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POLICYBRIEF

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Building Resilience to Flooding

Shyama V. Ramani, Pranav Shankar Kaundinya, Natalie Perné and Serdar Türkeli.

Highlights

Technology and innovation can mitigate and even prevent the damage caused by floods. A recent review by Kaundinya, Perné and Türkeli (2022) identified three main pathways to flood resilience:

1. Infrastructural Innovation
2. Information Generation
3. Aid disbursement.

These three pathways lead to four points for policy reflection, as illustrated below with case studies:

1. Infrastructural changes are essential to improve prevention and mitigation.
2. Available digital technologies should be mobilised to augment preparedness, mitigation and response.
3. Data-based flood recovery programs must constantly update information to maximise effectiveness.
4. Publicly funded technology incubation must also ideate on and implement inclusive design.

Introduction

Technology and innovation can mitigate and even prevent the damage caused by floods. A recent review by Kaundinya, Perné and Türkeli (2022) identified three main pathways to flood resilience:

First, existing scientific knowledge and technology can be mobilised to create infrastructural innovations which can be either nature-based or non-nature based. The latter is more common and usually takes the form of the construction of dikes, dams and canals that directly reduce the probability of floods occurring. Large infrastructure projects tend to require significant financial and resource investments that are often state-backed as they are deemed too high-risk for the private sector.

The second pathway is information generation, which applies science and technology to create digital apps and platforms that improve preparedness, response and recovery from flooding through data generation and data visualisation.

The rapid dissemination of information on the course of the natural disaster enables better responses from vulnerable

populations as well as emergency services offering assistance during the crisis (as outlined below in point #2 of this brief). Better responses can take the form of alerts on the pathway of the floods, location of safe sanctuaries, identifying people in need and missing persons, availability of emergency services etc.

The third pathway mainly concerns response and recovery through aid disbursement. Here, a variety of instruments can be put in place, including ensuring that government departments help impacted households through focussed programmes. Essential services recovery must also be prioritised, and the recovery stage involves both economic and non-economic actors working together to return to a (new) normal.

These three pathways lead to four points for policy reflection, as illustrated below with case studies:

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1. Infrastructural changes are essential to improve prevention and mitigation.

The Stamford Diversion Canal, Singapore: In the 1960s and 1970s, Singapore was impacted by annual monsoonal flooding that submerged large swathes of built-up land . The low-lying island city state's water agency, the Public Utilities Board (PUB), expanded its network of urban stormwater drainage and reservoirs to better capture and conduct excess stormwater to reservoirs. The government created a separate drainage master plan in 1972 identifying new gaps in the system which, thanks in part to efficient bureaucracy, were effectively dealt with by extending the drainage system between the 1980s and 2000s. Thus, by 2020, the incidence of pluvial flooding was substantially reduced. Singapore's technical capabilities and water-security improved as an offshoot of their flood-prevention measures.

2. Available digital technologies should be mobilised to augment preparedness, mitigation and response.

Fort Bend is a county in Texas, USA, that faces a compound risk of fluvial and pluvial flooding due to its location on a flood plain as well as dense urban settlement. When it was hit by twin floods in 2016, the municipality made innovative use of an existing technology. State authorities sent small unmanned aerial vehicles (SUAVs) to assess flood damage in order to better synchronise emergency responses. The drones improved the granularity of data for disaster response with minimal manpower. Publishing of flood footage on YouTube allowed citizens outside flood zones to observe the flood's progress which, in turn, reduced panic among the public. In addition, this data fed into the improvement of predictive models used for pre-emptive evacuations.

3. Data-based flood recovery programs must constantly update information to maximise effectiveness.

The US National Flood Insurance Programme uses map and satellite data to identify flood-risk zones and offer insurance against floods in high-risk areas. It is a science- and- data-based policy tool that is used to improve preparedness and recovery. However, between 2017-19, nearly 40% of insurance claims originated from outside flood zones as identified by the

data as it existed then. The inconsistency occurred because the maps used outdated data which was later replaced by a nationwide initiative to gather information for the insurance programme across states. Besides being overly technical, it also lacked socially relevant data that could be used to assess vulnerabilities.

4. Publicly funded technology incubation must also ideate on and implement inclusive design.

I-REACT (Improving Resilience to Emergencies through Advanced Cyber Technologies) is a European Horizon 2020 funded project that uses cyber technology to improve preparedness and response to flooding. The initiative engages citizens digitally, including via an app, where they report the impact of a disaster as it affects them, and their communities, allowing first responders to react and share their own information to create more holistic, effective support for the public. This and similar nascent technologies are works in progress and need continual improvement to be more effective. I-REACT would have benefited from more inclusion from end-users, civil society, NGOs and government bodies (especially municipalities – the main beneficiaries of the solutions). Nonetheless, this project is a useful reminder that collaboration and cooperation across sectors is required.

Summary

This policy brief argues that raising flood resilience is most effectively done by investing in infrastructure, mobilising digital technologies, gathering granular information and by ideating with the market in mind, in collaboration with the private and social sectors.

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