OECD Studies on Water

Applying the OECD Principles on Water Governance to Floods

A CHECKLIST FOR ACTION

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Foreword

Flooding is the most common of all natural disasters, and there is growing consensus that the frequency and number of people at risk from floods will increase. Global megatrends, including climate change, population growth and urbanisation profoundly exacerbate the frequency, intensity and impact of flooding. The OECD estimates that the number of people at risk will increase from 1.2 to 1.6 billion people between now and 2050. This will represent around 20% of the world population. In 2016, 23.5 million people were displaced because of weather-related disasters, of which the majority were associated with floods or storms. In between 1998 and 2017, floods accounted for close to one-quarter of global economic losses due to natural disasters.

Social, economic and environmental losses due to floods relate to both infrastructure and governance challenges. The increase of such losses in the recent past is not only due to more frequent and extreme floods, but also because of inadequate water and land use planning, as well as unsustainable infrastructure and technical solutions for managing floods. The report acknowledges that "hybrid" solutions, combining green and grey infrastructure measures are needed to address floods. Therefore, careful analyses should be conducted to evaluate the range of available options and design flood management schemes that combine natural, infrastructural and policy instruments in the most effective way.

Adaptation to flood risk requires a diversified approach from structural flood protection measures, early warning systems to nature-based solutions, social protection and risk financing instruments. The correct mix of measures varies from place to place, subject to levels of risk, funding, and political will, therefore, one size-fits-all approach cannot be applied. It will be increasingly important to evaluate choices with strengthened comprehensive, integrated and participatory multilevel governance approaches across foresight, mitigation, preparedness, response and recovery stages of flood management.

The report argues that improved flood governance greatly enhances the design, implementation and impact of flood-related policies and management measures. It stresses the importance of involving stakeholders in flood governance decision-making and increasing policy coordination, especially between water, land and climate change management. Four years after the adoption of the *OECD Principles on Water Governance* and in the framework of the implementation strategy developed under the *OECD Water Governance Initiative*, this report applies the 12 OECD Principles to analyse a compilation of 27 specific cases of flood management from around the world (one case focuses on transboundary strategic plan for flood management; nine cases concern national policy and/or programmes; five cases describe the governance arrangements for the day-to-day management of floods in specific locations; three cases present state/provincial flood management plans; three cases look at specific flood events; and six cases concern research projects, at the national or basin level). The report also builds on the guidance from the Recommendation of the 2014 OECD Council on the Governance of Critical Risks and its high relevance to floods.

The report suggests a Checklist with self-assessment questions to support flood management decision making. The Checklist intends to encourage stakeholder dialogue and peer learning, help understand better how flood governance systems are performing at

local, basin and national level, and guide decisions at all levels. The Checklist primarily targets decision makers and practitioners directly responsible for flood management from the local to the national level, and is expected to be of relevance to risk managers and the broader range of water constituencies and stakeholders.

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Executive summary

Floods have severe impacts on human well-being, economies and ecosystems. The report applies the *OECD Principles on Water Governance* to flood management and unpacks challenges and key features of flood governance approaches, building on insights from 27 case studies from OECD member and non-member countries. For each Principle it provides a Checklist (Annex A) to support stakeholders' self-assessment of flood governance policy frameworks (*what*), institutions (*who*), and instruments (*how*).

Main findings

Fragmentation: Flood management strategies often occur in fragmented policy and institutional settings with gaps, duplications, unnecessary delays, high transaction costs, patchy data and information in decision making. To varying degrees, countries have allocated the increasingly complex and resource-intensive competences on flood management to lower levels of government without necessarily re-distributing required financial and human resources, resulting in suboptimal coordination. The report finds that overall ministries and stakeholders share limited data and information related to floods despite the mutual benefits of doing so, with only 14 of 27 case studies sharing information systems and databases in a systematic fashion.

Policy coherence: A range of policy areas, such as climate change, land-use, environment, agriculture, urban development and infrastructure, influence flood management but tend to be insufficiently co-ordinated. Such mismatches can fuel stakeholder conflicts and generate investment inefficiencies. The progress by countries to improve policy coherence differs and where flood management strategies tend to be insufficient and/or not fully implemented. For instance, the report demonstrates that 22 out of 27 case studies to varying degrees have included consideration of other sectors (e.g. land use, infrastructure, environmental protection and spatial planning) in their strategies, but as many as 19 out of 27 case studies reported that policy incoherencies led to increased costs that could have been avoided by better coordination.

Scale: Floods cut across administrative, hydrological and political boundaries. Policy and planning gaps are common between local and national frameworks, leading to blurred allocation of roles and responsibilities coupled with limited co-ordination across levels of government that can hinder integrated strategies across water users, territorial scales, urban and rural areas. For instance, in Australia responsibility for land and water management, and by extension flood management, is primarily a state/territory government responsibility. However, flood management activities are often devolved to the municipal or local government level where they can become exposed to competing local demands within the same basin.

Stakeholder engagement: Stakeholder platforms are key to foster long-term flood management strategies and plans. Engaging civil society can assist in bridging the public administration's capacity gap for flood management, as illustrated by the experience of Kampen, Netherlands. A variety of stakeholders from governments to experts, users, landowners and NGOs are usually involved in flood-related decisions. However, the report finds that only a few cases engage systematically under-represented groups such as women, poorer local communities and indigenous people, who frequently lack financial resources as well as access to social and political networks.

***Insurance*:** Public and private insurance systems are insufficient and fail to integrate a long-term vision to minimise future flood impacts. The persistent financial protection gap leaves households and businesses – and ultimately governments – exposed to significant risk of financial losses. An example seeking to close this gap is the German "Floodlabel" (*HochwasserPass*) developed by insurance companies and the German Flood Competence Centre as a long-term mitigation approach to support and guide home and building owners in minimising flooding damages.

Recommendations

Conduct self-assessments of flood governance to identify what works, what does not, what should be improved and who can do what.

Governments should assess flood governance to spark stakeholder dialogues and set priorities of what should be done, and develop an implementation action plan. Assessments should be conducted in a transparent, non-biased, open and inclusive manner. The proposed Checklist in the report (Annex A) provides a useful tool for guiding strategic multi-level flood management decision making related to policies, strategies and plans.

Promote multi-level governance to overcome flood management fragmentation.

A multi-level governance approach can minimise misalignments, complexity and overlaps in flood management. For instance, the *Joint Flood Commission* in France brings together the *Steering Council for major natural risks prevention* and the *National Water Committee* to co-ordinate flood management across levels of government and stakeholders from civil and environmental protection, urban planning and land-use.

Encourage policy complementarities across sectoral policies.

Governments must treat climate change and flood management as complementary policy domains and foster more efficient investment decisions. Regulatory frameworks can mediate potential clashes between flood regulations and land use, as illustrated by the *Dutch Delta Programme* and the *Regional Water Forums* in Bavaria (Germany). Greater involvement of spatial planners and risk managers in policy decisions is also required to mitigate flood risk.

Promote stakeholder engagement for inclusive flood policies, strategies and plans.

Flood-related stakeholder engagement often relates to specific measures such as establishing flood-risk maps. Governments must establish platforms to shape long-term strategies and plans within an integrated basin approach. As flood risk intensifies, engaging property developers and landowners will become increasingly important as in the case of the participatory flood-monitoring programme of Vivaqua, a drinking water and sanitation service provider in Belgium. It is equally important to ensure that marginalised or vulnerable stakeholders benefit from engagement, as exemplified by the flood prevention

programme of Alsace-Moselle (France), where the benefits and costs of flood governance measures were distributed equitably.

Enhance coordination across local, regional, basin and national levels of government.

Political will is important for addressing flood challenges. Floods are basin wide phenomena that do not respect administrative borders. Flood management is a shared responsibility with a primary role for national governments to develop policies, laws and institutions, and effective strategies for natural resources development. However, multi-level cooperation is key to manage trade-offs, share information and co-ordinate upstream and downstream water users. River basin organisations or catchment-oriented institutions have an important role to play as intermediaries for inter-municipal or regional flood co-operation as exemplified by the work of river committees in Wallonia (Belgium) and the expansion of the scope of municipal flood management in France.

Promote financing mechanisms that respond to flood management mitigation.

Governments should diversify sources of finance and promote payments for ecosystem services, international development cooperation, co-finance schemes and robust insurance systems. Belgium, England, France and Poland employ cost-benefit analyses to increase the efficiency of flood governance approaches, while other countries rely on the "polluter pays" and "user pays" principles to manage trade-offs for financing flood management. Greater *ex ante* investment in flood mitigation and prevention can effectively reduce long-term financial needs. At present, 90% of international assistance is spent on emergency response versus 10% on disaster-risk reduction and preparedness. An example in Japan noted the significant effect of preventive measures: if the *Levee Reinforcement* prevention project had been implemented before the 2000 Tokai storm flood, USD 5 billion would have been saved.

Chapter 1. Managing floods today – Setting the scene

This chapter outlines some of the main challenges and drivers to floods. It points to some particular needs of reducing flood risks by not only working on conventional approaches but to work on coordination of policy measures (such as between water and land management) and more comprehensive multi-level governance approaches. The chapter presents some of the methodological elements and considerations of developing the OECD Checklist for Assessing Flood Governance Arrangements. The analytical framework of the Checklist is based on the 12 OECD Principles on Water Governance that aim to assist governments and stakeholders to improve water governance systems to help manage water resources and water services challenges of "too much", "too little" or "too polluted" water. Finally, the chapter discusses the collection of the 27 case studies in both OECD and non-OECD countries that have informed the report.

Mounting challenges of too much water

Almost no country in the world is spared from floods or the risk of floods. By 2050, 1.6 billion people will be at risk of flooding (as compared with 1.2 billion in 2013), affecting nearly 20% of the world's population (OECD, 2013a). Europe and North America face increasing economic, social and environmental risks related to flooding, while India, China and Viet Nam are salient examples of countries at risk in the developing world (Sadoff et al., 2015). China and India, in particular, are at greatest potential risk of urban flood damage, to the tune of more than USD 100 billion by 2080 (OECD, 2015c), while in Europe, annual flood damages could rise to EUR 100 billion by 2080 (Alfieri et al., 2015b.) Floods, "the temporary covering by water of land not normally covered by water" (EU, 2007), include river or fluvial floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods and floods produced by outbursts from glacial lakes (IPCC, 2012). Different forms of governance are required for each of type of flooding if they are to be tackled effectively.

Megatrends such as climate change, population growth and urbanisation have a high impact on the frequency and intensity of water-related events, such as floods. Population growth increases the likelihood and potential impact of floods, since it puts pressure on sewer systems and encourages urban expansion into areas at high risk of flooding. Rapid urban expansion can result in the loss of farmlands, forests and lands, thus increasing the pressure on drainage systems. This can lead to increased flood flow in urban areas, which may constitute a hazard for the population and infrastructure. Climate-driven rising sea levels threaten coastal cities and low-lying island states, and changing rain patterns associated with excess rainfall lead to greater surface runoff. Outdated land and water use plans and aging and inadequate infrastructure also increase the risk of water-related events. A combination of factors can cause floods, including if rivers overflow defences, groundwater levels rise, or as a result of extreme rainfall or recharge events, inadequate drainage systems, coastal flooding and erosion, storm surge and isostatic readjustment of the land following the last Ice Age.

Floods have social, economic and environmental consequences. Today, between 100 million and 200 million people per year are victims of water-related disasters, almost two-thirds of which are a result of floods. In 2016, 23.5 million people were displaced because of weather-related disasters, of which the majority were associated with floods or storms (World Meteorological Organization, 2017). Floods account for one-third of all economic losses due to water-related disasters (OECD, 2012). Economic losses due to water-related disasters were estimated at USD 50 billion to USD 100 billion per year between 1980 and 2009.[1] Other losses may include damage to the environment, biodiversity and cultural heritage, as well as human life and health, property (OECD, 2018a) and crop production (OECD, 2018b).

Global agendas are calling for the prevention of water-related disasters, including floods. The relevant Sustainable Development Goals (SDGs) that cover this issue include: SDG 6 on supply and sanitation for all, SDG 11 on making cities and human settlements inclusive, safe, resilient and sustainable and SDG 13 on climate change. The Sendai Framework for Disaster Risk Reduction 2015-2030 makes an urgent plea to "strengthen disaster risk governance to manage disaster risk". An integrated urban water management and waste management system, as part of an Integrated Water Resources Management aligned with the New Urban Agenda, can also help manage water resources in a holistic and sustainable manner. Meeting the Paris Climate Agreement and cutting emissions could help reduce

risk, damage and loss from flood disasters. To achieve these ambitious goals, it is crucial to co-ordinate water management across people, policies and places.

The need to improve flood governance

Conventional approaches are a prerequisite for sound flood management, but they need to be integrated in more comprehensive multi-level governance approaches. Conventional approaches for managing floods include a focus on traditional physical or *grey* infrastructure and reliance on physical science and technical expertise (OECD, 2013a; STAR-FLOOD, 2016). Grey solutions are considered constructed assets, such as flood defences in the form of dikes, dams and embankments, and are typically used in urban areas. Physical flood protection measures, such as dikes and levees, are generally cost-effective in areas with high population and asset concentrations. Moreover, estimations of the investment needed to reduce water risks, and cost-benefit analyses are typically used as a basis for decision making on floods (OECD, 2013a). Conventional approaches cannot be the sole basis of decision making (Rees, 2002), for several reasons:

- First, flood-risk assessment and management typically overlook stakeholders' perception of risk (whether individuals or businesses). Such perceptions have an important influence on decisions affecting vulnerability to flooding and ability to mitigate risk. Factoring in such perceptions is a crucial element in assigning clear roles and responsibilities for managing flood risk (Runhaar et al., 2016).
- Second, flood-risk assessment and management often fail to account for the complex interconnections between policy instruments, because they focus on simple, generic assessments of technical measures. They are often applied piecemeal to certain aspects of water management (e.g. drinking water standards and flood control) but do not cover water resource management holistically from a risk perspective (OECD, 2013a).
- Third, combining grey infrastructure with green infrastructure approaches (in the form of, for instance, nature-based solutions) can result in cost savings and reduced risk (UNWWAP/UN-Water, 2018).
- Fourth, most cost-benefit analysis methodologies discount the future (discount rate) and long-term negative externalities of some measures that manifest only decades later. This is a significant issue in the context of climate change. Users of these methodologies also have difficulty accounting for those that cannot be assigned a monetary value, and often omit cross-sectoral externalities as well as indirect costs and benefits.
- Fifth, governance and management of flood mitigation measures offer a window of opportunity to bridge incompatibility between water and land management. For example, restoration of floodplains, removal of embankments, riparian buffers and restriction of encroachments are measures that should combine land and water management (Milman et al., 2017). Often, these measures involve trade-offs, incurring costs or requiring changes to provide flood protection for others. Land use and management is a primary component of the flood-risk system (Hartmann et al., 2018b). The basin level is a "natural" scale for flood governance, allowing planning and mitigation measures to be co-ordinated across the basin (places) and linked with other sectors (policies) and stakeholders (people). More attention needs to be paid to governance and management as well as grey and green infrastructure

measures for living with floods and being prepared for them (OECD, 2017). The Sendai Framework also notes the importance of "public and private investments in structural and non-structural measures to increase economic and social resilience to disasters" (UNISDR, 2015b).

On the other hand, implementation of nature-based solutions remains somewhat piecemeal. Fully exploiting the potential of nature-based solutions will require overcoming a number of challenges (see for example Kabisch, et al., 2016; Nesshöver, et al., 2017; and O'Donnell, et al., 2017)

- First, "technical challenges": Nature based solutions cannot always replace grey infrastructure, as they have different characteristics and requirements than traditional approaches to infrastructure provision. For example, the use of wetlands for water purification requires significantly more land than building a wastewater treatment plant. In addition, many nature-based solutions rely on ecological restoration processes that can take many years to provide evidence of tangible results.
- Second, methodological challenges: There is still a need to demonstrate that nature based solutions can deliver an equivalent performance to conventional infrastructure, and continue to deliver benefits over time. For example, a key challenge associated with monitoring, reporting and verification of forest carbon removals is the non-permanence risk: the storage of carbon in forest biomass and soil is reversible (Grimault et al., 2018). Various engineering norms and standards may need to be updated to allow for the use of such non-traditional approaches.
- Third, institutional and governance challenges: Governments, local authorities and property developers may not consider nature based solutions because of a lack of knowledge and the perception that they cost more to install. Other barriers include siloed institutional arrangements; lack of government staff expertise, capacity and resources; and a disconnect between short-term actions and long-term goals. In addition, prevailing regulations, funding mechanisms and lock-in failures can act as disincentives to the use of nature-based solutions. Finally, policies relating to land ownership and use, biodiversity conservation, water management, energy and other sectors, are also key to the feasibility and appeal of implementing nature based solutions.

Managing flood risk involves dealing with uncertainty and complexity, and calls for appropriate, resilient[2] arrangements at the transboundary, national, regional and local levels.[3] The scale, size and spatial organisation of a given place, as well as its demographic and governance dynamics, have an impact on floodwater functions and management, linkages across sectors, the ability to engage other stakeholders and implementation capacity.

No single governance response to floods can fit all cases worldwide, but a combination of approaches and place-based policies integrating territorial specificities is called for. Each country has different governance conditions and capacities for responding to these challenges. For example, the Netherlands, where coordination across government levels and stakeholders allows for more effective longer term planning, has started to set up its proactive strategies and solutions for the climate scenarios forecast for 2050 (OECD, 2018a), while in Bangladesh, with highly fragmented water institutions and with big investment and human capacity challenges, responses tend to be reactive and short-term. Governance works as a means to an end and the type of governance needs to match the

level of risk or the magnitude of the problem to fit policies to places and people (OECD, 2018a). In both OECD and non-OECD economies, at local, national or transboundary levels, there is room for more adaptable, context-dependent and place-based policy responses. The water sector and the flood sub-sector is still very fragmented, and it is important to consider multiple, interconnected governance gaps that tend to reinforce each other (OECD, 2011).

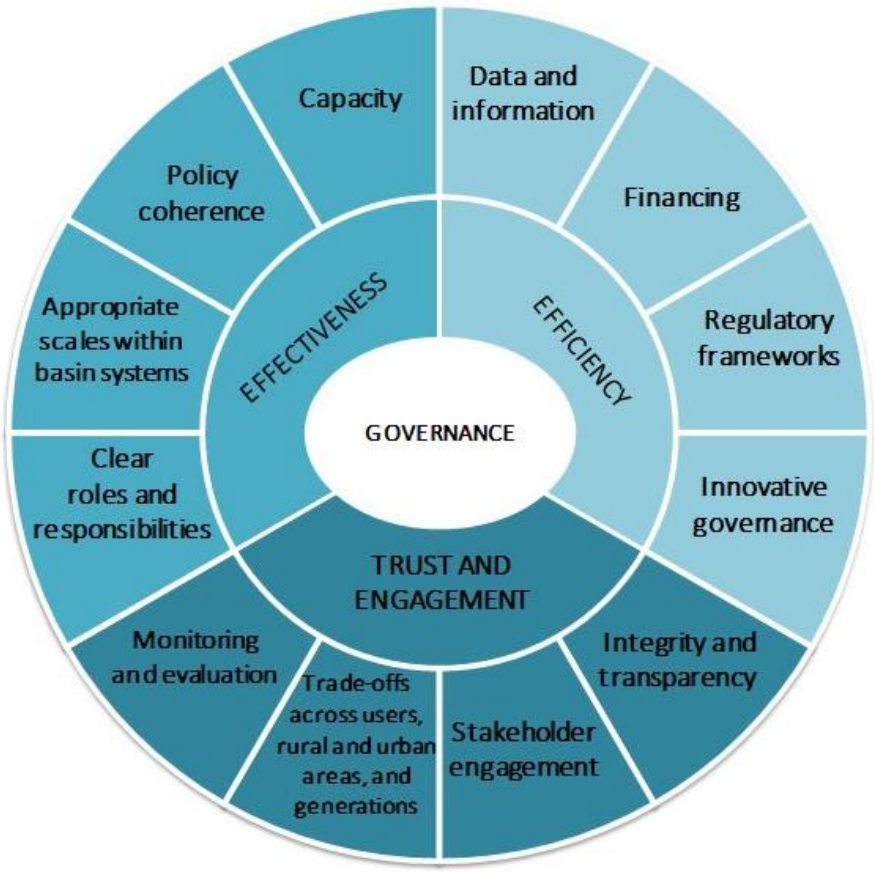
Governance systems should be designed based on the challenges they need to address. A comprehensive approach to flood policy requires diagnosing and overcoming multi-level governance challenges in design, regulation and implementation. These challenges include (as adapted from the OECD Multi-level Governance Framework):

- Institutional and territorial fragmentation of flood policy across multiple actors and lack of effective policy coherence across sectors (**policy gap**).
- Mismatched administrative and hydrological boundaries for managing flood and water resources at the relevant scale (**administrative gap**).
- Questionable resource allocation and patchy financial management in undertaking flood-related responsibilities (**funding gap**).
- Gaps in scientific, human, technical and infrastructural capabilities for designing and implementing sustainable, efficient and effective flood policies and strategies (**capacity gap**).
- Ineffective stakeholder engagement for inclusive and transparent flood-related decision making; insufficient or irregular monitoring, evaluation and enforcement (**accountability gap**).
- Divergent objectives that inhibit synergies and complementarities for managing floods at the appropriate scale (**objective gap**).
- Insufficient or incomplete flood-related data and information systems for assisting decision makers (**information gap**).

Analytical framework

The analytical framework in this report is organised around the 12 OECD Principles on Water Governance. These were adopted in May 2015 by the OECD Regional Development Policy Committee and backed by ministers at the OECD Council Meeting at Ministerial Level in June 2015.[4] The OECD Principles set standards for governments to improve the economic, social and environmental benefits of good water governance through effective, efficient and inclusive design and implementation of water policies. They aim to enhance water governance systems that help manage “too much”, “too little” and “too polluted” water in a sustainable, integrated and inclusive way, at an acceptable cost, and in a reasonable period (Figure 1.1. OECD Principles on Water Governance). The Principles apply to the overarching water management cycle and should be implemented in a systematic and inclusive manner.

Figure 1.1. OECD Principles on Water Governance



Source: OECD (2015a), accessible at www.oecd.org/governance/oecd-principles-on-water-governance.htm.

The Principles recognise that governance is contextual. They acknowledge that water policies need to be adapted to different water resources situations and places, and that responses should adapt to changing circumstances. The Principles establish that coping with current and future challenges requires robust public policies, targeting measurable objectives according to predetermined time schedules at the appropriate scale, relying on a clear assignment of duties across the authorities responsible, and performing regular monitoring and evaluation. They assert that governance can greatly contribute to the design and implementation of such policies, with the responsibility shared by different levels of government and by civil society, business and a broad range of stakeholders, as well as policy makers.

The OECD Principles on Water Governance provide a framework for understanding water governance systems, determining whether they are performing optimally, and helping to adjust them where necessary. They can catalyse efforts for making good practices more visible, learning from international experience, and putting reform processes in motion at all levels of government, to facilitate change when and where needed. They can also help avoid traps and pitfalls, learning from international experience.

The Principles were initially developed to apply to water governance arrangements in general, regardless of water management functions, water uses and ownership. However, since their adoption, the Principles have proven to be general and flexible enough to be applied to guide activities and practices across different scales, stakeholders and sectors (OECD, 2018a).

The Principles contribute to tangible and outcome-oriented public policies, based on three mutually reinforcing and complementary dimensions of water governance:

- *Effectiveness* relates to the contribution of governance to define clear, sustainable water policy goals and targets at all levels of government, to implement those policy goals and to meet expected targets (Principles 1-4).
- *Efficiency* relates to the contribution of governance to maximise the benefits of sustainable water management and welfare at the lowest cost to society (Principles 5-8).
- *Trust and engagement* relate to the contribution of governance to building public confidence and ensuring inclusiveness of stakeholders through democratic legitimacy and fairness for society at large (Principles 9-12).

The ensuing chapters deal with these three interrelated dimensions.

Managing floods is an emblematic of the shared responsibilities between public, private and civil society and across levels of government, and of the need for place-based policies within national frameworks. It offers an opportunity to explore how the OECD Principles relate to the specificities of flood management and help to appraise implementation of the framework conditions of the existing water governance system. This report aims to help interested countries self-assess and improve the performance of their flood governance system, as well as to encourage collective learning and peer support.

Methodology

Developing a Checklist to assess flood-risk governance arrangements

A Checklist was developed to help stakeholders and governments self-assess the preparedness of government systems to flood risks (see Checklist in Annex A). The Checklist is an application of the OECD Principles on Water Governance to floods, and for each principle, assesses the state of play of flood governance policy frameworks (what), institutions (who), instruments (how) and their impact. It consists of 100-plus priority questions and indicators to help governments and stakeholders appraise the governance of floods, identify areas of improvement and create common ground for policy makers and practitioners. The Checklist is applicable across all scales of water management (city, basin, region, country) and is conceived as a voluntary self-assessment tool to encourage a transparent, neutral, open, inclusive and forward-looking dialogue across stakeholders on what works, what does not, what should be improved and who can do what.

The Checklist was developed based on the 36 indicators (input and process) and the list (of more than 100 questions) that make up the OECD Water Governance Indicator Framework and the OECD Recommendations on the Governance of Critical Risks:

- The OECD Water Governance Indicator Framework provides the voluntary and self-assessment spirit of the Flood Checklist. The lessons learnt in developing the indicator framework were crucial for customising the questions of the Checklist.

- The OECD Recommendations on the Governance of Critical Risks (see Box 1.1) proposes a fundamental shift in risk governance towards a whole-of-society effort, and proposes actions that governments can take at all levels of government, in collaboration with the private sector and with each other.

Box 1.1. OECD Council Recommendations on the Governance of Critical Risks

The OECD Recommendations on the Governance of Critical Risks proposes five overarching actions that governments at all levels can take to assess, prevent, respond to and recover from the effects of extreme events, including floods:

1. Members establish and promote a comprehensive, all-hazards and transboundary approach to country risk governance to serve as the foundation for enhancing national resilience and responsiveness.
2. Members build preparedness through foresight analysis, risk assessments and financing frameworks, to better anticipate complex and wide-ranging impacts.
3. Members raise awareness of critical risks to mobilise households, businesses and international stakeholders and foster investment in risk prevention and mitigation.
4. Members develop adaptive capacity in crisis management by coordinating resources across government, its agencies and broader networks to support timely decision-making, communication and emergency responses.
5. Members demonstrate transparency and accountability in risk-related decision making by incorporating good governance practices and continuously learning from experience and science.

Source: OECD (2014a), Recommendation of the Council on the Governance of Critical Risks, adopted on 6 May 2014 at the Meeting of the OECD Council at Ministerial Level in Paris.

Collecting case studies

The Checklist was used to collect flood governance case studies from a wide range of stakeholders. The 27 case studies (Table 1.1) were collected after a broad call was sent out from 10 October and 2 November 2016, through channels that included the existing networks of flood protection professionals (e.g. STAR-FLOOD networks, European Union (EU) Working Group Floods members, etc.) and water-related email lists. Interested stakeholders were invited to complete the Checklist by marking the boxes and providing qualitative responses to the questions.

Table 1.1. List of case studies collected

	Case study	Location
1.	Upstream-downstream co-operation on flood management in Austria	Austria
2.	Strategies for delta governance in Bangladesh	Bangladesh
3.	The Piracicaba watershed flood in 2010 and 2011	Brazil
4.	Infrastructure vulnerability assessment of impacts of climate change in the United Counties of Prescott and Russell Culvert	Canada
5.	Adapting the suburb of Lystrup to heavy rain	Denmark
6.	Copenhagen's Cloudburst Management Plan	Denmark
7.	Flood governance in Middle Awash	Ethiopia
8.	Participation and flood management on the Rhone River	France
9.	Flood management in the upstream Bièvre River Basin	France
10.	Flood management in the Vilaine River basin	France
11.	Action programme for flood prevention of the Alsace-Moselle intermunicipal water service provider	France
12.	From flood protection to flood precaution: Cologne's approach update towards flood management	Germany
13.	The development of a draft Plan for the mitigation of hydrogeological risk in metropolitan areas and urban areas with high levels of population exposed to flood risk	Italy
14.	The role of the State Water Commission in flood protection in the state of Morelos	Mexico
15.	National Programme against Hydraulic Contingencies (PRONACCH)	Mexico
16.	Enhancing the emergency preparedness of flash flood victims in the Moldavian-Ukrainian transboundary Prut river basin, by establishing a numerical flash flood early-forecasting service	Moldavia / Ukraine
17.	The "Room for the River" programme	Netherlands
18.	The Flood Defence Programme of the Rivierenland Regional Water Authority	Netherlands
19.	Flood river management in the Chakar river basin of Sibi Balochistan	Pakistan
20.	Mediating integrated actions for reducing flooding in a changing climate	Poland
21.	The Eddleston Water Project	Scotland
22.	Assessing the dynamics of flood governance after the Seoul floods in 2013	South Korea
23.	Participatory flood management of the Arga and Aragon rivers	Spain
24.	Flood management in Granada	Spain
25.	The Herne Hill and Dulwich Scheme: Implementing partnership funding policy for flood management	England and Wales
26.	Surface water mapping for Flood Risk Regulations	England and Wales
27.	West Sussex Pathfinder: building community resilience	England and Wales

Note: A list of case study promoters is available in Annex B. Snapshots of the case studies are available at: https://oe.cd/pub/2Cd

Analysis of flood-risk governance arrangements

Drawing on the findings of the Checklist that made it possible to collect 27 case studies across OECD and non-OECD countries, this report attempts to unpack the key characteristics of flood governance arrangements, analyse common features and identify good practices. It builds on case studies that provide valuable insight into the realities of practicing flood governance. These experiences, together with discussions with flood practitioners, have shed light on the persistent challenges that must be overcome to deal with fragmentation and to make flood governance effective, efficient, inclusive and trustworthy.

The case studies represent a panorama of existing governance arrangements in areas where floods are a prevalent issue, and are introduced throughout the report to illustrate the assessment (Box 1.2).

Box 1.2. The 27 case studies on flood-risk governance arrangements

The 27 case studies collected in the framework of the project represent a diversity of geographic location, management scale and thematic focus. These cases were submitted by national government representatives (5 cases), sub-national authorities (3 cases), river basin organisations (5 cases), operators (2 cases), research institutes (11 cases), and a consulting firm (1 case).

Geographic distribution: The case studies collected are from 12 OECD and 5 non-OECD countries, and cover all five continents. The overrepresentation of European cases can be explained by the important role played by European researchers (STAR-FLOOD) and the EU Flood Working Group in putting out the call for case studies.

Table 1.2. Cases by geographical distribution

Europe [19 case studies]	Austria, Denmark (2), France (4), Germany, Italy, Netherlands (2), Poland, Scotland, Spain (2), England and Wales (3). One case study concerns transboundary contexts of the Prut river [Moldova/Ukraine].
Latin America [3 case studies]	Brazil and Mexico (2)
North America [1 case study]	Canada
Asia-Pacific [3 case studies]	Bangladesh, Pakistan, Korea
Africa [1 case study]	Ethiopia

Source: Author's research.

Scale: Case studies are set at different scales, according to the administrative (national, regional, local) or functional boundaries (floodplain, sub-basin, basin, transboundary basin, etc.).

Table 1.3. Cases by scale

Administrative boundaries	National level [7 case studies]
	Regional/provincial/state level [3 case studies]
	Local level [5 case studies]
Functional boundaries	Floodplain [2 case studies]
	River basin [9 case studies]
	Transboundary basin [1 case study]

Thematic focus: Case studies recount a variety of experiences on flood management.

- 1 case focuses on a transboundary strategic plan for flood management;
- 9 cases concern national policy and/or programmes;
- 5 cases describe the governance arrangements for the day-to-day management of floods in specific locations;
- 3 cases present state/provincial flood management plans;
- 3 cases look at specific flood events; and
- 6 cases concern research projects, at the national or basin level.

Conclusion

Governments at all levels have a critical role to play in setting the enabling environment for effective, efficient, fit-for-purpose and outcome-oriented flood policies. Central and sub-national authorities, as well as other stakeholders, can incentivise the wide range of options reflected in the set of overarching OECD Principles on Water Governance to address flood challenges and identify how to design approaches to flood governance in the future.

To guide public action in this direction, the OECD has developed a Checklist intended as a standard that governments can follow when designing, implementing and evaluating flood policy, projects and practice. The following chapters propose a Checklist for Flood Action and set out practices illustrating the Principles. This can help identify areas of improvement, provide some ways forward and create common ground for policy makers and practitioners. The questions in the Checklist concerning flood action and the OECD Water Indicator Framework, are organised around an assessment of the current situation, in a "policy framework" section (what); the governance tools in place, in an "instruments" section (how); the existence and functioning of dedicated institutions, in a "institutions" section (who); plus the effect of current policy choices, in an "impacts" section.

The Checklist was used to collect 27 case studies in flood governance across a wide range of stakeholders, and the information provided was analysed to sketch out best practices and lessons learnt for more effective, efficient and inclusive flood management. The key features of these case studies have been analysed against three mutually reinforcing dimensions of water governance: Effectiveness of flood governance (Chapter 2), Efficiency of flood governance (Chapter 3) and Trust and engagement in flood governance (Chapter 4). For each Principle, the chapters are structured around its content, its associated indicators and the customised questions for assessing flood governance. With each Principle, the information collected for the 27 case studies through the Checklist was analysed and organised around observations, areas to improve and ways forward. Cross-case reasoning can guide the reader through varying flood governance arrangements and encourage peer-to-peer dialogue and bench-learning across different governance scales facing similar types of flood challenges.

Notes

[1] Estimates of economic damage may not be reliable, given the different definitions, methods of estimation, monetary units and purchasing power across countries.

[2] Resilience is the capacity of a social-ecological system to absorb or withstand perturbations and other stressors, such that the system remains within the same regime, essentially maintaining its structure and functions. It describes the degree to which the system is capable of self-organisation, learning and adaptation (Gunderson and Holling, 2002; Walker et al., 2004). In the context of floods, resilience may entail the capacity to resist, absorb, recover and adapt. For a discussion on the concept of resilience, see Keessen et al. (2013).

[3] For state-of-the-art information on the changing flood risks, see Alfieri et al. (2015a).

[4] The OECD Principles on Water Governance were adopted by the OECD Regional Development Policy Committee on 11 May 2015 and welcomed by Ministers at the OECD Ministerial Council Meeting on 4 June 2015. The Principles were endorsed by 140 major stakeholder groups in 2015. Their development relied on a two-year bottom-up and multi-stakeholder process within the OECD Water Governance Initiative, a network of 100-plus stakeholders from public, private and civil society sectors, gathering twice a year in a Policy Forum.

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Chapter 2. Effectiveness of flood governance

This chapter looks at the Principles related to effectiveness of water governance. It brings attention to flood governance in association with the importance of defining and implementing clear institutional roles and responsibilities, policy coherence, the need for appropriate capacities to implement and manage floods at appropriate scales. It applies the Checklist and makes observations and analysis of each Principle, it points to particular areas of improvement and it points to examples of ways forward. The chapter contains case study examples highlighting flood governance under different contexts.

Principles 1 to 4 provide a framework for understanding whether the institutions and policies concerned with flood governance are performing effectively. *Effectiveness* of water governance relates to the contribution of governance to define clear sustainable water policy goals and targets at different levels of government and to implement those policy goals to meet expected objectives or targets.

The four Principles deal explicitly with institutional frameworks linked to policy development and implementation, such as co-ordination functions of water management and use. They include managing water across various scales (from local to transboundary) and various sectors, such as energy, agriculture, environment and industry, to ensure co-ordinated decision making and policy coherence. Finally, they also draw attention to developing the appropriate level of capacity to respond to various water challenges (see Figure 1.1).

The system used should enable institutions to realise their mandates (for example related to regulation of land and water use) and ensure that policies are implemented according to intentions for improved flood governance. Simply put, the performance of the governance system has a critical effect on for example, how well early-warning systems work, and to what extent flood control and mitigation measures achieve the desired results, as well as rapid-response mechanisms when flooding occurs.

Principle 1: Roles and responsibilities

Box 2.1. OECD Principle 1: Sub-principles, Indicators and Flood Checklist

Principle 1. Clearly allocate and distinguish roles and responsibilities for water policy making, policy implementation, operational management and regulation, and encourage co-ordination across the responsible authorities.

To that effect, legal and institutional frameworks should:

a) Specify how roles and responsibilities for water are to be allocated, across all levels of government and water-related institutions for:

- Policy making, especially priority setting and strategic planning;
- Policy implementation, especially financing and budgeting, data and information, stakeholder engagement, capacity development and evaluation;
- Operational management, especially service delivery, infrastructure operation and investment; and
- Regulation and enforcement, especially tariff setting, standards, licensing, monitoring and supervision, control and audit, and conflict management;

b) Help identify and address gaps, overlaps and conflicts of interest through effective co-ordination at and across all levels of government.

Figure 2.1. OECD Indicators Principle 1

Source: OECD (2018a), *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264292659-en.

Table 2.1. OECD Flood Checklist for Principle 1

	Checklist questions
Policy framework	How are roles and responsibilities allocated?
	In your case study, which reforms or changes in other policy areas affect the allocation of roles and responsibilities for flood management in particular?
	Is there a dedicated flood policy, indicating goals, responsibilities, resources needed?
	Are there flood-related legal and institutional frameworks or regulations in your country?
	Have applicable binding and non-binding flood-related international or supranational frameworks and regulations been transposed at the national (or sub-national) level(s)?
Institutions	Who is in charge (formally/informally) of what for the following stages of flood management in your case study?
Instruments	How are roles and responsibilities regularly reviewed to adapt to changing circumstances and make sure they are always fit?
	Which vertical co-ordination mechanisms are in place in your case study to regularly identify and address gaps, overlaps and conflicts of interest regarding roles and responsibilities for flood governance?
	Which horizontal co-ordination mechanisms are in place in your case study to manage interdependencies for flood policy design and implementation?
	In your case study, are the effectiveness, efficiency and inclusiveness of such mechanisms monitored and evaluated?
Impacts	Were the impacts of fragmentation of roles and responsibilities on the effectiveness of flood-risk governance arrangements assessed in your case study?
	In cases where fragmentation is negative and undesired, what were the impacts of a fragmentation of roles and responsibilities on the effectiveness of flood-risk governance arrangements?

Note: The full Checklist, including options for responses, can be found in Annex A.
Source: Authors' own research.

Observations

Various roles and responsibilities are involved in water management at large, and flood management in particular. In many OECD and non-OECD countries, the allocation of roles and responsibilities in flood management is widely distributed across several scales, ranging from national to sub-national and basin levels, as well as across sectors. Responsibilities are typically defined and allocated by the Constitution or by national law (accounting for 22 out of the 27 case studies collected). In other instances, modalities for defining the allocation of roles and responsibilities are set by contract, as evidenced by 10 of the case studies collected or by a charter, for seven cases. The case studies also illustrate situations where roles and responsibilities are not officially allocated but rather defined according to informal agreements, such as in the framework of partnerships (Figure 2). Unclear roles and responsibilities can lead to conflict between institutions, as occurred with the delta governance in Bangladesh. In France (Flood Prevention Action Programmes), the problem concerns discrepancies between the technical expertise and knowledge that undermines co-ordination across authorities.

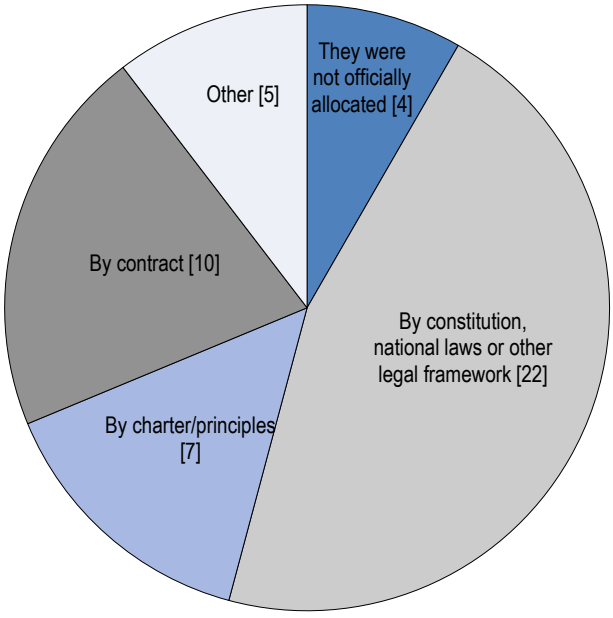
Allocation of roles and responsibilities may be regularly reviewed to adapt to changing circumstances and to ensure they are appropriate. The European Floods Directive requires that Flood Risk Management Plans be reviewed every six years. The review and/or update of flood-risk management policies and plans can be a good occasion to take stock of and adjust the allocation of roles and responsibilities, as illustrated by 19 case studies. Other means include the organisation of internal meetings as part of projects and citizen platforms, such as observatories or public meetings. They may also be the prerogative of the national regulator or a parliamentary commission. Often, several of these processes are used simultaneously to revise the allocation of roles and responsibilities. For 19 out of 27 case studies collected, more than one review mechanism is used. The design and implementation of Flood Risk Management Strategies (FRMSs) often take place in a fragmented setting. To varying degrees, countries have allocated the increasingly complex and resource-intensive competences to lower levels of government, including management of floods. This is not always compatible with the unpredictable and inadequate revenues of the institutions concerned (i.e. funding gaps) and tends to result in less coordination between multiple authorities.

- In France, for example, decentralisation has resulted increasingly in flood management policies at the local level. While the national government still have flood management programmes and controls policy and law making and procedures, the responsibility for flood infrastructure has devolved in part to the municipal level. Current territorial reforms in France have reallocated competences to the inter-municipal and metropolitan levels, for example for the maintenance of hydraulic structures used in flood prevention. However, French state services continue to manage flood and coastal risk prevention plans (*Plans de Prévention des Risques d'Inondation*, *Plans de Prévention des Risques Littoraux*).
- Such multi-level coordination challenges are also seen in England, where the Floods and Water Management Act of 2010 attempted to tackle the issue by making it a statutory duty for national agencies and local authorities to co-operate and align their strategies (Hegger et al., 2013).
- The division of responsibility is also a significant issue in Australia. The state governments are constitutionally responsible for land and water management, and by extension, flood management. However, Australian state governments, as in many other places of the world, face challenges in how to balance priorities in

planning portfolios of economic growth and flood management risks. The responsibility of state governments for flood prevention and mitigation does not always match with financial responsibilities once flooding occurs. The consequences of flooding are for the most part paid for by a different level of government: the federal level (see Productivity Commission, 2014; Abel et al., 2011). A risk with this set up is that it can dis-incentivise state governments to make some of the required investments in flood management.

Figure 2.2. How roles and responsibilities for flood management are defined

22 case study promoters responded



Note: Responses correspond to the total number of case studies that ticked each possible answer in the Checklist. Respondents could tick more than one answer.
Source: Data from studies on flood governance collected for the OECD project (October 2016).

Institutional fragmentation can affect the effectiveness of flood-risk governance arrangements. Two-thirds of the case studies collected assess this impact using methods such as interviews, stakeholder consultation and stakeholder mappings or parliamentary reviews. In these cases, the assessment revealed that fragmentation can spark conflicts among stakeholders in charge of flood management (as illustrated in 13 case studies); generate negative environmental impacts (in 8 case studies); or lead to an uneven distribution of resources and unclear accountability lines (seen in 8 case studies also). Experience in other case studies attests to multi-level challenges that can derive from institutional fragmentation, including inconsistencies between national and local goals/strategies, overlapping or conflicting policies, and the heavy workload assumed by lower levels of government for handling flood management.

Dispersion across agencies is not inherently negative. It may also imply what is called "polycentricity" (Cairney, 2012), where responsibilities are not all concentrated in a single place. It is essential to assess carefully whether dispersed decision making is positive and desired, or negative and unwanted. This implies looking at co-ordination mechanisms among responsible authorities and stages of flood management and their effectiveness. In the United States, for example, the Federal Emergency Management Agency (FEMA) is responsible for "co-ordinating government-wide relief efforts. It is designed to bring an orderly and systemic means of federal natural disaster assistance for state and local governments in carrying out their responsibilities to aid citizens" (FEMA, 2016).

Various mechanisms are used to address the negative effects of institutional fragmentation. The majority of case studies collected illustrate that organisations and tools that bridge knowledge development and decision-making processes are most often used. They typically include research institutes, interactive maps and simulation models. Other typical mechanisms for tackling overlaps or conflicts of interest are vertical and horizontal co-ordination mechanisms, such as conferences that gather local and sub-national players in flood governance, and the use of co-ordinating actors (as in 17 case studies). Information and knowledge also help to co-ordinate roles and responsibilities, such as shared database and information systems and platforms through which stakeholders can create collective knowledge (as in 14 case studies). Inclusive decision-making processes are key for co-ordinating various flood management actors, interests and conflicts. For instance, Alsace-Moselle Water and Sanitation Union (*Syndicat des Eaux et d l'Assainissement*) in France has deployed an adaptive governance model to combat the challenges of fragmentation (OECD, 2018a). It consists of allocating roles and responsibilities at the lowest appropriate level for the topic concerned. This is done through the SDEA's Thematic Commissions, which provide an opportunity for members to make proposals on the projects that SDEA is developing.

While monitoring the effectiveness, efficiency and inclusiveness of co-ordination mechanisms is current practice, it is not yet mainstreamed in flood-risk governance arrangements. Less than half of the collected case studies reported assessing the strength of their co-ordination tools. Those that do rarely use the same approach: some rely on indicators and regular monitoring (in two case studies), parliamentary reviews (1 case), research projects (1 case), while others carry out project implementation reviews (3 cases) and subsequent evaluations (2 cases).

Areas for improvement

As the observations show, the water sector is associated to high levels of territorial and institutional fragmentation of actors and lack of policy coherence (policy gap), and thus to deep complexity, provided that it faces overlaps. For each of the five stages of flood management[1] (see definitions in Annex C of the Checklist), there is a diversity of responsible stakeholders at various scales. They can be responsible for policy making (e.g. defining flood-policy directions), policy implementation (e.g. financing and budgeting, capacity development, evaluation), operational management (e.g. running warning systems, owning and maintaining flood-risk management assets), and regulation and enforcement (e.g. land use in floodplains, the EU Floods Directive and standards and licensing issues). The lack of co-ordination mechanisms across multiple actors can hinder effective policy design and implementation for flood management (e.g. delays, high transaction costs, patchy information, etc.). In the case of flood management in the city of Granada, Spain, there are too many institutions involved, which ends up dissipating responsibility and leadership and affects the decision-making processes. There is an

inherent potential for conflicts when the allocation of roles and responsibilities across policy areas and between levels of government is unclear.

Ways forward

In addition to the division of responsibilities over multiple levels, the distribution of responsibility over sectors is relevant (e.g. water system management, disaster management, spatial planning) (see Principle 3). A clear definition and allocation of roles and responsibilities in flood management, combined with effective coordination mechanisms are thus essential to diagnose inconsistencies and redundancies, to avoid grey areas, and to ensure the effectiveness of the water policy cycle. It can also serve to mobilise sufficient and stable finance for flood management. Furthermore, catchment authorities (where they exist) and the increasing autonomy of lower levels of governments need to be granted the financial support and capacity to carry out flood functions. Closing the knowledge and expertise gap may facilitate collaboration amongst authorities. Co-operation in the form of partnerships is required between levels of government and basin levels, as well as across sectors, to meet flood challenges. The case studies also show that more than one co-ordination mechanism is often needed, and that co-ordination is mainly achieved through a mix of instruments, both formal (co-ordinating bodies, contractual arrangements) and informal (bridging concepts such as multi-layered safety, etc.).

Principle 2: Appropriate scales within basin systems

Box 2.2. OECD Principle 2: Sub-principles, Indicators and Flood Checklist

Principle 2. Manage water at the appropriate scale(s) within integrated basin governance systems to reflect local conditions, and encourage co-ordination between the different scales.

To that effect, water management practices and tools should:

a) Respond to long-term environmental, economic and social objectives, with a view to making the best use of water resources, through risk prevention and integrated water resources management;

b) Encourage a sound hydrological cycle management from capture and distribution of freshwater to the release of wastewater and return flows;

c) Promote adaptive and mitigation strategies, action programmes and measures based on clear and coherent mandates, through effective basin management plans that are consistent with national policies and local conditions;

d) Promote multi-level co-operation among users, stakeholders and levels of government for the management of water resources; and,

e) Enhance riparian co-operation on the use of transboundary freshwater resources.

Figure 2.3. OECD Indicators for Principle 2

Source: OECD (2018a), *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264292659-en.

Table 2.2. OECD Flood Checklist for Principle 2

	Checklist questions
Policy framework	Are there Integrated Water Resources Management policies and strategies in place that address flood management aspects? Are there Integrated Flood Management policies and strategies?
	In your case study, are there policies in place to manage floods at the hydrographic scale?
	In your case study, are existing plans to manage flood risks consistent with national policies and local conditions?
Institutions	At which scale are the flood management functions primarily managed in your case study?
Instruments	Which multi-level and riparian co-operation mechanisms are in place among users, stakeholders and levels of government for the management of floods?
Impacts	What are the challenges towards vertical co-ordination (i.e. co-ordination across administrative levels)?

Note: The full Checklist, including options for responses, can be found in Annex A.
Source: Authors' own research.

Observations

Water issues, including floods, cut across administrative boundaries both in their ecological and their political dimensions. The relevant scale for flood management depends on the area considered as a unit of management, which may vary from transboundary to city levels:

- In the case of transboundary basins, various governments may be involved in flood management. Both the European Flood Directive and the Water Framework Directive recommend co-operation among neighbours in order to produce one single international Flood Risk Management Plan (Article 8.2) covering the entire transboundary river basin.
    - The Danube Flood Risk Management Plan is an exemplary transboundary initiative connecting different places. It was produced by the International Commission for the Protection of the Danube River (ICPDR), adopted in December 2015 and endorsed by Danube Ministers in February 2016 (ICPDR, 2015). The plan can be considered a major riparian co-operation mechanism on flood management at the basin-wide scale. Similar progress has been achieved in other transboundary river basin commissions in Europe, such as on the Rhine and Elbe rivers. Other transboundary initiatives include bilateral agreements, such as one for crisis management established after the 1997 flood on the Odra river basin shared between the Czech Republic, Poland and Germany. Similarly, bilateral agreements between the Slovak Republic and its neighbours define management steps in the case of critical hydrological situations.
    - Another example of linkages across scales but also of policies across levels is the Rhine flood-risk management plan, co-ordinated through the International Commission for the Protection of the Rhine (ICPR), created in 1950. In particular, co-ordinated measures implemented since 1995 and the drafting of the corresponding balances every five years have proved to be successful. The first Flood Risk Management Plan concerns the period 2015 to 2021 and will be assessed and eventually updated after six years. In the future, a digital instrument developed in 2015 should help ICPR determine the reduction of flood risks and the effects of measures when assessing the implementation of the flood-risk management plans in the International River Basin District Rhine. The initiative has also connected people, since public participation was key in the drafting of the plan.
    - Many other co-operation mechanisms are in place for transboundary flood management. The EU Common Implementation Strategy provides a platform to agree on views for implementation of both the European Flood Directive and the Water Framework Directive through the subsidiarity principle. It concerns the eight river commissions within ICPDR countries including the Danube and the Rhine.
- National river basins or sub-basins, which are basins falling entirely within the boundary of a given country, are the primary scales considered by the European Flood Directive and the Water Framework Directive for the management of flood risk. Catchment-based governance, in theory, offers decision makers more flood-risk management (FRM) options compared to decision making on a smaller scale (Dieperink et al., 2013). For instance, it is relevant for flood forecasting and warning systems to be set up along the whole river. Catchment management

organisations can also offer a platform for exchanging ideas and experiences on spatial planning, allocation politics or flood defence infrastructure construction. However, it is also worth noting that catchment approaches often fail to mesh with existing administrative boundaries.

- In addition, the national scale often plays an essential role in flood governance. Governments set out FRMSs and are involved in the funding of flood-related measures. Moreover, since cultures of risk, administrative structures and dominant approaches to flood risks vary within countries, local initiatives should be consistent and co-ordinated with national frameworks. In Belgium, England and the Netherlands, some good practices were found (e.g. Delta Programme and Room for the River in the Netherlands; the co-ordinating role of the environment agency in England, river committees in Wallonia, co-ordination and stimulation by the Flemish Environment Agency (*Vlaamse Milieumaatschappij*)).
- Finally, in many countries, crisis management, public information about floods and spatial planning are all managed at the city scale. In France, for instance, the recent territorial reform gave new competences on flood management to metropolitan areas and inter-municipal authorities, thus re-enforcing flood management at the city level. On the other hand, as is the case in Poland, shifting responsibilities to the municipal level without adequate resources can cause tensions or even backfire. In addition, responsibilities for public risk awareness and spatial planning are distributed at different scales: municipal, departmental, regional and national.

The relevant scale for flood management can also depend on the flood management function(s) under consideration. The collected case studies illustrate that in a given flood governance setting, different functions are managed at different scale. Figure 3 shows that while in a nearly equal number of cases, flood anticipation and foresight are managed at the national (for 12 case studies) or sub-national (either regional/provincial or local/metropolitan) levels (for 11 cases), flood prevention/mitigation, flood preparation and flood response are functions primarily managed at the local/metropolitan level (for 16, 20 and 18 cases respectively). Lastly, flood recovery is most often managed at sub-national level (either regional/provincial or local/metropolitan).

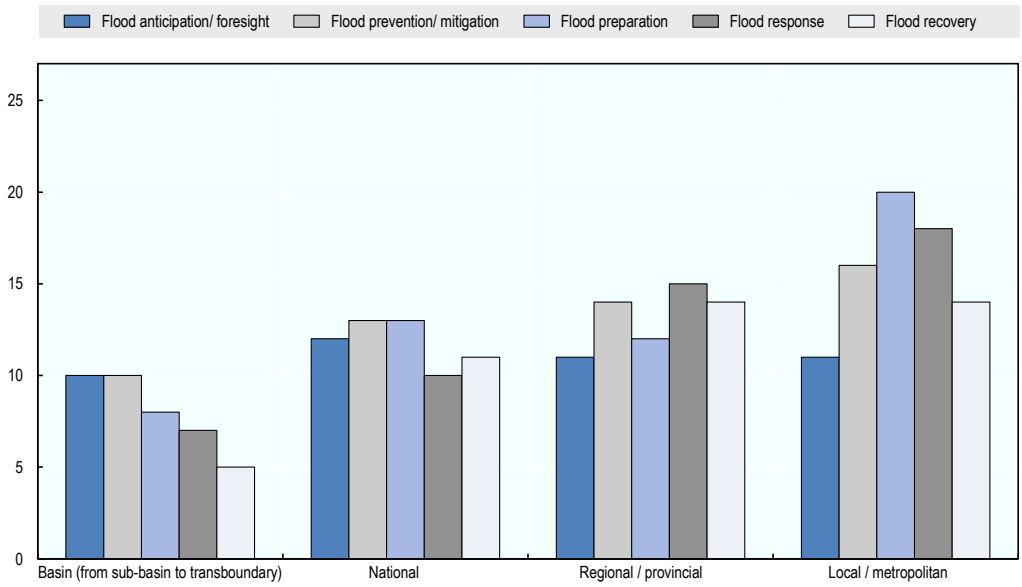
A number of challenges regarding flood management lie in aligning approaches at various scales. How to achieve a basin approach when governments are simultaneously devolving responsibilities to the local or city levels? How to ensure that local solutions, aiming to get rid of excess water as soon as possible, do not harm neighbouring communities? In many instances, vertical co-ordination is hampered by conflicting agendas, priorities and interests (as noted in 19 case studies), capacities and resources across scales (illustrated in 14 case studies). Challenges can also be the result of the legal allocation of roles and responsibilities or inconsistent budgeting, procurement and regulatory processes across levels of governance.

In the Australian context, flood mitigation planning and implementation are funded through state competitive grants processes, requiring local resources. Flood management is devolved to municipal levels, and usually only extends to city boundaries when preparing flood studies. Hence, flood management cannot be described as operating on a “basin” scale. Catchment management authorities, in states that have them, have limited legislative power to manage flooding and thus limited resources for it. Municipal government resources and skills to carry out flood management functions can also be a limiting factor and subject to competing local demands. Australia's National Strategy for Disaster Resilience acknowledges the increasing severity and regularity of disasters in Australia and

the need for a coordinated, cooperative national effort to enhance Australia's capacity to withstand and recover from emergencies and disasters. With a view to clarify responsibilities, enhance policy coherence and consistency across the country in the way flood risk information was collected and made available to the public, the federal government initiated the Natural Disaster Insurance Review in 2011. As a response to its findings, a National Flood Risk Information Project was established that for instance delivered a portal on Australian Flood Risk Information. It aims to enable flood information, currently held by different sources, to be accessible from a single online location. The portal includes a database of flood study information and metadata.

Figure 2.4. Scale at which flood management functions are managed

27 case study promoters responded



Note: Responses correspond to the total number of case studies that ticked each possible answer in the Checklist. Respondents could tick more than one answer.
Source: Data from case studies on flood governance collected for the OECD project (October 2016).

A menu of options exists for multi-level co-ordination mechanisms. These mechanisms are used more or less regularly, depending on the scale. At the local and basin levels, responses involve enhanced engagement in flood-related decisions, while at the national level, vertical and horizontal mechanisms stand out. For instance, participatory processes are common practice at the local and metropolitan level in the case studies, together with joint programmes of measures, co-financing arrangements and joint projects or contracts. At the national level, the use of shared data and information systems is more widespread, as are inter-governmental dialogues, while at the basin level, the river basin committees and other participatory processes tend to be the preferred options. As a result of these co-ordination mechanisms, more than half of the case studies report having flood-risk management plans that are aligned with national policies and/or locally adapted to local conditions. The Netherlands' national policy and flexible local implementation approach is a good example of resolution between geographical scales. At the international level, co-ordination is also essential, in particular across basins. The International River Protection Commissions for

the Danube and Rhine rivers (ICPDR and ICPR respectively) were set up to encourage transboundary basin-wide management and enhance co-ordination at the river basin scale, building on existing national administrative arrangements and in line with the river basin management approach dictated by the EU Water Framework Directive.

Areas to improve

Further efforts are needed to align the administrative boundaries of municipalities, regions and states to hydrological imperatives, and thus reduce the administrative gap. The blurred allocation of roles and responsibilities, coupled with limited co-ordination across scales and levels of government, often leads to contradictory flood management strategies. For instance, an adequate alignment between local initiatives and national frameworks was lacking in Sweden. Besides, the issue of scale touches upon conflicts and the lack of connectivity between spatially dislocated communities in upper storage and lower impacted catchment, which is a key challenge for the Eddleston Water Project in Scotland.

The basin level is one important level at which linkages between water and land need to be managed, particularly when it comes to flood planning. Land, whether private or public, can be very challenging when managing floods, given that private property rights can be highly controversial in a context of increasing climate-driven flooding. This raises questions such as: at what scales should land and water linkages be managed? who should pay to protect private property? Who is in charge of compensating the destruction of land that is suffering devaluation? (McCarthy et al., 2018). In England, managing floods in the public space and reducing the risk of flooding at a property level has been a key challenge for the Herne Hill and Dulwich Flood Alleviation Scheme.

Ways forward

There is no unique or agreed solution on how to align approaches at the various scales. Equal attention needs to be paid to the trade-offs that such co-ordination efforts imply, since they involve time and institutional effort, and can generate multiple types of costs. Managing trade-offs related to fairness and equity in flood management is key to ensure that general and specific interests are heard. In the case of flood management, assessing the hydrological and geographical logic is fundamental to addressing the linkages between urban, rural and watersheds. Addressing the scale can also help manage other multi-level dynamics inherent in flood management, in particular linkages and co-ordination between water and land management. Involving landowners is just as important as haggling amongst administrative bodies to find potential solutions and mechanisms to mitigate and prevent floods.

Ensuring that flood management is being handled at the right scale requires clear roles and responsibilities, as well as adequate resources and skills to carry out their functions. Devolution of flood management at appropriate scales needs to address such co-ordination issues. In this sense, it is important to acknowledge that the institutional setting is not only defined at the national level, but in many cases can be related to transboundary water entities (Menard et al., 2018). Mechanisms and incentives for co-ordination among riparian states are important when it comes to transboundary flood governance, since they can build on existing national administrative structures. Transboundary cooperation presents opportunities for riparian States to identify shared interests and to develop actions for mutual benefits. For cooperation to take place political will is needed. Sometimes existence of an agreement between riparian states does not certify always a real cooperation in the whole basin.

Principle 3: Policy coherence

Box 2.3. OECD Principle 3: Sub-principles, Indicators and Flood Checklist

Principle 3. Encourage policy coherence through effective cross-sectoral co-ordination, especially between policies for water and the environment, health, energy, agriculture, industry, spatial planning and land use through:

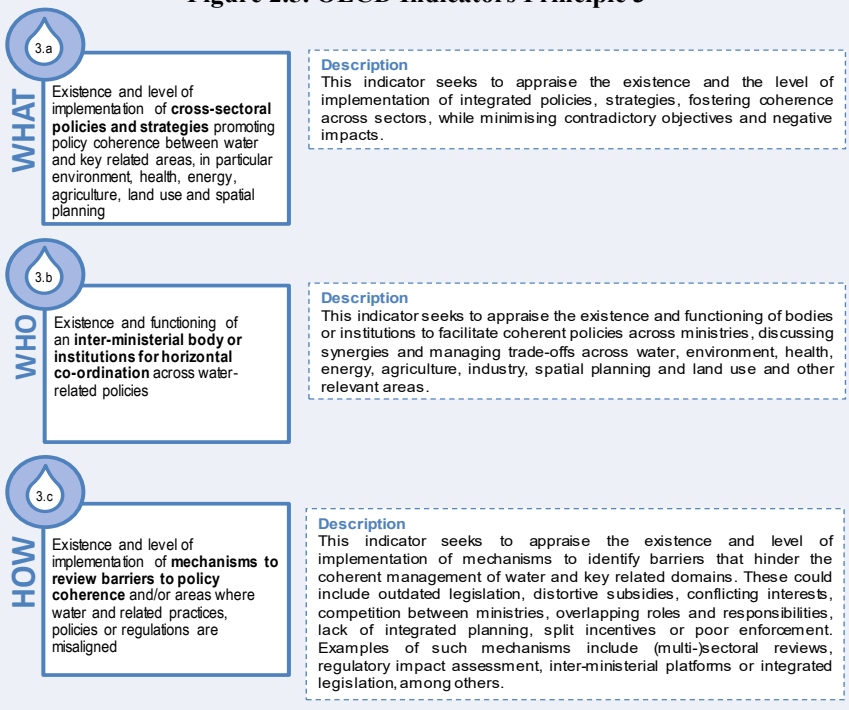
a) Encouraging co-ordination mechanisms to facilitate coherent policies across ministries, public agencies and levels of government, including cross-sectoral plans;

b) Fostering co-ordinated management of use, protection and clean-up of water resources, taking into account policies that affect water availability, quality and demand (e.g. agriculture, forestry, mining, energy, fisheries, transportation, recreation, and navigation) as well as risk prevention;

c) Identifying, assessing and addressing the barriers to policy coherence from practices, policies and regulations within and beyond the water sector, using monitoring, reporting and reviews; and

d) Providing incentives and regulations to mitigate conflicts among sectoral strategies, bringing these strategies into line with water management needs and finding solutions that fit with local governance and norms.

Figure 2.5. OECD Indicators Principle 3



Source: OECD (2018a), *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264292659-en.

Table 2.3. OECD Flood Checklist for Principle 3

	Checklist questions
Policy framework	In your case study, which policy areas are the most interdependent with flood management in practice?
	Please indicate the policy area(s) where synergies with flood management have been built:
	Do flood-risk management strategies include:
Institutions	Is there an inter-ministerial body or institution for co-ordination across flood-related policies?
Instruments	How are barriers to policy coherence identified in your case study?
	In your case study, which mechanisms are in place to facilitate coherence and mitigate conflict between flood management policies and other policy sectors?
	Are there conflict mitigation and resolution mechanisms to manage trade-offs across flood-related policy areas?
Impacts	Is there an assessment of the distributed impact on flood management of decisions taken in other areas, such as urban/spatial development, forestry, wetlands, agriculture or the environment?
	In the case of policy incoherence, what is the impact on flood management?
	Are costs due to absent/poor policy coherence evaluated and available to decision makers?

Note: The full Checklist, including options for responses, can be found in Annex A.
Source: Authors' own research.

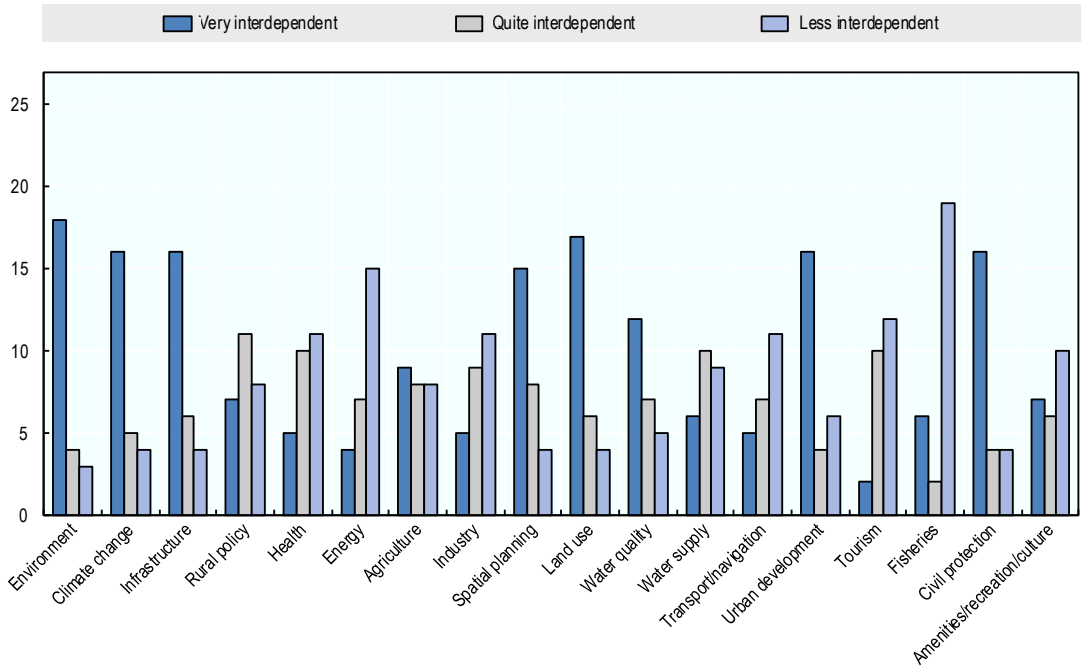
Observations

Flood risks are affected by decisions taken in various sectors. The most inter-dependent sectors include land use, civil protection, the environment, climate change, infrastructure, spatial planning and urban development. Thus, FRMSs cannot be isolated from these policy fields. Recent research shows that establishing a specific strategy or sector, such as FRM for instance, tends in practice to lead to a lack of integration among strategies (Matczak et al., 2016). Policy coherence within FRMSs, but also between FRMSs and other policy areas, is thus essential. For instance, FRMSs may require dams to be empty so that floodwater can be stored, while water supply strategies may require dams to be full, to guarantee stored water for all uses. Such concerns may become more critical if climate change puts pressure on water supplies. Water supply needs can also increase flood risk if groundwater extraction leads to subsidence, an issue in some cities.

Flood risks are often managed by water managers, but it is important to remember that spatial planners and risk managers also have an important role in cross-sector co-ordination. Indeed, cross-sectoral co-ordination should be careful to consider the role of spatial planners, who are generally in a good position to look at areas holistically (Hartmann and Driessen, 2013). Flood management should be included in spatial planning curricula, and spatial planners should be trained to take flood risks into account (De Smedt, 2014). Effective planning controls are the first line of defence and are at the heart of effective flood management. Integrating flood management and spatial planning is a top priority for effective cross-sectoral co-ordination in the field of FRM. It is essential that sectors other than water start to see flood risks as their problem. In addition, while in many countries, such as the Netherlands, water agencies take the lead on water infrastructure, flood management is often co-ordinated by risk managers, either through the interior ministry, civil protection, or a directorate general for the prevention of risk.

Figure 2.6. Interdependence between flood management and other policy areas

26 case study promoters responded



Note: Responses correspond to the total number of case studies that ticked each possible answer in the Checklist. Respondents could tick more than one answer.
Source: Data from case studies on flood governance collected for the OECD project (October 2016).

A lack of policy coherence can have severe distributional impacts on both the costs and benefits of flood management. Policy incoherence can: raise economic costs, as when infrastructure investments could have been avoided had there been better co-ordination (as exemplified in 19 case studies); generate conflicting actions, as for instance when urban policies support the development of housing in floodplains, while flood management policies use these floodplains for flood discharge (seen in 17 case studies); or alternatively, increase flood risks (16 cases). Other negative impacts of policy mismatch include greater risks of human casualties and greater transaction costs, for example, when conflicts arise between stakeholders involved in flood management. Lack of coherence in water-related areas can work against flood prevention policies.

A range of mechanisms can be employed to increase coherence and mitigate conflicts between flood management policies and other sectors. Some are legal/administrative, including legislation, regulation, cross-sectoral plans, inter-institutional agreements between sub-national authorities, financial incentives (e.g. subsidies) and contracts; others include learning mechanisms, such as research programmes, schooling and knowledge co-creation projects in different sectors. This can help ensure that flood management strategies include consideration of other sectors. For instance, 22 case studies collected reported that their strategies include information on areas that have the potential to retain floodwater (e.g. natural floodplains), while in other cases, the strategies include aspects of land use, infrastructure, environmental protections, spatial planning and soil/water management.

In many countries, existing procedures, rules and instruments could help promote proper consideration of flood risks in spatial planning. Examples of cross-sectoral policy co-ordination include Flanders' "water test" and "signal areas". The "water test" (*watertoets*) requires governments to obtain the expert advice of authorised water managers before granting construction permits (Wiering and Crabbé, 2006). "Signal areas" (*signaalgebieden*) are undeveloped areas with "hard planning" prospects (residential and industrial areas) located in flood-prone areas (De Smedt, 2014). Both these concepts require that permits be allocated subject to flood mitigating measures (e.g. flood-proof housing). French "zoning plans" (*plans locaux d'urbanisme*) and "territorial coherence plans" (*schéma de cohérence territorial*) and Polish "local spatial development plans" (*miejscowy plan zagospodarowania przestrzennego*) take into account housing developments, environmental considerations, transport and networks, approaches that have been found to encourage reflection on flood risks. Key elements of such approaches include risk awareness, knowledge exchange, active policy entrepreneurs and instruments that are not only enforceable but also actively enforced. These urban plans can also be regulated, in high flood-risk areas, by flood-risk prevention plans established by state services in conjunction with local authorities. The state of Queensland in Australia offers another example of cross sector coordination efforts. Its revised development legislation is now considering the possibility of granting some say to emergency response agencies, whose personnel and resources are put at risk due to floods (Raadgever et al., 2016). Cross-sector coordination measures should be increasingly promoted at all levels of government.

Areas to improve

OECD and non-OECD countries generally face problems in striking a balance between conflicting financial, economic, social, environmental areas and policy drivers for collective enforcement of flood policy (objective gap). For instance, municipalities may be willing to develop new housing and real estate, but this may conflict with the need to reduce flood risk. Often, time scales for policies diverge and can be difficult to align. In Bangladesh, for instance, different sectors compete fiercely for financial resources. One of the biggest challenges for the Flood Risk Maps for Surface Water in England and Wales was the limited data and information sharing across ministries and other essential water-related players. Water and flood policies are, in many cases, driven by decisions made in policy areas where water experts have little say (OECD, 2011). The issue of floods is generally spread across many different policy areas.

In practice, policy coherence in flood management is jeopardised by several factors: differences in policy goals, vested interests and perverse incentives, insufficient consultation and co-ordination, as well as inconsistencies and rigidities in the institutional structures that govern sectoral policies. Poor allocation of roles and responsibilities can create silos and amplify conflicting objectives. This is often the case when ministerial portfolios are strictly defined without sufficient mechanisms for cross-sectoral co-ordination.

Ways forward

Water is not an isolated sector and needs to seek out approaches that provide win-win solutions and combine diverse interests. Removing frequent bottlenecks through policy coherence and greater co-ordination is essential if governments are to prevent and mitigate floods. Legislation is also a good tool for ensuring policy coherence among national, regional/provincial and municipal authorities responsible for water, and other policies related to environment, land use and spatial development. The Environment and Planning

Act in the Netherlands, to take effect in 2021, simplifies the current laws and combines them into a single act, to speed up decisions on projects and activities, among other things. Conflict mitigation and resolution mechanisms are needed to manage trade-offs across flood-related policy areas and take advantage of synergies. Assessments of the distributional impacts on flood management of decisions taken in other areas can help avoid future mismatches.

Climate change and flood management (usually considered under disaster risk reduction) are often treated as separate domains, because scales, frameworks, policies, time horizons, actors and institutions tend to differ. This can lead to competition over how to address the same issues, leading to redundant investment and policy inconsistency. Adaptive governance provides a window of opportunity to generate more collaboration and increase socio-ecological resilience. It is a good means for addressing climate and water-related disaster challenges, because it is founded on the view that governance systems are based on learning. This helps the players concerned to modify their practice based on new insights and experiences and to be flexible enough to respond to the uncertainties of climate change and water-related disasters. Such governance is polycentric, and values local knowledge and the sharing of responsibility between different levels of government. It also facilitates participation and collaboration of other sectors, interests and institutional arrangements (Keessen et al., 2013).

Making the most of policy complementarities requires ministries and other actors in water management to share responsibility and information. Their temptation to retreat into silo approaches can be mitigated by greater involvement of spatial planners and risk managers in flood management, since they generally consider the issues in a broad, interdisciplinary context. Governance mechanisms that encourage policy complementarities can help to increase capacity (e.g. by combining management of multiple sectors – waste, water, energy) and optimising financial resources.

Principle 4: Capacity

Box 2.4. OECD Principle 4: Sub-principles, Indicators and Flood Checklist

Principle 4. Adapt the level of capacity of responsible authorities to the complexity of water challenges to be met, and to the set of competencies required to carry out their duties, through:

a) Identifying and addressing capacity gaps to implement integrated water resources management, notably for planning, rule making, project management, finance, budgeting, data collection and monitoring, risk management and evaluation;

b) Matching the level of technical, financial and institutional capacity in water governance systems to the nature of problems and needs;

c) Encouraging adaptive and evolving assignment of competences upon demonstration of capacity, where appropriate;

d) Promoting hiring of public officials and water professionals that uses merit-based, transparent processes and are independent from political cycles; and

e) Promoting education and training of water professionals, to strengthen the capacity of water institutions as well as stakeholders at large and to foster co-operation and knowledge-sharing.

Figure 2.7. OECD Indicators for Principle 4

Source: OECD (2018a), *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264292659-en.

Table 2.4. OECD Flood Checklist for Principle 4

	Checklist questions
Policy framework	In your case study, which capacities are in place to manage floods today and in the future?
	Are there mechanisms used for the hiring of public officials and flood-risk professionals?
	Are there incentives to create "flood" careers for staff in the public sector?
	Are there guidelines or standards for capacity building across authorities at your level?
Institutions	Are there flood-related networks at the national level?
Instruments	In your case study, how are capacities in flood governance systems assessed in terms of responding to actual problems and needs?
	How are capacity gaps identified in your case study?
	How are capacity gaps addressed?
	In your case study, which mechanisms are in place for the education and training of relevant stakeholders (e.g. floodplain managers, flood-risk professionals)?
	Are there decentralised development co-operation mechanisms in place (e.g. twinning, peer-to-peer learning activities, capacity building and knowledge transfer)?
Impact	Which of the following gaps have an impact on capacity development for flood management in your case study?

Note: The full Checklist, including options for responses, can be found in Annex A.
Source: Authors' own research.

Observations

Flood governance is contingent on mobilising the right capacities. OECD defines capacity as "the process by which individuals, groups and organisations, institutions and countries develop, enhance and organise their systems, resources and knowledge; all reflected in their abilities, individually and collectively, to perform functions, solve problems and achieve objectives" (OECD, 2006). Capacities fall under different categories[2]: *technical* capacity (e.g. modelling, early-warning systems, projections); *financial* capacity (e.g. ability to allocate funds for the construction of flood defences, willingness and capacity to pay for insurance schemes, capacity to raise taxes); *human* capacity (e.g. knowledge, skills, leadership, stakeholder engagement); *governmental* capacity (e.g. departments dedicated to flood management, policies, co-operation with research institutes); and *infrastructural* capacity (e.g. capacity to build green infrastructure, adaptive buildings, retention facilities, dams). The case studies indicate that each of these capacities is needed and in use for flood governance and that they condition the effective prevention and management of floods. Yet capacity levels vary widely: for example, rural areas with low population density have very different capacities for coping with flood risks from densely populated urban areas.

Some of the most common capacity gaps[3] in water and flood management include carrying out reforms, managing multi-level relations, allocating responsibilities and funds, ensuring co-ordinated, coherent policy approaches, and attracting skilled and competent flood-risk professionals. Assessing where technical capacity, staff, time, knowledge or infrastructure are lacking is a critical step in bolstering FRGAs. The case studies collected show different ways of identifying capacity gaps: 16 case studies carry out studies examining governance capacity at various levels, 14 cases conduct post-event reviews, while a smaller number rely on an index of technical, financial, infrastructure or human capacity.

If infrastructure is one of the "hard" capacities generally well developed in OECD countries, more attention could be paid to the quality and resilience of this infrastructure.

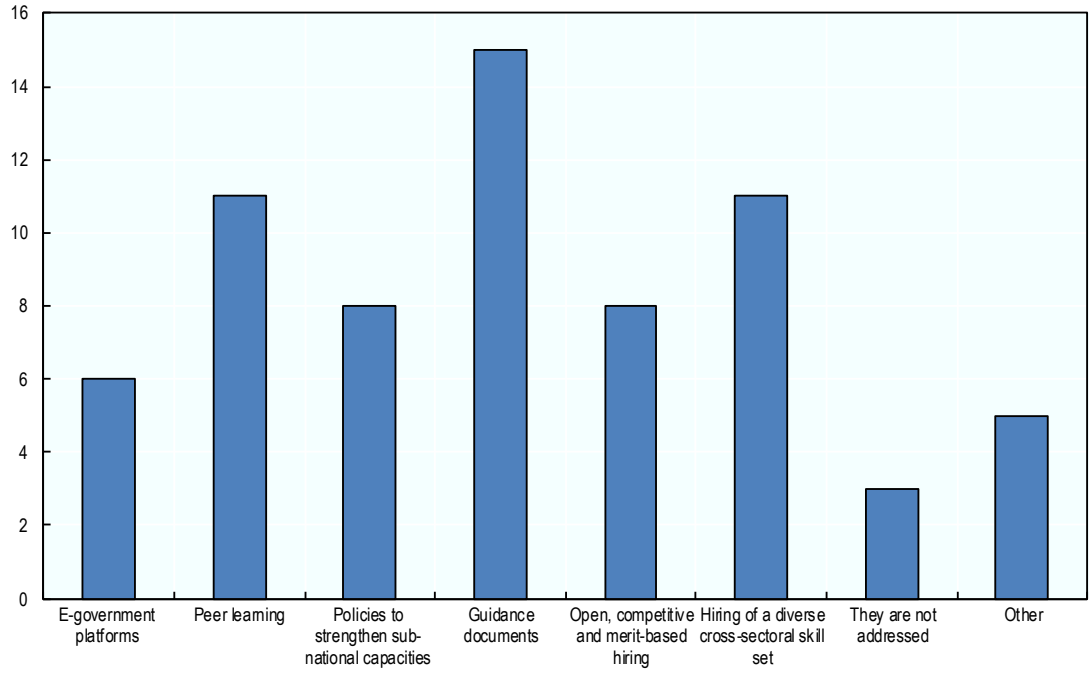
The G7 Ise-Shima Principles for Promoting Quality Infrastructure Investment call for *i)* ensuring effective governance, reliable operation and economic efficiency with a view to safety and resilience against natural disasters; *ii)* ensuring job creation, capacity building and transfer of expertise and know-how for local communities; *iii)* addressing social and environmental impacts; *iv)* ensuring alignment with economic and development strategies, including aspects of climate change and environment, at the national and regional levels; and *v)* enhancing effective resource mobilisation including through public-private partnerships.[4] In addition, the OECD has developed a Framework for the Governance of Infrastructure that offers a methodology for analysing challenges, mapping out options for how to solve them, and guiding decision-making processes.[5]

Developing and strengthening capacity throughout the policy cycle can be a daunting and resource-intensive task. The case studies collected illustrate some ways to address capacity gaps (Figure 2.8. How capacity gaps are addressed in flood governance), such as guidance documents (used in 15 case studies) and hiring a diverse cross-sectoral skill set and peer learning (in 11 cases). Workshops and public meetings, guidebooks, and support programmes on flood risks are highlighted in the case studies as mechanisms that help educate and train flood governance stakeholders (e.g. flood plan managers, flood-risk professionals).

The case studies suggest several instruments for responding to co-ordination failures. As for policy complementarities, the Dutch Delta Programme, in collaboration with many other ministries and actors,[6] has set up a Water and Climate Knowledge and Innovation Programme, focused on knowledge development and joint fact-finding through the development of a coherent set of knowledge agendas based on three pillars: *i)* bringing together the explicit and implicit knowledge from all stakeholders, including knowledge institutes, *ii)* developing knowledge only if it supports decisions and *iii)* managing knowledge only on demand. Social media and digital tools were used to encourage learning from each other (Bloemen, 2010). Furthermore, in Japan, drills (emergency exercises) are organised annually to prepare potential disasters with all stakeholders concerned at all levels and sectors. Such exercises help facilitate interaction, while building knowledge and behaviour about emergency response in cases of disasters. Finally, in England and Wales, a research study on potential measures to address financial capacity failures was carried out by UK Water Industry Research (UKWIR, 2016). Increased knowledge of funding opportunities and capabilities amongst different communities has helped them to undertake flood-risk measures and improve collaboration with water companies and other stakeholders.

Figure 2.8. How capacity gaps are addressed in flood governance

26 case study promoters responded



Note: Responses correspond to the total number of case studies that ticked each possible answer in the Checklist. Respondents could tick more than one answer.
Source: Data from case studies on flood governance collected for the OECD project (October 2016).

Areas to improve

Many case studies indicate persistent challenges in making flood governance effective, efficient, inclusive and trustworthy. In the Chakar river basin of Sibi Balochistan, Pakistan, for instance, and at the intersection of the Arga and Aragon rivers in Spain, capacity needs to be built among such key stakeholders as farmers, associations of water users and citizens, so that they can effectively take part in decision making. Discrepancies in capacity not only affect a wide range of stakeholders but also amplify territorial disparities (urban, peri-urban and rural). In such cases, the differences in capacity, as well as political and economic factors, can complicate the relationship between places (OECD, 2013b).

A mismatch between the capacity needed to execute flood-related responsibilities and the capacity of the authority actually responsible can hold back flood management policies. Shortfalls in financial resources; in the political will to allocate resources to capacity development; in staff and technical skills; and in training tools and methodology, affect capacity development and need to be addressed. For example, the human capacity, tools and experience required to implement the EU Floods Directive are in short supply in the countries of the Western Balkans (European Commission, 2015). At present, higher education institutions in most Western Balkan countries are not turning out enough flood management experts and water professionals with the requisite skills to establish and operate databases, monitoring and early-warning systems necessary to comply with the Floods Directive (European Commission, 2015). Organisations also often fail to recognise the wide range of characteristics (both "soft" and "hard") that are needed for effective flood

management. Building sufficient capacity may include educating engineers to adopt a more holistic perspective on flood management, the exchange of expertise through communities of research and practice, and knowledge co-creation.

Ways forward

Assessing capacity gaps is a critical step towards reinforcing the skills needed to face and manage flood risks. Ensuring a diverse skill set within organisations is critical for effecting change, and can have a major influence on organisational culture and the flood management approach used (see for example Huitema, 2002). Including stakeholders from the public, private and non-profit sectors can play an important part in pooling resources, skills and expertise, and integrating flood management, as well as knowledge sharing. This also relates to the science-policy interface mentioned in Principles 5 and 8. Policy makers and decision makers may be quick to adopt measures and approaches they are familiar with (e.g. from their specialist field) but they may resist evidence-based findings if the findings do not mesh with their values or worldview. For example, engineers may be resistant to undertake new ecosystem-based measures that ecosystem scientists are quick to embrace (Huitema, 2002). Employing personnel who are receptive to scientific advances across a range of fields and disciplines, and who are conversant with the science, is important, as is ensuring that capacity building includes both "soft" and "hard" skills.

Notes

[1] Flood anticipation or foresight, flood prevention or mitigation, flood preparation or preparedness, flood response, flood recovery.

[2] Generally, capacities can be distinguished between "soft" and "hard". "Hard" capacities relate to tangible financial and infrastructural "deliverables" and associated technical skills (e.g. early-warning systems, urban green infrastructure, tax systems). "Soft", more intangible capacities include human aspects such as leadership, staff motivation, shared values, co-ordination, social expertise, communication, facilitation and knowledge.

[3] In the case studies collected, these capacity gaps are assessed most often through specific studies examining governance capacity at various levels (in 16 case studies) and post-event reviews (in 14 cases). Four of the case studies collected indicated not assessing capacity gaps.

[4] They were released on 27 May 2016, see www.japan.go.jp/g7/summit/documents/index.html.

[5] See OECD (2015), *Towards a Framework for the Governance of Infrastructure*, available online at: https://www.oecd.org/gov/budgeting/Towards-a-Framework-for-the-Governance-of-Infrastructure.pdf (accessed on 6 October 2016).

[6] Ministry of Infrastructure and the Environment, the Ministry of Economic Affairs, the Foundation for Applied Water Research (STOWA), the Netherlands Organisation for Scientific Research (NWO), the Royal Netherlands Meteorological Institute (KNMI), the Netherlands Environmental Assessment Agency (PBL), Deltares, the independent Netherlands Organisation for applied Scientific Research (TNO), Alterra, universities, and the Dutch Topsector Water.

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Chapter 3. Efficiency of flood governance

This chapter looks at the Principles related to efficiency of water governance. Based on a number of case study examples it highlights the importance of data and information, financing and investments, regulatory frameworks and that the governance system should allow for incentivising technological as well as social and institutional innovations. It applies the Checklist and makes observations and analysis of Principles associated with efficiency, it points to particular areas of improvement and finally it points to examples of ways forward.

The OECD Principles 5 to 8 provide a basis for analysing whether institutions and policies involved in flood governance are performing efficiently. *Efficiency* of water governance relates to the contribution of governance to maximise the benefits of sustainable water management and welfare at the lowest cost to society.

The four Principles emphasise the production and sharing of relevant data and information. They stress the need to ensure that governance frameworks help in mobilising and allocating financing for investment in required infrastructure, institutional development and human capacity. They recommend developing sound regulatory frameworks to set clear, transparent and proportionate enforcement rules, procedures and incentives, to facilitate compliance. The governance framework should also promote and incentivise social and technological innovations (see Figure 1.1).

In the area of flood governance, Principles 5 to 8 can help to ensure that decision making is based on a good knowledge of flood-related data and information. Sound responses to floods will require a mix of investments in infrastructure, planning and data and in building institutional capacity for flood mitigation and control. The regulation of water and land use is critical, for example, for reducing certain flood risks. Promoting innovations can lead to more efficient policies for flood governance, such as new ways of collaboration between upstream and downstream water users.

Principle 5: Data and information

Box 3.1. OECD Principle 5: Sub-principles, Indicators and Flood Checklist

Principle 5. Produce, update, and share timely, consistent, comparable and policy-relevant water and water-related data and information, and use it to guide, assess and improve water policy, through:

a) Defining requirements for cost-effective and sustainable production and methods for sharing high-quality water and water-related data and information, e.g. on the status of water resources, water financing, environmental needs, socio-economic features and institutional mapping;

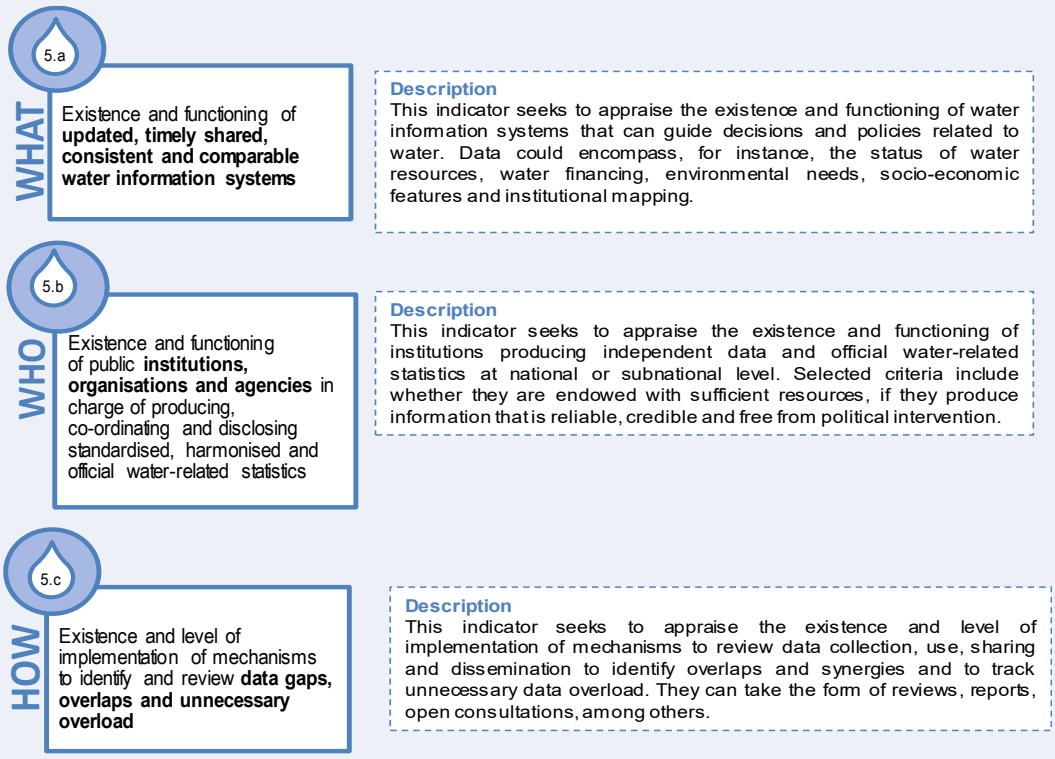
b) Fostering effective co-ordination and experience sharing among organisations and agencies producing water-related data between data producers and users, and across levels of government;

c) Promoting engagement with stakeholders in the design and implementation of water information systems, and providing guidance on how such information should be shared to foster transparency, trust and comparability (e.g. data banks, reports, maps, diagrams, observatories);

d) Encouraging the design of harmonised and consistent information systems at the basin scale, including in the case of transboundary water, to foster mutual confidence, reciprocity and comparability within the framework of agreements between riparian countries; and

e) Reviewing data collection, use, sharing and dissemination to identify overlaps and synergies and track unnecessary data overload.

Figure 3.1. OECD Indicators for Principle 5



Source: OECD (2018a), *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264292659-en.

Table 3.1. OECD Flood Checklist for Principle 5

	Checklist questions
Policy framework	Which flood-risk and flood-related data and information are currently being collected for flood management in your case study?
	Is the flood-risk information system harmonised, integrated, standardised and co-ordinated among relevant agencies and responsible authorities across relevant governance scales?
	Are there real-time data and do they guide decision making?
	How are flood-risk and flood-related data and information used to guide decision making?
Institutions	In your case study, who are the main flood-risk and flood-related data and information producers?
	Who are the main flood-risk and flood-related data and information users?
Instruments	How are flood-risk and flood-related data and information shared?
	Are there platforms for dialogue between data producers and users?
	Do online platforms/tools/agreements exist for sharing experience and knowledge?
	Do tools exist to produce, disclose and use flood-related data and information in innovative ways? (Examples are big/smart/mobile data, digital maps, real-time sensors and monitoring.)
	How are data overload and dispersion of information regularly tracked in your case study?
	Which co-ordination and experience-sharing mechanisms are in place in your case study?
	Are there bottom-up mechanisms to produce and disclose flood-related data and information across levels of government, public, private and non-profit stakeholders?
Impacts	What is the impact of data overload and dispersion of information on flood management?

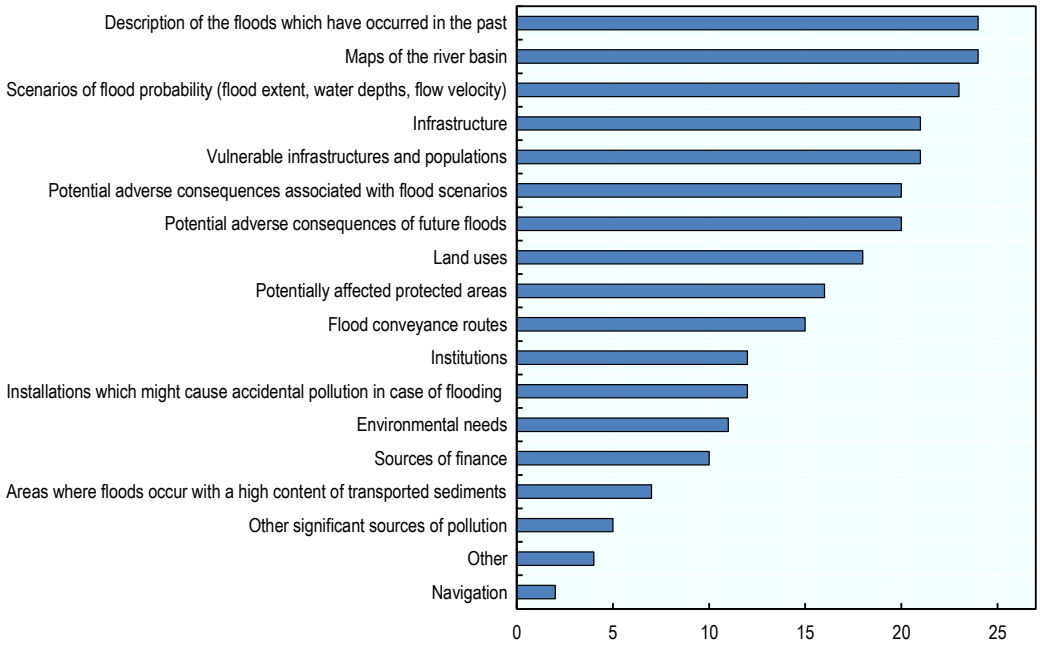
Note: The full Checklist, including options for responses, can be found in Annex A.
Source: Authors' own research.

Observations

Improving flood prevention requires hydrological, climate, technical, economic, financial and social data and information, so that each situation can be analysed objectively, and so that performance-oriented, cost-effective and pertinent strategies can be devised at different levels. Standard data and information collected for flood management cover a wide range of topics and include the description of past floods and their consequences, maps of river basins where floods occur, scenarios of flood probability, vulnerable infrastructure and population (e.g. the elderly and hospitals), etc. (See Figure 3.2.). Such data and information are used to develop flood-risk management plans (as illustrated by 21 of the case studies); to assess flood risks (20 cases); to develop flood risk/hazard maps (19 cases); and to inform participatory decision-making processes (15 cases).

Figure 3.2. Data and information collected for flood management

27 case study promoters responded



Note: Responses correspond to the total number of case studies that ticked each possible answer in the Checklist. Respondents could tick more than one answer.
Source: Data from case studies on flood governance collected for the OECD project (October 2016).

One key elements in developing the knowledge base about water risks is flood-risk assessment, and in particular, assessment of potential losses related to flooding (OECD, 2013a). However, such assessments do not necessarily need to be lengthy or costly. The sophistication of risk assessment should match the level of water risk. In big cities, where billions of critical assets are at risk, thorough risk appraisal may be required, but where current levels of risk are low, a basic risk appraisal may be sufficient. Priority 4 of the Sendai Framework for Disaster Risk Reduction emphasises the importance of "people-centred, multi-hazard, multi-sectoral forecasting and early-warning systems, disaster risk and emergency communications mechanisms, social technologies and hazard-monitoring

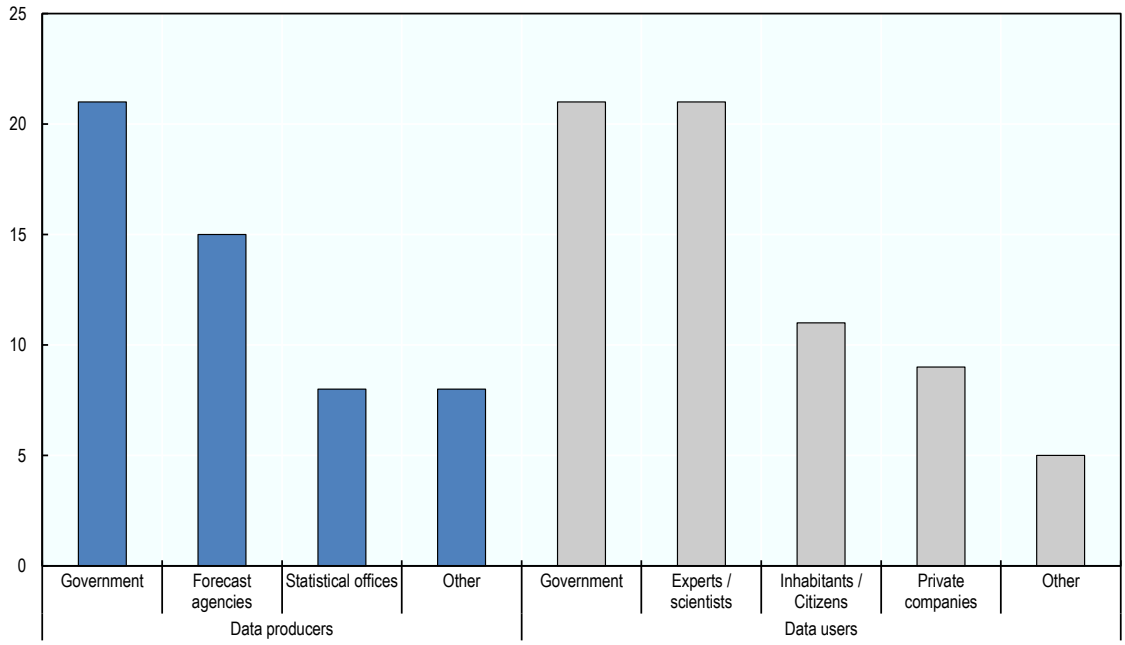
telecommunications systems […]" (UNISDR, 2015b), all of which are all key elements of flood-risk assessments.

Developing a robust information system to guide decisions related to floods must be shared between countries, levels of government and stakeholders. However, information systems on their own cannot solve the magnitude of flood challenges. Based on mutual understanding and interest, countries should consider taking additional concrete steps. The production and use of data and information on flood risks involve an array of different actors, beginning with governments (Figure 3.3). On the one hand, insights from the case studies collected indicate that public authorities at various levels (including river basin organisations) are the biggest data producers, followed by forecast agencies and statistical offices. The case studies also show that independent consultancies and NGOs produce data. On the other hand, governments are also the first users of flood-related data and information, with experts and scientists. To a lesser degree, citizens, private companies and water operators also use such data. Science and knowledge institutes play an important role in informing decision makers about past, present and future flooding. This can inform future scenarios and can be developed with the stakeholders who affect and are affected by floods. It can also help assess different societal preferences concerning flood risks (e.g. through joint fact-finding and interactive planning).

Examples of good practices that consolidate data from various sources and actors can be found in online atlases, such as the transboundary Rhine Atlas, developed in 2015.[1] In addition, the obligation under the EU Floods Directive (EU, 2007) to issue flood hazard and flood-risk maps seems to have served as a positive driver in this respect. In 2013, the Netherlands launched the Digital Delta initiative in partnership with IBM, to integrate and analyse big data on water (OECD, 2014b). These instruments can serve to help co-ordinate knowledge between institutes, governments, water managers, citizens and companies. Furthermore, the case of India highlights the importance of information sharing at the transboundary level for encouraging governments to collaborate on better decision making. India used to have difficulties accessing information from upstream countries like China, but in 2015, a memorandum of understanding required China to provide Brahmaputra data flows during the flood season. However, co-ordination across places and policies is still in the early phases and not without setbacks, particularly because there is not an integrated framework for managing flood risk for all riparian states in the area, which can exacerbate political instability.

Figure 3.3. Flood-related data producers and users

Data producers: 27 case study promoters responded; data users: 26 case study promoters responded



Note: The blue bars represent data producers and grey bars represent data users. Responses correspond to the total number of case studies that ticked each possible answer in the Checklist. Respondents could tick more than one answer.
Source: Data from case studies on flood governance collected for the OECD project (October 2016).

Co-ordination is a fundamental building block for improving data and information. This can be done through mechanisms for sharing experience, as exemplified in the case studies: 23 report relying on meetings among organisations and agencies producing flood-related data, while 16 reported visits of flood-risk professionals to other areas affected by floods to meet with their peers, and 15 to conferences between data producers and users. A broader set of approaches is also used to share flood-risk and flood-related data, starting with closed-door meetings (i.e. within river basin organisations, flood-related associations, etc.) and web-based technologies such as interactive web-based flood-risk information systems, maps and data banks, online forums, newsletters, as well as social media, which have proved useful for co-ordinating action. Public meetings organised by public authorities or flood observatories help diffuse information to civil society, with the help of traditional media (e.g. press releases, radio broadcast, report and videos). The Global Earth Observation System of Systems (GEOSS) is one good example of collaborative data sharing among scientists and space agencies in the European Union, the United States and Japan.[2] GEOSS has assumed an important role in using satellite data for disaster-risk reduction and water resource management.

Areas to improve

Asymmetries in the quality, quantity and type of flood-related information available to different stakeholders involved in water policy remains a major concern in managing flood governance. Inadequate generation of information and sharing among the relevant actors,

as well as fragmentation of the primary data generated, tends to produce bottlenecks. This includes information on how climate change could impact future flood risk, e.g. coastal storm surges and changes in precipitation). Overall, policy makers make little use of the research results; and the science-policy interface has not contributed as much as it might have to guiding decision making and implementation. This has also been complicated by the fact that the players do not always use the same definitions and common terminology. These obstacles are generally exacerbated by a lack of capacity. In Ethiopia, for example, the lack of technical capacity makes it difficult to collect, process and analyse flood-related data and information, and in Bangladesh, updating flood information systems and databases is expensive and time-consuming. The lack of capacity can also affect users, and limit co-ordination between data producers and users. In West Sussex, for example, information was not always sufficiently scaled down for the stakeholders working on flood resilience at the community level.

Dispersed, mismatched and incomplete data impair the efficiency of flood governance, whether for data about the terrain, the watercourses or hydro-meteorological phenomena. Unnecessary data overload and dispersion can make it difficult for decision makers to choose what to use in developing policies. This can result in inconsistencies and uncertainties in models and scenarios, generate delays, or create redundancies in producing data. Moreover, since information is not uniformly available across institutions, inequitable situations may arise. In Belgium's fragmented political context, for instance, it was found that Flanders and Wallonia could better share the expertise developed in flood governance, for example on spatial planning instruments and river contracts (Hegger et al., 2013; Mees et al., 2016).

Ways forward

Tracking data and information overload and asymmetries should thus be emphasised to a greater extent in FRGAs, through specific reviews, meetings between data producers and users, or the reprioritisation of objectives for data collection and data requirements. In this respect, it is vital to continue developing practices and projects to consolidate an information base that can drive informed policy discussions, as well as guided budgeting debates. Ultimately, evaluating the use of the data and information produced is also a vital part of making sure it is relevant and effective.

Focusing on generating and sharing information, particularly on the economic and institutional implications of flood management, can provide a robust foundation for evidence-based approaches to flood governance. The production and adequate use of data and information is a typical illustration of a shared responsibility, and of the need for interaction and measures taken in concert with civil society and other flood-relevant stakeholders. Although many approaches are producer and user-friendly, some use new technologies that exclude vulnerable communities living in rural and informal areas. Bridging the digital divide can help engage the broad range of stakeholders and improve preparedness and response to floods. Making sure that the scientific findings are translated into flood governance practices is fundamental for making better joint decisions and prioritising action.

Principle 6: Financing

Box 3.2. OECD Principle 6: Sub-principles, Indicators and Flood Checklist

Principle 6. Ensure that governance arrangements help mobilise water finance and allocate financial resources in an efficient, transparent and timely manner, through:

a) Promoting governance arrangements that help water institutions across levels of government raise the necessary revenues to meet their mandate, building for example principles such as the polluter-pays and user-pays principles, as well as payment for environmental services;

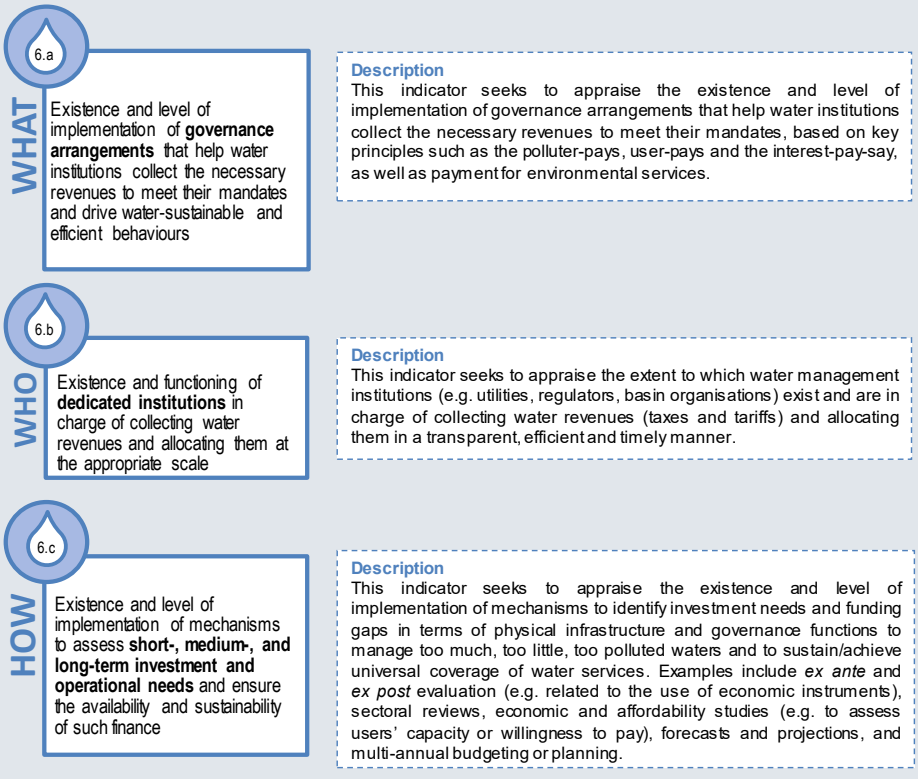
b) Carrying out sector reviews and strategic financial planning to assess short, medium and long term investment and operational needs and take measures to help to ensure availability and sustainability of such finance;

c) Adopting sound and transparent practices for budgeting and accounting that provide a clear picture of water activities and any associated contingent liabilities, including infrastructure investment, and aligning multi-annual strategic plans to annual budgets and medium-term priorities of governments;

d) Adopting mechanisms that foster the efficient and transparent allocation of water-related public funds (e.g. through social contracts, scorecards and audits); and

e) Minimising unnecessary administrative burdens related to public expenditure while preserving fiduciary and fiscal safeguards.

Figure 3.4. OECD Indicators for Principle 6



Source: OECD (2018a), *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264292659-en.

Table 3.2. OECD Flood Checklist for Principle 6

	Checklist questions
Policy framework	What is the nature of the major costs related to flood governance in your case study?
	Are there enough financial revenues to cover operational costs and long-term assets renewal to mitigate floods?
	Are there investment plans and programmes, and do they guide decision making?
	Are clear budget transparency principles and rules applied at all levels of government?
	Do flexible and solidarity mechanisms exist in case of water-related disasters?
	In your case study, what measures have been taken to help ensure availability and sustainability of investments?
Institutions	What are the most relevant sources of finance for flood governance in your case study?
	To which strategies are these sources of finance allocated?
Instruments	In your case study, how are administrative burdens related to public expenditure regularly being tracked?
	Are there measures to minimise unnecessary administrative burdens when collecting and disbursing water-related revenues?
	Which mechanisms are used to ensure that practices for budgeting and accounting are sound and transparent and that they provide a clear picture of flood-risk activities and any associated contingent liabilities?
	Which mechanisms are used to align multi-annual flood-risk management strategies to annual budgets and medium-term government priorities?
	Which mechanisms are in place in your case study to encourage the efficient and transparent allocation of flood risk-related public funds?
	In your case study, which mechanisms are in place to assess short-, medium- and long-term investment and operational needs?
Impacts	What are the main impacts of obscure, ineffective financial governance in your case study?

Note: The full Checklist, including options for responses, can be found in Annex A.
Source: Authors' own research.

Observations

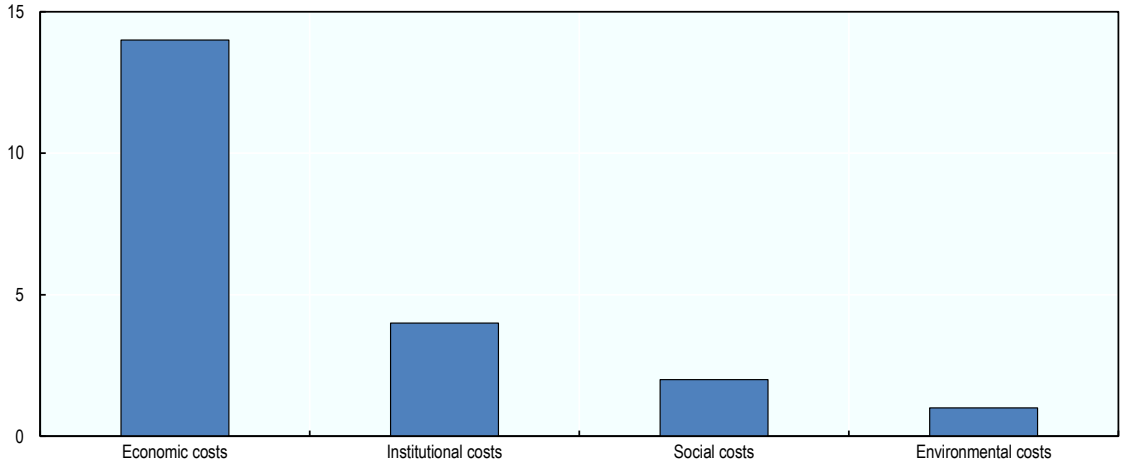
Financial resources matter to sustain effective flood management measures, both in terms of institutions and infrastructure. Furthermore, resources are sometimes needed to recover costs. Quite apart from the direct and indirect costs that flood disasters generally entail, flood governance may also raise a number of costs, whether economic (e.g. building protective infrastructure or producing and collecting data), institutional (e.g. co-ordination with stakeholders), social (e.g. social conflicts, population displacement) or environmental (e.g. impact on ecosystems, land management, etc.) See Figure 3.5.

Countries differ in the ways that they cover the costs of flood management, using different mechanisms. Nonetheless, the financial aspect of flood governance tends to include varying degrees of sophistication.

Flood management differs from other water functions, such as water supply, in that cost recovery is not necessarily called for. A few examples of cost recovery for flood management can be noted, for example payments for insurance premiums, payments by beneficiaries directly (e.g. where local drainage boards or local water authorities charge landowners or inhabitants for their expenses to reduce flood risks) or indirectly making use of a solidarity fund (WGF, 2012).

Figure 3.5. Major costs related to flood governance

20 case study promoters responded



Note: The figure considers the types of costs rated on a scale from 1, major, to 4, minor. Responses correspond to the number of case studies.
Source: Data from case studies on flood governance collected for the OECD project (October 2016).

Another question is the sources of finance for flood governance. Three main sources of finance can be noted:

- *Contributions from the government*: the main source of finance is contributions from the general budget of public authorities, either at the national or regional levels. These contributions can come from taxation of actions that exacerbate flood problems, for example new construction in flood-risk areas that increase the impermeability of the soil, the occupation of natural flood areas, or failure to comply with various regulations.
    - The case studies indicated that public spending is by far the greatest source of funding for flood governance (although in some cases contributions came from private sources). This runs the risk that the availability of resources for flood management may become sensitive to political processes. However, tax money from authorities such as governments or the EU is by far the biggest source of funding, in particular that related to flood defence. OECD countries vary widely in the funding base they have available. Poland, for instance, has been shown to be highly dependent on European funds, such as the EU Solidarity Fund and the European Cohesion Fund, while the Netherlands has a national mechanism (the Delta Fund) to which EUR 1 billion will be contributed each year in the coming years and 23 regional water authorities (functional democracies) with tax raising power.
- *Insurance schemes*: the second source of finance for flood management is insurance schemes, typically operating at the individual or private level. Insurance schemes can be effective in preventing people from building new construction in risk areas and in providing incentives to encourage property owners to take account of the flood risk to which they are exposed (WGF, 2012). Some insurance schemes, such as the National Flood Insurance Program in the United States, operate in flat contradiction of this principle. In practice, in many cases, insurance schemes pay to rebuild properties in the same location after repeated floods and continue business as usual with no regard for

future risk. These schemes tend to be very expensive for the public sector and can create disincentives for mitigation and adaptation to risk. These programmes are failing to integrate a long-term vision that acknowledges and reacts on the basis that certain homes will be repeatedly flooded as climate change puts them at greater risk.

- *Transfers*: the third source of finance is transfers from European funds or international funds, such as the European Fund for Regional Development, the European Cohesion Fund, the European Social Fund and the European Agricultural Fund for Rural Development.

Payments for ecosystem services are also increasingly considered a source of finance for flood management. The development of green infrastructure, for example, can both aid flood regulation and provide alternative services such as recreation or climate regulation. In the United Kingdom, a Country Park pilot project was set up in Yorkshire to address surface-water flood risks, through swales, bunds, ponds, replacement of permeable road and car park surfaces and conversion of amenity grassland to semi-natural grasslands and more varied woodlands. This green infrastructure would also deliver water quality, recreation opportunities (with "floodable" sports pitches, a pavilion, fishing ponds, and circular walking and cycling paths), landscape and amenity and climate regulation (taking account of the urban heat island effect and carbon sequestration). Several buyers were solicited for the project, including the local water company, the local community (through volunteer works and payment for the use of sport facilities), and other national and European organisations (DEFRA, 2013).

The "polluter pays" and "user pays" principles can help determine who pays for flood management and can offer a solution for managing trade-offs across places. In the case of flood management, "polluters" are the stakeholders who increase the level of flood risk, for example, by creating impermeable areas. The "polluter pays" principle can also be applied to flood mitigation measures that reduce flood storage areas, for example through wetland destruction or isolating floodplains. In such cases, funding collected from polluters could be used to offset impacts through wetland restoration, improved floodplain connectivity or construction of artificial wetlands. To some extent, the "polluter pays" and "user pays" principles tend to go in opposite directions: the former charges for runoffs, while the latter charges those benefiting from a reduced probability of flooding, or reduced consequences from flooding. In Germany, the "polluter pays" principle has been widely adopted at the urban level to charge for surface water runoff on the basis of impermeable area, while in the Netherlands the "beneficiary pays" principle applies for primary defences, given the significant externalities associated with their benefits for the national interest (OECD, 2014b). However, in other countries like Ethiopia, legislation is needed to allow these principles to help bridge the funding gap.

More and more, co-finance schemes that bring together several partners are being employed as a mechanism to co-ordinate flood policy. In England and Wales, pooling resources at the relevant scale has been a useful way to co-operate and optimise resources. In this case, funding came from private, public sector organisations and the local community. Consequently, partners not only aligned funding programmes but also aligned policy on the ground. Another key aspect of the collaboration was the transparency of outcomes and benefits amongst partners to ensure the sustainability of the Herne Hill and Dulwich schemes. In France, the successful Plan Rhône was able to mobilise state and regional funding, with funding coming from local interest groups for flood-risk prevention (OECD, 2017), engaging different stakeholders at that stage of the flood management cycle.

Differing normative principles underpin these various funding options. In France, solidarity is seen as a key value, and the national solidarity financing system is based on the compulsory Cat-Nat (for natural catastrophes) insurance system, involving a public-private partnership between government and insurance companies. In a context of financial constraints, public-private partnerships are seen as one of many financial solutions for sustaining flood management. In the United Kingdom, the private interest principle is seen as more important, resulting in public-private partnership funding mechanisms based on cost- benefit analyses. These choices also touch on the issue of legitimacy: do governments want to provide an acceptable level of basic safety to all citizens, or are they content with "the best affordable safety" based on cost and benefits?

Areas to improve

Funding gaps hamper the implementation and sustainability of water-related disaster policies and the ability of the authorities responsible to carry out their functions. Such challenges generally stem from a mismatch between administrative responsibilities and resources and unsustainable and/or insufficient revenues. In Bangladesh, the obstacles involve insufficient capacity to apply financial schemes like water taxes or charges, resorting to the Green Climate Fund or enhancing the creditworthiness of water-related investments. Overcoming financial obstacles is thus very important in managing flooding across levels of government and for building capacity at the local and national scale. Financing is a particularly challenging issue in transboundary river basins, where the impact of floods is not limited to a single country, and regional or international action is called for.

Another challenge in financing is the delicate balance between recovery and prevention. Strong recovery mechanisms, like the French CAT-NAT system,[3] may reduce the incentive for pro-active spatial planning that can reduce the consequences of flooding. Risk exposure plans (*plans d'exposition aux risques* or PER), the predecessors of risk prevention plans (*plans de prévention des risques* or PPR), were a counterpart for the implementation of the national Cat-Nat solidarity system and included prescriptions on existing assets in flood-prone areas. However, they could not fully counterbalance the effects of a strong recovery system.

Ways forward

To reverse the current situation, disaster risk reduction should be made a priority for the international community. At present, 90% of international assistance is spent on emergency response and only 10% for disaster-risk reduction and preparedness. Between 1991 and 2010, of USD 106.7 billion (from total international aid) allocated to disasters, only 12.7% of funding was for risk-reduction measures preparing for natural disasters (Kellet and Caravani, 2013). The High Level Experts and Leaders Panel on Water and Disasters (HELP) has developed draft principles on Investment and Financing for Water-related Disaster Risk Reduction (2018). The aim is to double the investment and finance for water-related disaster-risk reduction, and to shift international assistance from disaster response to disaster preparedness. A background study in Japan noted the effect of preventive measures: if the Levee Reinforcement prevention project had been implemented before the 2000 Tokai storm flood, JPY 500 billion (the equivalent of USD 5 billion) would have been saved. Pre-disaster prevention measures include securing investment for the maintenance and management of infrastructure to cope with ageing infrastructure. The increasing amount of ageing infrastructure in Japan (including ageing gates and coastal levees) has increased disaster risk.

There is a need to diversify and combine different sources of finance through several specific solutions, including payments for ecosystem services; generating funding through international collaboration; and co-finance schemes. Unblocking climate finance from international sources such as the Global Climate Fund (GCF), as well as from mitigation and adaptation funds, can help to leverage larger amounts of money at the international level to allow flood projects to be carried out. This requires building capacity among key stakeholders, so they can make sufficient funding available. For this purpose, there is a need to mainstream climate change resilience to make flood projects eligible for more sources of funding, as there are few international funds dedicated exclusively to flood protection. This could amplify the range of opportunities for promoting flood projects. In addition, matching climate finance with traditional official development assistance for water and/or climate change, as well as private sector contributions, could be a good strategy for achieving a safe mix of financial resources in a context of fragmented finance.

Bridging this gap implies ensuring sound governance frameworks for sustainable financing as well as funding to carry out flood-related responsibilities cost-effectively. This means that governments should improve their fiscal systems and secure a sufficient budget in order to continue reducing the number of flood-related fatalities. Even though recovery and prevention activities are primary for flood management, policy and financing continuity in between two or more floods is also key to efficient flood governance. Sufficient and sustainable sources of finance require adequate regulation, offering incentives to different actors to engage in flood governance. This will require roles and responsibilities, as well as the necessary funds to put them into practice, be clearly spelled out, which is not usually the case for transboundary river basins. However, the global financial markets can play a key role here, and, as the HELP panel has suggested, making disaster-risk reduction mainstream in financial strategies is an important way forward. Governance arrangements should also bolster and help to ensure shared financing schemes between a broad range of actors, which can create stronger stakeholder engagement and ownership and create trust. Adopting mechanisms or incentives that encourage the efficient and transparent allocation of funds could increase the appeal of co-funding and other financial schemes. Finally, science and technology should support decision making on better investment.

Principle 7: Regulatory frameworks

Box 3.3. OECD Principle 7: Sub-principles, Indicators and Flood Checklist

Principle 7. Ensure that sound water management regulatory frameworks are effectively implemented and enforced in pursuit of the public interest, through:

a) Ensuring a comprehensive, coherent and predictable legal and institutional framework that set rules, standards and guidelines for achieving water policy outcomes, and encourage integrated long-term planning;

b) Ensuring that key regulatory functions are discharged across public agencies, dedicated institutions and levels of government and that regulatory authorities are endowed with necessary resources;

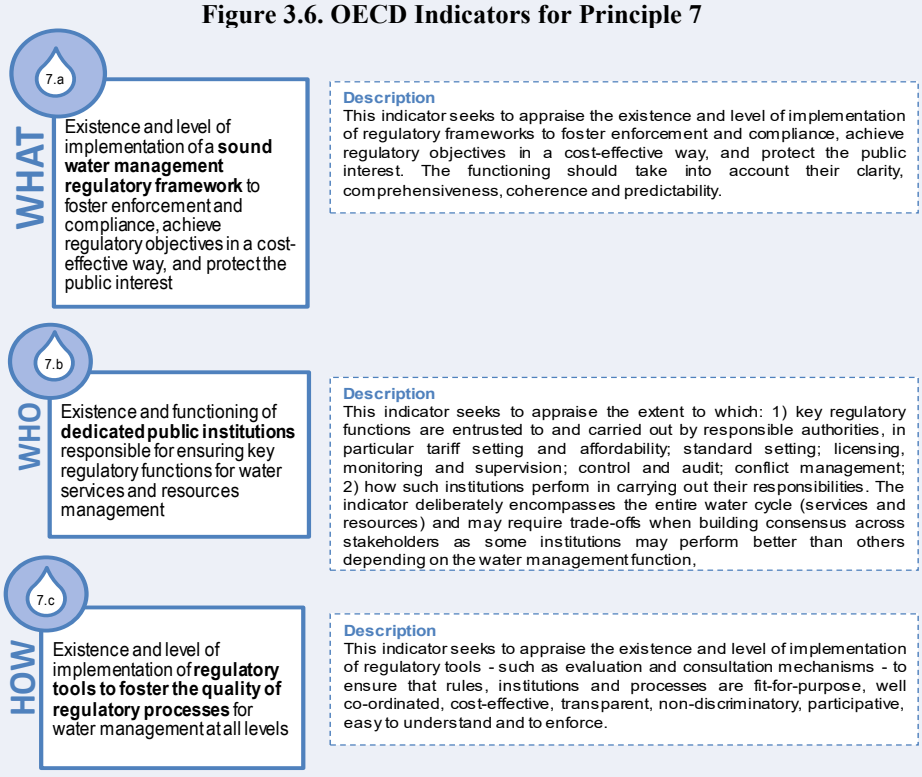
c) Ensuring that rules, institutions and processes are well-co-ordinated, transparent, non-discriminatory, participative and easy to understand and enforce;

d) Encouraging the use of regulatory tools (evaluation and consultation mechanisms) to foster the quality of regulatory processes and make the results accessible to the public, where appropriate;

e) Setting clear, transparent and proportionate enforcement rules, procedures, incentives and tools (including rewards and penalties) to promote compliance and achieve regulatory objectives in a cost-effective way; and

f) Ensuring that effective remedies can be claimed through non-discriminatory access to justice, considering the range of options, as appropriate.

Figure 3.6. OECD Indicators for Principle 7



Source: OECD (2018a), *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264292659-en.

Table 3.3. OECD Flood Checklist for Principle 7

	Checklist questions
Policy framework	In your case study, what is regulated in flood management?
	In your case study, which enforcement rules, procedures, incentives and tools are used to promote compliance and achieve regulatory objectives?
Institutions	Which institutions bear these key regulatory functions?
	To which strategies are these sources of finance allocated?
	Are regulatory authorities endowed with the necessary resources?
	Are there reviews of the governance and performance of regulatory authorities?
Instruments	In your case study, which regulatory tools are in place to encourage the quality of regulatory processes and make the results accessible to the public, where appropriate?
	Which remedies can be claimed through access to justice?
	Are evaluation mechanisms in place to systematically and regularly assess performance/effectiveness, gaps and overlaps in the regulatory framework (e.g. areas with regulatory gaps, incoherent and/or contradictory objectives, deficient implementation and/or limited enforcement, overlaps/duplication of responsibilities, etc.)?
	Where self-regulation mechanisms exist, are they subject to regular performance assessment?
	Are there co-ordination instruments between flood relevant ministries and bodies to improve regulatory processes?
Impacts	In your case study, what are the impacts of uncoordinated, irrelevant and ineffective regulatory frameworks?
	Are flood-related legislations subject to regulatory impact assessment?

Note: The full Checklist, including options for responses, can be found in Annex A.
Source: Authors' own research.

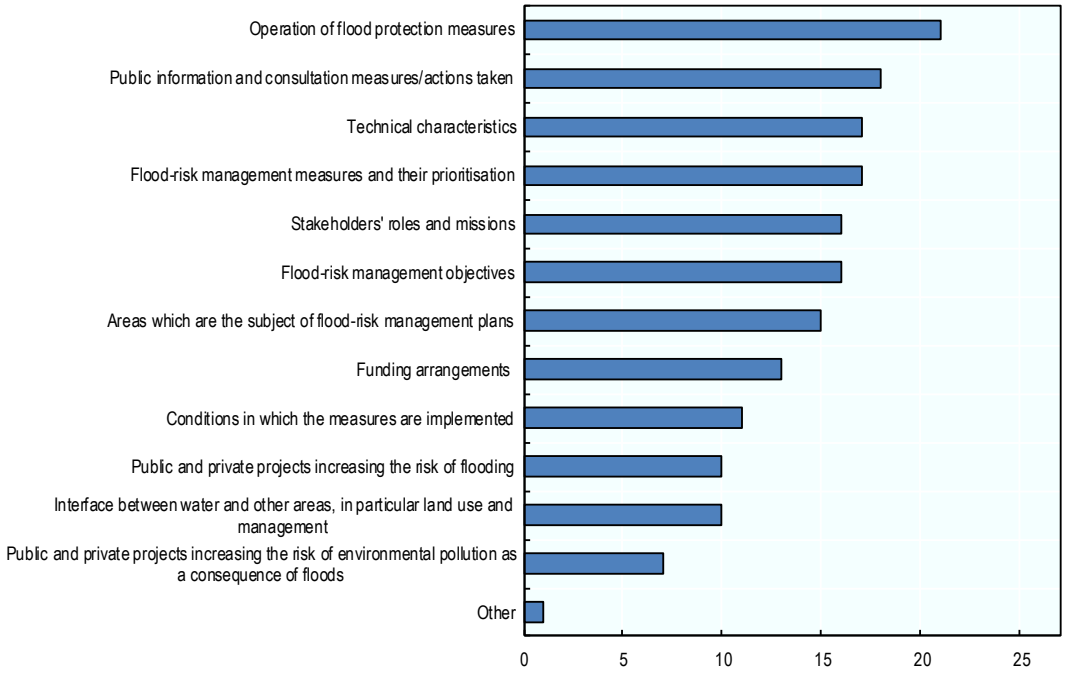
Observations

Regulation concerning flood management concerns not only infrastructure but also other functions, such as the establishment of efficiency incentives, collection of information and monitoring of performance, and the organisation of citizens' engagement in decisions about water security. The institutional framework is not only defined by laws or the national level, but by many other sub-national actors setting the rules (in many cases by informal water institutions such as customary water rights). Unclear or non-existent regulatory frameworks can widen the accountability gap.

The case study promoters report that their FRGAs primarily regulate the operation of flood protection measures; public information and consultation measures/actions; flood management measures and their prioritisation; technical characteristics of flood management; and stakeholders' roles and missions (Figure 3.7)Thus, flood management schemes may be multi-functional, so that synergies with other societal goals can be determined. A distinction should be made between substantive and procedural regulatory frameworks. In the Netherlands, substantive regulatory frameworks involve legally embedded safety norms. For example, procedural regulatory frameworks require that flood risks be reflected upon in spatial planning procedures. The relevance of these options depends on the physical and institutional context.

Figure 3.7. What is regulated in flood management?

25 case study promoters responded



Note: Responses correspond to the number of case studies that ticked each possible answer in the Checklist. Respondents could tick more than one answer.
Source: Data from case studies on flood governance collected for the OECD project (October 2016).

Regulatory frameworks may concern various levels of regulation, from the local to the international levels. At the international level, the European Floods Directive is one such example. Insights from the case studies show that, most often, local institutions (e.g. municipalities, local drainage boards, local water authorities, etc.) assume regulatory functions for flood management (as observed in 22 case studies), followed by national authorities (e.g. ministries, agencies, inter-ministerial committees, etc.), in 17 case studies. To a lesser degree, some case studies report that river basin committees perform regulatory functions. In many cases, regulatory prerogatives are not concentrated at one level alone, but are shared between national and local authorities (11 case studies), between basin and local authorities (in 6 case studies), or occasionally between supranational and national levels (3 cases). To promote compliance and achieve regulatory objectives for flood management, these authorities rely on different procedures and incentives: in most case studies (19), specific multilateral discussions and meetings are used, together with common agreements. Others use penalties, sanctions, reparations, incentives or rewards.

The case studies note various challenges raised by uncoordinated regulatory frameworks, such as conflicts about roles and responsibilities (12 case studies); policy complexity and confusion in the implementation of regulation (10 case studies); and rising costs of implementing regulatory frameworks (9 case studies).

In France, the Joint Flood Commission (*Commission Mixte Inondation*) brings together the Steering Council for major natural risks prevention (*comité d'orientation pour la*

prevention des risques naturels majeurs) and the National Water Committee (*Comité National de l'Eau*), allowing co-ordination not only between the water and flood actors but also with civil protection, environmental protection, and urban planning and land-use stakeholders. Flood Risk Management Plans (FRMPs) are strategic tools decreed by the river basin District Co-ordinator Prefect (the state representative at the district level). They are opposable to all administrative decisions in the field of water policy, including flood-risk prevention plans (PPRI) and local urban masters plan in the river basin district. These are implemented through local strategies at the scale of Areas of Potentially Significant Flood Risk.

An array of tools can help improve the quality of flood management regulation. Some tools relate to *monitoring and evaluation*, for example: regulatory impact assessments, particularly when carried out at the early stages of the policy process; reviews of existing regulations, including costs and benefits; and mechanisms or institutions that oversee procedures and goals to support regulatory policies. Others relate to *transparency and participation*, ensuring regulations are comprehensible and clear to the public, so that the different parties can easily understand their rights and obligations, and to provide meaningful opportunities (including online) for the public to help prepare regulatory proposals. The EU Floods Directive requires EU Member States to involve the public in planning procedures and drafting FRMPs. For example, in Bavaria, Germany, flooding planning has been passed on to Regional Water Forums, an important participatory mechanism under the Water Framework Directive. These tools are often complemented by remedies that can be claimed through access to justice; 12 case studies report using compensations for damages, while 8 include social interest litigation and 7 have ombudsmen. Six case studies out of 27 reported that no remedies had been claimed.

Areas to improve

Unclear regulatory frameworks tend to be associated with poor allocation of regulatory functions and, thus, in a lack of knowledge and awareness of rights and responsibilities. This can be linked to a mismatch between government-induced water policies and deeply embedded informal institutions (Menard et al., 2018). Conversely, flood-related regulatory frameworks can prove counterproductive; in Granada, Spain, over-regulation has generated additional administrative burdens for flood-risk management. Even if these frameworks have been set up, they can be ineffective, irrelevant or undermined by the lack of collaboration between different levels of government and ministries. For example, in Bangladesh, differentiated approaches between the Ministry of Water Resources, the Ministry of Environment and the Ministry of Disaster Management and Relief resulted in inconsistencies that undermined the enforcement of existing legislation. Furthermore, co-ordination with entities with related responsibilities is often pursued on an extemporaneous basis rather than through systematic and institutionalised mechanisms. More can be done to ensure that flood regulation is consistent with regulations in other fields.

Ways forward

Flood management requires establishing an effective regulatory framework that supports sound regulatory practices and protects people against floods as efficiently as possible and with the greatest possible benefits for the actors involved. Regulatory measures for the enforcement of legislation related to flooding, and for more coherence with regulations in other fields, such as land use, law on local governance or local regulations are therefore necessary. Bridging the divide between land and water is a central element of regulations governing flood management and a way of helping to co-ordinate policy geographically.

Apart from increasing flood management efficiency, a sound institutional framework needs to address the potential clashes that can arise between flood regulations and land use, as property owners become increasingly exposed to risk. Flood management regulation on public participation and clear, transparent regulatory functions can help co-ordinate various actors and interests. In sum, regulation, coupled with flood policy and long-term strategies, can offer a more holistic approach.

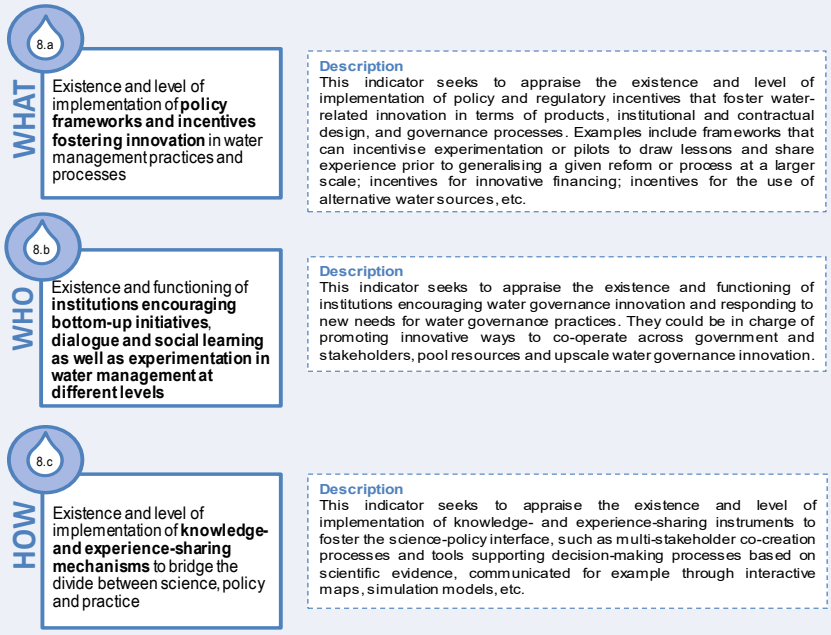
Principle 8: Innovative governance

Box 3.4. OECD Principle 8: Sub-principles, Indicators and Flood Checklist

Principle 8. Promote the adoption and implementation of innovative water governance practices across responsible authorities, levels of government and relevant stakeholders, through:

a) Encouraging experimentation and pilot-testing on water governance, drawing lessons from success and failures, and scaling up replicable practices;
b) Promoting social learning to facilitate dialogue and consensus-building, for example through networking platforms, social media, Information and Communication Technologies (ICTs) and user-friendly interface (e.g. digital maps, big data, smart data and open data) and other means;
c) Promoting innovative ways to co-operate, to pool resources and capacity, to build synergies across sectors and search for efficiency gains, notably through metropolitan governance, inter-municipal collaboration, urban-rural partnerships, and performance-based contracts; and
d) Promoting a strong science-policy interface to contribute to better water governance and bridge the divide between scientific findings and water governance practices.

Figure 3.8. OECD Indicators for Principle 8



Source: OECD (2018a), *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264292659-en.

Table 3.4. OECD Flood Checklist for Principle 8

	Checklist questions
Policy framework	Which innovative flood governance practices are implemented in your case study?
	Which policy frameworks and/or incentives are in place to encourage innovation in flood management practices and processes?
	Are there reviews to evaluate the state of play of and potential for technical and non-technical innovation, costs/benefits of innovation, as well as regulations and standards hindering innovation?
Institutions	Are there institutions encouraging bottom-up initiatives, dialogue and social learning as well as experimentation in flood management at different levels?
Instruments	In your case study, which mechanisms to promote social learning are in place to facilitate dialogue and consensus building?
	Which innovative ways to co-operate are in place in your case study, to pool resources and capacity, to build synergies across sectors and to search for efficiency gains?
	Which science-policy interface is in place in your case study to contribute to better flood governance and bridge the divide between scientific findings and flood governance practices?
	Are information and communication technologies used to guide better public action in flood management, and how?
Impacts	In your case study, what are the main barriers to innovative governance?

Note: The full Checklist, including options for responses, can be found in Annex A.

Observations

The rising risk of water-related disasters requires new solutions. The challenges generated by climate and societal changes call for innovative approaches to flood governance. Innovations in flood governance include new or more effective rules, practices and processes through which decisions for flood management are taken and implemented, stakeholders can articulate their interests and decision-makers are held accountable (adapted from OECD, 2015a). Innovations can relate to any of the other 11 water governance principles, such as data and information (e.g. involving citizens in the collection of flood-related data) or financing (e.g. new insurance schemes). Innovation may become necessary, for instance in the case of unusual major floods like those that struck the Seine and Loire valleys in France in 1910 and 1907. In such cases, governance frameworks tend to innovate in response to a rare disaster. However, flood governance should not only innovate after a disaster, but also be preventive and take lessons from other regions and countries where disasters are more frequent.

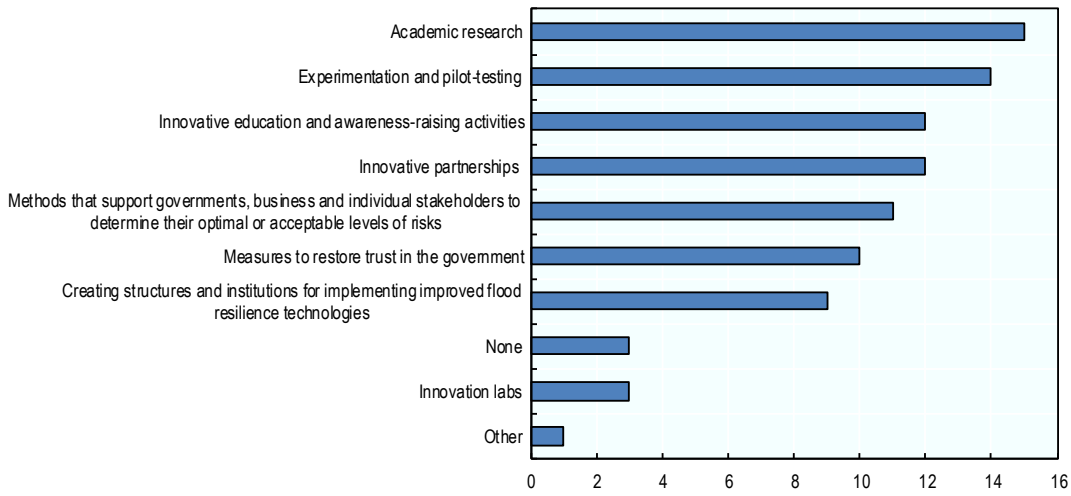
However, the capacity of decision makers to innovate in flood governance practices is fraught with a number of challenges. The case studies point to responsibility fragmentation of institutions as main barrier to innovative governance (as indicated by 16 case studies). Populations' lack of awareness and preparedness for dealing with flood risks were also identified as an obstacle to innovation in 14 case studies, while 10 reported dealing with insufficient knowledge on the economic value of flood risks. These obstacles can hinder solutions that allow to "do better with less money" and more people on board helping to accelerate innovation.

Efficient flood management involves both innovative flood management and innovative flood governance. Innovations in flood *management* include green infrastructure, such as green roofs and sustainable urban drainage systems (e.g. rain gardens, bio-retention ponds), or technological developments, such as mobile apps that can record live flooding and early-warning systems. Innovations in flood governance include citizen involvement, financial

incentives towards green infrastructures and innovative policies and ordinances. The objective of innovative flood *governance* is to ensure that a broad range of management options, including alternatives to traditional flood management are considered before any decisions are taken. Practices in innovative flood governance include academic research, such as developing models to estimate the effectiveness of evacuation decisions, or evaluating risk exposure by considering the evolving risk patterns (as observed in 15 case studies); experimentation and pilot-testing (14 case studies); innovative education and awareness-raising activities (e.g. introducing flood-control curriculum in schools or flood-control games for children); and innovative partnerships, between governments, knowledge institutes and the business sector, for instance (12 cases). (Figure 3.9).

Figure 3.9. Innovative flood governance practices implemented in the case studies

22 case study promoters responded



Note: Responses correspond to the number of case studies that ticked each possible answer in the Checklist. Respondents could tick more than one answer
Source: Data from case studies on flood governance collected for the OECD project (October 2016).

National and local authorities can collaborate to encourage experimentation and pilot-testing on prevention and mitigation, by scaling up (or down) replicable practices. This is the case for 14 out of 27 case studies that indicate relying on inter-municipal collaborations, which is an innovative way to improve co-operation among places, but also to pool resources and capacity, to build synergies across sectors and to look for gains in efficiency. A majority of case studies reported using such tools as digital maps and social media to promote social learning and facilitate dialogue and consensus building. Various innovative flood governance practices could be a source of inspiration for other countries and actors involved in flood management: for example, the Thames estuary 2100 in the United Kingdom, the Sigma plan in Belgium and Room for the River in the Netherlands. Other programmes set up by local stakeholders, whether local governments or private actors, have been noted in France, Ireland and the Netherlands. They constitute interesting examples of innovative practices at a more local level. The co-ordination of retention measures along the Rhine and the Danube transboundary basins can also be inspiring, in terms of innovative practice that cuts across countries.

The science-policy interface is also a critical element of flood governance and management measures. Effective co-ordination of interdisciplinary water research programmes including social sciences, and involvement of water end users, can be useful for reaching a critical mass in the uptake of the results. However, replication of good practices and pilot tests is not straightforward. Innovation uptake and implementation rely on high-level support. They require not only changes in actions and behaviour, but also changes in the assumptions guiding these actions and even more deeply of the structural context and factors that determine these assumptions. These elements are commonly referred to as triple-loop learning (Hargrove, 2002; Pahl-Wostl, 2009). Change also requires adaptive capacity, underlining the importance of strong knowledge infrastructure, knowledge institutes and large research programmes. This, however, is not easy to implement on the ground. To establish innovative flood governance practices, concerted effort is needed.

Innovation can mean going back to basics. Outreach campaigns can successfully influence attitudes towards what today can be considered innovative solutions (e.g. temporary flood storage) but which have in fact been around for thousands of years, for example, nature-based solutions (NBS). Colombia was able to introduce local behavioural change through social marketing campaigns in Valle de Cauca that helped increase the number of upstream landowners and downstream water users practicing conservation measures, as well as promoting inter-sectoral collaboration by setting up watershed management committees (OECD, 2018a). The co-benefits of NBS in reducing flood risks, such as nature conservation and natural resources management, were made tangible and ended up generating strong stakeholder engagement in Pilsen, Czech Republic (OECD, 2018a). Developing innovative practices today can be especially linked to the combination of NBS with grey infrastructure, such as the "sponge cities" programme in China aiming to help 30 cities reuse rainwater to deal with floods. It is important to note that, although green infrastructure solutions can achieve significant savings, making the financial case for them is often hard, as it is not easy to carry out valid comparisons between them and grey infrastructure expenses and benefits. This is why the EU has oriented its policy in that direction (e.g. 2013 European Commission Strategy on Green Infrastructure). Many EU countries have individually prepared national guidance documents and/or strategies to encourage investments in green infrastructure as a building block of sustainable spatial planning (EEA, 2015).

Areas to improve

Different places face different challenges and have different financial resources and capacities with which they can respond. Many OECD and non-OECD case study promoters report shortcomings associated with a lack of capacity to embark in innovation. When innovative practices are in place, fragmented institutional structures, actors and responsibilities have a negative impact on the possibilities of sharing and up-scaling innovation. Scattered innovative policies and tools across many scales and countries increase the risk of actors reinventing the wheel each time and incurring unnecessary costs and time-consuming tasks. Another important challenge refers not only to sharing mechanisms and responses with other regions and countries, but also learning how to capitalise on the acquisition of knowledge internally. Managing to use the lessons learnt to move forward and using them in other settings has proved difficult in many cases.

Ways forward

Innovation, apart from being central for the achievement of the 2030 Development Agenda (SDG 9 concerns innovation, infrastructure and industry), can help to bridge any of the

seven multi-level governance gaps, as well as enhance solutions that connect policies, people and places. Future flood management should strive to find a balance between different innovative approaches in search of more resilient social-ecological relations. Innovation should combine technical and non-technical solutions, as well as integrate the potential power of nature to spark the transition to sustainability. In this sense, the science and research community will play a major role in finding pathways to use innovation to find solutions that mutually support nature, society and local economies and contribute to better governance. Bridging the divide between scientific findings and flood governance practices can allow for forward-looking knowledge sharing, communication and co-ordination between stakeholders for responsive policy formulation.

In innovative governance, the time scale is also important. In addressing increased flood risks due to climate change, there is a need for long-term planning horizons. These may allow anticipating future problems, split incentives between those who generate the risks and those who bear the related liabilities, as well as land use decisions that generate long-term commitments and liabilities.

Notes

[1] http://geoportal.bafg.de/mapapps/resources/apps/ICPR_EN/index.html?lang=en.

[2] https://www.earthobservations.org/geoss.php.

[3] The CAT-NAT system is a French natural catastrophe insurance and reinsurance regime. It requires property damage insurance policies to include a provision for natural catastrophe coverage. When the state of natural disaster is declared by inter-ministerial decree, the provision extends the cover of the insurance to all "uninsurable damage" caused by natural phenomena (OECD, 2014a).

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Chapter 4. Trust and engagement in flood governance

This chapter looks at the Principles associated with trust and engagement of water governance. It highlights the importance of stakeholder engagement, integrity, transparency and accountability in decision making at several levels. It also points to what extent the governance systems can make trade-offs across water uses as well as the need for being able to monitor and evaluate progress made and where gaps are to be filled. It applies the Checklist and makes observations and analysis of Principles in relation to flood governance, it points to particular areas of improvement and finally it points to examples of ways forward. It uses a number of examples from the case studies to illustrate the importance of trust among stakeholders as one important element that can strengthen implementation of flood related policies and other measures.

The Principles 9 to 12 provide a foundation for understanding how trust and engagement between stakeholders help promote improved decision making. *Trust and engagement* in water relate to the contribution of governance to building public confidence and ensuring inclusiveness of stakeholders through democratic legitimacy and fairness in society at large.

The Principles 9 to 12 draw explicit attention to the role of transparency, integrity and accountability, for the quality of water decision making. They point to the importance of participatory decision making by promoting stakeholder engagement for inclusive decision making, as well as water governance frameworks should help manage trade-offs between different water uses. Finally, they also point to the need for consistent learning, regular monitoring and evaluation of water policies and governance frameworks for reform and adjustments whenever required.

How these principles play out have effects on flood governance. Opaque and non-transparent decision making can lead to weak implementation of flood related policies, rules, regulations and plans leading to inappropriate water and land uses that can help drive more severe impacts of floods. The exclusions of critical stakeholders can drive biased decision making disfavouring certain groups that are likely to be hardest hit by flood events. Finally, regular monitoring and assessment of flood governance will assist detecting what works, inefficiencies and where improved levels of trust and engagement need to be in place for sound flood policies and their implementation.

Principle 9: Integrity and transparency

Box 4.1. OECD Principle 9: Sub-principles, Indicators and Flood Checklist

Principle 9. Mainstream integrity and transparency practices across water policies, water institutions and water governance frameworks for greater accountability and trust in decision-making, through:

a) Promoting legal and institutional frameworks that hold decision-makers and stakeholders accountable, such as the right to information and independent authorities to investigate water related issues and law enforcement;

b) Encouraging norms, codes of conduct or charters on integrity and transparency in national or local contexts and monitoring their implementation;

c) Establishing clear accountability and control mechanisms for transparent water policy making and implementation ;

d) Diagnosing and mapping on a regular basis existing or potential drivers of corruption and risks in all water-related institutions at different levels, including for public procurement; and

e) Adopting multi-stakeholder approaches, dedicated tools and action plans to identify and address water integrity and transparency gaps (e.g. integrity scans/pacts, risk analysis, social witnesses)

Figure 4.1. OECD Indicators for Principle 9

Source: OECD (2018a), *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264292659-en.

Table 4.1. OECD Flood Checklist for Principle 1

	Checklist questions
Policy framework	In terms of integrity and transparency, where has the emphasis been put in your case study?
	When roles and responsibilities for flood management and risk reduction are delegated to dedicated public or private entities, are there contractual arrangements between organising and executive bodies?
	Are there provisions for transparency and integrity in national legislation?
	Are there provisions for whistle-blower protection in legal and institutional frameworks?
	Which legal and institutional frameworks that hold decision-makers and stakeholders accountable are in place in your case study?
	Are norms, codes of conduct or charters on integrity and transparency in national or local contexts in place and their implementation monitored?
	Are there requirements in place for regular financial disclosure of assets, income and interests?
Institutions	Are there independent authorities (not necessarily water-specific) and supreme audit institutions that can investigate water-related issues and ensure proper enforcement (e.g. policy effectiveness and procurement)?

Instruments	Which accountability and control mechanisms for transparent flood-risk policy making and implementation are in place in your case study?
	Are corruption risks and actual corruption in the water sector (e.g. manipulation of knowledge and information, bribery, extortion) diagnosed?
	Are potential drivers of corruption and corruption risks regularly diagnosed and mapped in all institutions involved in flood management at different levels, especially<??>:
	In your case study, how are integrity and transparency gaps regularly identified and addressed?
Impacts	In your case study, how is the impact of corruption assessed in terms of environmental, social and economic costs?

Note: The full Checklist, including options for responses, can be found in Annex A.
Source: Authors' own research.

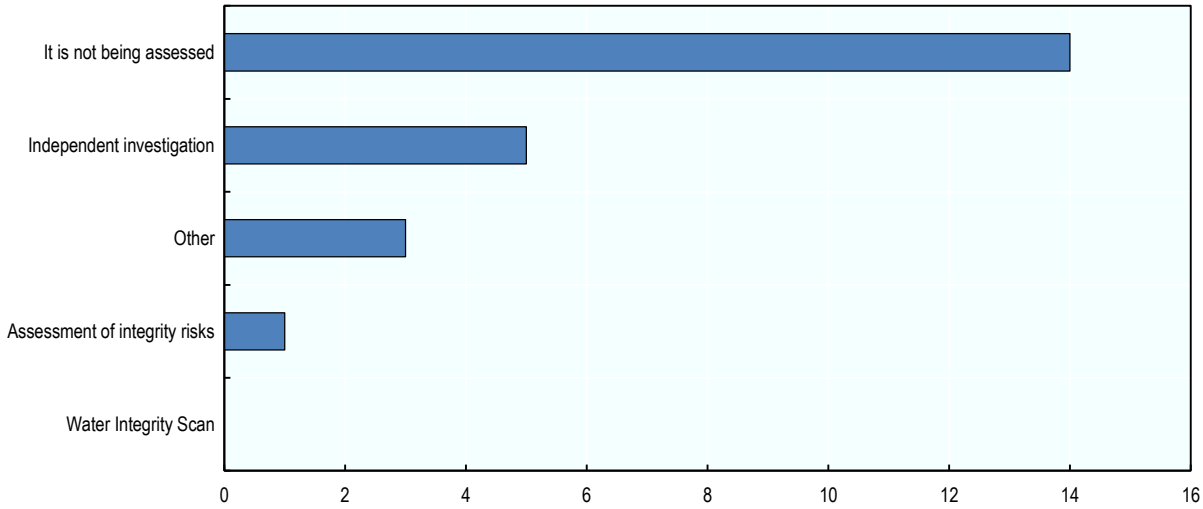
Observations

Corruption in the water sector can pose a significant risk to integrity, transparency and safety. In 2014, for example, the Mayor of Venice and 35 other people were arrested for allegedly siphoning off millions from the "Moses" flood prevention project. The Mayor was accused of having received illicit funds from the consortium behind the construction of the project, to fast-track the approval of contracts. Politicians used the funds for their electoral campaigns as well as for personal gain.

The lack of accountability and transparency in water policy is a symptom of governance deficiencies both in the private and public arenas. Insights from practice reveal that the risks and impacts of corruption in flood management are still rarely diagnosed and assessed (Figure 4.2). While some tools and action plans exist to map potential drivers and risks of corruption (e.g. integrity scans/pacts, risk analysis and social monitoring), their use is still anecdotal in flood governance. The majority of case studies collected acknowledge that institutions involved in flood governance do not conduct any diagnosis. For the same reason, there is little done to assess the impact of corruption in terms of environmental, social or economic costs. Only a few isolated case studies conduct independent investigations or integrity risk assessments.

Figure 4.2. How is the impact of corruption assessed in flood governance?

24 case study promoters responded



Note: Responses correspond to the number of case studies that ticked each possible answer in the Checklist. Respondents could tick more than one answer.
Source: Data from case studies on flood governance collected for the OECD project (October 2016).

Legal and institutional frameworks on flood governance put an emphasis on information to ensure accountability. The majority of case studies count on the right to information as the primary channel for holding decision makers and stakeholders accountable, and to ensure that flood-risk policy making is transparent. However, in some cases this is not enough. In Ethiopia, for example, there is a need for enforcement tools to guarantee compliance with existing principles of integrity and transparency. Multi-stakeholder approaches and social witnesses are also considered useful to identify and address integrity and accountability, as well as to build trust among partners. In Austria, to drive its decision-making processes the ICPDR has developed a set of rules of procedure that mainstream integrity and transparency practices, which range from the micro-organisational level to the international arena with fundamental treaties.

Many countries suffer an "accountability gap" when there is little public concern for water-related policy making, or where there is no monitoring and evaluation of water policy outcomes (OECD, 2011). In the Netherlands, communication to citizens about flood risks is low; partly because, under the law, the national and regional water authorities are responsible for dealing with water safety and because the country has not suffered any serious flooding since 1953. As a result, the population is not fully aware of the risk. This false sense of security and the choices of decision makers about flood management are rarely scrutinised or questioned (OECD, 2014b). After the OECD issued policy recommendations on the subject in 2014, various awareness-raising activities have been undertaken by the Dutch government, such as a "water week" twice a year, as well as a website[1] where citizens may enter their postal code to see whether they are at risk for flooding and what they should do if it does occur. This has helped to resolve some of the asymmetries of information and co-ordination issues. In addition, it is important to cite another stakeholder-related challenge affecting accountability. Given the drop in governments' provision of public goods in recent decades, the private sector has taken on increasing importance as a strategic partner in flood management. This has transformed

traditional governance accountability (OECD, 2011), which at times fractured approaches to stakeholder engagement, undermining the mechanisms of mutual control for ensuring integrity.

Areas to improve

Various gaps exist, both in OECD and non-OECD countries, for ensuring integrity and transparency in flood management among different constituencies (OECD, 2011). These can have severe consequences. Corruption and bribery undermine the protection of citizens against floods and can take place at all stages of the flood-management cycle, from anticipation to recovery. Embezzlement and fraud can threaten the quality of flood-protection measures and put lives at risk. Contracting, permitting and licensing processes are particularly vulnerable. Bribes and collusion, for example, are common means of influencing design and procurement processes and can amount to grand corruption in large-scale infrastructure development (WIN, 2016). Moreover, another challenge can arise from the inclusion of private-sector stakeholders. The increasing importance of the private sector as a strategic partner for flood management was accompanied by the transformation of traditional governance accountability (OECD, 2011), which sometimes fractured stakeholder engagement approaches that undermined mutual control mechanisms for ensuring integrity.

In many countries, institutional dysfunction and opaque decision making undermine collective action for properly managing floods. Accountability in flood management tends to be predominantly limited to technical reporting and financial accounting to institutional superiors. Few mechanisms exist for holding flood-risk managers accountable to the public. A lack of transparency among actors regarding practices and operations can also be a barrier to institutional lesson-learning. The lessons learned from post-tsunami reconstruction in Indonesia, Malaysia or Pakistan are relevant, since flood response is vulnerable to corruption (see ADB, OECD and Transparency International, 2005).

Ways forward

Integrity and transparency need to be mainstreamed throughout governance approaches to flood management, and at all levels and sectors, to promote greater accountability, transparency and participation. Various aspects can be emphasised to help ensure that this happens (WIN, 2016):

- *More co-operation*: between the water sector, the anti-corruption sector, public finance institutions and the judiciary is needed, through joint investigations and information sharing or judicial assistance; between flood actors and public finance institutions; between water agencies, authorities involved in flood management and users, to support and build trust around the operations and maintenance processes;
- *More participation and multi-stakeholder decision making should be encouraged*: this can encourage awareness of citizens' rights to water and help build capacity for participation;
- *Information should be shared*: information on the quality and sustainability of flood-risk infrastructure and services could and should guide decisions;
- *Sources of funding should be included in the budget in a clear and transparent manner*, and funding and evaluation mechanisms should be aligned;

- *Comprehensive accountability mechanisms should be set up*: independent monitoring of activities by the media, governmental and non-governmental institutions, academic institutions and civil society holds flood-risk managers accountable. Mechanisms like procurement processes should be transparent, fair, non-discriminatory, accountable and verifiable.

Principle 10: Stakeholder engagement

Box 4.2. OECD Principle 10: Sub-principles, Indicators and Flood Checklist

Principle 10. Promote stakeholder engagement for informed and outcome-oriented contributions to water policy design and implementation, through:

a) Mapping public, private and non-profit actors who have a stake in the outcome or who are likely to be affected by water-related decisions, as well as their responsibilities, core motivations and interactions;

b) Paying special attention to under-represented categories (youth, the poor, women, indigenous people, domestic users), newcomers (property developers, institutional investors) and other water-related stakeholders and institutions;

c) Defining the line of decision-making and the expected use of stakeholders' inputs, and mitigating power imbalances and risks of consultation capture from over-represented or overly vocal categories, as well as between expert and non-expert voices;

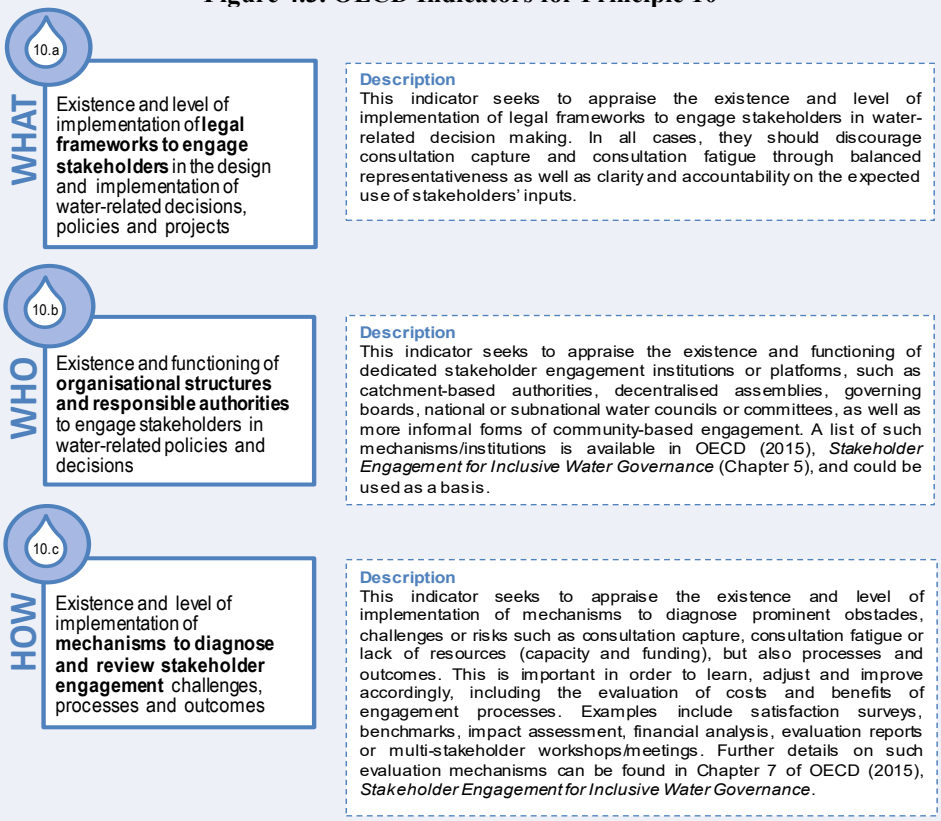
d) Encouraging capacity development of relevant stakeholders as well as accurate, timely and reliable information, as appropriate;

e) Assessing the process and outcomes of stakeholder engagement to learn, adjust and improve accordingly, including the evaluation of costs and benefits of engagement processes;

f) Promoting legal and institutional frameworks, organisational structures and responsible authorities that are conducive to stakeholder engagement, taking account of local circumstances, needs and capacities; and

g) Customising the type and level of stakeholder engagement to the needs and keeping the process flexible to adapt to changing circumstances.

Figure 4.3. OECD Indicators for Principle 10



Source: OECD (2018a), *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264292659-en.

Table 4.2. OECD Flood Checklist for Principle 10

	Checklist questions
Policy framework	In your case study, who are the stakeholders involved in flood-related decision making?
	Which legal and institutional frameworks, organisational structures and responsible authorities conducive to stakeholder engagement are in place in your case study?
Institutions	Was a stakeholder mapping carried out to make sure that all those who have a stake in the outcome or who are likely to be affected are clearly identified, and their responsibilities, core motivations and interactions understood?
	Are the ultimate line of decision making, the objectives of stakeholder engagement and the expected use of input clearly defined?
	Which stakeholder engagement structures and/or mechanisms are in place in your case study, and at which stage of development?
	In your case study, at which scale are these efforts carried out?
	Are there mechanisms in place to engage with scientists in decision making?
Instruments	Which monitoring and evaluation mechanisms are in place to assess the process and outcomes of stakeholder engagement to learn, adjust and improve accordingly?
	Are stakeholder engagement mechanisms flexible to adapt to changing circumstances?
	Are there mechanisms or regular assessments of stakeholder engagement costs or obstacles at large?
	Is needed information for result-oriented stakeholder engagement shared?
	Do tailored communication strategies exist for relevant stakeholders, including the general public, regarding all aspects of flood management?
Impacts	In your case study, what are the main barriers to stakeholder engagement in flood management?

Note: The full Checklist, including options for responses, can be found in Annex A.
Source: Authors' own research.

Observations

Citizens are protagonists in flood governance, and it is essential that they be at the core of flood-management policies, but more can be done to encourage their participation. In England, local flood action groups have developed community flood emergency plans. Another example can be found in Belgium, where Vivaqua, the Belgian drinking water and sanitation service provider, has collaborated since 2013 with municipalities and citizens to develop a participatory flood-monitoring programme. This consists of carrying out "audits" of building conditions to take account of flood risks, and identifying practical measures to be taken to reduce the magnitude and frequency of floods. To date, a number of visits have taken place and successfully provided inhabitants with the information they requested for protecting their business against floods (OECD, 2015b). The case studies indicate that citizens and inhabitants of flood-prone areas are second to governments as the stakeholders most often involved in decision making on flood management. However, this observation should be qualified, as in several European countries (Netherlands, Belgium, Sweden, Poland, France and even England, which seems the most advanced in this respect) it was found that communicating risks to citizens is difficult and that citizens tend to adopt the attitude that "The government will take care of me" (Hegger et al., 2013). In the Netherlands and Poland, for example, citizens are strikingly uninformed about key water management functions, how they are performed and by whom, the regional water authorities they belong to and the basics of evacuation policy. Perception of water risks is equally low (KZGW 2012; OECD, 2014b). This can partly be explained by the fact that Dutch and Polish citizens are legally entitled to a certain degree of flood protection, either at the local or national level (CBOS, 2010). Similar attitudes were observed in England and Belgium, where flood management authorities only have permissive power, and citizens do not have an explicit constitutional right to flood protection.

As risks of floods intensify, new players have gained interest and influence in flood governance. Property developers and landowners, amongst others, now play an important role, as spatial development generates long-term liabilities and financial implications in water management, such as compensation for the loss of nature values, green areas and water amenities. They can help seek out new sources of finance and to the development of non-technical solutions for managing floods. In Belgium, for instance, a new paradigm emerged in the 1990s that considers flood management as the shared concern of water managers and spatial planners, and which was institutionalised through the creation of a Co-ordination Committee on Integrated Water Policy in Flanders and the Interdepartmental Flood Group in Wallonia (Mees et al., 2016). In Italy, the Council of Ministers Presidential Decree of 28 May 2015 gave a legal and transparent framework to the allocation of functions and definition of procedures that have helped anticipate flood-related bottlenecks. Finally, the Kampen (Netherlands) experience, by engaging civil society, has helped bridge the capacity gap of the public administration to manage floods (OECD, 2018a).

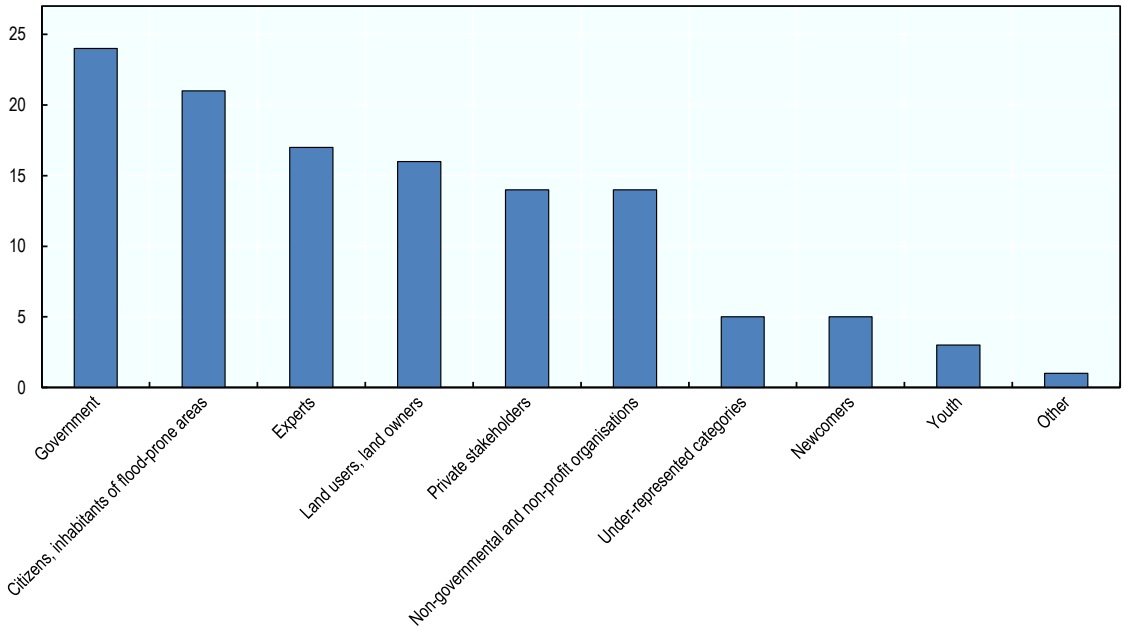
Innovative stakeholder engagement mechanisms and tools for decision making are gaining traction in the water sector, thanks to technological advances and greater skill and openness in applying the tools for discussion. While "traditional" engagement tools that enhance collaboration across people, such as meetings/workshops, policy dialogues and river basin committees, are still largely used (as exemplified by the majority of case studies collected), new tools are emerging. Electronic participation (e-participation) can contribute to more responsive, cost-effective and inclusive flood governance. E-participation has been used to set up citizens' observatories for flood management in the Netherlands and the United Kingdom, where it consisted in a variety of citizen groups (volunteers, elected citizens, citizen scientists and communities) and rested on a range of communication modes from

listening as a spectator to expressing and developing preferences on specific issues (Wehn et al., 2014). However, non-face-to-face communication may also have adverse negative impacts, such as biases or misunderstandings, which need to be taken into account.

Monitoring and evaluation mechanisms are increasingly being used to assess stakeholder engagement processes and their outcomes, to identify where weaknesses lie and improvement is needed. These include regular stakeholder meetings (as observed in 17 case studies), cost-benefit analysis (in 12 case studies), questionnaires and interviews. The case studies identify many other actors as key players in the making of flood-related decisions, including land users and landowners, experts/scientists and private actors such as water industries, water providers and insurance companies (Figure 4.4). In fact, in many instances, requirements for stakeholder engagement are part of flood-related projects (as observed in 18 case studies), organisational practices include multi-stakeholder forums (in 13 case studies), or river basin committees dealing with flood management include representatives of various stakeholders (11 cases).

Figure 4.4. Stakeholders involved in flood-related decision making

25 case study promoters responded



Note: Responses correspond to the number of case studies that ticked each possible answer in the Checklist. Respondents could tick more than one answer. "Under-represented" categories refer to youth, the poor, women, indigenous people, and domestic users); "newcomers" include property developers and institutional investors.
Source: Data from case studies on flood governance collected for the OECD project (October 2016).

Areas to improve

- Stakeholder mapping is a useful instrument for assessing how effectively flood protection is being carried out. Diagnosing gaps and redundancies can help achieve synergies across policies and sectors, but adequate stakeholder engagement also means going beyond "who does what". In other words, actors within and outside the flood domain need to be identified and engaged. For instance, residents can be

collaborative actors in flood mitigation and co-responders in flood response, particularly in rural areas. FRGAs should promote behavioural change and increased responsibilities among all stakeholders, including decision makers, youth, land users and landowners. Insurance systems can play a major role in this respect. There is a wide variety of approaches across countries to protecting households and businesses against the financial impacts of floods. In some countries, flood insurance arrangements have led to broad coverage of flood damage and losses although this is far from universal. Overall, a significant financial protection gap remains, which leaves households and businesses – and ultimately governments – exposed to substantial risk of financial losses (OECD, 2106b).

- In Germany, for instance, insurance companies, along with the German Flood Competence Centre, were involved in the development of a "Floodlabel" (*HochwasserPass*) for homes and buildings.[2] The Floodlabel system takes a long-term mitigation approach and aims to support and guide home and building owners worldwide in minimising the disruptive damage created by flooding. In a first step, Floodlabel helps the homeowner to detect the flood danger spots and weak points in and around the home. It then guides the homeowner in equipping the property for the best possible individual flood resilience, through achievable measures that are easy to apply.

Some players may dominate decision-making processes and/or "capture" the stakeholder engagement process. Hydraulic bureaucracies are a potential governance hazard for decision-making processes (Molle et al., 2009). In some countries, flood prevention and mitigation can be dominated by engineering firms, as they have the expertise to carry out flood studies, assess options and carry out cost-benefit analysis. This may result in unintended bias, given the skills required for these tasks. In some countries governments fund a variety of engineering options but do not fund mitigation measures, like elevating houses or relocation of properties at risk. Stricter building controls may be supported by one level of government but blocked by another. This suggests there is a need to secure the required financial and human resources at the appropriate levels to sustain the engagement process and avoid over-representation. Enabling co-decisions and co-production of policies will be crucial in allowing voices that typically are not heard to take more control and develop a sense of ownership over processes and outcomes.

In many cases, compensation is not an effective remedy for those asked to reduce the risk across the watershed while they experience increased flood risk in their property (Thieken et al., 2007). This is often rooted in bad measurement of the values and impacts of flood for different landowners and more broadly, stakeholders. For instance, neglecting behavioural components, such as the willingness to relocate, can result in different and confusing estimates of risks and impacts. Landowners' diverging preferences and motivations for flood strategies reflect the heterogeneity of worldviews of the stakeholders involved. They might be motivated, for example, by a desire to maximise utility, by governance values or by a perceived responsibility for protection (Milman et al., 2017). Understanding motivations and interests is also fundamental for mapping all stakeholders who have a stake in the outcome or are likely to be affected, and thus for developing long-term strategies and plans.

Ways forward

Flood governance is not solely a government issue, since many other stakeholders play a role. Trust and public acceptance in policy choices governing flood management should rely on inclusiveness, bottom-up decision making and the capacity of policy makers to accommodate a broad range of often conflicting interests across the water chain and policy cycle. Governments now acknowledge that water policies, however well intentioned, require stakeholder engagement if they are to be implemented on the ground. This is also true for flood governance. The traditional role of governments as the single decision-making authority has in many instances been replaced by multi-level and polycentric governance. Furthermore, a critical test of trustworthy and legitimate flood management approaches is not just whether stakeholders are engaged, but whether they are also playing their part and have enough information to do so. Unbalanced power, interests and needs may be hard to align, and result in problems co-ordinating actions and strategies, since the interests of stakeholders are so different. The fragmentation of players with unclear and overlapping responsibilities can lead to a high degree of policy incoherence.

A critical step in moving forward is to address the awareness gap in flood protection, risks and costs. This involves increasing the awareness of risks to allow property owners, businesses and citizens to make informed choices, be better prepared and become more involved in flood management. Awareness can also mean informing local actors of what they are capable of doing and preparing for, to strengthen the resilience of a community. Awareness of the problem can also serve to increase the willingness to pay for services and the management of flood risks. Citizens often take them for granted and feel no responsibility for flood preparedness. Raising awareness can also help to increase the sense of responsibility, enabling local communities to play a greater role in planning and decision making, as well as in proposing alternative solutions. In addition to awareness-raising campaigns and public meetings as a two-way communication channel, risk maps on the Internet also help raise awareness, as do social media postings on Twitter (e.g. @epawater), Facebook, Instagram or YouTube, and such initiatives as the World Youth Parliament for Water network. The fact that many authorities do not have the capacity to guarantee preparedness is an entry point for public participation.

Participation of stakeholders throughout the policy cycle is deemed essential for informed and outcome-oriented FRMSs. Stakeholder engagement in flood management often relates to specific measures, like establishing flood-risk maps, but less to setting objectives and strategies. Even though evidence of the benefits of stakeholder engagement is becoming more robust, the time and resources needed to set up such engagement processes can be a deterrent. Discussions and trade-offs are needed to determine the objectives of the engagement process, the stakeholders to be engaged, the decisions to be made and the information to be collected, to strike a just balance between the resources available.

Principle 11: Trade-offs between users, places and generations

Box 4.3. OECD Principle 11: Sub-principles, Indicators and Flood Checklist

Principle 11. Encourage water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations, through:

a) Promoting non-discriminatory participation in decision-making across people, especially vulnerable groups and people living in remote areas;

b) Empowering local authorities and users to identify and address barriers to access quality water services and resources and promoting rural-urban co-operation including through greater partnership between water institutions and spatial planners;

c) Promoting public debate on the risks and costs associated with too much, too little or too polluted water to raise awareness, build consensus on who pays for what, and contribute to better affordability and sustainability now and in the future; and

d) Encouraging evidence-based assessment of the distributional consequences of water-related policies on citizens, water users and places to guide decision-making.

Figure 4.5. OECD Indicators for Principle 11

Source: OECD (2018a), *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264292659-en.

Table 4.3. OECD Flood Checklist for Principle 11

	Checklist questions
Policy framework	What are the main trade-offs linked to flood management in your case study?
	Are there formal provisions or legal frameworks encouraging equity across policies, rural and urban areas, and generations, etc.?
Institutions	Is there an Ombudsman or institution(s) (not necessarily water-specific) to protect vulnerable groups, mediating disputes and managing trade-offs when necessary?
Instruments	Which mechanisms are in place in your case study to ensure that the main trade-offs are addressed?
Impact	What are the distributional consequences of flood-risk management strategies on citizens and places in your case study?

Note: The full Checklist, including options for responses, can be found in Annex A.
Source: Authors' own research.

Observations

The governance of floods inherently generates trade-offs that need to be managed. A trade-off occurs when two opposing situations or qualities have to be balanced, which can sometimes result in accepting something bad in order to secure something good. The implementation of FRMSs at a certain time can imply that not all inhabitants of a country are equally protected against flood risks or that those who generate future liabilities do not always bear the related costs. Compromises and trade-offs are needed to correct imbalances in the distribution of flood-related costs and benefits, socially and geographically. The major trade-offs related to flood management are Figure 4.6

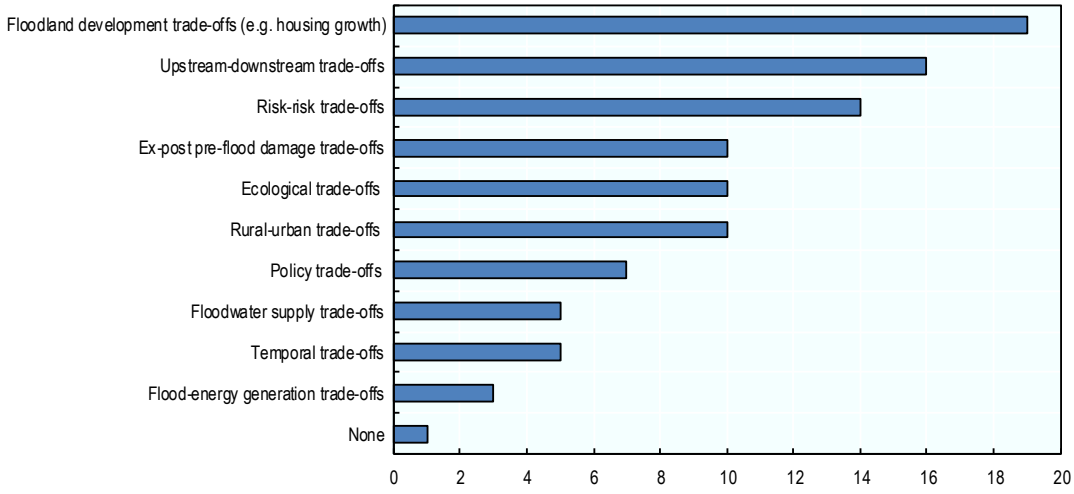
- *Upstream-downstream trade-offs*: the construction of dikes, drainage systems or floodplain enlargements in upstream areas can have both negative and positive downstream effects. In Austria for example, the area downstream from the Aist catchment is highly vulnerable, since it is shaped by varying conditions like economic and social development and administrative/political differences. The upstream municipalities tend to be economically weaker than the small towns downstream, where there is a larger industrial sector and thus more job opportunities (Seher et al., 2018). The opposite is also true, as retention areas that have been created upstream can have effects downstream.
- *Risk-risk trade-offs*: A risk-risk trade-off occurs when interventions to reduce one risk increase other risks. This may influence policy choices, such as in Turkey or Japan, where governments have to decide whether to prioritise water-related and seismic risks. It may also influence other water risks. For example, in many places, climate change generates droughts at some periods of the year and floods at others, requiring flood-drought trade-offs.
- *Ex-post – pre-flood damage trade-offs*: Floods can cause *ex-post* damage, but measures to prevent floods from happening can also cause losses and damages for small groups of people (in pre-flood damage), for example when houses are located on dike construction sites.
- *Ecological trade-offs*: Sea-level rise in coastal areas often means that a choice has to be made between managing retreat, in order to maintain the area of offshore mudflats, or protecting the existing onshore ecosystems. Retention measures have positive effects both on reducing flood hazard/risk and the environment (e.g. dike

shifting). Flood-risk management strategies therefore need to balance trade-offs and incorporate green intervention strategies.

- *Rural-urban trade-offs*: Flooding may generate greater damages in cities. Higher population densities and greater levels of stormwater runoff due to the increase in impermeable surfaces can affect greater numbers of people (OECD, 2013a). Areas that are more significant economically are often afforded greater levels of protection. The draft plan for the mitigation of hydrogeological risk in Italian metropolitan and urban areas, for instance, is intended to protect the large numbers of people exposed to floods. Both these aspects can result in imbalances between cities and rural areas. It is essential for FRGAs to ensure that rural areas are not only used as floodplains and forced to bear the costs of FRMSs designed to protect cities.
- *Policy trade-offs*: as highlighted in Principle 3, other policy areas regarding housing or transport, for instance, may have positive or negative impacts on flood management. Conflicting policies can be expressed in the form of an objective gap. Cross-sectoral co-ordination is required to find a balance between competing land uses.
- *Temporal trade-offs*: Decision-making tools that discount the future can be problematic, as they may lead to short-term solutions and quick fixes. Development planning often resorts to short-term solutions. In selecting structural solutions, decision makers do not necessarily look at the long-term impact, such as the degradation of ecosystem services, natural resource or environmental assets, and increased flood risk. Strengthening inter-generational linkages is one among other possible options for addressing temporal trade-offs. The Water and Waste Services Regulation Authority in Portugal (*Entidade Reguladora dos Serviços de Aguas e Residuos* or ENSAR) manages trade-offs across generations, with tariff policies and service provision practices defined by the regulator.

Figure 4.6. Main trade-offs linked to flood management

24 case study promoters responded



Note: Responses correspond to the number of case studies that ticked each possible answer in the Checklist. Respondents could tick more than one answer.
Source: Data from case studies on flood governance collected for the OECD project (October 2016).

Areas to improve

The trade-offs mentioned above indicate a number of multi-level governance gaps – e.g. in accountability, objectives, administrative issues and policy – which suggest several areas for improvement. First, due to the complex nature of the trade-offs involved in flood management, the relative benefits and costs of FRMSs are often controversial (OECD, 2013a). Second, compensation is generally monetary, and the effect on the ecosystem is not taken into account. Many benefits and costs do not necessarily have a market value, something that is particularly true in dealing with water-related disasters, which can lead to irreversible and disastrous outcomes. Third, different stakeholders may have different views on justice. This often conflicts with the egalitarian principle that requires that flood-risk management strategies should target the most vulnerable people. Is a higher risk acceptable in some locations to compensate for possible damages? And what if citizens can freely choose to live in a flood-prone area: should they be protected at the same level as people who choose to live in a naturally safer area? Decisions tend to be top-down; public administrations have a central role in the decision-making process, while local stakeholders are generally excluded. For instance, in Germany, the National Flood Protection Programme addresses upstream-downstream conflict by incorporating the principle of solidarity to finance measures in a catchment. The national government set up a fund to carry out flood protection measures and compensate costs between these parties (Thaler and Hartmann, 2016). To tackle these challenges, integrated FRMSs are required, to encourage the participation of multiple stakeholders. If they are properly involved in public debate and empowered to identify and address barriers to sound flood management measures and resources, stakeholders can modify their behaviour and discuss justice issues.

This situation calls for a thorough assessment of the distributional consequences of flood-related policies on citizens and places. Such consequences may require certain stakeholders to bear the costs of flood management rather than other actors (e.g. property developers).

They may also require upstream water users to bear the costs of infrastructure investments, or leave poor and marginalised populations increasingly vulnerable to floods. A FRMS implemented in one area should not burden another area with problems. In France, a win-win approach was adopted for the action programme for flood prevention of the Alsace-Moselle, in order to maximise benefits and outcomes. An equitable division of benefits and costs of flood governance approaches should be shared, while ensuring an acceptable and minimum safety level for all. The poorest people are often unable to afford insurance, or do not have the resources to recover their lifestyle and livelihood easily after a flood event. In the United Kingdom, many homeowners used to have great difficulty obtaining affordable insurance if their households were at high risk and/or had previously been flooded. To address this issue, the government has introduced Flood Re, a reinsurance scheme designed to keep premiums affordable, and funded by a levy on all insurance premiums. However, no help is provided for those who cannot afford insurance or to flood-proof their homes. Tackling such issues of injustice was one of the reasons for establishing the EU Floods Directive.

Ways forward

The trade-offs generated by flood governance must be better assessed and addressed through, for instance, public debate, stakeholder consultation, and cost-benefit or multi-criteria decision analyses. In Bulgaria, a participatory approach was adopted to resolve the complexity of trade-offs. The design of a drought and flood management strategy in the Upper Iskar Basin implied the involvement of a wide range of regional stakeholders, including government ministers, private companies, NGOs, local council members, national experts and local residents (Daniell et al., 2011). Inter-municipal co-operation in Austria is an example of effective flood alleviation and planning co-ordination across places (upstream and downstream) based on a catchment-wide approach. The case of Aist also shed light on the primary role of land-use planning, which is considered as a necessary formal instrument to ensure binding land use regulations that integrate flood management, as well as coherence across sectoral policies (Seher et al., 2018). Furthermore, the share of costs for flood protection measures could be improved by expanding the sources of funding to other parties, making possible more flood protection measures, bridging the financial gap and enhancing engagement of non-state actors and local authorities in flood management discussions. In England, approximately 25% of the projects are funded by other parties (Thaler et al., 2016).

Principle 12: Monitoring and evaluation

Box 4.4. OECD Principle 12: Sub-principles, Indicators and Flood Checklist

Principle 12. Promote regular monitoring and evaluation of water policy and governance where appropriate, share the results with the public and make adjustments when needed, through:

a) Promoting dedicated institutions for monitoring and evaluation that are endowed with sufficient capacity, the appropriate degree of independence and resources and the necessary instruments;

b) Developing reliable monitoring and reporting mechanisms to guide decision making effectively;

c) Assessing to what extent water policy fulfils the intended outcomes and whether water governance frameworks are fit for purpose; and

d) Encouraging timely and transparent sharing of the evaluation results and adapting strategies as new information becomes available.

Figure 4.7. OECD Indicators for Principle 12

Source: OECD (2018a), *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*, OECD Studies on Water, OECD Publishing, Paris. https://doi.org/10.1787/9789264292659-en.

Table 4.4. OECD Flood Checklist for Principle 12

	Checklist questions
Policy framework	What, in respect to flood-risk management strategies and flood-risk governance arrangements, is monitored and evaluated?
	Are there policy frameworks in place promoting regular monitoring and evaluation of flood policy and governance?
	Are there provisions or incentives for monitoring by civil society?
	Are the results of the monitoring and evaluation process shared with the wider public?
Institutions	Who monitors and evaluates flood-risk management strategies and flood-risk governance arrangements in your case study?
	Are there financial resources available to train civil society organisations in project monitoring?
Instruments	Which monitoring and reporting mechanisms effectively guiding decision making are in place in your case study?
	In your case study, do reviews of flood-risk management plans include:
	Are there agreed-upon performance indicators?
	In your case study, how are the monitoring and evaluation results shared?
Impacts	What are the main challenges to robust monitoring and evaluation in your case study?

Note: The full Checklist, including options for responses, can be found in Annex A.
Source: Authors' own research.

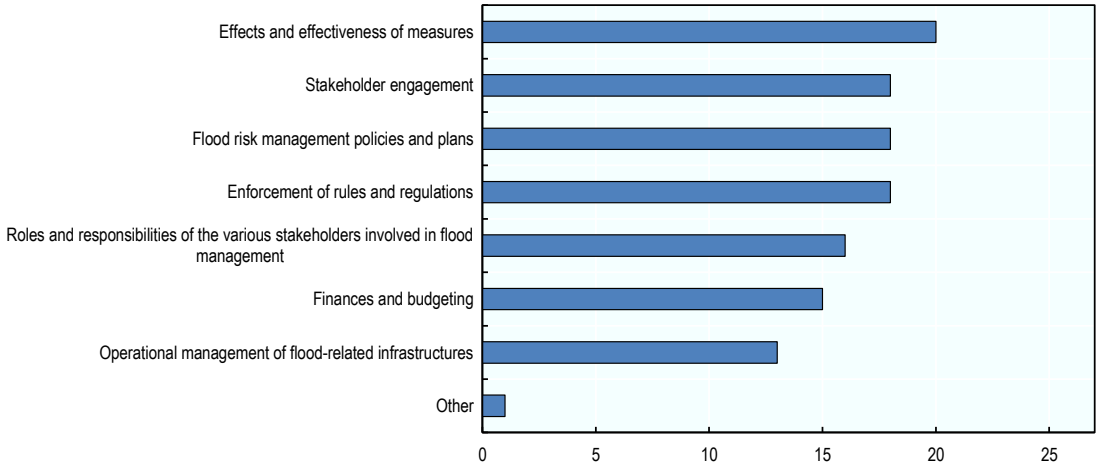
Observations

Insights from case studies highlight that FRGAs' evaluation often includes checking the effects and effectiveness of flood-risk management measures (as in 20 case studies), the enforcement of rules and regulations, the implementation of flood-risk management policies and plans, and compliance with stakeholder engagement requirements (as seen in 18 cases (Figure 4.8).

Reviews of flood-risk management plans typically cover any changes or updates since the publication of the previous versions of the plans (as observed in 15 case studies collected); the assessment of the progress made towards the achievements of objectives (in 14 case studies); the description of any additional measures taken since the previous version of the plans (in 11 cases); and/or the rationale for any measures foreseen in earlier version of the plans which have not been implemented (in 10 cases).

Figure 4.8. What is monitored and evaluated in flood-risk management strategies

25 case study promoters responded



Note: Responses correspond to the number of case studies that ticked each possible answer in the Checklist. Respondents could tick more than one answer.
Source: Data from case studies on flood governance collected for the OECD project (October 2016).

Monitoring frameworks can also draw on indicators at different levels, such as the EU Floods Directive monitoring system (e.g. the Floods Directive Scoreboard, the EU Court of Justice ruling for non-compliance), national supervision (e.g. flood safety standards) or municipal assessments (e.g. on risks and costs of flood events in land-use planning). This raises questions as to how monitoring and evaluation results can be fed back into the flood-management process in an iterative manner and at appropriate intervals delays and formats. For example, in France, local strategies and action programmes on territories exposed to floods were approved in 2016, in accordance with their related Flood Risk Management Plans. However, these monitoring and approval processes can at times be hampered by time mismatches, and some local strategies cannot be included in Flood Risk Management Plans because they cannot be finalised by the time these plans are to be issued.

Monitoring and evaluation is a responsibility that must be shared between different authorities and stakeholders. Insights from the case studies show that river basin organisations, citizens, experts (e.g. scientists, knowledge institutes specialised in flood management) and private actors (e.g. auditing and consultancy firms) are involved alongside national authorities in monitoring and assessing FRMSs. Monitoring of how flood-management policies are being carried out can provide information for policy makers, investors and citizens regarding public investment and public spending. This holds true provided that the data collected is shared with all interested stakeholders, for instance through closed-door (e.g. within river basin organisations) or public meetings, ICTs or traditional media, as noted in the case studies. Such data can also inform the effects and effectiveness of implemented or planned measures on the reduction of risk (e.g. the geographical information system, or GIS-Tool of the ICPR in the case of the Rhine transboundary basin). In Poland, Belgium (Flanders), France[3] and England for instance, the government is using cost-benefit analyses to increase the efficiency of flood governance approaches (Hegger et al., 2013).

Areas to improve

As flood-related policies or programmes may not work or new risks and information may arise, timely evaluation and analysis are needed to figure out whether a given FRMS is still fit for purpose. Assessing flood-risk governance arrangements includes evaluating their effectiveness, efficiency and inclusiveness. It also consists of reviewing flood management plans and accounting for the progress made towards the achievement of the stated objectives. Evaluation can provide useful insights into why some flood protection measures may be highly efficient in one basin, but not necessarily in another, or to understand why some comparisons over time are not always possible. In all, evaluation can provide the evidence base for guiding decision making and planning with tangible data and information, and for identifying which flood governance models are most cost-effective and replicable.

Indicators can help address information and accountability gaps. The OECD has recently launched an indicator framework that can be useful to assess the diversity of flood dimensions and serve as a self-assessment tool to track and measure them, although it must also be accompanied by other evaluations (OECD, 2018b). The goal of the framework is also to help identify flaws and to trigger action to bridge any of the seven governance gaps. For example, in Scotland, the difficulties encountered in processing and assessing data were rooted in a lack of adequate technical and human capacity. There is common agreement that many countries have fallen behind in developing data production and sharing. This is why the 2030 Agenda has prioritised regular, integrated monitoring, opening a window of opportunity to encourage action at all levels, to unlock funding and to use SDGs indicators to ensure accountability and transparency.

Ways forward

Consolidating the information base and the monitoring framework involves implementing the appropriate mechanisms to collect information and to consolidate key performance indicators agreed upon by all the stakeholders concerned. Such mechanisms include reviews of previous flood events or of flood-risk management plans, strategic meetings, or occasionally, online reporting platforms, as observed in the case studies. Since various stakeholders may have diverse values and frame the topic differently, monitoring and evaluation frameworks need to be adapted to them. For instance, simple indicators may be needed which can be used to consult non-specialists, like citizens, on FRMSs. On the other hand, indicators that are more detailed may be used when collaborating with academia and researchers on the monitoring and evaluation of FRMSs. Monitoring and evaluation need to be sufficiently generic to allow comparisons to be made across FRMSs, but they also need to adapt to the requirements, needs and resources of each specific case. It is a challenge to develop information about the effectiveness and efficiency of new FRMSs – e.g. spatial planning and awareness raising – and to be able to compare costs and benefits across strategies, measures and instruments.

Monitoring and assessment can be a milestone for effective governance across multiple scales, policies and authorities. They cut across all the OECD governance principles and can be distinguished according to what and when they measure: input, process, output, outcome, and impact (UNDP, 2013). Tracking performance indicators and sharing databases and information systems can be a useful means to co-ordinate vertically and horizontally. In transboundary contexts, as in China, India and Bangladesh, monitoring and sharing hydrological data of the river during monsoon season (even though collection is still limited and irregular) in the highly vulnerable Brahmaputra basin can be extremely

helpful for India and Bangladesh in planning and co-ordinating strategies and policies. Nonetheless, it has provoked a strong dependence that can only partially be resolved by countries building their own capacity to monitor hydrological data. The case of Eddleston in Scotland illustrates a mechanism that can encourage co-ordination across people, using adequate stakeholder engagement for effectively reporting and monitoring to guide decision making. Co-evaluation is also a powerful means of allowing for the participation of multiple sectors. Moreover, cost-benefit analyses should put strong emphasis on stakeholder engagement to make sure that the interests of all the actors, including those who are under-represented, are respected and that an adequate distribution of flood-related impacts, benefits and compensation across people, and places, is ensured. It is no longer possible to rely on monetary measures in this respect. It will be key for integrating ecosystem services and for considering how individual values can shape the perception of benefits.

Notes

[1] www.overstroomik.nl.

[2] For further information, see www.hochwasser-pass.de.

[3] For more information, see: www.developpement-durable.gouv.fr/Analyse-multicriteres-des-projets.html; http://www.developpement-durable.gouv.fr/IMG/pdf/Annexes_techniques_V7_CC_ACB_PAPI-2.pdf; http://www.eau-mer-fleuves.cerema.fr/cout-des-protections-contre-les-a1313.html.

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Annex A. OECD Checklist for Assessing Flood Governance Arrangements

This checklist is meant to support decision-makers and stakeholders at national, basin and local level in their efforts to self-assess whether flood governance arrangements are performing well and/or whether adjustment are needed.

Checklist for OECD Principle 1: Roles and Responsibilities

Policy framework

How are roles and responsibilities allocated? Generally speaking, *role* defines your position in an organisation and *responsibility* defines the functions of your position.

☐They were not officially allocated, allocation results from historical arrangements

☐By constitution, national laws or other legal framework

☐By charter/principles

☐By contract

☐Other, specify:

In your case study, which reforms or changes in other policy areas affect the allocation of roles and responsibilities on flood management in particular? Please tick as many as apply in your case study.

☐Territorial reforms (e.g. decentralisation, regionalisation, recentralisation, etc.)

☐Regulation (e.g. new regulations, increasing use of ‘’oft' instruments such as gentlemen’s agreements)

☐New co-operation between public and private partners

☐Competitiveness/market-oriented reforms (e.g. in the insurance sector)

☐Financial reform (e.g. less public funding at the city level, changes in procurement systems)

☐None

☐Other, specify:

Is there a dedicated flood policy, indicating goals, responsibilities, resources needed?

☐Yes

☐No

Are there flood-related legal and institutional frameworks or regulations in your country?

☐Yes. Please specify:

☐No

Have applicable binding and non-binding flood-related international or supranational frameworks and regulations been transposed at the national (or sub-national) level(s)?

☐Yes. Please specify:

☐No

Institutions

***Who* is in charge (formally/informally) of *what* for the following stages of flood management in your case study?** Please indicate as many responsible organisations as relevant for your case study.

	Policy-making	Policy implementation[1]	Operational management[2]	Regulation and enforcement
Flood anticipation/foresights				
Flood prevention/mitigation				
Flood preparation				
Flood response				
Flood recovery (Annex A)				

Instruments

How are roles and responsibilities regularly reviewed to adapt to changing circumstances and make sure they are always fit? Please tick as many as apply to your case study.

☐They are not regularly reviewed.

☐Parliamentary commission

☐National regulator

☐Citizen observatory

☐Revision of flood-risk management policies and plans

☐Internal meetings within projects

☐They are not reviewed.

☐Other, specify:

Which vertical co-ordination mechanisms are in place in your case study to regularly identify and address gaps, overlaps and conflicts of interest regarding roles and responsibilities for flood governance?

☐Presence of co-ordinating actors

☐Contractual arrangements

☐Intermediate bodies or actors

☐Conferences between local and sub-national flood governance players

☐Bridging concepts (e.g. multi-layered safety)

☐Shared databases and information systems

☐Performance indicators

☐None

☐Other, specify:

Which horizontal co-ordination mechanisms are in place in your case study to manage interdependencies for flood policy design and implementation?

☐Organisations/tools that bridge knowledge development and decision-making processes (e.g. research institutes, interactive maps, simulation models)

☐Knowledge multi-stakeholder co-creation processes

☐Financial transfers or incentives

☐Inter-municipal or metropolitan collaboration

☐Informal co-operation around projects

☐Inter-ministerial co-ordination platforms

☐Joint financing

☐None

☐Other, specify:

In your case study, are the effectiveness, efficiency and inclusiveness of such mechanisms monitored and evaluated?

☐Yes. Please specify how:

☐No

Impacts

Were the impacts of a fragmentation of roles and responsibilities on the effectiveness of flood-risk governance arrangements assessed in your case study?

☐Yes. Specify how:

☐No

In cases where fragmentation is negative and undesired, what were the impacts of a fragmentation of roles and responsibilities on the effectiveness of flood-risk governance arrangements ? Please tick as many as apply to your case study.

	Flood anticipation/foresight	Flood prevention/mitigation	Flood preparation	Flood recovery
Uneven distribution of resources				
Lower levels of government have a heavy burden of work regarding flood management				
Inconsistency between national and local goals and strategies				
Conflicts among stakeholders in charge of flood management				
Overlapping or conflicting policies				
Unclear accountability lines/chains				
Negative economic impacts				
Negative environmental impacts				
Negative social impacts				
Other, specify:				

Overall, what were the main challenges your case study had to face for Principle 1? Please provide further details and concrete examples.

Checklist for OECD Principle 2: Appropriate scales

Policy Framework

Are there Integrated Water Resources Management policies and strategies in place that address flood management aspects?

☐Yes. Please specify:

☐No

In your case study, are there policies in place to manage floods at the hydrographic scale?

Please tick as many as apply to your case study.

☐River basin plans

☐Early-warning systems

☐Information system

☐Models and decision support system

☐Research, development and innovation

☐Other, specify:

In your case study, are existing plans to manage flood risks consistent with national policies and local conditions?

☐There are no flood-risk management plans.

☐Flood-risk management plans are in place but some aspects are contradictory with national policies.

☐Flood-risk management plans are in place but some aspects are not adapted to local conditions.

☐Flood-risk management plans are in place and they are aligned with national policies.

☐Flood-risk management plans are in place and they are adapted to local conditions.

☐Other, specify:

Institutions

At which scale are the flood management functions primarily managed in your case study?

	Transboundary basin	National (basin and/or sub-basin)	National	Regional/ provincial	Local/metropolitan	Other, specify:
Flood anticipation/foresight	☐	☐	☐	☐	☐	
Flood prevention/mitigation	☐	☐	☐	☐	☐	
Flood preparation	☐	☐	☐	☐	☐	
Flood response	☐	☐	☐	☐	☐	
Flood recovery	☐	☐	☐	☐	☐	

Instruments

Which multi-level riparian co-operation mechanisms are in place among users, stakeholders and levels of government for the management of floods?

	Basin (from sub-basin to transboundary)	National	Regional/ provincial	Local/ metropolitan	Other, specify:
Basin committee	☐	☐	☐	☐	☐
Participatory processes	☐	☐	☐	☐	☐
Shared data and information systems	☐	☐	☐	☐	☐
Joint programmes of measures	☐	☐	☐	☐	☐
Joint projects or contracts	☐	☐	☐	☐	☐
Co-financing arrangements	☐	☐	☐	☐	☐
Inter-governmental dialogue	☐	☐	☐	☐	☐
Public participation fora	☐	☐	☐	☐	☐
Early-warning and alarm procedures	☐	☐	☐	☐	☐
Joint research and innovation	☐	☐	☐	☐	☐
Flood emergency-response plans	☐	☐	☐	☐	☐

Impacts

What are the challenges towards vertical co-ordination (i.e. co-ordination across administrative levels)? Please tick as many as apply to your case study.

☐Conflicting agendas, priorities and interests

☐Capacity gaps

☐Inconsistent budgeting, procurement and regulatory processes across levels

☐Language barriers

☐Unbalanced power, capacities and resources

☐Legal allocation of powers and responsibilities

☐None

☐Other, specify:

Overall, what were the main challenges your case study had to face for Principle 2? Please provide further details and concrete examples.

Checklist for OECD Principle 3: Policy coherence

Policy Framework

In your case study, which policy areas are the most interdependent with flood management in practice?

Policy areas	Very interdependent	Quite interdependent	Less interdependent
Environment (including ecosystems, nature conservation and development)	☐	☐	☐
Climate change	☐	☐	☐
Infrastructure	☐	☐	☐
Rural policy	☐	☐	☐
Health	☐	☐	☐
Energy	☐	☐	☐
Agriculture	☐	☐	☐
Industry	☐	☐	☐
Spatial planning	☐	☐	☐
Land use	☐	☐	☐
Water quality	☐	☐	☐
Water supply	☐	☐	☐
Transport/navigation	☐	☐	☐
Urban development	☐	☐	☐
Tourism	☐	☐	☐
Fisheries	☐	☐	☐
Civil protection	☐	☐	☐
Amenity/recreation/culture (architectural and cultural assets, etc.)	☐	☐	☐
Forestry	☐	☐	☐
Other, specify:	☐	☐	☐

Please indicate the policy area(s) where synergies with flood management have been built:

Please provide a description of what has been done.

☐ Environment (including ecosystems, nature conservation and development)

☐Climate change

☐Infrastructure

☐Rural policy

☐Health

☐Energy

☐Agriculture

☐Industry

☐Spatial planning

☐Land use

☐Water quality

☐Water supply

☐Transport/navigation

☐Urban development

☐Tourism

☐Fisheries

☐Civil protection

☐Amenity/recreation/culture (architectural and cultural assets, etc.)

☐Forestry

☐None

☐Other, specify:

Do flood-risk management strategies include:

☐Costs and benefits

☐Flood extent

☐Flood conveyance routes

☐Areas which have the potential to retain floodwater (e.g. natural floodplains)

☐Environmental objectives

☐Soil and water management

☐Spatial planning

☐Land use

☐Nature conservation/nature-based solutions

☐Water quality

☐Water supply

☐Navigation

☐Infrastructure

☐Tourism

☐Fisheries

☐Amenity/recreation/culture (architectural and cultural assets, etc.)

☐Flood-risk prevention plans (formulated for industrial facilities, schools, etc.)

☐Forestry

☐None

☐Other, specify:

Institutions

Is there an inter-ministerial body or institution for co-ordination across flood-related policies?

☐Yes. Please specify:

☐No

Instruments

How are barriers to policy coherence identified in your case study?

☐They are not identified, assessed or addressed.

☐They are identified through cross-sectoral groups/meetings.

☐They are identified through cross-sectoral policy reviews.

☐They are identified through external/independent reviewers.

☐They are identified by political leaders and/or policy entrepreneurs who have a stake in the issue.

☐They are identified by citizens or NGOs.

☐They are identified through risk exercises.

☐Other, specify:

In your case study, which mechanisms are in place to facilitate coherence and mitigate conflict between flood management policies and other policy sectors?

	Transboundary basin	National (basin and/or sub-basin)	National	Regional/ provincial	Local/metropolitan	Other, specify:
Legislation/regulation/specific policy instruments	☐	☐	☐	☐	☐	
Financial incentives/subsidies	☐	☐	☐	☐	☐	
Contracts	☐	☐	☐	☐	☐	
Cross-sectoral plans and programmes	☐	☐	☐	☐	☐	
Cross-sectoral groups/meetings	☐	☐	☐	☐	☐	
Joint actions of ministries/agencies at sub-national level	☐	☐	☐	☐	☐	
Inter-institutional agreement between sub-national governmental actors	☐	☐	☐	☐	☐	
Technical means (e.g. floodwater stored for irrigation)	☐	☐	☐	☐	☐	
Conditionalities	☐	☐	☐	☐	☐	
Catchment authorities	☐	☐	☐	☐	☐	
Research programs	☐	☐	☐	☐	☐	
Schooling	☐	☐	☐	☐	☐	
Knowledge co-creation projects	☐	☐	☐	☐	☐	
Stakeholder groups facilitating collaborative solutions	☐	☐	☐	☐	☐	
Public consultation	☐	☐	☐	☐	☐	
None	☐	☐	☐	☐	☐	

Are there conflict mitigation and resolution mechanisms to manage trade-offs across flood-related policy areas?

☐Laws, regulations

☐Public consultation

☐Stakeholder groups facilitating collaborative solutions

☐Not in place

☐Other, specify:

Impacts

Is there an assessment of the distributed impacts on flood management of decisions taken in other areas, such as urban/spatial development, forestry, wetlands, agriculture or the environment?

☐Yes. Please specify:

☐No

In the case of policy incoherence, what are the impacts on flood management?

☐Economic costs (e.g. infrastructure investments that could have been avoided with better co-ordination)

☐Greater risk of human casualties

☐Social costs (e.g. if measures destroy a public amenity or divide communities "inside" and "outside" a levee)

☐Environmental costs (e.g. if measures cause geomorphological changes or isolate floodplains)

☐Transaction costs (e.g. conflict among stakeholders involved in flood management)

☐Conflicting actions (e.g. urban policies for the development of housing in floodplains vs. flood-management policies using these floodplains for flood discharge)

☐Reduced implementation capacity

☐Increase in flood risks

☐It does not have any impact.

☐Other, specify:

Are costs due to absent/poor policy coherence evaluated and available to decision makers?

☐Yes. Please specify how:

☐No

Overall, what were the main challenges your case study had to face for Principle 3? Please provide further details and concrete examples.

Checklist for OECD Principle 4: Capacity building

Policy Framework

In your case study, which capacities are in place to manage floods today and in the future?

☐Technical capacity (e.g. modelling, early-warning systems, projections)

☐Financial capacity (e.g. capacity to allocate funds for the construction of flood defences, willingness and capacity to pay for insurance schemes, capacity to raise taxes)

☐Infrastructural capacity (e.g. capacity to build green infrastructure, adaptive buildings, retention facilities, dams)

☐Human capacity (e.g. knowledge, skills, leadership, stakeholder engagement)

☐Governmental capacity (e.g. departments dedicated to flood-management, policies, co-operation with research institutes)

☐Multilateral and/or international agreements

☐None

☐Other, specify:

Are there mechanisms used for the hiring of public officials and flood-risk professionals? (tick the box when appropriate)

☐Merit-based?

☐Transparent?

☐Independent from political cycles?

☐Other, specify:

Are there incentives to create "flood" careers for staff in the public sector?

☐Yes. Please specify:

☐No

Are there guidelines or standards for capacity building across authorities at your level?

☐Yes. Please specify:

☐No

Are there flood-related networks at the national level?

☐Yes. Please specify:

☐No

Institutions

In your case study, how are capacities in flood governance systems assessed in terms of responding to actual problems and needs?

☐Regular reviews

☐Public hearings

☐Commissioning reports

☐National monitoring

☐Simulation exercises

☐They are not assessed.

☐Other, specify:

How are capacity gaps identified in your case study?

☐They are not identified or addressed.

☐Guidelines for *ex-ante* appraisal are available and used at all levels of government.

☐Index of technical, financial, infrastructural or human capacity

☐Studies examining governance capacity at various levels

☐Post-event reviews

☐They are not identified.

☐Other, specify:

How are capacity gaps addressed?

☐E-government platforms

☐Peer learning

☐Policies to strengthen sub-national capacities

☐Guidance documents

☐Open, competitive and merit-based hiring (for human capacity)

☐Hiring of a diverse cross-sectoral skill set

☐There are not addressed.

☐Other, specify:

Instruments

In your case study, which mechanisms are in place for the education and training of relevant stakeholders (e.g. floodplain managers, flood-risk professionals)?

☐None

☐Information provision; guidebooks

☐Training and communication support programmes on flood risks

☐Insurance companies

☐Local authority networks

☐Workshops

☐Other, specify:

Are there decentralised development co-operation mechanisms in place (e.g. twinning, peer-to-peer learning activities, capacity building and knowledge transfer)?

☐Yes. Please specify:

☐No

Impacts

Which of the following gaps have an impact on capacity development for flood management in your case study?

☐Financial resources

☐Lack of training tools and methodologies

☐Lack of political will to allocate resources to capacity development

Please specify at which level:

☐Lack of staff and technical skills

☐None

☐Other, specify:

Overall, what were the main challenges your case study had to face for Principle 4? Please provide further details and concrete examples.

Checklist for OECD Principle 5: Data and information

Policy Framework

Which flood-risk and flood-related data and information are currently being collected for flood management in your case study? Please tick as many as apply to your case study.

☐Maps of the river basin

☐Flood-risk maps

☐Description of the floods which have occurred in the past, including their consequences

☐Potential adverse consequences of future floods

☐Scenarios of flood probability and for each, the flood extent, water depths and flow velocity

☐Flood conveyance routes

☐Potential adverse consequences associated with flood scenarios, especially number of affected inhabitants, affected economic activity

☐Vulnerable infrastructure and populations (e.g. elderly, hospitals)

☐Installations which might cause accidental pollution in case of flooding

☐Potentially affected protected areas

☐Areas where floods with a high content of transported sediments and debris floods can occur

☐Other significant sources of pollution

☐Environmental needs

☐Land uses

☐Navigation

☐Infrastructure

☐Institutions

☐Sources of finance

☐None

☐Other, specify:

Is the flood-risk information system harmonised, integrated, standardised and co-ordinated across relevant agencies and responsible authorities across relevant governance scales?

☐Yes

☐No

Are there real-time data and do they guide decision making?

☐Yes. Please specify:

☐No

How are flood-risk and flood-related data and information used to guide decision making?

☐They are incorporated in flood-risk and flood hazard maps

☐They are used to develop flood-risk management plans

☐They are shared within participatory decision-making processes

☐They are used to assess flood risk

☐Other, specify:

Institutions

In your case study, who are the main flood-risk and flood-related data and information producers?

☐Statistical offices

☐Forecast agencies

☐Basin agency

☐Government

☐Other, specify:

Who are the main flood-risk and flood-related data and information users?

☐Government. Please specify at which level(s):

☐Private companies

☐Urban planners

☐Inhabitants/citizens

☐Experts/scientists

☐Other, specify:

Instruments

How are flood-risk and flood-related data and information shared?

☐Traditional media (press release, newspaper inserts, reports, radio broadcasts and video presentations)

☐Web-based technologies (flood-risk information sIms, fora, newsletters, social media, data banks, maps)

☐Other information and communication technology (SMS, information hotlines)

☐Open public meetings (e.g. organised by public authorities or flood observatories)

☐Closed meetings (meetings of river basin organisations, of flood-related associations)

☐Engaging schools and community groups

☐They are not shared

☐Other, specify:

Are there platforms for dialogue between data producers and users?

☐Yes. Please specify:

☐No

Do online platforms/tools/agreements exist for experience and knowledge sharing?

☐Yes. Please specify:

☐No

Do tools exist to produce, disclose and use flood-related data and information, through innovative ways? (Examples are big/smart/mobile data, digital maps, real-time sensors and monitoring)

☐Yes. Please specify:

☐No

How are unnecessary data overload and dispersion of information regularly tracked in your case study?

☐Reviews of data collection, use, sharing and dissemination

☐Re-prioritisation of the objectives for data collection and data required

☐Participatory workshops including data producers and users

☐Data producers and users meetings

☐They are not being tracked.

☐Other, specify:

Which co-ordination and experience sharing mechanisms are in place in your case study?

☐Meetings among organisations and agencies producing flood-related data

☐High-level meetings on exchange of information between member states before drafting flood-risk assessments, flood hazard maps, flood-risk maps in cases where floods affect international areas

☐Conferences between data producers and users

☐Online platforms/knowledge infrastructure

☐Visits of flood-risk professionals to other areas affected by floods and meeting with colleagues

☐None of the above

☐Other, specify:

Are there bottom-up mechanisms to produce and disclose flood-related data and information across levels of government, public, private and non-profit stakeholders?

☐Yes. Please specify:

☐No

Impacts

What is the impact of data overload and dispersion of information on flood management?

☐Overlap: many levels and agencies produce and share the same information

☐Conflicting data and difficulty to choose what to use to develop policies

☐Data inconsistencies leading to greater uncertainty in models and scenarios

☐Delays in processing data

☐Outdated information

☐None

☐Other, specify:

Overall, what were the main challenges your case study had to face for Principle 5? Please provide further details and concrete examples.

Checklist for OECD Principle 6: Financing

Policy Framework

What is the nature of the major costs related to flood governance in your case study? (Rank from 1, major cost, to 4, minor costs).

Social costs (e.g. social conflicts, population displacement)

Economic costs (e.g. building protection infrastructure, producing and collecting data)

Environmental costs (e.g. impact on ecosystems, land management, etc.)

Institutional costs (e.g. co-ordination with stakeholders)

Are there enough financial revenues to cover operational costs and long-term assets renewal to mitigate floods?

☐Yes. Please specify:

☐No

Are there investment plans and programmes and do they guide decision making?

☐Yes. Please specify:

☐No

Are there clear budget transparency principles and rules applied at all levels of government?

☐Yes. Please specify:

☐No

Do flexible and solidarity mechanisms exist in case of water-related disasters?

☐Yes. Please specify:

☐No

In your case study, what measures have been taken to help ensure availability and sustainability of investments?

☐Diversification of financial sources

☐Identification of financial risks and debate about the appropriate fiscal policy course to adopt

☐Use of innovative financing instruments

☐Incentives and capacity building to increase the ability of the utilities to charge for water

☐No measure has been taken

☐Other, specify:

Institutions

What are the most relevant sources of finance for flood governance in your case study? (Rank from 1, biggest source, to 7, smallest source; N/A when not applicable to your case study).

Public funding (national, regional or local)

Private funding

Local funding (e.g. solidarity funds or more direct contributions from beneficiaries)

Contribution from the beneficiaries (private, public or voluntary organisations or communities)

Taxes on actions that contribute to the flood problem

European funding (e.g. Fund for Regional Development, Cohesion Fund, Social Fund, Agricultural Fund, etc.)

Joint financing between public and private sources

To which strategies are these sources of finance allocated? *(Use +++ to indicate high amounts, ++ for medium amounts and + for small amounts)*

	Public funding	Private funding	Local funding	Contribution from the beneficiaries	Taxes	European funding	Other, specify:
Flood prevention							
Flood mitigation							
Flood response							
Flood recovery							
Flood rehabilitation							

Instruments

In your case study, how are administrative burdens related to public expenditure regularly being tracked?

☐They are not being tracked

☐Audits of financial administrations

☐Investments in the skills and capacity of staff to perform their roles effectively (line ministries, other institutions)

☐Other, specify:

Are there measures to minimise unnecessary administrative burdens when collecting and disbursing water-related revenues?

☐Yes. Please specify:

☐No

Which mechanisms are used to ensure that practices for budgeting and accounting are sound and transparent and that they provide a clear picture of flood-risk activities and any associated contingent liabilities?

☐Budget documents and data are open, transparent and accessible

☐A comprehensive, participative and realistic debate on budgetary choices

☐No mechanism is used.

☐Other, specify:

Which mechanisms are used to align multi-annual flood-risk management strategies to annual budgets and medium-term priorities of governments?

☐Multi-annual FRMSs are not aligned with annual budgets and medium-term priorities of the government

☐A strong medium-term dimension is included in the budgeting process, beyond the traditional annual cycle

☐Budget allocations are organised and structured in a way that corresponds readily with national objectives.

☐Close relationship between Central Budget Authority and flood-related ministries/agencies (e.g. planning ministry)

☐Mechanisms for reviewing existing expenditure policies, including tax expenditures

☐None of the above

☐Other, specify:

Which mechanisms are in place in your case study to encourage the efficient and transparent allocation of flood-risk-related public funds?

☐Social contracts

☐Scorecards

☐Audits

☐Cost benefit analysis

☐Reporting

☐No mechanism is in place.

☐Other, specify:

In your case study, which mechanisms are in place to assess short-, medium- and long-term investment and operational needs?

☐Sector reviews

☐Strategic financial planning

☐*Ex-ante* and *ex-post* evaluation

☐Economic and affordability studies

☐Forecasts and projections

☐ "Value for money"

☐Multi-annual budgeting or planning

☐None

☐Other, specify:

Impacts

What are the main impacts of obscure, ineffective financial governance in your case study?

☐Build-up of large, unsustainable debts

☐Financial problems during difficult economic times

☐Local opposition

☐Corruption/opaque decision making

☐Future liabilities for current generations

☐Lack of consideration of low-cost options (e.g. green infrastructure/permeable surface, instead of large reservoirs)

☐None

☐Other, specify:

Overall, what were the main challenges your case study had to face for Principle 6? Please provide further details and concrete examples.

Checklist for OECD Principle 7: Regulatory frameworks

Policy Framework

In your case study, what is regulated in flood management? Please tick as many as apply to your case study.

☐Areas which are the subject of flood-risk management plans

☐Flood-risk management objectives

☐Flood-risk management measures and their prioritisation

☐Operation of flood protection measures (dams, retention basins...)

☐Technical characteristics (e.g. resilience of dykes)

☐Conditions in which the measures are implemented (e.g. level of acceptable risk)

☐Interface between water and other areas, in particular land use and management

☐Stakeholders' roles and missions

☐Funding arrangements

☐Public information and consultation measures/actions taken

☐Public and private projects increasing the risk of flooding (e.g. floodplain development)

☐Public and private projects increasing the risk of environmental pollution as a consequence of floods (e.g. plants using dangerous substances)

☐Other, specify:

In your case study, which enforcement rules, procedures, incentives and tools are used to promote compliance and achieve regulatory objectives?

☐Incentives/rewards (e.g. reduction of insurance premiums when owners or tenants sign up to flood-warning service and fit measures, such as flood boards)

☐Specific multilateral discussions and meetings, common agreements

☐Penalties, sanctions (e.g. fines for owners of buildings which increase flood risk)

☐Reparations

☐Requirements to disclose information and inputs used for regulatory decisions

☐None

☐Other, specify:

Institutions

Which institutions bear these key regulatory functions?

☐International: International River basin committee, European Union

☐Basin: River basin committee

☐National: Ministry of Environment, Environment Agency, inter-ministerial flood committee

☐Local (municipalities, local drainage boards, local water authorities)

☐Other, specify:

Do regulatory authorities have clearly stated mandates and powers?

☐Yes

☐No

Are regulatory authorities endowed with the necessary resources?

☐Yes

☐No

Are there reviews of the governance and performance of regulatory authorities?

☐Yes

☐No

Instruments

In your case study, which regulatory tools are in place to encourage the quality of regulatory processes and make the results accessible to the public, where appropriate?

☐Participation: providing meaningful opportunities (including online) for the public to contribute to the process of preparing draft regulatory proposals

☐Transparency: ensuring that regulations are comprehensible and clear and that parties can easily understand their rights and obligations

☐Mechanisms/institutions for oversight of procedures/goals, support and implementation of regulatory policy

☐Regulatory Impact Assessment in the early stages of the policy process

☐Reports on the performance of regulatory policy and reform programmes

☐Reviews of existing regulations (including consideration of costs and benefits)

☐None

☐Other, specify:

Which remedies can be claimed through access to justice?

☐No remedies can be claimed

☐Social interest litigation

☐Damage compensation

☐Ombudsman

☐Other, specify:

Are evaluation mechanisms in place to systematically and regularly assess performance/effectiveness, gaps and overlaps in the regulatory framework?

(E.g. areas with regulatory gaps, incoherent and/or contradictory objectives, deficient implementation and/or limited enforcement, overlaps/duplication of responsibilities, etc.)

☐Yes. Please specify:

☐No

Where self-regulation mechanisms exist, are they subject to regular performance assessment?

☐Yes

☐No

Are there co-ordination instruments between flood relevant ministries and bodies to improve regulatory processes?

☐Yes. Please specify:

☐No

Impacts

In your case study, what are the impacts of un-co-ordinated, irrelevant and ineffective regulatory frameworks?

☐Conflicts over roles and responsibilities

☐Increased policy complexity leading to confusion when it comes to their implementation

☐Costs of implementing regulatory frameworks overcoming the benefits

☐Authorities adopting an "I-choose-what-I-prefer" approach

☐Distrust towards actors bearing regulatory functions

☐None

☐Other, specify:

Are flood-related legislations subject to regulatory impact assessment?

☐Yes

☐No

Overall, what were the main challenges your case study had to face for Principle 7? Please provide further details and concrete examples.

Checklist for OECD Principle 8: Innovative governance

Policy Framework

Which innovative flood governance practices are implemented in your case study?

☐Experimentation and pilot-testing

☐Creating structures and institutions for implementing improved flood-resilience technologies (e.g. door guards, flood resilient cavity wall insulation, mobile barriers)

☐Innovative partnerships (e.g. consortiums bringing together governments, knowledge institutes and the business sector)

☐Innovative education and awareness-raising activities (e.g. involving school children in flood-control curriculum and flood control games)

☐Innovation labs

☐Academic research (e.g. models estimating the effectiveness of evacuation decisions, evaluation of risk exposure considering evolving risk patterns)

☐Measures to restore trust in the government (e.g. transparency, accountability)

☐Methods that support governments, business, and individual stakeholders to determine their optimal or acceptable levels of risks

☐None

☐Other, specify:

Which policy frameworks and/or incentives are in place to encourage innovation in flood management practices and processes?

☐Incentives for innovative financing

☐Frameworks that incentivise experimentation

☐Pilot-testing to draw lessons and share experience prior to generalising a given reform or process at a larger scale

☐None

☐Other, specify:

Are there reviews to evaluate the state of play of and potential for technical and non-technical innovation, costs/benefits of innovation, as well as regulations and standards hindering innovation?

☐Yes. Please specify:

☐No

Institutions

Are there institutions encouraging bottom-up initiatives, dialogue and social learning as well as experimentation in flood management at different levels?

☐Multi-stakeholder platforms

☐Entities sharing knowledge and experience

☐Entities encouraging the science-policy interface

☐Entities enabling crowdsourcing

☐None

☐Other, specify:

Instruments

In your case study, which mechanisms to promote social learning are in place to facilitate dialogue and consensus-building?

☐Networking platforms

☐Social media

☐Information and communication technologies (ICTs)

☐User-friendly interface

☐Digital maps

☐Big data, smart data and open data

☐None

☐Other, specify:

Which innovative ways to co-operate are in place in your case study, to pool resources and capacity, build synergies across sectors and search for efficiency gains?

☐Metropolitan governance

☐Inter-municipal collaboration

☐Urban-rural partnerships

☐Performance-based contracts

☐None

☐Other, specify:

Which science-policy interface is in place in your case study to contribute to better flood governance and bridge the divide between scientific findings and flood governance practices?

☐Science-policy platforms

☐Organisations or tools that bridge knowledge development and decision-making processes (e.g. research institutes, interactive maps, simulation models)

☐Knowledge multi-stakeholder co-creation processes

☐Scientists involved in drafting policy briefs

☐None

☐Other, specify:

Are information and communication technologies used to guide better public action in flood management, and how?

☐Yes. Please specify:

☐No

Impacts

In your case study, what are the main barriers to innovative governance?

☐Lack of integration of scattered monitoring networks

☐Uncertainty in meteorological forecasts for flood and drought risk assessment

☐Lack of integration of different dimensions of risk

☐Insufficient knowledge on the economic value of risk

☐Lack of awareness and preparedness of populations to deal with risks

☐Fragmentation of institutions and responsibilities

☐None

☐Other, specify:

Overall, what were the main challenges your case study had to face for Principle 8? Please provide further details and concrete examples

Checklist for OECD Principle 9: Integrity and transparency

Policy Framework

In terms of integrity and transparency, where has the emphasis been put in your case study? (Rank from 1, major emphasis, to 4, no emphasis)

Public procurement

Costs

Quality of infrastructure

Levels of risks

When roles and responsibilities for flood management and risk reduction are delegated to dedicated public or private entities, are there contractual arrangements between organising and executive bodies?

☐Yes

☐No

Are there provisions related to transparency and integrity in national legislation?

☐Yes

☐No

Are there provisions for whistle-blower protection in legal and institutional frameworks?

☐Yes. Please specify:

☐No

Which legal and institutional frameworks that hold decision makers and stakeholders accountable are in place in your case study?

☐There are no frameworks that hold decision-makers and stakeholders accountable.

☐Right to information

☐Public procurement

☐Transposition on applicable international conventions

☐Parliamentary commissions

☐Other, specify:

Are norms, codes of conduct or charters on integrity and transparency in national or local contexts in place and their implementation monitored?

☐They are not in place.

☐They are in place but not monitored.

☐They are in place and monitored.

Are there requirements in place for regular financial disclosure of assets, income and interests?

☐Yes. Please specify:

☐No

Institutions

Are there independent authorities (not necessarily water-specific) and supreme audit institutions that can investigate water-related issues and ensure proper enforcement (e.g. policy effectiveness and procurement)?

☐Yes. Please specify:

☐No

Instruments

Which accountability and control mechanisms for transparent flood-risk policy making and implementation are in place in your case study?

☐Financial disclosure of income, assets and interests

☐Conflict-of-interest restrictions

☐Freedom of information

☐Immunity provisions

☐None

☐Other, specify:

Are corruption risks and actual corruption in the water sector (e.g. manipulation of knowledge and information, bribery, extortion) diagnosed?

☐Yes. Please specify how:

☐No

Are potential drivers of corruption and corruption risks regularly diagnosed and mapped in all institutions involved in flood management at different levels, especially:

☐They are not diagnosed and mapped.

☐Identification of corruption risk areas

☐Identification of internal and external drivers

☐Evaluation of the frequency and potential severity of risks

☐Risks prioritisation

☐Action plan using online or offline platforms

☐Other, specify:

In your case study, how are integrity and transparency gaps regularly identified and addressed?

☐They are not identified and addressed.

☐Multi-stakeholder approaches

☐Integrity scans/pacts

☐Risk analysis

☐Risk maps

☐Auditable anti-corruption plans

☐Social witnesses

☐Other, specify:

Impacts

In your case study, how is the impact of corruption assessed in terms of environmental, social and economic costs?

☐Water Integrity Scan

☐Assessment of integrity risks

☐Independent investigation

☐It is not being assessed.

☐Other, specify:

Overall, what were the main challenges your case study had to face for Principle 9? Please provide further details and concrete examples

Checklist for OECD Principle 10: Stakeholder engagement

Policy Framework

In your case study, who are the stakeholders involved in flood-related decision making?

☐Government (e.g. ministries, agencies and authorities at different levels)

☐Private stakeholders (e.g. water industry, insurance companies)

☐Non-governmental and non-profit organisations (e.g. Flood Action Group)

☐Experts (e.g. scientists and knowledge institutes specialised in flood management)

☐Citizens, inhabitants of flood-prone areas

☐Land users, land owners

☐Youth

☐Under-represented categories (youth, the poor, women, indigenous people, domestic users)

☐Newcomers (property developers, institutional investors)

☐Other, specify:

Which legal and institutional frameworks, organisational structures and responsible authorities conducive to stakeholder engagement are in place in your case study?

☐Stakeholder engagement is a requirement prior to any project.

☐Existence of a basin committee including representatives of the various stakeholders

☐Multistakeholder fora

☐None

☐Other, specify:

Institutions

Was a stakeholder mapping carried out to make sure that all those who have a stake in the outcome or that are likely to be affected are clearly identified, and their responsibilities, core motivations and interactions understood?

☐Yes. Please specify:

☐No

Are the ultimate line of decision making, the objectives of stakeholder engagement and the expected use of inputs clearly defined?

☐Yes. Please specify:

☐No

Which stakeholder engagement structures and/or mechanisms are in place in your case study, and at which stage of development? Please tick as many as apply to your case study.

	Early stages	Decision making	Implementation/operation	Evaluation
Alert systems	☐	☐	☐	☐
Meetings/workshops/fora	☐	☐	☐	☐
Flood-related associations	☐	☐	☐	☐
River-basin organisations/councils	☐	☐	☐	☐
Web-based technologies	☐	☐	☐	☐
Policy dialogues	☐	☐	☐	☐

In your case study, at which scale are these efforts carried out:

Meetings/workshops/fora	☐	☐	☐	☐
Flood-related associations	☐	☐	☐	☐
Web-based technologies	☐	☐	☐	☐
Alert systems	☐	☐	☐	☐

Are there mechanisms in place to engage with scientists in decision making?

☐Yes. Please specify:

☐No

Instruments

Which monitoring and evaluation mechanisms are in place to assess the process and outcomes of stakeholder engagement to learn, adjust and improve accordingly?

☐Cost-benefit analysis

☐Questionnaires

☐Satisfaction surveys

☐Interviews

☐Participant observation

☐ (Regular) meetings with stakeholders

☐None

☐Other, specify:

Are stakeholder engagement mechanisms flexible to adapt to changing circumstances?

☐Yes. Please specify how:

☐No

Are there mechanisms or regular assessments of stakeholder engagement costs or obstacles at large?

☐Yes. Please specify:

☐No

Is needed information for result-oriented stakeholder engagement shared?

☐Yes. Please specify how:

☐No

Do tailored communication strategies exist for relevant stakeholders, including the general public, regarding all aspects of flood management?

☐Yes. Please specify:

☐No

Impacts

In your case study, what are the main barriers to stakeholder engagement in flood management?

☐Stakeholder-based barriers (e.g. lack of institutional support, a "closed" institutional culture, lack of flexibility for open and transparent discussions due to unclear lines of accountability, lack of capacity of government to explain/persuade/co-ordinate to stakeholders)

☐Time-related barriers (e.g. stakeholders engaged only at the later stage of the policy cycle)

☐Barriers caused by power inequalities (e.g. power imbalances, consultation capture)

☐Financial barriers

☐Scepticism towards the stakeholder engagement process (e.g. not seen as seeking genuine input)

☐Lack of transparency of the decision-making process

☐Information about flood-risk or involvement mechanisms do not fit with the targeted audience

☐None

☐Other, specify:

Overall, what were the main challenges your case study had to face for Principle 10? Please provide further details and concrete examples.

Checklist for OECD Principle 11: Trade-offs between users, places and generations

Policy Framework

What are the main trade-offs linked to flood management in your case study?

☐Rural-urban trade-offs

☐Upstream-downstream trade-offs

☐Policy trade-offs

☐Ecological trade-offs

☐Temporal trade-offs

☐Risk-risk trade-offs

☐Flood-water supply trade-offs

☐Flood-energy generation trade-offs

☐Flood-land development trade-offs (e.g. housing growth)

☐Exposed pre-flood damage trade-offs

☐None

☐Other, specify:

Are there formal provisions or legal frameworks encouraging equity across policies, rural and urban areas, and generations, etc.?

☐Transposition of international binding regulations

☐Transposition of international non-binding regulations

☐Soft law (e.g. sustainable development goals, new urban agenda)

☐None

☐Other, specify:

Institutions

Is there an Ombudsman or institution(s) (not necessarily water-specific) to protect vulnerable groups (mediating disputes and managing trade-offs when necessary)?

☐Yes. Please specify:

☐No

Instruments

Which mechanisms are in place in your case study to ensure that the main trade-offs are addressed?

	Multi-criteria decision analysis	Cost-benefit analysis	Public debate/ stakeholder consultation	Other
Rural-urban trade-offs	☐	☐	☐	☐
Upstream-downstream trade-offs	☐	☐	☐	☐
Policy trade-offs	☐	☐	☐	☐
Ecological trade-offs	☐	☐	☐	☐
Temporal trade-offs	☐	☐	☐	☐
Risk-risk trade-offs	☐	☐	☐	☐
Floodwater trade-offs[3]	☐	☐	☐	☐
Exposed pre-flood damage trade-offs	☐	☐	☐	☐

Checklist for OECD Principle 12: Monitoring and evaluation

Policy Framework

What, in respect to flood-risk management strategies and flood-risk governance arrangements, is monitored and evaluated?

☐Enforcement of rules and regulations

☐Flood-risk management policies and plans

☐Effects and effectiveness of measures

☐Roles and responsibilities of the various stakeholders involved in flood management

☐Finances and budgeting

☐Stakeholder engagement

☐Operational management of flood-related infrastructure

☐None

☐Other, specify:

Are there policy frameworks in place promoting regular monitoring and evaluation of flood policy and governance?

☐Yes. Please specify:

☐No

Are there provisions or incentives for monitoring by civil society?

☐Yes. Please specify:

☐No

Are the results of the monitoring and evaluation process shared with the wider public?

☐Yes. Please specify how:

☐No

Institutions

Who monitors and evaluates flood-risk management strategies and flood-risk governance arrangements in your case study?

☐Court of Justice ruling for non-compliance

☐Basin Organisations

☐National authorities: controller and auditor general

☐Private stakeholders: auditing and consultancy firms

☐Independent experts (e.g. scientists and knowledge institutes specialised in flood management, consultants)

☐Citizens, inhabitants of flood-prone areas (e.g. online evaluation of flood policies)

☐No one

☐Other, specify:

Are there financial resources available to train civil society organisations in project monitoring?

☐Yes. Please specify:

☐No

Instruments

Which monitoring and reporting mechanisms effectively guiding decision-making are in place in your case study?

☐Reviews of flood-risk management plans

☐Review of previous flood events

☐Strategic meetings

☐Online reporting platforms

☐No mechanism is in place.

☐Other, specify:

In your case study, do reviews of flood-risk management plans include:

☐Any changes or updates since the publication of the previous version of the flood-risk management plan

☐An assessment of the progress made towards the achievement of the objectives

☐A description of, and explanation for, any measures foreseen in the earlier version of the flood-risk management plan which were planned to be undertaken and have not been taken forward

☐A description of any additional measures since the publication of the previous version of the flood-risk management plan

☐None

Are there agreed-upon performance indicators?

☐Yes. Please specify:

☐No

In your case study, how are the monitoring and evaluation results shared?

☐Traditional media (press release, newspaper inserts, reports, radio broadcasts and video presentations)

☐Web-based technologies (flood information systems, fora, newsletters, social media, data banks, maps, websites)

☐Other information and communication technology (SMS, information hotlines)

☐Open public meetings (e.g. organised by public authorities or flood observatories)

☐Closed meetings (meetings of the river basin organisation, of flood-related associations)

☐Results are not shared.

☐Other, specify:

Impacts

What are the main challenges to robust monitoring and evaluation in your case study?

☐Lack of frameworks which are sufficiently generic to allow comparison and sufficiently specific to adapt to each case

☐Lack of instruments

☐Large amounts of data

☐Disconnection between monitoring and evaluation procedures and policy making and implementation

☐Lack of resources allocated to monitoring and evaluation

☐None

☐Other, specify:

Overall, what were the main challenges your case study had to face for Principle 12? Please provide further details and concrete examples

Notes

[1] Financing and budgeting, data and information, stakeholder engagement capacity development and evaluation.

[2] Infrastructure operation and investment.

[3] A floodwater trade-off can occur between flood prevention, storing water for consumption and providing sufficient environmental flows (OECD, 2013a).

Annex B. List of case study promoters

Name	Organisation/Company	Title
Thomas Thaler	Institute of Mountain Risk Engineering, University of Natural Resources and Life Sciences (Austria)	Research Fellow
Joana Guerrin	University of Nîmes (France)	Researcher and Professor
Antonio Eduardo Giansante	School of Sociology and Politics of the State of São Paulo (Brazil)	Professor and Head of Research
Tomasz Walczykiewicz	Institute of Meteorology and Water Management - National Research Institute (Poland)	Deputy Director for National Hydrological and Meteorological Service
Jean-Marie Bordes	*Syndicat Intercommunal pour l'Assainissement France Vallée de la Bièvre* (France)	Director General
Eline Bötger	Ministry of Infrastructure and the Environment (Netherlands)	Political Advisor
Kyujin Jung	Sungkyunkwan University (Korea)	Assistant Professor
Danielle MacKinnon	South Nation Conservation Authority (Canada)	Engineering Assistant
Andriy Demydenko	Ukrainian Centre of Environmental and Water Projects (Ukraine)	Head, IWRM Department
Wondafrash Wondmagegn Meshesha	Awash Basin Authority (Ethiopia)	Director for Integrated Watershed Management and River Training
Allah Bakhsh	Spate Irrigation Network (Pakistan)	Co-ordinator
Otto Schaaf	Cologne Agency for Sewage Disposal and Surface Water + Flood Management (Germany)	CEO
Alba Ballester, Eva García Balaguer and César Pérez Martin	Autonomous University of Barcelona (Spain)	Researcher, Director-General of Environment and Director of Water Service
Jean-Pierre Arrondeau and Aldo Penasso	*Institution d'aménagement de la Vilaine* (France)	Deputy Director and Head of Drinking Water and Hydraulics
Jonathan Hunter	Environment Agency (England and W–les, United Kingdom)	Senior Advisor - flood and coastal risk management.
Kate Marks	Environment Agency (England and Wales, United Kingdom)	Deputy Director
Kate Kipling	Environment Agency (England and Wales, United Kingdom)	Senior Scientist
Rob Uijterlinde	Rivierenland Water Authority, Dutch Water Authorities and Ministry of Infrastructure and the Environment (Netherlands)	Strategic Advisor
Franck Hufschmitt	*Syndicat des Eaux et France Assainissement Alsace-Moselle* (France)	Head of Water Ecosystems and Related Risks
Gaia Checcucci	Ministry of the Environment, Land and Seawater (Italy)	General Manager of Water and Land Protection and Environmental Remediation Direction
Christopher J Spray	University of Dundee (Scotland, United Kingdom)	Professor of Water Science and Policy
Heriberto Galicia	Water Commission of the State of Morelos (Mexico)	General Directorate for Water Infrastructure and Flood Protection

Jaap M. de Heer	Twynstra Gudde Advisors and Managers (Netherlands)	Senior Partner/Director Bangladesh Delta Plan 2100
Asensio Navarro Ortega, Estanislao Arana García and Sergio Iglesias Asenjo	University of Granada and Local Civil Protection Service of Granada (Spain)	Assistant Law Professor, Full Law Professor, Responsible for Planning and Managing Natural Hazards
Signe Marie Iversen	Municipality of Aarhus, Department of Environment and Energy (Denmark)	Landscape Manager
Jan Rasmussen	City of Copenhagen, Technical and Environmental Administration (Denmark)	Head of Projects
Victor Hugo Alcocer Yamanaka	National Water Commission (Mexico)	Deputy Technical Director

Snapshots of the case studies are available at: https://oe.cd/pub/2Cd

Annex C. Glossary of Terms

- **Flood-risk governance:** set of rules, practices, and processes (formal and informal) through which decisions for the management of flood risk are taken and implemented, stakeholders articulate their interest and decision makers are held accountable (adapted from OECD, 2015a).
- **Flood-risk management:** holistic and continuous societal analysis, assessment and reduction of flood risk (Samuels and Gouldby, 2009).
- **Flood-Risk Governance Arrangements (FRGAs)**: institutional constellations resulting from an interplay between actors and actor coalitions involved in all policy domains relevant for flood risk management, including water management, spatial planning and disaster management; their dominant discourses; formal and informal rules of the game; and the power and resource base of the actors involved (Hegger et al., 2014).
- **Flood-Risk Management Strategies (FRMSs)**: approaches for dealing with flood risks that can be distinguished from one another by their focus on the probability of flooding, its consequences or on recovery after a flood has struck (Hegger et al., 2014).

The five stages of flood management considered in the Checklist are:

- **Flood anticipation or foresight**: Activities and measures to look at what might happen to flood risk and its management far into the future. Flood anticipation or foresight generally takes the form of quantitative and/or qualitative estimates of the impacts of various drivers and responses on flood risk under different future scenarios (adapted from Evans et al., 2008).
- **Flood prevention or mitigation**: Activities and measures to avoid existing and new disaster risks (UNISDR, 2015a). Flood mitigation is closely associated with "prevention", except that it aims to *reduce* flooding rather than *eliminate* floods.
- **Flood preparation or preparedness**: The knowledge and capacities developed by governments, professional response and recovery organisations, communities and individuals to effectively anticipate, respond to and recover from the impact of likely, imminent or current disasters (UNISDR, 2015a). Preparedness is sometimes incorporated into mitigation, but as it is *behavioural* and *institutional* rather than physical, it is considered here as a separate stage. It relates to accessibility of flood information, public awareness of risk, knowledge of what to do in an emergency, and the measures individuals and emergency authorities take to ensure they are prepared, like drills, putting in place household, municipal, regional and national emergency plans (and regular updating), supporting legislation and arrangements.
- **Flood response**: Actions taken during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic

subsistence needs of the people affected (UNISDR, 2015a). Flood response relates to the capacity (e.g. staff numbers) and capability (e.g. quality of technology and systems) of emergency management organisations to deal with a flood during or immediately after it occurs.

- **Flood recovery**: Decisions and actions aimed at restoring or improving livelihoods, health, as well as economic, physical, social, cultural and environmental assets, systems and activities, of a disaster-affected community or society, aligning with the principles of sustainable development, including building back better to avoid or reduce future disaster risk (UNISDR, 2015).

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