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Managing Urban Flood Risk: A Framework for Evaluating Alternative Policy Instruments

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Key Points

- To maximize the effectiveness of flood risk management, city governments should employ multiple policy instruments to balance the objectives of resilience (i.e., risk reduction), efficiency (i.e., benefits exceed costs) and legitimacy (i.e., political and public support).
- Flood risk management instruments differ to the extent that they emphasize some of these objectives over others, so informed trade-offs are required when selecting and combining them.
- Contextual factors, such as available resources, the level of flood risk and the degree of public risk awareness, are also salient when choosing among policy instruments for flood risk management.

Introduction

Cities face growing flood risk due to population growth, expansion of economic activities in flood-prone areas and more frequent and severe weather associated with climate change (Casey 2015; Winsemius et al. 2016). Managing this growing flood risk, it is argued, requires a coordinated strategy involving multiple policy instruments that reduce flood-related impacts (Driessen et al. 2016; Hegger et al. 2016). Choosing appropriate policy instruments is challenging, however, given both the range of choices available and the need to balance trade-offs between different decision criteria, such as economic efficiency (ensuring benefits exceed costs) and political feasibility (meaning the degree of support from relevant authorities and constituencies).

This policy brief offers a framework for city officials to evaluate flood risk management policy instruments. Its purpose is to explore trade-offs between three different policy objectives, and how the prioritization of one or more objectives over others might be suitable in different local contexts. The brief concludes with recommendations for policy makers to reduce uncertainty in selecting policy instruments for flood risk management.

About the Authors

Daniel Henstra is a CIGI senior fellow and associate professor of political science at the University of Waterloo. At CIGI, Daniel's research centres on the multi-level governance of complex policy areas, such as climate change adaptation and flood risk management, where he focuses on the networked relationships among elected officials, public servants, stakeholders and the public. Daniel's research has been supported by grants from the Social Sciences and Humanities Research Council, as well as from the Marine Environmental Observation Prediction and Response Network. In addition to his academic work, he has substantial experience in applied policy analysis, including contract research with government departments such as Infrastructure Canada, Natural Resources Canada and Public Safety Canada. Daniel holds a Ph.D. in political science from the University of Western Ontario (2007).

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Policy Instruments and Flood Risk Management Objectives

Policy instruments are tools of governance that use state authority and resources to shape the behaviour of individuals or groups in order to achieve strategic public objectives (Howlett 2005). Based on an extensive literature review, the authors identified 14 policy instruments that contribute to urban flood risk management by: sharing with other parties the burden of loss associated with flooding, which would otherwise be borne entirely by city governments; spreading the responsibility for risk reduction among non-governmental parties that contribute to, or are affected by, flood risks; or sharing the costs associated with publicly funded flood risk reduction measures (Thistlethwaite and Henstra 2017) (see Table 1).

In choosing among these instruments, decision makers must first consider the central policy objective and the capacity of different instruments to achieve this policy objective over time. Three key flood risk management objectives include strengthening resilience to flooding, improving the efficiency of flood risk management and enhancing the legitimacy of flood risk management decision making (Alexander, Priest and Mees 2016; Driessen et al. 2016).

Resilience

Flood resilience has several dimensions, including the capacity to resist flooding to prevent adverse impacts (for example, by retaining water with dikes and dams), the capacity to absorb and recover quickly from flood-related stress (for example, by preparing for effective response and recovery) and the capacity to adapt and transform in response to flood impacts (for example, by learning from flood experiences and adopting new policies) (Hegger et al. 2016). Instruments that support flood resilience should demonstrate effectiveness, meaning that they are likely to achieve the policy objectives regardless of the economic or political costs (Salamon 2002, 23). Flexibility, or the degree to which an instrument and its effects can be adjusted and even reversed in the future, is another important criterion supporting resilience (Nair and Howlett 2016). Flood risk is highly

Table 1: Policy Instruments for Urban Flood Risk Management

Instrument	Description
Land use regulation	Legal restrictions on the location, type, scale and density of development in flood risk areas to minimize exposure of people and property. Also includes conserving and protecting natural flood mitigation. Examples: restricting lands in floodplain and flood fringe to non-residential uses (for example, parks); preserving wetlands.
Development conditions	Rules that impose conditions on building permits with the objective of minimizing flood risk. Example: bylaw imposing a minimum setback distance from a waterway or minimum elevation above a groundwater table.
Green infrastructure / low-impact development	Comprehensive approaches to decrease the volume of runoff by detaining stormwater on site and allowing it to infiltrate soil. Examples: swales, permeable landscaping and green roofs.
Stakeholder engagement	Collaboration with individuals who could be affected by decisions or who have the resources to support implementation to find collective flood risk management solutions. Example: stakeholder advisory group that participates in flood management decision making.
Flood mapping	Mapping areas and assets at risk of flood inundation to estimate potential damages and inform risk reduction measures.
Flood warning system	Mechanism to alert residents about impending flood threats.
Flood hazard disclosure	Mandatory release of information from sellers to potential buyers about a property's past flood damage or risk of future flooding.
Corrective tax	Targeted tax on property owners in flood-prone areas to offset flood protection costs.
Stormwater charge	Fee levied from property owners based on their property's contribution to stormwater runoff (usually calculated based on impermeable surface area).
Subsidies	Conditional public contribution toward the cost of flood risk reduction activities, such as installing a sump pump system or backflow prevention valve.
Credits	Reduction or elimination of a financial obligation in exchange for actions that reduce flood risk. Example: property tax credit for installation of rain barrels, underground cisterns or rain gardens.
Compassionate grants	Financial transfer from municipal governments to individuals to cope with flood-related losses not recoverable through private insurance.
Property buyouts	Public purchase of properties in flood-prone areas to reduce risk.
Special surcharge	Fee added to all property tax or utility bills to fund flood mitigation initiatives.

Source: Thistlethwaite and Henstra (2017).

Table 2: Policy Objectives and Instrument Characteristics

Policy Objective	Instrument Characteristics
Resilience	
→ effectiveness	→ degree to which the instrument achieves the core objectives
→ flexibility	→ degree to which the instrument is adjustable or reversible
Efficiency	
→ economic efficiency	→ degree to which the instrument's economic benefits outweigh the costs
→ administrative operability	→ human and organizational resources required to implement the instrument
→ technical viability	→ data and expertise required to implement the instrument
Legitimacy	
→ political feasibility	→ degree of support from elected officials and influential community interests
→ equity	→ extent to which benefits and burdens are fairly distributed
→ coherence	→ degree to which the instrument aligns with other policy objectives

Source: Authors.

uncertain and requires policy approaches that can adapt in response to changing environmental conditions (for example, climate change).

Efficiency

Flood risk management is supported largely by public resources (human and technical), so ensuring efficiency by conserving resources and by avoiding overlap between levels of government and between state and societal actors is desirable. Economic efficiency in flood risk management is one dimension, whereby solutions with a lower cost-benefit ratio are prioritized for implementation. Administrative operability is a second criterion: instruments that require significant additional human or organizational resources to operate and implement can limit the efficiency of flood risk management (Salamon 2002, 24). Finally, technical viability is a measure of the extent to which there are sufficient knowledge resources, such as data and expertise, to implement a particular policy instrument.

Legitimacy

Legitimacy is regarded as an essential ingredient for "good governance" (Agere 2000; Graham, Amos, and Plumptre 2003). An instrument's political feasibility — the degree to which it is supported by elected officials, public servants and influential interests — is an important measure of legitimacy (May 2005). Instruments also contribute to the legitimacy of flood risk management by ensuring equity in the distribution of benefits and burdens among multiple stakeholders affected by the policy intervention (Mees et al. 2014; Salamon 2002). Finally, instruments that achieve coherence with other policy objectives contribute to the legitimacy and implementation of flood risk management, in particular among bureaucrats and civil servants. Table 2 summarizes the three policy objectives and their corresponding instrument characteristics.

Policy Instruments and Local Context

It is difficult to balance the three core objectives of flood risk management — resilience, efficiency and legitimacy — and the choice between policy instruments typically involves trade-offs between these objectives. For this reason, the mix of policy instruments a city employs to manage flood risk must ultimately align with the local context,

which is influenced by institutional frameworks (for example, rules, regulations, distributions of authority and resources), physical conditions (for example, proximity to rivers, low-lying areas) and social conditions (for example, risk perceptions, political beliefs) (Hegger et al. 2016; Driessen et al. 2016). The section below illustrates how these contextual factors might influence instrument selection and the trade-offs between the three flood risk management objectives.

Institutional Framework: Limited Resources

Local governments face significant institutional constraints that impede flood risk management implementation, and perhaps the most difficult is limited fiscal capacity. Unlike higher-level governments, which can draw on a broad tax base, local governments rely almost entirely on property taxes and development charges for operating revenue. As a consequence, efforts by local governments to prioritize policy tools that support resilience often carry a heavy economic opportunity cost and experience political resistance. Limiting development in high-risk areas, for example, comes at the expense of critical property tax revenue, but also triggers political opposition from developers and residents. In this context, instruments that prioritize efficiency and legitimacy are more suitable for local governments.

A stormwater charge is an example of such an instrument. It does not directly reduce risk (i.e., enhance resilience), but it is efficient since it is a user fee that does not rely on general budget revenue and is legitimate since it aligns with existing municipal capacity as a utility provider (for example, hydro, water). Revenue from the stormwater charge may not be sufficient to fund costly resilience measures such as property buyouts, but it can be used to fund local stormwater and flood defence measures.

Physical Conditions: High-risk Zones

In communities with high exposure to flood risk, policy instruments that prioritize resilience at the expense of efficiency and legitimacy are likely to be more suitable. Instruments such as property buyouts and corrective taxes are considered highly effective for flood risk reduction, but require some property owners to bear a significant burden, such as moving from their property or paying additional costs to pay for flood defences. As a result, these tools lack political feasibility, so policy makers typically regard them as less legitimate tools of flood risk management. Nevertheless, local governments in high-risk areas must consider deploying these mechanisms that deliver long-term resilience benefits despite short-term economic costs and temporary social and political resistance.

Social Conditions: Low Risk Awareness

Low public flood risk awareness is a common problem in most jurisdictions and is an obstacle to strengthening flood risk management. This lack of awareness often underpins a broader perception that governments are responsible for managing flood risk while property owners have no role to play. In this context, information-based policy instruments such as flood maps and stakeholder engagement are important to raise risk awareness and influence public beliefs. While flood maps increase the legitimacy of flood risk management, this comes at the expense of efficiency (i.e., the information and administrative costs are significant) and resilience (i.e., the maps themselves do not achieve risk reduction).

Recommendations

Effective urban flood risk management requires a diversity of policy instruments that work together to enhance resilience, achieve efficiency in the use of scarce resources and strengthen the legitimacy of flood risk management decisions. Since achieving a balance between these three objectives is difficult, city governments should consider the following recommendations:

→ When selecting policy instruments to implement flood risk management objectives, consider the various evaluation criteria noted above (see Table 2). Although there are many policy tools that contribute to reducing and managing flood risk, they vary considerably across different instrument characteristics, such as flexibility, administrative operability, equity and so on. Carefully anticipating the material impacts of choosing one instrument over another, and their interactive effects when combined, helps to ensure that the mix of policy instruments is complementary.

→ Recognize that there are trade-offs between resilience, efficiency and legitimacy, and select policy instruments that are most suitable for the local context. The policy choices of city governments are inevitably constrained by local contextual factors such as limited fiscal resources, variable exposure to flood risk and weak public flood risk awareness. Prioritizing a set of policy instruments that maximizes effectiveness, even if other flood risk management objectives are forfeited, is likely to achieve greater benefits in terms of risk reduction over the long term.

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