Summary

Integrated Flood Management (IFM) is holistic approach derived from IWRM principles that stresses the interrelationship between socio-economic development environmental sustainability and flood-risk management. IFM Plans provide a foundation for flood related decision-making as it paves forward aspects of sectoral developments that must be included for sustainably managing floods. This Tool provides an introduction to the IFM approach and discusses key principles and steps for effective IFM planning.

The Need Integrated Flood Management (IFM)?

Flood-related disasters have risen by 134% since 2000 when compared with the two previous decades (WMO, 2021). The insufficient attention paid to flood risk management has resulted in a dramatic increase in the number of people affected and the economic damages related to floods (APFM, 2017).The World Bank estimates that approximately 1.65 billion people have been impacted by floods from 2000 to 2019 (World Bank, 2021). The GWP/OECD Task Force on Water Security and Sustainable Growth estimated urban property flood damages resulted in approximately US$120 billion per year (Sadoff C. et al., 2015).

In the past, flood control and protection measures have been engineeering-centred and largely relying on structural solutions, with little consideration given to the social, cultural and environmental effects of the chosen flood control measure or to long-term economic sustainability. There has been a growing recognition, however, that non-structural elements can also play an important role in preventing loss socio-economic developments from flooding. As such, we have been witnessing a recent paradigm shift from thinking of flood control beyond putting up dikes and dams. The Integrated Flood Risk Management approach is a response to a call for more a effective, holistic, and

forward-looking vision on how to manage floods (Tariq, Farooq, and van de Giesen, 2020).

Defining the Integrated Flood Risk Management Approach

The Integrated Flood Risk Management approach implies for the integration of land and water resources management in a river basin (Tool A3.02), coastal zone (Tool A3.04) and in urban planning (Tool A3.05) using a combination of measures that focus on building the capacity at various levels for coping with floods within an IWRM governance framework (Tool A3.01) (Figure 1) (APFM, 2009; APFM, 2017). It requires adopting risk management principles to minimise loss of life and property due to flooding, while recognizing that floods have beneficial impacts derived from the use of flood plains and coastal zones. This approach takes in consideration environmental preservation, balancing development needs with flood risk towards a sustainable development which makes it an essential component of IWRM.

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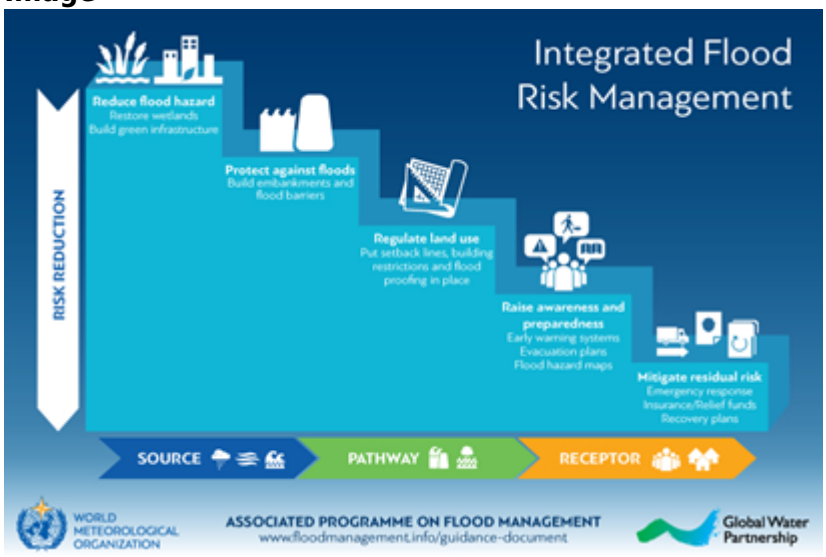

Figure 1. Integrated flood Risk Management Model. Source: APFM (2017).

Principal Elements of IFM that should reflect in an IFM plan

There is no one good recipe for developing a successful IFM strategy, however, there are few key considerations that can contribute to the successful development of IFM plans and strategies. These include:

- **Managing the water cycle as a whole** while considering all types of possible floods. IFM seeks to manage both land and water resources as they relate to the water cycle by restoring groundwater recharges (Tool A3.03) through various nature-based solutions (Topalovic & Marković, 2018).
- **Integrating land and water management**, as both have impacts on flood risks. This is a crucial element because hydrological response to rainfall is highly dependent on soil and surface characteristics. Therefore, close collaboration and knowledge and information exchange between the two disciplines may create multifunctional landscapes resulting in multiple benefits (Topalovic & Marković, 2018)
- **Stakeholder participation**: The effectiveness of an IFM approach is largely dependent on greater participation of all relevant stakeholders in flood policy development, hence

communication and stakeholder engagement is centred in the framework for policy analysis and planning to guide the steps of IFM. Stakeholders involvement allows to: 1) Ensure implementation of basin flood management plans with full public support; 2) Ensure sustainability of plans and associated decisions; 3) Build consensus and public support on the flood management options; 4) Build stakeholders commitment; 5) Build resilience of flood-prone communities; and 6) Provide all stakeholders, including the public, with full opportunities to share their views and influence the outcome (APFM, 2006).

- **IFM should be part of a wider risk-management system**: adopting integrated hazard management approaches, taking into consideration all related hazards such as landslides, debris flows, mudflows, avalanches, storm surges and tsunamis; and creating synergies.
- **Adopting a best mix of measures**: focusing both structural and non-structural (including protection and mitigation measures, planning and building codes, emergency management, raising of risk awareness and preparedness, risk sharing, etc.); depending on the climate, the basin characteristics and the socio- economic conditions in the region to reduce flood risk and mitigate the consequences once a flood occurs.
- **Including nature-based and ecosystem-oriented solutions**: recognising that green infrastructure has a potential to enhance the capacity and resilience of natural systems to climate change (Tool C3.04). There are various ecosystem approaches such as Integrated River Management, Ecosystem-based Adaptation (EbA) and Eco-based Disaster Risk Reduction (Eco-DRR) that are already in practice which embody the philosophy of IFM (Juarez-Lucas and Kibler, 2015).
- **Adaptive multi-disciplinary approach**: to address all aspects of flood management including scientific and engineering, social aspects, environmental aspects, economic aspects, legal and institutional aspects, and should embrace adaptive management.
- **Linking the IFM strategy to existing frameworks**: integrates flood risk with economic development and environmental sustainability, therefore promote local linkages to other policy domains linking the strategy to a variety of investment agendas from both public and private sectors. Other anchoring frameworks include: the Sustainable Development Goals (SDGs) and the Sendai Framework for Disaster Risk Reduction to facilitate implementation of a strategy and provide added value to society (Tool A1.02).

Steps for IFM Planning

IMF planning is an iterative and interactive process that involves four major steps (APFM, 2017):

1. **Framing of flood risk**: the process of IFM planning begins with a stakeholder analysis to identify relevant actors that will partake in the analysis (Tool C1.03). Together these stakeholders then develop a description of the system reflecting the key aspects and elements that will feed into the flood-risk analysis. Exploring scenarios can help in the process of defining socially acceptable levels of risk. Running multiple possible scenarios can additionally help in reducing the uncertainties prior to conducting the flood-risk analysis.
2. **Flood-risk analysis**: involve the identification of hazards and the probability of flood occurrences based on projected future scenarios (Tool C1.01; Tool C1.02). Flood-risk analysis are often done through computer modelling based on GIS and hydrological software mapping the extent, duration, and estimated damages of the forecasted flood events (Tool C2.01; Tool C2.02; Tool C2.04). The exposure to these hazards constitute the building blocks for the flood risk evaluation.
3. **Flood risk evaluation**: is the process of defining what are the socially accepted levels of

protection against flood-risks. This includes a thorough analysis of the flood-risk analysis of the potential array of mitigation measures and their respective pros and cons. Cost-benefit analyses and economic analyses are used in the process to evaluate the various potential options (Tool D1.01). The agreed upon level of safety guides the decision-making process.

4. **Flood-risk management**: entails for the selection and implementation of the strategies to be implemented. The strategies should represent a balanced mix of structural and non-structural methods. Aspects of institutional, financial, and technical capacity need to be considered. Environmental impact assessments can help to understand whether a structural measure would cause harm to the biodiversity and water-related ecosystems. Other types of assessments, including economic feasibility analysis can assist in evaluating and comparing the short and long terms costs associated to different packages of flood-risk mitigation (Tool D1.02). Decision support systems can assist in getting feedback on the performance of the selected methods (Tools C2).

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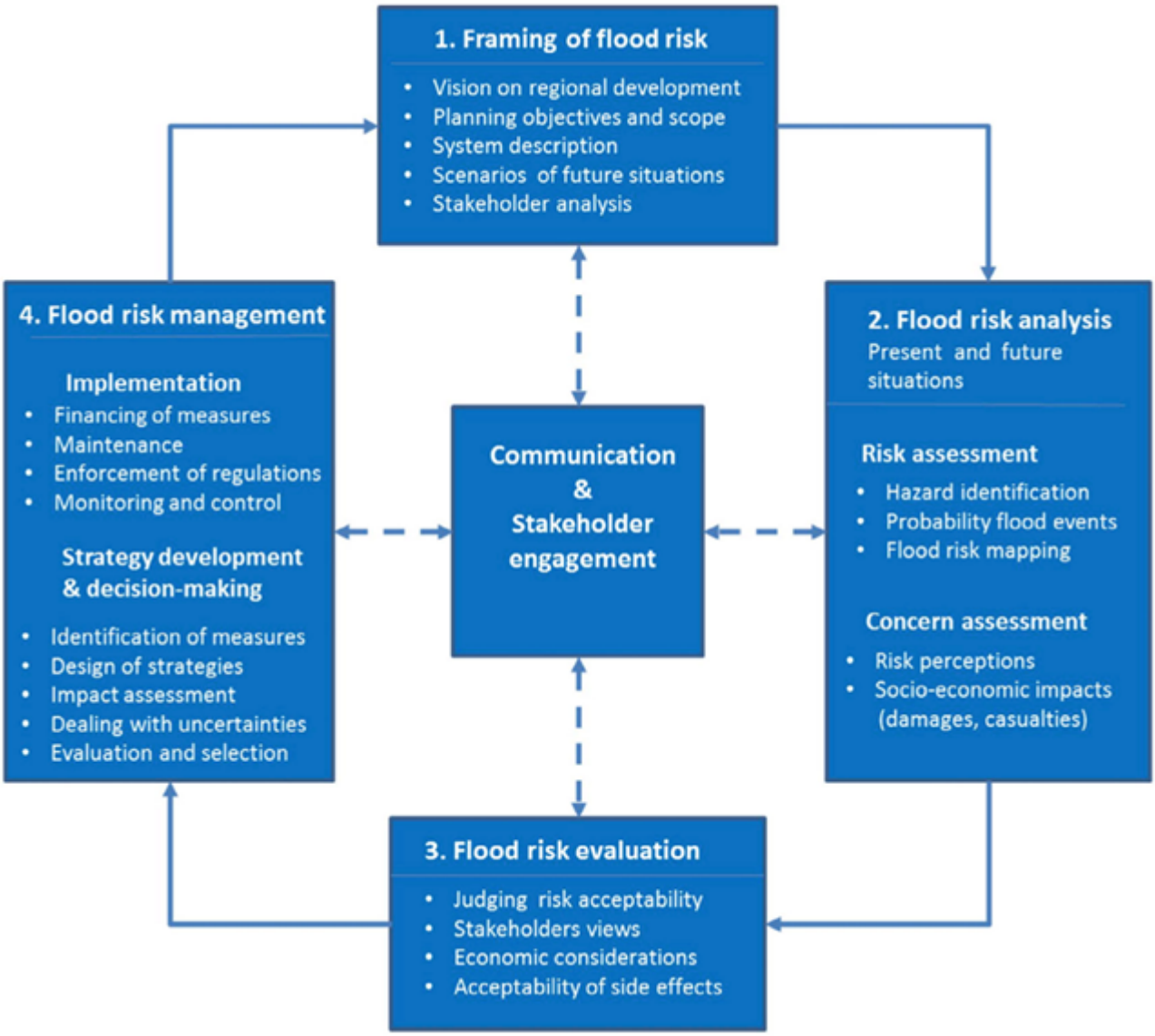

Figure 2: Framework for Policy Analysis and Planning to guide the steps of IFM. Source: APFM (2017).

Countries that seek to adopt the IFM concept and develop their IFM plan can request for assistance from the Associated Programme on Flood Management (APFM) HelpDesk for Integrated Flood Management (APFM, 2021), a facility that provides guidance on flood management policy, strategy,

and institutional development.

Thematic Tagging
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