Key Points

- Effective disaster risk management (DRM) requires scaling efforts to leverage water hazard data as much as possible.
- Due to the spread of the coronavirus disease (COVID-19) pandemic, disaster risk reduction has become even more challenging.
- Human capacity development (public education and literacy, empowerment of local governments and community leaders, and media briefings) by adequately addressing the local knowledge and wisdom is a necessity for future policy frameworks.
- Effective disaster preparation, warning, response, and recovery are best made when local governments and organizations work well together and coordinate with organizations on the national level.
- Effective governance is one of the most essential elements of an overall DRM strategy.
- For future dialogues, additional focus should be on identifying best practices related to using state-of-the-art technology to enable efficient governance for DRM.

Frontiers of Water-Related Disaster Management and the Way Forward

Poe Oo, Intern, Asian Development Bank Institute (ADBI)
Nikhil Bugalia, Research Associate, ADBI
K E Seetharam, Senior Consulting Specialist for Capacity Building and Training Projects, ADBI
Tetsuya Ikeda, Deputy Director (International Coordination), International Centre for Water Hazard and Risk Management (ICHARM)
Toshio Koike, Executive Director, ICHARM

Our world has been witnessing a consistent rise in water-related disasters in recent years. Water-related disasters refer to meteorological events such as cyclones and storms; hydrological events such as floods; and climatological events such as extreme temperatures, drought, and forest fires. Such disasters derail sustainable development, making it paramount to embed water-related disaster resilience into the Sustainable Development Goals. The coronavirus disease (COVID-19) pandemic has made disaster risk reduction even more challenging.

From 2004 to 2018, Asia experienced more than 3,400 water-related disasters. This number was 2.5 times higher compared to the reported numbers recorded previously in the 15 years from 1980 to 1994. Such an increase in disasters can be seen across developed and developing countries in South and Southeast Asia, such as Indonesia, Japan, Myanmar, the Philippines, and Sri Lanka. These disasters are also associated with huge economic losses. The relevant water-related disasters between 2004 and 2018 are estimated to result in $634 billion in economic losses in Asia, also about 2.5 times higher compared to the figure for 1980–1994. Among these disasters, catastrophic events caused the most havoc, an estimated $491 billion in 2004–2018 (Figure 1). Such trends in both the number of water-related disasters and the figure for the associated economic losses are expected to continue, based on the consistent predictions by various scientific committees (IPCC 2014). Therefore, the issue of water-related disaster management warrants urgent attention.
Human factors that increase disaster-related exposure and vulnerability, such as poverty, rapid population growth, disorderly urbanization, and changes in land use, also aggravate the negative consequences of water-related hazards intensified by climate change. Moreover, the issue of managing climate change-induced disasters has grown to become complex.

Due to such complexity, the management of disasters requires cooperation between governments, regional organizations, international institutions, businesses, nonprofit organizations, and individuals. The Sendai Framework for Disaster Risk Reduction 2015–2030 established four priority areas: understanding disaster risk, improving disaster preparedness for response and bettering recovery efforts, strengthening the governance framework for managing disaster risk, and investing in disaster risk reduction (United Nations 2015). In addition to cooperation within countries, the framework also called for further regional and global cooperation by sharing best practices and building partnerships across sectors and countries. This is a daunting challenge, particularly for disaster-prone developing countries in Asia and the Pacific. Developing countries are more vulnerable to climate-induced water disasters due to underlying factors that increase risks, such as poverty, inequality, and weak institutions for disaster risk management. The framework states that international, regional, and cross-border cooperation is required for supporting the resources and capabilities of developing countries. In order effectively manage disasters, states, regional and international organizations, the private sector, non-state organizations, and individuals need to work together in strengthening governance structures and investment.

**Background**

The Asian Development Bank Institute (ADBI) and the International Centre for Water Hazard and Risk Management (ICHARM) hosted a policy dialogue on 27–28 January 2020, attended by senior officials of several related government agencies from Indonesia, Japan, Myanmar, the Philippines, and Sri Lanka. The policy dialogue focused on several areas of disaster risk management (DRM), such as the structural and nonstructural measures for preparedness, as well as early warning. Also discussed were cross-disciplinary aspects such as financial management, governance, and law, as well as the roles of national and local authorities across different phases of DRM. A detailed description of the associated terms is in the next section.

This policy brief collates the country experiences, identifies the key policy challenges facing the developing member countries, discusses successful case studies and acclaimed academic frameworks, and provides...
recommendations for moving forward. ADBI and ICHARM participated in the Fifteenth Meeting of the High-level Experts and Leaders Panel on Water and Disasters (HELP) on 29 May 2020 and contributed to the Principles to Address Water-related Disaster Risk Reduction (DRR) under the COVID-19 Pandemic (see Box), which were adopted at the meeting.

**Principles to Address Water-related Disaster Risk Reduction under the COVID-19 Pandemic**

- Principle 1: Enhance leaders’ awareness on disaster risk reduction in the pandemic
- Principle 2: Integrate actions on risk management of disasters and pandemics
- Principle 3: Provide clean water, sanitation, and hygiene sustainably during and after disasters
- Principle 4: Protect disaster risk management stakeholders from threat of COVID-19
- Principle 5: Protect scarce medical resources from disaster impact
- Principle 6: Protect disaster evacuees from threat of COVID-19
- Principle 7: Protect COVID-19 patients from threat of disasters
- Principle 8: Develop specialized evacuation guidance for cities and areas under COVID-19 lock-down
- Principle 9: Finance DRR actions under COVID-19 effectively to avoid economic catastrophe
- Principle 10: Strengthen global solidarity and international cooperation to cope with these cooccurring challenges towards building our world back better


The Framework of Disaster Risk Management

DRM is a comprehensive approach applied across the life stages of a disaster to reduce systematically its impacts. An overview of the DRM strategy is shown in Figure 2. A disaster occurs when a hazard (water-related natural hazards in this case) interacts with an exposed and vulnerable population, causing damage. Depending on the timescale, the damage can also be classified as immediate, short run, or long run. Immediate or direct damage includes harm to people and physical assets, such as property or infrastructure. Indirect losses denote the adverse effects of a disaster on economic activity in the short run and loss to well-being in the long run.

Various structural and nonstructural measures are then implemented across the life stages of a disaster to reduce the overall damage. Structural measures usually refer to the physical construction of infrastructure. In contrast, nonstructural measures refer to knowledge or practices as represented through policies, laws, public awareness programs, and other socioeconomic measures.

Depending on the life stage at which these measures are implemented, they can be classified into four phases: preparedness, early warning, response, and recovery. Measures for disaster preparedness aim to reduce the hazard, exposure, and vulnerability. Structural measures in the disaster preparedness phase include disaster-resilient infrastructure development and the information infrastructure needed to support disaster monitoring and forecasting. Proactive measures taken in planning land use, housing, and buildings reduce damage more effectively by absorbing the impact of a powerful hazard. Nonstructural measures in this phase include preparing community networks to impart knowledge and training related to disaster preparedness, developing appropriate hazard maps, and putting a DRM plan into practice.

For water-related hazards, an early warning system plays an essential role. In many cases, the hazard monitoring systems put into place to monitor the water-related hazards can be used to issue a warning so that residents can evacuate to safer places. Early warning systems thus play an essential role in reducing the loss of human life.

The response phase refers to the actions taken by the relevant stakeholders to minimize the impact of the hazard and, if possible, restore some functions that are essential for society. Structural measures here include the recovery of utilities, development of evacuation centers, arrangement for temporary housing, and other measures to restore physical structures. Nonstructural
measures relevant for this phase include rescue, medical, logistic support, and other measures to address obstacles to people’s health and livelihoods. In some instances, financial inputs are provided by the government to recover economic activities.

Finally, in the recovery phase, the emphasis is on restoring the functions of the society to the pre-disaster level through structural measures such as reconstruction, nonstructural measures such as renewal of urban plans, and economic recovery measures. In many instances, disasters are also seen as an opportunity to enhance the functions of society to a level even higher than before the disaster. The concept, commonly known as “Build Back Better” (United Nations 2015), often is seen as an opportunity to correct the non-optimal spatial distribution of societal functions prevalent in the past.

Apart from the various structural and nonstructural measures applicable to various phases of the disaster, several cross-disciplinary activities are essential across various stages. Capacity building and training, financial management, operation and maintenance management, governance, law, and issues pertaining to balancing actions from local and central governments are all examples of such cross-disciplinary topics. While the “Build Back Better” framework offers promising opportunities to correct the non-optimal developments of the past and reduce the disaster risk going forward, preparedness and early warning systems are considered the most essential and useful forms of defense to minimize the impact of disasters, especially for resource-constrained developing economies (Noy, Ferrarini, and Park 2019).

The experience shared at the ADBI–ICHARM policy dialogue established the interactions between several structural, nonstructural, and cross-disciplinary aspects of DRM, resulting in the effectiveness of the first two phases of DRM. Their essential characteristics are discussed in the subsequent sections.

Understanding Disaster Risk and Disaster Preparedness

The fundamental building block supporting these phases is water hazard data. Data here refer to the past, real-time, and estimated information related to water hazards. They come from weather stations, satellites, and weather forecasting agencies and form the basis of hydrological forecasting (rainfall forecasting, etc.). Depending on the timescale of these estimates (daily, weekly, monthly, seasonal, etc.), these forecasts serve

Figure 2: Framework for Disaster Risk Management

![Figure 2: Framework for Disaster Risk Management](https://example.com/framework.png)

Source: Authors.
different aspects of DRM preparedness at structural and nonstructural levels.

For example, the daily forecasts, when combined with hydrodynamic models, which essentially help estimate the temporal and spatial spread of a typical hydrological disaster event (excess rain, etc.), can help estimate the number of affected people (and severity of the effect) in case of a flood. In Sri Lanka, rainfall simulations in combination with hydrodynamic models have been used also to study the potential response to manage the event. Based on the risk estimations using simulations, government agencies at all levels in Sri Lanka were able to prioritize the development, operation, and maintenance plans of several flood control facilities needing attention. The seasonal forecasts in combination with hydrodynamic modeling have been extensively used to develop hazard maps in all participating countries. Such hazard maps then form the basis of the long-term structural measures, such as renewal and mitigation measures at the urban and rural levels.

However, not all countries have focused on adopting structural measures in response to the outputs of the hydrological and hydrodynamic models. Countries such as the Philippines are utilizing such hazard maps as part of building climate resilience, inspired by the Community-Based Adaptation (CBA) to climate change framework (Kurukulasuriya, Ganapin, and Nyandiga 2015). The Philippines is focusing on assuring climate-resistant livelihoods, enhancing adaptive capacity, addressing poverty and vulnerability, and implementing a smart risk reduction strategy. An example of CBA in the agriculture sector shared by the representative from the Philippines highlighted measures such as adopting crop and farming method variations, adjusting land topography to reduce soil erosion, and enhancing the water absorption capacity of the soils to counter seasonal rainfall variability, decline in precipitation, increase in mean temperatures, and changes in climate. The Philippines is also undertaking efforts for community participation and awareness development as a measure to enhance the effectiveness of the nonstructural preparedness measures.

Based on a review of the experiences from the participating countries, substantial efforts on enhancing water hazard data collection, storage, analysis, and utilization capacity are visible across all member countries. Despite the significant progress on this front, many data management issues must be addressed continuously. A few applications described above emphasize that an effective DRM data management approach should be able to handle large volumes of a variety of data in a short processing time. Such a data-dependent approach enables us to reproduce natural events and have people experience such extreme events in virtual space, therefore establishing a seamless connection between emergency and normal times. By preparing for an emergency through the effective use of science and technology in data integration and communication, residents and governments will be able to take timely action at each stage of a disaster. To achieve a society where each individual is sure of being protected safely, however, it is critical to further strengthen the capabilities of human resources, in particular the capacity for data management.

Participants at the policy dialogue reached consensus that for effective DRM, it is necessary to scale efforts to leverage water hazard data as much as possible and that such efforts should be the focus for future bilateral and multilateral development programs.

**Early Warning and Improving Response**

The information from the hydrological and hydrodynamic models updated in real time often serves an essential element for issuing early warning of disasters. Such an early warning is usually categorized into different levels according to severity. Hence, the warning of each severity level is expected to trigger a different response from the relevant government agencies as well as from communities living in the disaster-affected areas. While the principles of such early warning systems are well established and well understood, there are several prevalent challenges often relating to nonstructural and cross-disciplinary measures.

The first challenge relates to the effective implementation of an integrated multi-hazard warning system (MHWS). From an end-user perspective, such a system is desirable as users can access information in a consistent manner.
and through easy-to-use channels. Indonesia and Japan have been successful in implementing such systems. They rely extensively on modern technology and information-sharing platforms (such as social media, news, and official websites) through easy-to-use mediums such as smartphones. However, Sri Lanka, for example, continues to face several challenges in implementing such an MHWS. These challenges include assuring collaboration between multiple government departments and divisions whose responsibility for issuing warnings frequently limits them to one specific aspect of a disaster. Besides, often there is not one standard scale for categorizing the severity of different types of disaster. Challenges also remain in determining agreed threshold values on the disaster severity scales. These thresholds are used to determine the level of response from relevant government agencies. Hence, the selection of the threshold values is not only an issue related to uncertainty in assessing the threshold but also constraints faced by the individual government agencies in providing the desired response. In Japan, the challenges of MHWSs are managed through a centralized and transparent governance structure. A single agency in the country is tasked with issuing warnings, the same scale for measuring disaster severity is used, and the information and response coordination procedures across several national and state-level government agencies are well established in the normal processes.

The second challenge relates to triggering a response from people living in the disaster-affected areas upon issuing an early warning. The lack of a prompt response from residents was a challenge, with or without an MHWS. Citing the example of rainfall in July 2018, which caused more than 200 casualties, the most enormous damage in the past 30 years due to rainfall, the Japan Meteorological Agency identified that even the MHWS was not effective in conveying the real sense of the risk. As a result, the agency has been working to enhance user risk perception by providing high-resolution data about the potential effect for a given warning level. The Japan Meteorological Agency, in partnership with municipalities, also conducts citizen-level workshops to promote understanding and use of the information provided through such warning systems. Experts from Indonesia and Myanmar also emphasized such community-level engagement to promote the use warning systems. Hence, human capacity development (public education and literacy, empowerment of local governments and community leaders, as well as media briefings) adequately addressing local knowledge and wisdom is considered a necessity for future policy frameworks.

**Governance**

The Sendai Framework for Disaster Risk Reduction 2015–2030 views states as having the primary responsibility for improving disaster risk reduction (DRR) within their boundaries. DRR requires an all-of-society engagement and partnerships that are inclusive, accessible, and pay special attention to the most vulnerable groups.

The policy dialogue helped increase understanding of how the real-life implementation of the Sendai framework looks and what could be done to further enhance its implementation. In particular, the discussions identified important stakeholders in an effective DRR governance structure. These key stakeholders are the national government, local government, and local communities, as well as civil society organizations (CSOs), international organizations, academia, business, and the media. Each of these players has a quintessential role in effective DRR.

**Role of National Governments**

The two main activities of national governments relate to mainstreaming DRR and coordination with other stakeholders. Disasters will destroy economic, social, environmental, and political life in countries, so the mitigation of risks requires DRR to be included in national planning. The cooperation of stakeholders from multiple sectors is needed to address investment, planning, technological capacity, communication, and other issues.

In this regard, participants deemed it necessary to create DRR platforms to coordinate stakeholders from the
national level to the community level and across sectors.\(^1\) The presenters from all participating countries also shared how their national governments are engaging with various ministries and agencies, local communities, academia, and the private sector. For example, the representative of the Cabinet Office for Disaster Management in Japan spoke in detail about how DRR is included in national planning, for example, for flood control. The government constructed levees and flood diversion channels to mitigate the effects of disasters and created a governance model to coordinate and implement flood control activities.\(^2\)

As stated in the guiding principles of the Sendai framework, the national government should act as the focal point of the DRR policy-making process. A majority of the dialogue participants were of a similar view and shared experiences from their own countries. National governments in Indonesia and Sri Lanka have been engaging with local governments and local communities to cater to highly diverse populations. Their experiences suggest that adequate disaster preparation, warning, response, and recovery are best made when local governments and organizations work well together and coordinate with organizations at the national level. The role of national governments is essential in coordinating the efforts as they hold more financial, technical, and other resources compared to local governments.

**Role of Local Governments and Civil Society Organizations**

Participants from Indonesia, Myanmar, and the Philippines shared their country experiences, highlighting their activities related to implementation of DRR in local environments. They reaffirmed the importance of work done by the local authorities. In several of the participating countries, the local authorities engage with civil society organizations (CSOs) to raise awareness among local communities through public education campaigns and social media platforms concerning the warning systems and evacuation plans. A key feature expected of local governments is to ensure information coordination with the national government in a clear and timely manner before, during, and after disasters. Hence, local governments should maintain good relations not only with local communities and CSOs but also with the national government. This is especially important in places with high levels of diversity where local governments may need to ask CSOs and local communities for input in the DRR policy formulation and implementation process. CSOs can also assist local governments in policy implementation. For example, community representatives in Indonesia helped agencies and local governments organize education campaigns and raised awareness among local communities.

**Role of Businesses**

DRR requires investing in technology, infrastructure, capacity, and other areas. Businesses are an indispensable part of any society, and their involvement in DRR can be advantageous. Mainstreaming DRR is not an easy task for any government. The private sector is expected to work with the government to invest in DRR infrastructure and come up with innovative solutions for the challenges that are unique to each case.

**Role of the Media**

Providing accurate information to the public before, during, and after a disaster is important for the government to carry out its DRR functions effectively. Many countries engage with conventional forms of media such as television and radio to reach people in rural parts of the country. On the other hand, social networking sites have become useful tools to relay such information to the public, as the number of people using the social media platforms has increased significantly in recent years. However, an important responsibility for the media is not to sensationalize the news about disasters, which could spread panic among the public.

**Role of Academia**

Understanding the nature of disasters and the various aspects of DRR puts science and technology at the forefront. Activities previously described in this policy brief clearly establish the importance of innovative solutions based on scientific and technological knowledge for overall DRM. Hence, scholars should continue to research DRR, preparedness, early warning, responses, recovery, and other aspects. An important role of the government is to realize the contributions from these academic activities and promote

---

Role of International Organizations

For developing countries, international organizations are another stakeholder in the DRR field. Especially low-income countries find it difficult to mainstream DRR, so international organizations can provide financial and technical assistance (see Appendix on the International Flood Initiative). International organizations in Sri Lanka are integrated into the DRR coordination mechanisms in the country. Therefore, national and local offices of international organizations can learn about the situation on the ground and relay this to their national offices and headquarters. More tailored assistance at the local level can also be provided because of the presence of local offices.

Characteristics of the Desired Governance Framework

The main stakeholders and their roles for effective DRR are summarized in Figure 3. Looking at the figure immediately provides a sense of the complexity involved in managing such highly coupled interactions. In a disaster, all stakeholders need to collect, analyze, identify, and share critical information on a real-time basis, making timebound critical decisions often under extremely difficult physical conditions while coordinating their actions horizontally and vertically across several stakeholders. While a majority of the countries facing disaster risks are still able to identify the key stakeholders and to some extent engage with them, in the context of increasing numbers of disasters and the amount of information and coupling of systems, the effective implementation of the overall governance framework remains a challenge even for many developed economies.

This is still an area that needs further deliberation to identify potential working models. One proposal featuring an online synthesis system and a facilitator could serve as a guiding framework for the future design of such systems (footnote 1). Today, it is possible that some local governments have never experienced a disaster, therefore making it essential to establish a support system that helps local governments execute basic actions without delay in the event a disaster does occur. To ensure such a system, a portal site for sharing disaster information is indispensable, as it would allow disaster management personnel of local governments to select real-time information and risk information necessary for an effective disaster response and customize a website to monitor the selected information together without switching webpages. Also urgently necessary is to develop a procedure that enables local governments

Figure 3: Disaster Risk Reduction Governance Framework

CSO = civil society organization; DRR = disaster risk reduction.
Source: Authors.
Designing disaster risk mitigation infrastructure projects should serve multiple functional requirements simultaneously, which requires functional coordination between several agencies of the government.

to allocate human resources appropriately according to different stages of a disaster starting from forecasting, followed by evacuation advisories and orders, rescue, emergency response, restoration, and reconstruction.

Further, it is also important for stakeholders of each country and locality to engage in the improvement of disaster resilience and sustainable development in an inclusive manner while maximizing integrated scientific knowledge. Facilitators play a critical role in achieving this goal and should provide appropriate knowledge, experience, and approaches for each locality, leading the effective introduction of experiences and resources from the outside. They should also assist stakeholders involved in protecting their lives and assets to continue their livelihoods and businesses by wisely applying science and technology.

Financing

Financing is a cross-disciplinary issue affecting both structural and nonstructural measures at different stages of DRM. Further, financing DRM is an issue faced across the world, more so in low- and middle-income countries but still a central discussion theme in high-income countries. The financial resources are in fact limited. Hence, efforts are needed to find new resources, such as private sector financing, and to maximize the returns of any investment.

One idea that has been put forward is to measure the spillover effects of infrastructure development and share these spillover benefits with the private sector to enhance their returns. Developing roads and other infrastructure attracts more businesses to an area, and more houses are built. This urbanization process brings about various external economic effects and consequently leads to more tax revenues. Similarly, it is possible to evaluate the effectiveness of a river improvement project, for example, by calculating how much tax revenue may be lost and for how long such a loss may last in case of a flood. Considering that the tax revenue loss can be prevented or recovered through river improvement, it is possible to see river improvement as creating extra tax revenues, part of which can be earmarked for further river improvement. If such a mechanism can be established, more investment in river improvement can be encouraged. Yoshino, Helble, and Abidhadjaev (2018) point out that good investment creates spillover or external economic effects and prevents decreases in tax revenues from riverside areas.

While finding new financing sources was deemed useful, participants also agreed that the existing financial resources should be utilized to maximize the socioeconomic returns. Hence, designing disaster risk mitigation infrastructure projects should serve multiple functional requirements simultaneously, which requires functional coordination between several agencies of the government. In this way, any specific infrastructure assets could be used to operate throughout its life cycle, and different infrastructure projects could also be combined to complement each other’s functional performance (Yoshino, Helble, and Abidhadjaev 2018).

Case Studies

India: Odisha State’s Learning from Previous Disasters

In 1999, a cyclone devastated the state of Odisha in India, leaving more than 10,000 people dead and 19 million affected (Walch 2019). The government of Odisha at the time was criticized sharply for not doing enough to prevent the large number of casualties. Taking this experience to heart, the Odisha government changed the way it dealt with stakeholders. When Cyclone Phailin struck Odisha in 2013, it affected 11 million people, but only 23 people were killed. The factors responsible for this improved management of a cyclone are illustrated in Figure 4 based on the DRM framework introduced in

---

3 In 2011, the Government of India approved the name change of the State of Orissa to Odisha. This document reflects this change. However, when reference is made to policies that predate the name change, the formal name Orissa is retained.
this policy brief. A centralized and highly coordinated governance structure implemented by the Odisha state government is often mentioned in this regard.

Currently, the Odisha State Disaster Management Authority (OSDMA) is working closely with several other departments in the government as well as international and local nongovernment organizations to take care of cyclone shelters and manage volunteers. More importantly, the government used its economic gains to invest in disaster management. For example, there were not enough cyclone shelters in 1999, so the government built more multipurpose shelters. It created community-based shelter management and maintenance committees (Walch 2019), which were tasked with taking care of the shelters and leading pre-disaster evacuations. Since the shelters were multipurpose, they could be used as venues for social events for which the committees could charge a small fee to help with maintenance costs. Such multipurpose usage of the shelters maximized the benefits of the infrastructure, creating and resulting in resource efficiency. Long-term commitment from the Odisha government was also essential for building trust between the authorities, civil society, and the residents, ensuring timely evacuation. These changes, among others, explain why Odisha was able to make such drastic changes in its disaster management efforts.

**Japan: Challenges to Adapt to Climate Change**

In September 2015 and August 2016, Japan experienced heavy rain disasters in the Kanto and Tohoku regions and the Hokkaido and Tohoku regions, respectively. These disasters that occurred in areas along rivers managed under national and prefectural supervision revealed issues related to the issuance of evacuation information and delays in evacuating residents, as well as catastrophic damage to the local economy caused by extremely severe floods. To address these issues, the national government developed a policy on “Rebuilding Flood-Conscious Societies,” which was realized through the revised Flood Control Act in May 2017.

Only 2 weeks after the revised law went into effect, heavy rains of 169 millimeters per hour caused serious flooding in northern Kyushu. An extremely severe flood disaster occurred across western Japan in July 2018 and another in eastern Japan due to Typhoon Hagibis in October 2019. The 48-hour rainfall reached a record high at 125 observation points throughout western Japan in 2018, and the 12-hour rainfall at 120 observation points throughout eastern Japan in 2019. Thus, record rainfalls were rewritten at about 10% of all observation points (about 1,300) in Japan within a span of 2 years.
While efforts have been made to enhance the capacity to respond to water-related disasters, much more is required to strengthen resilience and preparedness at all levels to counter the recurrence of unprecedented, extremely severe flood disasters such as those that have seriously affected the whole country in recent years. While all possible efforts should focus on recovery and rehabilitation from the recurring severe flood disasters, it is equally important to present a basic policy that stresses the necessity to invest in flood control for further growth of the country. Such a policy would be the key factor to promote the implementation of essential proactive measures. The chair of the Council for Social Infrastructure Development has proposed a new basinwide flood management policy to the Minister of Land, Infrastructure, Transport and Tourism of Japan. The proposal set three goals: improving disaster resilience, introducing the concept of sustainability, and promoting more inclusiveness. The urgent task for the government now is to incorporate this policy into various other policies and measures so that it will be put into practice through concrete actions across the country.

Conclusion

Water-related disasters are serious threats to critical infrastructure (public services such as energy, communications, transportation, and water supply) and can cause devastating social and industrial consequences, significantly disrupting efforts made toward achieving sustainable development. The Sendai Framework for Disaster Risk Reduction 2015–2030, the Sustainable Development Goals, and the Paris Agreement within the United Nations Framework Convention on Climate Change, all agreed in 2015, require concerted efforts to ensure resilience, sustainability, and inclusive growth for societies. Among these, water is a cross-cutting area with a strong relationship with several other aspects included in the three global agendas. It is because of the importance of water that a high-level panel on water consisting of 11 heads of state and a special advisor issued An Agenda for Water Action, calling for a fundamental shift in the way the world manages water (High-Level Panel on Water 2018). Among the important recommendations of the panel was to put emphasis on developing a platform and a global network of research and higher education institutions, each contributing to the scientific assessment of the risks.

In this regard, participants at the policy dialogue shared experiences on a variety of scientific, engineering, and socioeconomic approaches in developing and effectively implementing such a platform. The policy dialogue illustrated the importance of scientific approaches in synthesizing relevant information (high veracity) from large volumes of data, from a variety of sources, and captured at a high velocity for quantifying the risks associated with climate change-related disasters. Significant progress has been made toward obtaining such scientific information and using it to make corresponding engineering efforts (such as operation and management of disaster control facilities) for several developing countries in Asia and the Pacific. However, continued support (financial and otherwise) for further scale-up of the scientific and the engineering efforts is necessary.

The policy dialogue also emphasized that engineering solutions cannot be the only answer to the complex
Effective governance was identified as one of the most essential elements of an overall DRM strategy

Challenges posed by disasters related to climate change. Financial and community uptake-related challenges are present even in developed countries, warranting a more comprehensive approach to DRM. Therefore, based on the discussions and the case studies shared at the policy dialogue, human capacity development (public education and literacy, empowerment of local governments and community leaders, as well as media briefings) by properly addressing local knowledge and wisdom is considered a necessary focus for future policy frameworks.

Efforts are also needed to improve disaster prevention capacity by investing in infrastructure that can be used continuously. Finally, effective governance was identified as one of the most essential elements of an overall DRM strategy. In the context of developing countries, efficient governance structures proved to be effective for DRM even in the absence of sophisticated scientific and engineering solutions. Nevertheless, modern-day technology has not only enabled high-quality input for effective governance but has also placed immense pressure on the coordination of decisions across different levels of stakeholders working at different timescales in the overall DRM strategy. Future dialogues could focus also on identifying best practices related to usage of state-of-the-art technology to enable efficient governance for DRM.

In the current pandemic, competition between the water-related DRR emergency response and the COVID-19 health-care response could magnify the negative impacts for some countries. Further, some DRR responses may not be suitable considering the risks of infectious diseases. In this regard, it is strongly recommended to apply the 10 HELP principles (see Box), which offer practical advice to political leaders managing DRR and COVID-19 responses and all stakeholders to formulate strategies and actions. These principles further emphasize proactive approaches to DRM, highlighting the key messages and future directions identified in this policy brief.
Appendix: International Flood Initiative—Activities in Davao City, Philippines

The International Flood Initiative (IFI) is a worldwide framework to promote collaboration in flood management among international organizations such as the United Nations Educational, Scientific and Cultural Organization (UNESCO), the World Meteorological Organization and the United Nations Office for Disaster Risk Reduction. The International Centre for Water Hazard and Risk Management (ICARM) has been the secretariat of IFI since its establishment. Under the IFI framework, Indonesia, Myanmar, the Philippines, and Sri Lanka have established platforms on water resilience and disasters involving various stakeholders in water-related disaster management such as government agencies, academia, and local communities. ICARM has been acting as a facilitator supporting the platform stakeholders in making well-informed decisions.

Davao City in the Philippines is among the most active participants in the platform activities. The HELP Davao Network, a member of the UNESCO HELP component of the International Hydrological Programme to promote a global network of basins, has committed to strengthening collaboration among local water stakeholders since 2004 to improve the management of water issues and the decision-making process based on the concept of integrated water resources management (IWRM). The HELP Davao Network, which is represented by the Department of Science and Technology Regional Office No. XI (DOST XI), has been cooperating closely in the country platform to combat water-related disasters and climate change.

In October 2019, DOST XI and ICARM jointly hosted participants from approximately 20 organizations at the Orientation on Climate Change. ICARM researchers spoke on climate change impact assessment and disaster resilience improvement, and the participants formulated activities for climate change adaptation measures after detailed discussions and exchange of perspectives with different stakeholders.

Implementation plans and proposals to policy makers in line with a further localized activity design will be developed to improve resilience to water-related disasters and climate change. Sharing the significance, roles, and benefits of resilience improvement of the successful case of multistakeholder engagement in Davao City will serve as a useful reference for other areas and regions.

Activity Design of Adaptation Measures for Climate Change in Davao City

**Experiencing Climate Change**
- Climate change impact assessment based on S&T Visualization
- 1/100 Flood (200 m grid)
- Experiencing events
- Infrastructure design

**Strengthening Resilience**
- Predict climate change impact and scenario
- Resilient society beyond saving lives
- Evacuation
- BCM: Business Continuity Management
- “Nudging” psychological process to disaster risk
- Resilient communities
- Incentive for investment

**Toward the Prosperous Davao**
- Design a brilliant future
- Coordination with relevant ongoing energies
- Groundwater use
- Agriculture, Aquaculture and Natural Resources (AANR)
- Biodiversity

m = meter, S&T = science and technology.

Source: ICARM.
References


