

Strengthening And Redesigning European FLOOD risk practices (STAR-FLOOD): Towards appropriate and resilient flood risk governance arrangements.

Paper for the 2013 Tokyo Conference on Earth System Governance

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Abstract

European urban agglomerations face increasing but uncertain flood risks due to urbanization and the effects of climate change. These risks are addressed at the European, the national and the regional policy levels. A diversification and alignment of Flood Risk Management Strategies (FRMSs) has to make vulnerable urban agglomerations more resilient to flooding. This may require changes in their institutional embedding. Scientific insights in the actual and/or necessary institutional embedding of FRMSs so far are rather limited and fragmented. In this article we will address this knowledge gap by introducing the Flood Risks Governance Arrangements (FRGAs) approach which allows us to integrate insights from policy scientist and legal scholars into one coherent framework that can be used to identify, analyse, explain and evaluate (shifts in) existing flood risk management practices. The approach is illustrated by referring to the shift in the Netherlands' flood risk management practices (from diking to 'multi-layered safety'). The approach has to be further elaborated in future comparative research. Therefore we conclude this article with a research agenda. We will argue that comparative analyses of FRGAs in different regions can identify best practices that can be translated into policy design principles as well as concrete recommendations for policy and law at the level of the EU, its member states, regional authorities, and public-private partnerships.

1 Flood risks on the policy and research agendas

Judged by its likelihood and impact, climate change is number 1 and flooding number 9 in the 2011 top 10 of global risks.¹ These two risks are clearly related. Climate change is expected to result in sea-level rise and to induce more extreme weather events. As a result, modifications in frequency, severity and duration of hydro-meteorological hazards will occur.² Water level patterns in rivers are expected to change and the flash flood hazard is expected to increase in frequency and severity.³ Even without taking climate change into account, the potential consequences of these extreme weather events are intensified due to population growth, economic growth and urbanization.⁴ These consequences will be suffered by the whole EU, due to interdependencies between economic sectors and between regions. Urban areas in particular face increasing flood risks. Between 2000 and 2005, Europe suffered more than 100 floods, including nine major flood disasters. These major flood events caused 155 casualties and economic losses of more than € 35 billion. Furthermore, the material flood damage of 2002 is estimated to be higher than in any previous single year.⁵ Both urbanization and the regional consequences of climate change are associated with large uncertainties.

Dealing with flood risks is a multilevel and a multi-sector and actor policy issue. Traditionally regional authorities and the national governments play a key role, but in 2007 the European Union issued its Flood Directive which requires member states to check the adequacy and eventually enhance and/or change their Flood Risks Management Strategies (FRMSs). Apart from water-managers'

¹ World Economic Forum (2011). *Global risks 2011*, Available online: <http://www.riskreport.weforum.org/>.

² IPCC (2011) *Summary for Policymakers of Intergovernmental Panel on Climate Change Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* Cambridge University Press, Cambridge.

³ Borga, M., Anagnostou, E.N., Blöschl, G., Creutin, J.D. (2011). "Flash Flood forecasting, warning and risk management: the HYDRATE project" *Environmental Science and Policy* **14**: 834-844.

⁴ Mitchell, J.K. (2003). "European river floods in a changing world." *Risk analysis* **23**(3): 567-574.

⁵ Barredo, J.I. (2007). "Major flood disasters in Europe: 1950-2005." *Natural Hazards* **42**(1): 125-148.

physical planners' as well as non-governmental actors' and businesses' involvement has grown over the last decades. Research is needed to understand and to guide these processes.

For a long time a natural and technical science perspective has dominated the research on FRMSs in Europe. Research projects such as IRMA SPONGE, FLOODsite and HYDRATE have strongly improved the state-of-the-art of risk assessment, future scenarios, technical measures and early warning systems.⁶ Other European research projects have addressed, amongst other things, technologies for improved safety of the built environment (FLOODprobe/SMARTeST); the costs of natural hazards (ConHaz); resilience approaches (e.g. CORFU⁷; FREEMAN); integrated multi-hazard vulnerability assessment (ENSURE); social capacity building (CapHaz-Net); adaptive water management under uncertainty (NeWater) and emergency management (UrbanFlood).⁸ Although some programmes, like NeWater, have addressed social-scientific research questions, social-scientific, institutional and legal studies on flood risk management are still rare, fragmented and limited in scope. Relevant conceptual work has been done (e.g. the adaptive capacity wheel as developed by Gupta et al.⁹ as well as Kuhlicke et al.'s¹⁰ model of social capacity building). However, the application of these and other approaches to the domain of flood risk management strategies, is still in its infancy (but see Van Den Brink et al., 2011¹¹), although it is known that social and institutional factors often form strong barriers to the successful implementation of (new) FRMSs.¹² Current knowledge on the institutional embedding of FRMSs is, however, limited and fragmented. Little is known about the actors, discourses, rules and resources through which FRMSs are developed and put into practice. These are, however, crucial factors in explaining regional differences, successes and failures in the adoption and implementation of FRMSs.

The analysis and evaluation of the institutional embedding of FRMSs requires policy scientific (public administrative) and legal expertise. Issues that have been traditionally addressed by scholars in policy sciences include analyses of governance, policy performance, public-private partnerships, policy discourses and political influence. Although fragmented initial knowledge on stakeholder and market parties' involvement and related issues is available, so far systematic comparative empirical research on the institutional embedding of FRMSs is lacking. Legal scholars, on the other hand, can provide expertise on the extent to which FRMSs are compatible with existing legal frameworks, including European legislation, national constitutions, power divisions within EU member states as well as the possibilities of changing formal authority and legal instruments. The legal knowledge gap is even more serious. We do know that the EU has many ambitions regarding FRMSs, which are exemplified by the implementation of the EU Floods Directive (2007/60/EC), the financing of projects on flood issues and adaptation, and the publication of a White Paper on climate change adaptation (2009). The EC has also started a public consultation on policy measures needed to lessen the impacts and costs of increasing climate change-related calamities such as floods and forest fires (EC 2007¹³). However, the

⁶ (<http://www.irma-sponge.org/>; <http://www.floodsite.net/>; <http://www.hydrate.tesaf.unipd.it>)

⁷ Djordjevic, S., D. Butler, P. Gourbesville, M. Ole, E. Pasche, E. (2011) "New Policies to deal with climate change and other drivers impacting on resilience to flooding in urban areas: the CORFU approach" *Environmental Science and Policy* **14**: 864-873.

⁸ Quevauviller, P. (2011). "Adapting to climate change: reducing water-related risks in Europe – EU policy and research considerations" *Environmental Science and Policy* **14**: 722-729.

⁹ Gupta, J., Termeer, C., Klostermann, J., Meijerink, S., Van Den Brink, M., Jong, P., Nooteboom, S., Bergsma, E., 2010 "The adaptive capacity Wheel: a method to assess the inherent characteristics of institutions to enable the adaptive capacity of society" *Environmental Science and Policy* **13**(6): 459-471.

¹⁰ Kuhlicke, C., Steinführer, A., Begg, C., Bianchizza, C., Bründl, M., Buchecker, M., De Marchi, B., Di Masso Tarditti, M., Höppner, C., Komac, B., Lemkow, L., Luther, J., McCarthy, S., Pellizzoni, L., Renn, O., Scolobig, A., Supramaniam, M., Tapsell, S., Wachinger, G., Walker, G., Whittle, R., Zorn, M., Faulkner, H. (2011) "Perspective on social capacity building for natural hazards: outlining an emerging field of research and practice in Europe" *Environmental Science and Policy* **14**: 804-814.

¹¹ See for instance: Van den Brink, M., Termeer, C., Meijerink, S. (2011) "Are Dutch water safety institutions prepared for climate change?" *Journal of Water and Climate Change* **2**(4): 272-287

¹² See also: Van den Brink, M., Termeer, C., Meijerink, S. (2011) "Are Dutch water safety institutions prepared for climate change?" *Journal of Water and Climate Change* **2**(4): 272-287.

¹³ Public consultation on the green paper "adapting to climate change in Europe": <http://ec.europa.eu/environment/water/adaptation/consultation.htm>.

Floods Directive and EU adaptation policies, influenced by the subsidiarity principle, leave much policy discretion in flood risk management to individual Member States. There are only a few comparative assessments of national legal frameworks that are relevant for the implementation of FRMSs.¹⁴ Hence, we lack substantive understanding as to whether, to what extent and how legal frameworks could allow for the implementation of (new) FRMSs. Worse still, we lack knowledge on how these legal frameworks relate to other issues, such as the involvement of communities and market parties in flood risk governance.

We can thus conclude that there is a lack of systematic comparative empirical research on the comprehensive mix of FRMSs, their institutional embedding and more specifically the role of both public and private actors in flood risk management. In this paper we aim to develop a research approach which allows us to do such comparative studies and to draw lessons for future policy developments. The latter implies that the framework should enable us to identify normative principles which dominate current debates on flood risk management. Our approach starts with the identification of existing FRMSs. The next research steps concern the analysis (par. 2), explanation (par. 3) and evaluation (par. 4) of their institutional embedding. We will illustrate the approach by referring to the shift in the Netherlands' flood risk management practices (from diking to 'multi-layered safety'). In our conclusion we will specify the agenda for further research.

2 Five Flood Risk Management Strategies

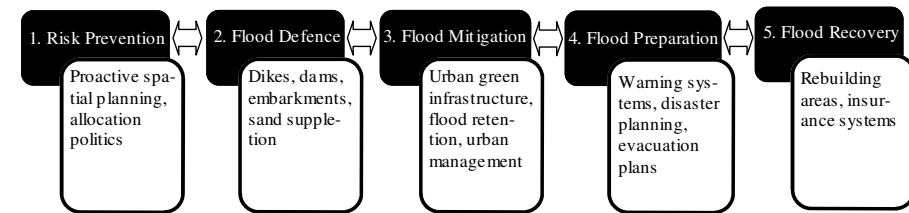
Literature on flood risk management often (implicitly) refers to the in system literature well known DPSIR model to identify different FRMSs. Flood risks may be categorized and identified by referring to their Drivers, resulting Pressures and State, Impacts and Responses (the DPSIR-model). Following this argumentation we identify five different FRMSs¹⁵ (see also figure 1):

1. *Flood Risk Prevention: pro-active spatial planning.* Flood-related risks can be *structurally prevented* by planning as well as land use policies ("keeping people away from water"), e.g. by proactively locating housing or building areas at a safe distance or altitude;
2. *Flood Defence: decreasing the probability of flooding.* Flood risks can be prevented by infrastructural works, dikes, dams, embankments, sluices etc. ("keeping water away from people"), mostly referred to as "flood defence" or "structural measures";
3. *Flood Mitigation: decreasing the consequences of flooding.* Consequences of floods when they do occur can be mitigated through spatial or building orders, regulations such as conditions for building houses in flood prone areas or retention of water in the river basin (natural flood management);
4. *Flood Preparation: develop flood warning systems and prepare disaster management plans.* When mitigation is not feasible or appropriate, people should prepare for eventual flood problems (e.g. evacuation plans);
5. *Flood Recovery.* Finally there is the last resort of *recovery* from flood damage, increasingly popular in the realm of (unpredictable) climate change effects. In this respect reconstruction or rebuilding plans as well as insurance systems are relevant.

¹⁴ Reese, M., Möckel, S., Bovet, J., Köck, W. Helmholtz Centre for Environmental Research (UFZ) Department of Environmental and Planning Law, *Rechtlicher Handlungsbedarf für die Anpassung an die Folgen des Klimawandels 2010*. (<http://www.esv.info/978-3-503-13003-0>) (English summary: *Adapting Environmental Law to the impacts of climate change, Analysis, development and innovation of legal instruments*); Van Rijswijk, H. (2004). "The water test in Flanders and The Netherlands; appropriate instrument for external integration?" in: Michiels, F., Lavrysen, L. (Eds), *Environmental Law in the Low Lands*, The Hague (in Dutch/Flemish only); Haumont, F., Born, C.H. (forthcoming). *Proceedings of the Reseau d'Eau Conference on the relation between water management and spatial planning*, Reseau d'Eau/CIDCE, seminar organized in April 2011 at the Université Catholique de Louvain, which offers a comparative legal research across the EU Member States.

¹⁵ Meijerink, S., Dicke, W. (2008). "Shifts in the public-private divide in flood management." *International Journal of Water Resources Development* 24(4): 499-512. Apart from the category of flood mitigation strategies our categorisation resembles that of EU flood risk policies, e.g. WISE (2011) Online: http://ec.europa.eu/environment/water/flood_risk/flood_risk.htm.

Figure 1: Five Flood Risk Management Strategies (FRMSs) and associated typical measures



Although the FRMSs listed on the previous page can address both sea-based and land-based flood risks, we will restrict ourselves to the latter. Notwithstanding the differences, for long most countries and regions in Europe were focused on *flood defence*. In literature and in practice (the European Flood Directive and the Netherlands' multi-layered safety concept), however, we see arguments for and efforts towards a diversification of FRMSs. Such diversification entails applying multiple strategies simultaneously as well as establishing links between different strategies. We also see efforts at improving spatial planning in or recovery of floodplains. Scientific literature shows that a diversification of FRMSs may lead to more resilience to flood hazards¹⁶ (just as the introduction of airbags in cars next to safety belts has further improved car safety). A resilient approach is one that is intended to enable society to cope with flood risks in a flexible and multifaceted way and to recover to the initial state as quickly as possible after a flood event. The wish to diversify FRMSs is also visible in European policy. The five strategies distinguished above (apart from the category of flood mitigation) largely resemble that of EU flood risk policies.¹⁷ The EU Floods Directive (2007/60/EC) and the UNISDR Hyogo framework ask for a diversification of FRMSs. Consequently, in several EU Member States, policy concepts have been introduced which can be linked to this wish to diversify FRMSs.¹⁸ However, such a shift in FRMs is not everywhere feasible. Apart from geographical factors, institutional factors are highly relevant in this. A shift might for instance imply that new actors get a role in flood risk management which might need more knowledge and resources. For instance, in the actual Netherlands' floods risks management debates more emphasis is laid on flood mitigation instead of taken the traditional flood defense measures. This implies that the traditional flood risks managers (the Public Water Management Department and the Water boards) lose some management autonomy as they have to involve urban planners from Provinces and Municipalities in the development and implementation of measures.

¹⁶ Aerts, J.C.J.H., Botzen, W., Van der Veen, A., Kryukow, J., Werners, S. (2008) "Dealing with uncertainty in flood management through diversification" *Ecology and Society* 13(1): 41-57; Innocenti, D., Albrito, P. (2011) "Reducing the risks posed by natural hazards and climate change: the need for a participatory dialogue between the scientific community and policy makers" *Environmental Science and Policy* 14: 730-733; Van den Brink, M., Termeer, C., Meijerink, S. (2011) "Are Dutch water safety institutions prepared for climate change?" *Journal of Water and Climate Change* 2(4): 272-287; Vinet, F. (2008) "From hazard reduction to integrated risk management: Towards adaptive flood prevention in Europe" *WIT Transactions on the Ecology and the Environment* 118: 113-122.

¹⁷ e.g. WISE (2011) Online: http://ec.europa.eu/environment/water/flood_risk/flood_risk.htm.

¹⁸ In Dutch policy discourses, the wish to expand water safety policy is explicitly stated. In The Netherlands, policy discussions focus on the notion of 'multiple lines of defense' (Meerlaagse Veiligheid in Dutch). See for instance: <http://www.helpdeskwater.nl/algemene-onderdelen/serviceblok/english/water-and-safety/>.

arrangements found (e.g. more public hierarchical steering, private governance, or public-private partnerships).

Table 1: Governance arrangements: operationalization of the concept (based upon Wiering and Arts, 2006)

<i>Actors</i>	<i>Discourses</i>	<i>Rules</i>	<i>Power & Resources</i> ²³
<i>Public actors involved</i> <i>Private actors involved</i> <i>Coalitions and oppositions</i> <i>Interaction patterns</i>	<i>Relevant scientific paradigms and uncertainties</i> <i>Policy programmes, policy objectives and policy concepts</i> <i>Historical metaphors/narratives</i>	<i>Legislation</i> <i>Formal material norms</i> <i>Informal material norms</i> <i>Formal procedural norms (including the right to regulate property rights)</i> <i>Informal procedural norms</i> <i>Cross-country and cross-sector alignment of rules (integration)</i>	<i>Legal authority, including the right to regulate property (expropriation)</i> <i>Financial power</i> <i>Knowledge</i> <i>Informal political networks</i> <i>Interaction skills</i>

Analysing the dynamics of the institutional embedding of FRMSs by using the governance arrangements approach is an important first research step in an assessment. This step is necessary, before we can explain the emergence of these FRGAs, evaluate their success and eventually derive design principles and other recommendations to improve flood risk management practices.

4 Analysing dynamics in the institutional embedding of FRMSs

Every country (or region) has specific preferences and shows historical pathways in dealing with flood risks that have eventually evolved into a specific dominant approach to flood hazards (a dominant FRMS in many countries has been “flood protection” until recently, as mentioned before). We expect that patterns will occur in the relationship between FRMSs and FRGAs (see table 2). For instance, flood prevention, a FRMS that is mainly based on spatial measures needs a strong role of proactive spatial planning, while flood defence, a FRMS that bears upon measures like the constructions of dams, dikes, embankments or sand suppletion in coastal zones needs an elaborate water management sector to fulfil these tasks. The involvement of market parties – the public-private divide differ between the FRMSs.²⁴ Private parties do play a role in flood recovery. For instance in the United Kingdom, the government does not provide compensation in case of flooding, but private insurance companies do (under a concordat with the government). In France, insurance arrangements are also based on public-private partnerships. Insurance coverage against flooding is mandatorily included in building and home contents insurances. In Germany private insurance is possible as supplements to home contents and building insurance.²⁵ The main lesson to derive from the table is that broadening and linking FRMSs requires innovative FRGAs. There is a need for new partnerships (actors), new policy programmes and coordination with existing programs (discourses), new procedures and instruments (rules) and new resources (e.g. interaction resources).

²³ See also: Lukes, S. (1974) *Power* Macmillan, London; Green, C. (2011) ‘The practice of Power: Governance and Flood Risk Management’ in: Pender, G., Thorne, C., Cluckie, I., Faulkner, H. (Eds.) *Flood Risk Science and Management*, Oxford, Blackwell.

²⁴ Meijerink, S., Dicke, W. (2008). “Shifts in the public-private divide in flood management.” *International Journal of Water Resources Development* 24(4): 499-512.

²⁵ Botzen, W.J.W., Van Den Bergh, J.C.J.M. (2008). “Insurance against climate change and flooding in the Netherlands: present, future, and comparison with other countries.” *Risk Analysis* 28(2): 413-426.

3 Assessing dynamics in the institutional embedding of FRMSs

FRMSs are – in one way or another – institutionalized in society.¹⁹ The policy or governance arrangements approach (GAA) is a way to analyse processes of institutionalization. The approach builds upon different frameworks of policy analysis (e.g. policy network models, discourse analysis, the advocacy coalitions framework and regime theory in international relations). All these models have their strengths and weaknesses, but because of their specific emphasis, none of them give a comprehensive view of all dimensions of policy that are relevant for an understanding of institutionalisation processes. The GAA claims to link up all relevant dimensions of a policy domain and enables a study of dynamics in the institutionalisation of societal phenomena. This approach has been applied in earlier studies of environmental policies, nature conservation and water management.²⁰ According to the GAA, a governance arrangement (GA) can be considered as “a temporary stabilisation of the content and organisation of a policy domain” (p. 96).²¹ Similarly, we conceptualise FRGAs as (the result of) a dynamic interplay between:

- 1) Actors and actor coalitions, including partnerships;
- 2) Dominant discourses, including scientific and policy debates;
- 3) (Formal and informal) rules of the game;²² and
- 4) The power and resource base of the actors.

Liefferink (2006) visualises a governance arrangement as a tetrahedron, with these four dimensions connected to each other as the four angles of this tetrahedron. Each angle can be an entry point to start analysing the policy domain. Another way of doing this analysis is by disentangling and clarifying the dimensions by adding indicators, as depicted in Table 1. The dynamics in the institutional embedding of FRMSs can be analysed by studying historical dynamics through each factor listed in the table. These indicators allow for the comparison of arrangements in time (longitudinal research) and in space. The approach makes clear that the discursive dimension of a policy domain pays attention to both concrete policy programmes (in a region or country) as well their underlying driving forces, which are often more implicit, such as the general policy objectives and the paradigms of the scientific community (epistemic communities) that deals with flood risks.

As table 1 shows, governance arrangements comprise factors which have been traditionally researched by policy scientists (actors and partnerships, policy discourses), but also factors which have been the domain of legal scholars such as legislation, regulation and legal authority (to regulate property rights, including compensation regimes, the right to expropriate and to enforce rules). In order to clearly identify the dimensions of the GAA, legal scholars will study the relation and alignment between European and national laws as well as between sector laws. Apart from legislation, existing jurisprudence will be studied. The main strength of the governance arrangements approach is that it helps to bring the perspectives from policy science (public administration) and law together in one integrated framework. It enables us also to look for patterns (ideal types) in the governance

¹⁹ Compare: Ostrom, E., Crawford, S. (1995) “A grammar of institutions” *American Political Science Review* 89: 3 (582-600); Young, O.R., Underdal, A. (1996) *Institutional dimensions of global change, a scoping report to the International Human Dimensions Program* Dartmouth College, Institute on International Environmental Governance, Hanover NH.

²⁰ Van Tatenhove, J., Leroy, P. (2000) (Eds). *Political modernisation and the environment: the renewal of environmental policy arrangements* Kluwer Academic Publishers.; Wiering, M., Immink, I. (2006) “When water management meets spatial planning: a policy-arrangements perspective” *Environment and Planning C: Government & Policy* 24(3): 423-438. Arts, B., Leroy, P., Van Tatenhove, J. (2006). “Political modernisation and policy arrangements: a framework for understanding environmental policy change” *Public organization review* 6(2): 93-106.; Wiering, M., Arts, B. (2006) “Discursive shifts in Dutch water management: ‘Deep’ institutional change or adaptation strategy?” *Hydrobiologica* 565(1): 327-338.

²¹ Arts, B., Leroy, P., Van Tatenhove, J. (2006). “Political modernisation and policy arrangements: a framework for understanding environmental policy change” *Public organization review* 6(2): 93-106.

²² North D C 1990 *Institutions, Institutional Change and Economic Performance*, Cambridge, Cambridge University Press.

Table 2: Expected link between Flood Risk Management Strategies (FRMSs) and Flood Risk Governance Arrangements

Basic direction	Prevention		Response		
	FRMSs	1.Risk Prevention	2.Flood defence	3.Flood mitigation	4.Flood preparation
Typical measures	Proactive spatial planning /allocation politics/ location of building areas	Dikes, dams, embankments, sand banks	Urban green infrastructure, flood retention, urban design taking into account flood risks	Warning systems, plans for disaster management / evacuation	Rebuilding areas, insurance systems
Flood Risk Governance Arrangements (FRGAs)					
Dominant actors and coalitions	Spatial planning authorities	Public authorities, water managers	Public authorities, private parties, NGOs, citizens	Public authorities and citizens	Citizens, NGOs, public authorities or private (insurance) companies
Dominant Discourses	"Precautionary principle"	"Technology may protect you"	"Risk Integration (culture of risk) will minimize flood impacts"	"Early warning will prevent calamities and loss of life"	"Public or private solidarity will ease the burden"
Rules of the game	Public hierarchical steering	Public hierarchical steering	Public and private forms of governance are possible	Public and private forms of governance are possible	Public and private forms of governance are possible
Division of resources	Legal power of public authorities	Legal, cognitive and financial resources of public authorities	Legal, cognitive and financial resources can be concentrated or diffuse	Centralization of control and resources	Legal, cognitive and financial resources can be concentrated or diffuse

The above table can also be used if we want to study shifts in the institutional embedding of FRMSs. A proper understanding of stability and change in policy processes requires that a time frame of at least a decade must be taken into account.²⁶ If we illustrate the use of the table by referring to the

²⁶ Meijerink, S. (2005) "Understanding policy stability and change. The interplay of advocacy coalitions and epistemic communities, windows of opportunity, and Dutch coastal flooding policy 1945-2003" *Journal of European Public Policy*

Netherlands we see that several changes occurred during the last two decades. Traditionally engineering approaches dominated Dutch flood risk management. Following the 1953 flooding of the South-Western part of the country, the so-called Delta plan (1960) asked for the seclusion of tidal waterways and the construction of storm surge barriers and higher dikes. Flood mitigation options became reality after the 1993 and 1995 near floods in the Rhine and Meuse catchments. The Room for the River project concentrated on the lowering of floodplains and the removing of obstacles. A further broadening of FRMSs was done in 2009 with the introduction of the multi-layered safety concept in flood risk management. Apart from Flood Defence more emphasis has to be put on Flood Mitigation ((flood-proofing houses, elevating houses, re-locating etc.) Flood Preparation (flood warning, crisis management and evacuation) and Flood recovery measures in the coming years. These discursive shifts are embedded in societal discourses in which global climate change and climate change adaptation have gained/are gaining increasing attention. It has been acknowledged that the latter needs to take place at the regional level but the discussion about the safety norms that should guide adaptation policies is still going on. Also, in this period, major EU policy initiatives (WFD, FRD) were developed and discussed and a start was made with their implementation. Following these discursive shifts legal rules have changed too. The river basin approach had to be institutionalized in Dutch water law. One of the more striking changes concerns the introduction of the water test in spatial planning. This instrument enables water policy makers to specify and politicize their interests. Fundamental changes in these policy making actors and their power bases however haven't occurred yet. The Public Work Department and the 25 water boards did and do play a key role in flood defence. However, compared to the past they should be willing to cooperate more with other public and non-public actors to fulfil their tasks. Above example illustrates that the institutional embedding of FRMSs may change over time. Several factors might explain these changes.

5 Explaining institutional stability and dynamics in FRMS

Having analysed recent dynamics in Flood Risk Governance, our next step will be to *explain* the stability and dynamics observed. Why are FRMSs institutionally embedded as they are? In line with insights from general social theory on the relationship between structure and agency²⁷ as well as between technology and social practice²⁸ we can distinguish the following explanatory factors for stability and change in the application and emergence of FRMSs and associated FRGAs:

- *Physical circumstances* (seasonality of rainfall patterns, climate change trends; altitude; gradient) determining the nature and characteristics of flood events. These physical circumstances can be considered very stable, and regional actors will have virtually no direct possibilities of changing them. On the other hand, sudden changes in these circumstances (e.g. severe floods) can have tremendous influence on the strategies used and the governance arrangements that are called upon (see under shock events);
- *Physical and social infrastructure* (the presence of dams, dikes, sewer systems, railways, ships, houses; but also educational systems, including handbooks and training facilities, and knowledge infrastructure). In terms of the dimensions of the GAA, physical and social infrastructures can be considered "precipitated resources". Due to large past investments (billions of Euros), they have gained *momentum*.²⁹ This momentum powerfully reinforces

¹²(6): 1060-1077; Sabatier, P.A. (1993) "Policy Change over a decade or more", in: Sabatier, P.A., Jenkins-Smith (Eds.) *Policy Change and Learning: An Advocacy Coalitions Approach*, Westview Press, Boulder, CO, pp. 13-39.

²⁷ Giddens, A. (1976) *New rules of sociological method*. London/New York, Basic Books; Giddens, A. (1984) *The constitution of society*. Cambridge, Polity Press.

²⁸ Shove, E. (2004) "Efficiency and consumption: Technology and practice", *Energy and Environment* 15(6): 1053-1065.

²⁹ See also: Callon, M. (1980) "The state and technical innovation: a case study of the electrical vehicle in France" *Research Policy* 9: 358-376; Hughes, T.P. (1987) "The evolution of large technological systems" in: Bijker, W.E., Hughes, T.P., Pinch, T. (Eds) *The social construction of technological systems: new directions in the sociology and history of technology*, Cambridge, MIT Press; Summerton, J. (1994) (Ed) *Changing large technical systems* Boulder, Westview Press.

path-dependency and lock-in. Infrastructure can be expected to enable some FRMSs by providing the necessary capabilities, but to constrain others. The chance that new FRMSs are actually implemented is probably enhanced in cases in which the new strategies make use of infrastructures that are already in place.

- *Non-material structural factors* (formal and informal rules of the game, dominant policy discourses) can also be expected to give stability to current flood risk governance. But while material infrastructures, once implemented, can be considered to be “out there”, there is much more variation in the extent and ease to which non-material structural factors can change. For instance, it would take at least a decade to change a national constitution and in some cases, it is extremely unlikely that such a revision would be made at all.³⁰ National governance cultures may even take longer to change. But at the other extreme, the vocabulary used by water managers in everyday practice develops and probably changes on a day-to-day basis. At the same time, mental models are a stable way of thinking and reasoning.³¹
- *Agency*, or the purposeful actions of knowledgeable and capable agents (e.g. policy entrepreneurs), forms a fourth explanatory factor. When explaining dynamics in flood risk governance, we expect to find examples of agency, how it came about and how it was enabled. But we may also find examples in which potential change agents did not influence flood risk governance (e.g. because of a lack of political power). In the Dutch Ooijpolder (located in the Rhine Basin)³² the mobilization of local resistance and counter-expertise prevented the (top-down) creation of a water storage facility (or so-called calamity polder). Likewise, an initial lack of stakeholder acceptance and support was experienced in the process of creating a retention area in the Dutch Overdiepse polder, partly caused by the stakeholders’ lack of flood awareness.
- *Shock events*. Flood consciousness has been shown to vary greatly between regions, predominantly depending on the presence and memory of catastrophic events.³³ A flood is an external shock, which creates a disturbance throughout the interconnected ecological, economic and social systems.³⁴ Shock events may lead to major, but temporary, changes in public opinion or governmental priorities,³⁵ accelerating policy change. For instance, in The Netherlands, in 1995, an emergency situation arose because of the threat of dikes being breached due to extremely high water levels in some major rivers. As Driessen and De Gier have shown,³⁶ this shock event helped the implementation of flood defence measures, which had been hoped for by many water sector professionals for some time. In this specific example, however, the main thrust of the change was acceleration along existing paths and trajectories (flood defence). It is uncertain, under which circumstances shock events might contribute to path-breaking change.

By determining the relative importance of explanatory factors, we will gain insight into possible action perspectives. The regional physical context, material infrastructures, formal and informal rules of the game (including legislation and jurisprudence), policy discourses and established actor networks give dominant institutional arrangements a certain degree of stability, inertia and predictability. This stability likely has positive and negative features. It enables and facilitates existing FRMSs, but it may complicate the implementation of new strategies or the establishment of links between different strategies.³⁷ The question whether new strategies are required or not is a normative one. Before such a normative question can be answered we first have to evaluate existing and/or emerging FRMs and related arrangements.

6 Evaluating FRGAs: appropriateness and resilience

As a next step, after analysing and explaining the institutional embedding of FRMs, we will evaluate this institutional embedding with the help of the overall criteria of *appropriateness* and *resilience*.³⁸ The choice for these overall criteria is based on two starting assumptions. The first assumption is that urban agglomerations vulnerable to flooding will be more resilient, if multiple FRMSs are applied simultaneously and are aligned. A resilient approach is one that is intended to enable society to cope with flood risks in a flexible and multifaceted way and to recover to the initial state as quickly as possible after a flood event. The second assumption is that implementation of a diverse, resilient, set of FRMSs in a certain area is only possible if these strategies and their coordination are appropriate (legitimate, effective and efficient), i.e. properly institutionally embedded given the opportunities and constraints of their physical and social context.

When we evaluate FRGAs, we propose to use the concepts of appropriateness and resilience in two different ways. First, we use them as *success criteria*. We will assess whether and to what extent actors in vulnerable urban regions actually managed to diversify, link and align FRMSs (resilience) as well as whether the strategies and their coordination were properly institutionally embedded (appropriateness). The more both conditions have been met, the more successful we consider flood risk management to be. Second, it is necessary to challenge our starting assumptions, and eventually, nuance them. For instance, in terms of our assumption about resilience, implementation and coordination of all five FRMSs would be an ideal to aspire to. But one can logically assume that this is not always necessary. In a very sparsely populated area (risk reduction), for instance, it would be less essential to have sound evacuation plans (flood preparation). The term *appropriateness* is derived from governance literature. Examples of a *lack of* appropriateness are that existing governance arrangements are incompatible with explicit rules; that institutionalised ideals are present which can never be realized in practice; that there is a lack of faith in institutions; or that intra- or inter-institutional tensions are present between organizational and normative principles.³⁹ The meta-criterion of appropriateness will be operationalised using three sub-criteria. FRGAs need to be:

- *Legitimate*,⁴⁰ by securing the rule of law and ensuring transparency, accountability and participation of national and regional public and private actors. We will ask ourselves, amongst other things, if the voice of minority groups is heard (e.g. inhabitants of emergency retention areas) (actors); what types of expertise are deemed relevant (and whether the carriers of some

³⁷ Pahl-Wostl, C. (2009) “A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes” *Global Environmental Change* 19: 354–365.

³⁸ See also: Adger, W.N., Brown, K., Nelson, D.R., Berkes, F., Eakin, H., Folke, C., Galvin, K., Gunderson, L., Goulden, M., O’Brien, K., Ruitenbeek, J., Tompkins, E.L. (2011) “Resilience implications of policy responses to climate change” *Wiley Interdisciplinary Reviews: Climate Change* 2(5): 757-766; Van den Brink, M., Termeer, C., Meijerink, S. (2011) “Are Dutch water safety institutions prepared for climate change?” *Journal of Water and Climate Change* 2(4): 272-287; Wardekker, J.A., De Jong, A., Knoop, J.M., Van der Sluijs, J.P. (2010) “Operationalizing a resilience approach to adapting an urban delta to uncertain climate changes” *Technological Forecasting and Social Change* 77: 987-998.

³⁹ Olsen, J.P. *Europe in search of Political Order* Oxford University Press, Oxford, UK.

⁴⁰ Compare: Johnson, C., Dowd, T., Ridgeway, C.L. (2006) “Legitimacy as a social process” *Annual review of sociology* 32; Jost, J.T., Major, B. (Eds.) (2001) *The psychology of legitimacy: emerging perspectives on ideology, justice and intergroup relations* Cambridge University Press, Cambridge; Pettit, P. (1980) *Judging justice: an introduction to contemporary political philosophy* Routledge, London.

³⁰ For instance, in Germany, water management is reserved by the constitution to the Länder, and it is unlikely that a revision of the Basic Law would be undertaken to change this.

³¹ Otto-Banaszak I., Matczak P., Wesseler J., Wechsung F. (2010) „Different perceptions of adaptation to climate change: a mental model approach applied to the evidence from expert interviews” *Regional Environmental Change* 11: 217-228; Werners, S.E., Matczak, P., Flachner, Z. (2010) „Individuals matter: exploring strategies of individuals to change the water policy for the Tisza River in Hungary” *Ecology And Society* 15(2): 24.

³² Roth, D., Warner, J. (2007). “Flood risk, uncertainty and changing river protection policy in the Netherlands: the case of ‘calamity polders.’” *Tijdschrift voor Economische en Sociale Geografie* 98(4): 519-525.

³³ Driessen, P.P.J., De Gier, A.A.J. (1997). *Born of necessity. An administrative-legal assessment of dike reinforcements and wharf construction under the Delta Law Major Rivers*, VUGA (In Dutch only).

³⁴ Green C, Viavattene C, Thompson P. (2011) *Guidance for Assessing Flood Losses*, CONHAZ report Flood Hazard Research Centre, Middlesex University.

³⁵ See also: Downs, A. (1972) “Up and down with ecology: the issue attention cycle” *Public Interest* 28: 38-50.

³⁶ Driessen, P.P.J., De Gier, A. (1999) ‘Flooding, River management and emergency legislation – experiences of the accelerated reinforcement of dikes in The Netherlands’ *Tijdschrift voor economische en sociale geografie (TESG)* 90(3): 336-342.

types of expertise, e.g. local knowledge, or scientific disciplines not traditionally connected to flood risk management are marginalized) (discourses); if FRGAs are in accordance with the law at the national/EU level; if governments are legally authorized to, for instance, expropriate and if citizens are adequately compensated for this.

- *Efficient*, by using public and private resources in a cost-efficient way. We will be asking if tasks are carried out by those actors who can perform them in the most efficient way; if the content of sectoral policy programmes is adequately coordinated (discourses); if formal rules and legal frameworks strengthen (synergy) or contradict each other (rules); how many (public or private) financial resources are used, and how this relates to the opportunity costs of acting differently (resources). The latter also requires that FRGAs adequately deal with uncertainty about the regional consequences of climate change. For instance, in the Stern review (p. 417) it is estimated that the additional costs of making new infrastructure and buildings more resilient to climate change in OECD countries could range from \$15 – 150 billion each year (0.05 – 0.5% of GDP), with higher costs possible with the prospect of higher temperatures in the future.⁴¹ It is also claimed that stronger flood defences to protect infrastructures will be a significant part of these costs. Hence, flood risk governance needs to be adaptive in order to avoid over- or under-investments.
- *Effective*, by reducing the flood risks and related vulnerabilities through a variety of region- and context-specific norms, instruments, processes and strategies. We will try to assess what existing FRGAs mean for the risks and vulnerabilities faced by specific actors. We will also look at the role of risk perception (e.g. flood awareness) in this. On the one hand, one could argue that effective FRGAs ensure, not only, that citizens *are* safe, but also that they *feel* safe. On the other hand, risk awareness (including flood awareness) could be instrumental in that it may lead to support for new measures.

To assess the legitimacy, efficiency and effectiveness of the FRGAs, we will confront normative ideas of what is needed in a specific case with empirical evidence. It is an open question, as to whether required changes will be incremental (i.e. looking for how to “fit” FRMSs in a specific context) or radical/transformativ, i.e. “stretching” the institutional context, making use of windows of opportunity.

7 Research agenda

Previous sections have proposed a research approach for assessing the institutional embedding of flood risk management strategies. We have shown that it can be used to assess the institutional embedding of FRMSs in the Netherlands. However, this has been done on a very general level. Further specification of the approach by confronting it with the empiric is required. The latter can best be done by conducting comparative case studies in different countries. By doing this we expect to identify examples of successful and less successful broadening of FRMSs. We will also be able to tell how generic or context-specific these examples are. From there, it will be a small step to identify good practices for flood risk governance. A reflection on these good practices with relevant stakeholders and/or experts will be fruitful in order to be able to translate them into actor-, discourse-, rules and/or resource related design principles that have proven to be valid in different contexts and ideally encourage learning and adaptive management.⁴² These principles shouldn't be considered as 'one size fits all' blueprints for future governance initiations, but merely as sources of inspiration to structure future governance processes.

Actor-related design principles

- Public-private partnerships – we could formulate concrete recommendations which can be used by regional actors, for instance about the types of public-private partnerships actors can engage in,

how to strengthen existing partnerships, and – once established – what to expect from these partnerships;

Discourse-related design principles

- Policy discourses and programmes – we expect to identify policy discourses and -programs that make sense in different contexts. Further, we expect to identify potential synergies with other sector policy programmes;
- Implementation of current European policies –we could provide recommendations for enhancing the implementation of current European policies as well as for the development of new policies;
- Provision of information – we could provide recommendations for national and regional governments on how to supply information (e.g. regional climate predictions, especially on rainfall and storm patterns) in such a way (e.g. through flood hazard maps) that market parties are stimulated to respond to flood hazards;
- Coping with uncertainties – we could provide recommendations on how to deal with uncertainties (related to economic development or regional consequences of climate change in the long term). How can public authorities make their policies adaptive? What are no-regret measures? What types of path-dependencies can be created?

Rules-related design principles

- Legal instruments – we could make recommendations for legal instruments which national and regional governments can use, but also about how the EC can promote their development and implementation;

Resource-related design principles

- Financing – we could consider different ways of public and private financing of FRMSs;
- Long-term policies – our recommendations could deal with the dilemma of how governments can engage in long-term policies, where the costs (e.g. transaction costs of implementing new FRMSs) and benefits (e.g. reduced vulnerability) of action are often allocated between different generations;
- Competences – we could make recommendations on competences which are needed to apply certain FRMSs and elaborate on what this means for the knowledge infrastructure and competence development in terms of formal education, lifelong learning or attracting external expertise;
- Distributional effects – we could consider the potential distributional effects of our recommendations. We could ask ourselves, for instance, if all citizens in a region may benefit from a certain measure, if there is a risk of depriving the poor and vulnerable, and how such risk may be dealt with.

A further reflection on identified design principles with relevant stakeholders and/or experts will be fruitful.

⁴¹ See also: Stern, N. *Review on the Economics of Climate Change*, Cambridge UK, Cambridge University Press.

⁴² See also: Ostrom, E. (1990) *Governing the commons: The evolution of institutions for collective action*. New York, Cambridge University Press.