for non-monetary impacts (*e.g.* England)

Regular assessments of the expected societal benefits and costs associated with investments, for example in flood defence or mitigation measures, are considered an enhancing factor for resource efficient flood risk management. Cost-benefit analyses are implemented in all STAR-FLOOD countries; while it is institutionalised in England it is becoming increasingly common in all countries. Uncertainties have been identified in the case studies (*e.g.* in Sweden) on how to assess a monetary value on the highly uncertain expected benefits in terms of reduced future flood risks. In Poland, although standard cost-benefit analyses are applied, funding is fragmented and vested interest of administration and business groups affect recourse allocation, which make analysis of resource efficiency complex in Poland.

A factor constraining resource efficiency prevailing in all STAR-FLOOD countries is the limited implementation of small-scale property based measures (see also Section 2.1.1). Incentivising investments in small-scale property measures (*e.g.* so-called check valves) is thus likely to a cost-efficient measure in the STAR-FLOOD countries, and elsewhere.

Table 3.3 Design principles for legitimate flood risk governance

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, fairness and perceived accessibility	- The process demonstrates due concern for matters related to social equity - Stakeholder involvement for informed and outcome-oriented contributions to the design and implementation of flood risk management strategies and measures are guaranteed - Attention is paid to under-represented categories and newcomers, including property developers and institutional investors - 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: a) The expected use of stakeholders' input; b) 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 for "pushing" warnings and "pulling" vulnerable people in advance (England) - Community engagement (England) - Duty to inform (Belgium)
Mechanisms/arrangements are in place to ensure accountability	- Decision-making in FRM is subject to independent reviews and public scrutiny - Decision-makers can be held accountable	- Independent reviews and public inquiries (England)
Citizens are aware of their rights and responsibilities in connection with the planning and	- Citizens are informed of their responsibilities - Citizens are informed of how they can carry out their responsibility in practice	- Multi-layered safety (Belgium) - Duty to inform (Belgium)

Design principles for legitimate flood risk governance	Conditions for success	Good Practices
implementation of Flood Risk Management measures.		
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 - FRM is subject to public and/or independent inquiries to evaluate its performance	- Principle of public access (Sweden)
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 - The process of resolving disputes is considered to be just	- Low costs for litigation (Belgium, Sweden, the Netherlands)

In Section 2.3, the concept of legitimacy and its implications for flood risk governance was analysed with starting point in the legal regime that builds on the 1998 Aarhus Convention together with the evaluation criteria for legitimacy developed in the STAR-FLOOD project. Section 2.3 further discloses key factors that enable, or constrain, a high degree of legitimacy in flood risk governance arrangements, and the extent to which these factors influence Flood Risk Management in the STAR-FLOOD countries, expressed in terms of high, medium or low (or a combination thereof).

For the Flood Risk Governance Arrangements to be characterised by a high degree of legitimacy, **participation** and **transparency** in the decision-making process are essential preconditions; stakeholders as well as the general public must perceive the process accessible and fair. While public participation in (environmental) decision-making is a formal requirement in all STAR-FLOOD countries, constraints in terms of, most notably, lack of duty to take into account the results of the participatory processes, limitations with respect to the consultation circuit, and that consultations are held too late in the process have been identified. Addressing these issues, and to strive to implement the social structures, procedures, regulatory design, resources etc. that need to be in place in order to successfully deliver well-functioning participation processes is thus necessary in all STAR-FLOOD countries. Regarding **social equity**, the main conclusion from the comparison is that what is perceived as fair will differ and depend on the prevailing norm system; what is considered fair in a particular context can be seen as unfair in another.

Accountability and procedural justice are also important factors for a system to be perceived as legitimate. Issues with regard to these factors include judicial backlog, high costs and institutional distrust (and corruption) and while this is not a general problem in the STAR-FLOOD countries, it is imperative to have in place a system for regular and independent reviews of Flood Risk Management.

Like with the other evaluation criteria, *legitimate* flood risk governance calls for enhanced **awareness**; people need to be aware of their rights and responsibilities in connection with the planning and implementation of flood risk management strategies and measures, also in terms of the decision-making processes.

4. Conclusions and policy recommendations

This report aimed to develop design principles for resilient, resource efficient and legitimate flood risk governance and provide implications for EU policies and directives. The design-principles, success conditions and good practices are based on empirical evidence from the STAR-FLOOD countries and the 18 case studies as well as from the evaluations and comparisons thereof.

First, it should be stressed that there is not one single yardstick against which the resilience, efficiency and legitimacy of flood risk governance arrangements in all countries ought to be evaluated. Instead, the appropriateness of flood risk governance arrangements should be evaluated in relation to the goals set in each country. As a result of the substantial variation between countries in terms of physical conditions, flood risk, experience of floods, administrative and legal context, as well as in normative values, the level of acceptable flood risk will differ. The analysis and evaluation of flood risk governance in the STAR-FLOOD countries reveals for instance that the level of commitment to the different facets of resilience varies across the countries. The emphasis on resistance (flood defence) is, for example, strong in the Netherlands, whereas in England the focus has been on improving the societal capacity to respond to flooding and all strategies are regarded as equally important. While the commitment towards resistance in the Netherlands can be explained by the high and relatively concentrated flood risk in the country, the lack of statutory right to flood protection in England reflects a normative stance of floods as natural phenomena that cannot always be prevented. At the other end of the scale, the relatively low risk and limited experience of floods in Sweden explains the country's lack of policy domain for flood risk management. Having said this, there are some shared normative ideas about what flood risk governance should deliver, i.e. resilience, efficiency and legitimacy, although the recommendations and design principles that we present should be interpreted within the context of the country.

Lack of awareness of flood risk has proven to be an issue in the STAR-FLOOD countries. The consequences of this are (potentially) considerable in relation to the implementation of all flood risk management strategies, and there is thus a need to take action to raise awareness at all levels of governance.

4.1 Distribution of roles and responsibilities

The prevailing view in some countries that the State should defend and prevent against all flooding is becoming increasingly challenged in light of projected increases in flooding. Initiatives and incentives for encouraging citizens to engage in flood risk management and adopt partial responsibility for managing their own risk are becoming more important, even in countries where there is a statutory right to flood protection. Sustainable flood risk management moreover requires efforts to mitigate flooding at the property and community scale, for example through the implementation of property-level measures to enhance capacities to resist flooding, or through preparatory activities, like flood rehearsals, to enhance capacities to respond and recover.

It follows that it is of great importance that the distribution of responsibilities is clear, between the several layers of government but also between the government and the citizens. A development towards accepting a higher level of risk and the implementation of strategies that require more

individual responsibilities, calls for a clear division of responsibilities. It should, for example, **be clear for citizens what protection they can expect from the (national or local) government and what their own responsibilities are,** as well as in what ways these can be effectively carried out in practice.

Recommendations

- Take action at all levels of governance to **raise awareness** among the citizens
- Clarify the **division of responsibilities** between government levels and between the government and the citizens

Examples

- Facilitate use of information and communication technologies for flood forecasting and warning at EU and national level
- Establish arrangements for identifying vulnerable groups in the community
- Introduce a 'duty to inform' at national level

4.2 Diversification, development and coordination of flood risk management strategies

The diversification of flood risk management strategies (and measures within these strategies) supports societal resilience; i.e. a diversified approach enhances the capacity to resist flooding, the capacity to absorb and recover from flood events when they occur, and the capacity to adapt to improve flood risk management in the future. However, this is dependent on the effectiveness of the strategies individually as well as collectively. Since diversification inherently risks causing fragmentation in governance it is thus essential to have in place effective bridging mechanisms (*e.g.* bridging insurance and spatial planning policy domains). Moreover, it should be borne in mind that the diversification of strategies must come with sufficient investment in all of these instead of leading to underinvestment in some of them.

Enforcement mechanisms in spatial planning are cited as a recurring weakness in the STAR-FLOOD project. This could be reinforced by a) increased political ambition to enforce legislation; b) increased powers within competent authorities; and c) legal instruments which ensure the implementation of national goals at the local level. This can, for example, include overarching planning instruments that direct the legally binding plans and control functions for the content, adoption and implementation of these plans, including detailed guidance on building on the floodplain. There is a need to **establish mechanisms to better bridge actors** *e.g.* operating within distinct spatial planning and flood risk management policy domains and deliver a more integrated approach. The requirement of water assessment/water test that is applied in Belgium and the Netherlands could be an effective way to integrate flood risks in the planning and permitting processes also in other countries.

Continued development on the floodplain is subject of ongoing criticism, but in a society where economic development and housing shortages are issues that need to be addressed, it is necessary to resolve the conflict between the need for development on the one hand and the management of (increasing) flood risk on the other. Whilst future development in areas at high risk of flooding should be discouraged, development in flood risk areas may be necessary; however, provisions need

to be in place to ensure that development is adaptive (*e.g.* raised floor heights, use of SUDS) to minimise future damages should a flood occur.

In each of the five flood risk management strategies, it should be analysed how property level measures can be induced. For example, in the prevention strategy, the duty to inform is a very useful and "easy to implement" legal measure to (i) keep people away from water and (ii) raise awareness generally (people are, in real estate searches, consistently confronted with information regarding floods). In the recovery strategy, there is also ample opportunities to promote property level measures: **the insurance scheme could provide incentives for people to (i) not build in high risk areas, and (ii) build adaptively**, i.e., take measures to improve existing buildings to limit negative consequences of floods. The Government may have a role to play here: it can for example set limits to the premiums the insurers can ask, but exclude houses in high risk areas built after a certain date so that citizens are well aware of consequences of building there.

To support forward-planning**, climate change should be embedded in FRM policy** (and vice versa), for example in national policy strategies and planning documents through to the design of defence schemes. A long-term strategic approach (ca. 50 to 100 years) for decision-making is needed to ensure that future risks and uncertainties are accounted for.

Recommendations

- Establish effective **bridging mechanisms** across levels and sectors
- Implement **enforcement mechanisms** in spatial planning
- Introduce/develop the use of **property-level measures**
- Use, where appropriate, the insurance scheme to incentivize adaptive building

Examples

- 'Water assessment/water test' (national level)
- 'Duty to inform' (national level)
- Guidelines for building on the floodplain (national/local level)

4.3 Human and financial resources

Institutional cultures for learning appear to be well-established within STAR-FLOOD countries, but there are limited opportunities for exchanging these lessons between countries, especially between research and practitioner communities. Conferences, workshops and research consortiums are one way of transferring knowledge but often exclude practitioners. The outputs from projects, such as policy briefs and the Practitioner Guidebook developed within STAR-FLOOD, provide an important means of disseminating research findings in an accessible way, but do not enable the active exchange of ideas and dialogue. A flood risk governance knowledge exchange platform should be established in Europe to facilitate this.

Cost-benefit analysis is established and applied in the STAR-FLOOD countries; **continued use and development of whole-life costing and risk-based prioritisation are advocated to encourage long-term resource efficiency**.

In terms of improving capacities to resist flooding, financial resources from the State and public sector continue to be a constraint. Additional financial support could come from the private sector and there have been efforts to develop public-private partnerships (*e.g.* England's approach to Partnership Funding); however, private sector involvement is still limited. Further research is needed to understand the opportunities, incentives and barriers to successful public-private partnerships. The implementation of measures at property-level would thus not only enhance capacities to resist flooding, but also be favourable from the point of view of resource efficiency.

Recommendation

- Take action to **promote learning** and knowledge development
- Diversifying funding sources for FRM by i) encouraging private-sector investment in FRM and ii) aligning FRM to other policy goals (*e.g.* economic development, environmental improvement etc.) to increase access to other funding streams.

Examples

- Establish a flood risk governance knowledge exchange platform at European level
- Promote flood training exercises/flood rehearsals at national and local level

4.4 Improved legitimacy in flood risk governance

Although 'rules' exist to promote public participation in governance (*e.g.* the Aarhus convention, the Water Framework Directive and the Floods Directive) there is no prescription about how this should be done. Whereas public participation initiatives are institutionalised in some countries (*e.g.* Sweden, England), this is not the case everywhere. A legal requirement to consult with the public need moreover not mean that participation actually takes place, or that the input from the stakeholders is considered; in some countries participation is often a consultation exercise only. **Active citizen engagement is necessary** for a number of reasons – *e.g.* encouraging citizens to adopt some responsibility in FRM, raising risk awareness, building trust between authorities and the public, enhancing transparency and trust in science. Further guidelines or even legal prescriptions relating to public participation could help to increase public participation initiatives in Europe and their success. To enhance legitimacy of decision-making, the use of Citizens' Juries could be a useful addition to participation proceedings, and involve populations without exclusively relying on an open ended, open-invitation, participation procedure that might not always be effective.

Transparency and accountability are fundamental for legitimate flood risk governance. **Public inquiries and independent reviews** are often initiated following significant flood events and provide important 'windows of opportunity' to review current state of affairs. Resources must be made available and mechanisms established to ensure that such 'lessons learnt' are taken forward into policy and practice.

Recommendation

- Take action to **raise awareness** among the citizens
- Promote active **citizen engagement**

Examples

- Introduce the use of Citizens' Juries

- Public inquiries
- Independent reviews

4.5 Flood forecasting, warning and emergency management

Appropriate mechanisms for flood forecasting, warning and emergency management are essential for the possibilities to absorb and recover from flood events. While such mechanisms are typically well-established in the STAR-FLOOD countries, some countries could benefit from expanding formal communication pathways and involving citizens to help disseminate flood warnings. The technological developments in the form of *e.g.* informative websites in Belgium and the Netherlands could be used as a model to develop similar systems in other countries. In emergency management, **mechanisms for up-scaling and downscaling emergency response as well as formalised arrangements for identifying vulnerable and hard-to-reach groups in the community are essential**. Flood training exercises are also important, and although the Dutch statutory requirement for flood rehearsals is designed for the specific conditions in the Netherlands, experiences from these activities could be used to inform other countries.

Recommendation

- Take action at all levels of governance to **raise awareness** among the citizens
- Clarify the **division of responsibilities** between government levels and between the government, citizens and voluntary sector

Examples

- Facilitate use of information and communication technologies for flood forecasting and warning at EU and national level
- Ensure mechanisms for up-scaling and downscaling emergency response at national level
- Establish arrangements for identifying vulnerable groups in the community

4.6 The Floods Directive

The goal formulation of the Floods Directive is relatively open and flexible. As a result, the significance of the Floods Directive on the flood risk governance arrangements in the STAR-FLOOD countries is allowed to vary. Thus, the Directive has had a relatively limited importance in relation to the well-established flood risk management systems in *e.g.* the Netherlands and England, and quite a substantial impact on Polish and Swedish flood risk management.

In relation to the EU and in particular the Floods Directive, the research in the STAR-FLOOD project points towards a need to:

- Clarify the Floods Directive in terms of *e.g.* important definitions and concepts
- Set up a more transparent decision-making implementation process for the Floods Directive
- Clarify the legal responsibilities conferred by the Floods Directive and make this a compulsory part of the flood risk management plans, for example by specifying a set of measures with accompanying responsibilities for the relevant public and private actors in relation to a specific set of goals.
- Set out set out rules to deal with situations where the responsible parties fail to meet their obligations in the Floods Directive

- Strengthen the coordination with the Water Framework Directive by using the programmes of measure under the WFD to ensure enforcement of the Floods Directive

Finally, the value of applying cross-sectoral Catchment-Based Approaches currently encouraged in water and environmental policy is debated in the Flood Risk Management field. Further evidence is required to evaluate the effectiveness of this approach for alleviating flood risk and its potential for maximising the efficient use of resources.

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Appendix 1 – the matrix

Evaluation (for country and case studies)

Societal resilience	Which FRGA's factors enhance the ability to prevent flood hazards from occurring? Which FRGA's factors constrain the ability to prevent flood hazards from occurring? Which FRGA's factors enhance the ability to absorb or recover from flood events? Which FRGA's factors constrain the ability to absorb or recover from flood events? Which FRGA's factors enhance the capacity to learn, innovate and improve responses to flood risk? Which FRGA's factors constrain the capacity to learn, innovate and improve responses to flood risk?
Efficiency	Which FRGA's factors enhance the ratio of desired economic output(s) to economic input(s)? Which FRGA's factors constrain the ratio of desired economic output(s) to economic input(s)? Which FRGA's factors enhance the ratio of desired output(s) to input(s)? Which FRGA's factors constrain the ratio of desired output(s) to input(s)?
Legitimacy	Which FRGA's factors enhance the fairness in decision-making? Which FRGA's factors constrain the fairness in decision-making? Which FRGA's factors enhance the opportunities for stakeholders to challenge decisions that have been made? Which FRGA's factors constrain the opportunities for stakeholders to challenge decisions that have been made? Which FRGA's factors enhance the transparency of decisions that have been made? Which FRGA's factors constrain the transparency of decisions that have been made? Which FRGA's factors enhance the fact that opinions of stakeholders have been considered and integrated within decision-making? Which FRGA's factors constrain the fact that opinions of stakeholders have been considered and integrated within decision-making? Which FRGA's factors enhance the ability for stakeholders to have equal access to relevant information about the problem? Which FRGA's factors constrain the ability for stakeholders to have equal access to relevant information about the problem? Which FRGA's factors enhance the fact that decisions are accepted by stakeholders? Which FRGA's factors constrain the fact that decisions are accepted by stakeholders? Which FRGA's factors enhance the fact that decisions are accepted by stakeholders? Which FRGA's factors constrain the fact that decisions are accepted by stakeholders?

Good practices – recommendations.

Ia. Implementation, diversification and alignment of strategies (at national level and in case studies)

	Instruction
Risk prevention, *e.g.* spatial planning	Alignment between strategies…
Flood defence, *e.g.* dikes, dams, embankments, pumps, sandbags	
Flood mitigation, *e.g.* urban drainage, green infrastructure, building regulations	
Flood preparation, *e.g.* warning systems, mapping, knowledge building	

Ib. Performance evaluation: Evaluation of the extent to which FRGAs enhance societal resilience (at national level and in case studies)

	Instruction
High/Moderate/Low (in accordance with your relative assessment)	To deliver based on societal resilience (table H)
Indicators	To deliver based on societal resilience (table H)
Reference point	To deliver based on societal resilience (table H)
Comments (also with regard to *e.g.* the SWOT analysis)	To deliver based on societal resilience (table H)
Performance evaluation: Evaluation of the extent to which FRGAs enhance efficiency	To deliver based on societal resilience (table H)
High/Moderate/Low (in accordance with your relative assessment)	To deliver based on societal resilience (table H)
Indicators	To deliver based on societal resilience (table H)
Reference point	To deliver based on societal resilience (table H)

Ic. Performance evaluation: Evaluation of the extent to which FRGAs enhance legitimacy (at national level and in case studies)

	Instruction
High/Moderate/Low (in accordance with your relative assessment)	To deliver based on legitimacy (table H)
Indicators	To deliver based on legitimacy (table H)
Reference point	To deliver based on legitimacy (table H)
Comments (also with regard to *e.g.* the SWOT analysis)	To deliver based on legitimacy (table H)

Id. Performance evaluation: Evaluation of the extent to which FRGAs enhance legitimacy (at national level and in case

…	Instruction					
Highly resilient, efficient and/or legitimate FRGAs, instruments/measures or strategies	Dimensions				Design-oriented framework	
	Actors: who participates (who are the key players? Interaction patterns; how is participation organised; what is the outcome? Which bridging mechanisms exist?	**Discourses:** which perspectives/ interests are recognized (and carry weight)?	**Rules:** division of responsibilities; legal framework for action: who can act, within which boundaries and according to what substantial rules? How are the FRM instruments (*e.g.* expropriation, water test etc.) embedded in the legal frameworks and how are they enforced; how is public participation organised; which bridging mechanisms exist; how do rules promote coordination; is the river basin approach implemented?	**Resources:** who can mobilize the resources? Knowledge and learning; how is knowledge transferred and supported? Resource use (costs and benefits)?	Possible success conditions	Policy recommendations
Highly resilient FRGAs, instruments/measures or strategies						
Highly efficient FRGAs, instruments/measures or strategies						
Highly legitimate FRGAs, instruments/measures or strategies						
Weakly resilient, efficient and/or legitimate FRGAs, instruments/measures or strategies	**Actors**: who participates (who are the key players? Interaction patterns; how is participation organised; what is the outcome? Which bridging mechanisms exist?	**Discourses:** which perspectives/ interests are recognized (and carry weight)?	**Rules:** division of responsibilities; legal framework for action: who can act, within which boundaries and according to what substantial rules? How are the FRM instruments (*e.g.* expropriation, water test etc.) embedded in the legal frameworks and how are they enforced; how is public participation organised; which bridging mechanisms exist; how do rules promote coordination; is the river basin approach implemented?	**Resources:** who can mobilize the resources? Knowledge and learning; how is knowledge transferred and supported? Resource use (costs and benefits)?	Possible "failure" conditions	Policy recommendations (what to avoid)

Weakly resilient FRGAs, instruments/measures or strategies						
Weakly efficient FRGAs, instruments/measures or strategies						
Weakly legitimate FRGAs, instruments/measures or strategies						