ADB

Investing in Resilience

Ensuring a Disaster-Resistant Future

Asian Development Bank

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The cover design depicts a section of a geodesic sphere, a resilient structure made up of networks of geodesics (*) on the surface of the sphere. The geodesics intersect to form triangle elements that gain strength from the connections and distribute the stress across the structure. In the context of this report, it is these connections, between a wide range of instruments and mechanisms and core needs spanning the entire disaster risk management spectrum, that create the building blocks for strengthening resilience. The design conveys the notion of backward and forward linkages created by the interconnectedness of the different elements in the structure, thus recognizing the availability of many shared entry points and numerous opportunities to lead and direct change to strengthen resilience, or even to spur it from behind.

* A geodesic line is the shortest distance between any two points on a sphere.

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Foreword

The Asian Development Bank (ADB) has provided considerable resources to assist its developing member countries in reducing disaster risk and responding to disaster events over the past 25 years. Between August 1987 and December 2012, it has approved $17.60 billion, for a total 560 disaster risk management projects. Of this, 10.5% ($1.85 billion) has been for emergency assistance, 27.9% ($4.91 billion) for post-disaster rehabilitation and reconstruction, and 61.6% ($10.84 billion) for disaster risk reduction activities.

Developing member country requests for disaster risk reduction assistance are growing as awareness and understanding of the threat posed by natural hazards to inclusive sustainable development strengthens. Two-thirds of ADB's total investments in disaster risk reduction over the past 25 years have occurred in the past 8 years alone. Disaster risk reduction initiatives currently underway include actions to enhance urban resilience by developing risk-sensitive land-use planning tools; strengthen school seismic safety in Nepal; and integrate climate and disaster risk information into urban development and infrastructure planning in the Pacific. ADB is increasing efforts to integrate disaster risk management and climate change adaptation into its wider operational plans, country partnership strategies, and development investments. This is important in a region dominated by climate-related hazard impacts, and ADB's integrated disaster risk management framework and the draft Environmental Operational Plan bring together these key elements within an overarching context of resilience. Resilience is developed in many of ADB's approaches, and are captured in programs under the Water Operational Plan, the Urban Operational Plan, and the Financial Sector Operational Plan.

However, disaster losses continue to increase in Asia and the Pacific. Populations and economies have expanded, increasing the number of people and assets exposed to natural hazards. Much development has occurred with little regard to natural hazards, unintentionally exacerbating existing disaster risk and creating new forms of disaster risk. In anticipation of yet greater need for post-disaster emergency, early recovery, and reconstruction assistance in future years, ADB approved a new pilot disaster response facility in October 2012 for countries eligible for concessional Asian Development Fund Financing, to enable a more flexible, predictable, and systematic approach to disaster response. It has also embarked on several initiatives to support the development of city-level financing mechanisms for disaster response.

The continuing trend of rising disaster losses points to one clear message: much greater investment in resilience is needed. This investment must assess risk, reduce risk and ensure that residual risk is managed as efficiently as possible, spurring rapid, hazard-resilient recovery and reconstruction. It requires commitments of finance, know-how, and human resources on the part of governments, the private sector, civil society, and the international community in a wide array of, legislative, regulatory, policy, planning, institutional, financial, and capacity-building instruments and mechanisms.

This publication seeks to stimulate, secure and sustain this investment in resilience. It recognizes that there is an extensive array of disaster risk management tools and mechanisms available in Asia and the Pacific but that they are not being applied as often, or as effectively, as they could be. It encourages governments and their development partners to embark on a coordinated approach to resilience. It emphasizes the mutual connectedness between potential initiatives to strengthen resilience and encourages stakeholders to identify individual actions which collectively would complement and reinforce one another, together working towards a common vision of a disaster-resilient future.

We hope this publication will inspire governments, in collaboration with their development partners, to paint their individual visions of a resilient future in keeping with their particular disaster risk and other development challenges. It urges governments to place their visions, and related actions, within the context of broader poverty reduction and development policies and programs, seeking to ensure that each dollar spent on development is spent just once, not repeatedly as development gains are undone by disaster.

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Abbreviations

ADB	–	Asian Development Bank
ASEAN	–	Association of Southeast Asian Nations
CCA	–	climate change adaptation
DRF	–	disaster risk financing
DRM	–	disaster risk management
DRR	–	disaster risk reduction
FONDEN	–	Fund for Natural Disasters (Mexico)
GDP	–	gross domestic product
IDB	–	Inter-American Development Bank
IDNDR	–	International Decade for Natural Disaster Reduction
MDB	–	multilateral development bank
NDMO	–	national disaster management office
NGO	–	nongovernment organization
UN	–	United Nations
UNISDR	–	United Nations International Strategy for Disaster Reduction

Executive Summary

Natural hazards continue to cause significant loss of life in Asia and the Pacific, and existing trends suggest that growth in direct physical losses is outpacing regional expansion in gross domestic product. Behind each human and physical loss, there are additional indirect impacts and secondary consequences. These impacts can take many forms, including reduced output, disruptions to supply chains, lost schooling, and widening income and gender inequalities.

These losses are far from inevitable. There is a wide range of tools and mechanisms available to assess, reduce, and manage risk, covering a vast array of legislative, regulatory, policy, planning, institutional, financial, and capacity-building instruments. Moreover, there is increasing public awareness of the need to strengthen disaster resilience (hereafter shortened to resilience) at all levels of society as a critical component of efforts to achieve sustainable socioeconomic development and poverty reduction. However, as long as countries and their development partners continue to regard investment in resilience and investment in development as two separate issues, disaster risk will continue to accumulate and losses to expand, threatening long-term inclusive, sustainable growth in the region.

Purpose of the Report

This report offers an approach and ideas for reflection, inviting readers to consider how we can ensure that the actions that we know are required to strengthen resilience are actually taken. It is primarily aimed at investors in the public sphere, namely governments and their development partners. The report intentionally applies a loose definition of investment and investors, looking well beyond financial outlays on physical infrastructure. It covers the investment of a wide range of resources—including political commitment, human resources utilization, knowledge, know-how, and personal time and dedication—in an extensive array of structural and nonstructural instruments and mechanisms to identify and assess risk, reduce risk, and manage remaining risk. It includes investments in, for instance, institutions, legislative and regulatory frameworks, financing mechanisms, incentives for change, and systems of accountability. It encourages investors to integrate investments in resilience into their own areas and modes of work and to promote, incentivize, and coordinate on the part of the private sector and households.

The report is not a manual or handbook and deliberately does not present prescribed courses of action. Instead, it establishes a vision of a resilient future and equips investors with a framework and ideas to identify practical actions that will result in the realization of that vision. The vision shows how resilience can be accomplished through the coordinated action of governments and their development partners in the private sector, civil society, and the international community. It stresses the interconnectedness and complementarity of possible actions to achieve resilience across a wide range of development policies, plans, legislation, sectors, and themes. The vision encourages "investors" to identify and prioritize bundles of actions that collectively can realize that vision of resilience, breaking away from the current tendency to pursue disparate and fragmented disaster risk management measures that frequently trip and fall at unforeseen hurdles.

Ensuing investments should enhance the ability of countries, communities, businesses, and individual households to resist, absorb, recover from, and reorganize both in anticipation of and in response to natural hazard events without jeopardizing their sustained socioeconomic advancement and development. These investments should be undertaken within the context of a broader development framework, regarding strengthened resilience as an integral part of development goals, approaches, and individual initiatives.

Scope

The report begins in Part I by reviewing recent disaster losses in the region, both overall and for a range of key development themes and sectors, and their consequences for poverty reduction and sustainable economic development. It paints a potentially bleak future, characterized by a reversal of recent progress in poverty reduction and rising average losses. The report identifies some of the key gaps and obstacles to investment in resilience, examining the processes shaping and informing development decisions and directions. These gaps and obstacles hinder efforts to meet the three basic core needs in strengthening resilience: risk assessment, risk reduction, and the management of residual risk. The report then identifies opportunities, investors, entry points, incentives, and actions to overcome these gaps and obstacles. The tools of intervention are categorized into three groups: policy instruments, relating to the legislative, regulatory, practice, and process parameters for managing risk; capacity instruments, enabling households, communities, businesses, and governments with appropriate skills, knowledge, and know-how to meet those parameters; and investment instruments, providing adequate financing and human resources to implement policy and apply capacity. These instruments and mechanisms are well established and embody principles of integrated disaster risk management, entailing a systematic set of activities that collectively seek to avoid, lessen, or transfer the potential adverse effects of all hazards. Collectively, these instruments and mechanisms could satisfy—but as yet have not satisfied—the three core needs (risk assessment, risk reduction, and residual risk management), leading to a set of circumstances whereby investments in resilience are appropriately stimulated, the necessary investments are acted upon or secured, and investments continue into the future on a sustained basis.

Part II is less orthodox. It creates hypothetical stories of successful investment in resilience from the perspective of a range of levels of administration and development themes and sectors, using a backcasting approach. Visions of a desirable resilient future are established and then translated into possible steps and measures that can be taken to achieve them. Part II begins with a series of stories focusing on strengthened national, city, and household resilience. It then considers five key themes and sectors of particular relevance in strengthening resilience:

- livelihoods, where investment in resilience of the poor and near-poor can lead directly to poverty reduction;
- land use planning, where the integration of disaster risk considerations into the existing process represents a fundamental first step in strengthening resilience;
- transport, as the siting and satisfactory functioning of such infrastructure plays a central role in determining the location and continuing productivity of many other development investments;
- education, where investment in resilience translates into a direct transgenerational investment in the future of a country; and
- housing, a centerpiece of social fabric and human security.

The backcasting approach, combined with the related analysis of existing gaps and obstacles, reveals a wide variety of potentially useful tools and mechanisms to strengthen resilience. These range from more obvious steps, such as risk assessment, assignment of accountabilities, training, capacity building, and insurance, to less immediately obvious ones, such as extension of mobile phone networks, enhanced access to microcredit, the regularization of land tenure, and the creation of regional university insurance pools.

By adopting a backcasting approach, the analysis goes a step further and stimulates more unified thinking and action. Individual instruments and mechanisms are often designed to address a particular gap or challenge but may encounter other unforeseen—but not unexpected—gaps and challenges during implementation. These gaps and challenges often require additional action, well beyond the scope, area of expertise, and funding of those individual measures whose

progress they are hindering. Backcasting helps planners and policy makers explore the bigger picture, examining the potential interplay among different instruments and mechanisms across a range of development themes and sectors. It facilitates the critically-required coordinated development of bundles of mutually supportive tools that together overcome key gaps and obstacles and create synergies that enhance the sum of parts. As such, it helps embed the more theoretical discussion and ideas in Part I into on-the-ground realities in implementation and supports the design of sound wider resilience strategies as well as individual tools and relevant mechanisms.

Part III considers a sixth theme of particular relevance in strengthening resilience in Asia and the Pacific: disaster risk financing. It explores the future role that ex ante (anticipatory) disaster risk financing instruments can play in supporting timely and adequate post-disaster relief, early recovery, and reconstruction operations. It begins, again, with a vision of the future in which disaster risk financing is an accepted, institutionalized, and routinely employed part of the disaster risk management policy and practice, working back via backcasting to identify key steps to the vision's achievement. These steps include considerable strengthening of risk assessment capacity; the innovative application of existing disaster risk financing instruments, developed and supported by new financing vehicles; and concerted efforts to ensure that local and national governments can access disaster risk financing.

Concluding comments are provided in Part IV, returning to the importance of investing in resilience to help ensure a sustainable, inclusive, and prosperous future. A series of critical steps that can help jump-start greater investments of finance, know-how, and human resources in resilience, together with key indicators to monitor progress and outcomes, are discussed.

Critical Next Steps

The report identifies eight critical next steps toward strengthened resilience, building on the gaps and challenges identified in the report and the findings of the backcasting exercises:

Policy Change

- Governments can review and, where appropriate, revise disaster risk management legislative and regulatory frameworks to clarify and explicitly articulate the precise roles and responsibilities of individual households, communities, the private sector, governments, and the international community in strengthening resilience.

Risk Assessment

- Governments can ensure that some form of disaster risk assessment is undertaken for all new investments in their countries, whether financed directly by a government, via support from the international community, or privately.

Financing

- National and subnational governments can develop and implement comprehensive disaster risk financing strategies to reduce risk and to provide adequate and timely post-disaster support to strengthen financial resilience.
- Governments, in cooperation with the international community, can encourage the growth and development of the insurance and reinsurance sectors in their countries and generally provide for a range of disaster risk financing instruments.
- Governments, in cooperation with the international community, can establish public programs of financial support for community and local investment in risk assessment, risk reduction, and residual risk management.

Private Sector Engagement

- Governments, working in cooperation with the international community, can develop programs of work to strengthen private sector understanding and appreciation of the commercial opportunities in strengthening resilience.

Knowledge Management

- Governments and regional associations, working in cooperation with the international community and private sector partners, can establish an open-source, regional, online information platform to facilitate the development, exchange, and dissemination of hazard and risk data, including climate change modeling.
- Governments and regional associations, working in cooperation with the international community, can establish a regional knowledge-development and capacity-building program to strengthen understanding across government and the wider society of the potential returns on investments in risk assessment, risk reduction, and residual risk management.

Part I

Disasters and Development: Instruments and Mechanisms for Strengthened Resilience

Part I establishes the case for greater investment in disaster resilience, current gaps, and obstacles to investment in this area and potential opportunities to move forward. It begins by defining the report's two key terms—investment and resilience—stressing the inclusive interpretation of the former to include a wide range of financial and nonfinancial resources.

Recent loss of life and direct physical losses as a consequence of natural hazards in Asia and the Pacific and globally are reviewed, and the indirect impacts and secondary effects of natural hazards in five particularly vulnerable development themes and sectors are considered as well. The third chapter takes the discussion a step further, exploring the potential consequences for poverty reduction and economic growth if disaster risk is not tackled. It presents a potentially bleak future, characterized by a reversal of recent progress in poverty reduction; rising average losses in excess of average growth in gross domestic product; and a sharp rise in losses associated with low-frequency, high-impact hazard events in urban areas. The following chapter identifies current gaps and obstacles to investment in greater resilience.

The final chapter in Part I examines potential opportunities for stimulating, securing, and sustaining public and private investment in disaster resilience. It begins by exploring the scope for stimulating investment via policy change, focusing on national and subnational development planning, legislation, and regulative frameworks and national and subnational budgetary processes. It considers opportunities for securing investment in individual initiatives to strengthen resilience via project planning procedures, mechanisms to foster community and private sector participation, and public and private funding instruments, covering financing for both risk reduction and post-disaster relief, early recovery, and reconstruction. The chapter concludes with a discussion of the knowledge, information, capacity, and capabilities required to sustain investment in resilience many years into the future.

AFP

Rapid urban expansion can lead to densely built-up urban landscape in hazard-prone areas, Ho Chi Minh City, Viet Nam

1 Two Steps Forward, One Step Back—Development and Disasters

The dawn of the 21st century holds many challenges for Asia and the Pacific. To reach their development potential, countries in the region must manage risk in many forms, including risk emanating from natural hazards and the disasters they spawn. Climate hazards have drawn the most visible recent political attention, linked to concerns about potential consequences of global warming, due to their frequency and intensity. However, geologic hazards are also prevalent, wreaking far greater loss of life in recent years.

Natural hazards pose a significant threat to the attainment of both national and regional development goals. As recent experience has clearly demonstrated, natural hazards threaten the most-developed economies in the region just as they threaten middle- and lower-income countries. However, significant disaster losses and related setbacks in poverty reduction and development are not inevitable. Investments in disaster resilience (hereafter shortened to resilience) can reduce direct and indirect disaster losses dramatically, contributing to sustained economic growth, the achievement of poverty reduction and other Millennium Development Goals, and enhanced natural resources management. Indeed, as the Group of Twenty recently acknowledged, "Action must be taken to help vulnerable populations manage risks and the impact of external shocks, such as economic crises and natural disasters" (Group of Twenty 2012, 11).

Investments in resilience will have the most far-reaching effect if they are undertaken in the context of wider development and are carefully integrated into the development

Significant disaster losses and related setbacks in poverty reduction and development are not inevitable

process. Huge investment needs must be satisfied in Asia and the Pacific over the next few decades to sustain recent high rates of gross domestic product (GDP) growth, which averaged 7.4% per year in real terms during the first decade of the 21st century. Investments in resilience must be integrated into this process to help ensure that the broader investments lead to sustained socioeconomic development—that is, to use the United Nations International Strategy for Disaster Reduction's (UNISDR) definition of sustainable development, to ensure that development "meets the needs of the present without compromising the ability of future generations to meet their own needs" (UNISDR 2009, 29; see also Mileti 1999).

Disaster risk must be taken into account in determining the design and positioning of basic infrastructure, offices, factories, and homes; the direction and orientation of businesses and livelihood choices; and the broad thrust of economic and social development strategies. The effect of natural hazard events cannot be entirely eliminated, but it can be reduced, and new or amplified risk can be avoided (Box 1). Investment in resilience also helps ensure that the same investment is not paid for multiple times. Ultimately, the case and opportunity for investing in resilience should be considered with each and every development action.

Actions to strengthen resilience also need to be implemented within an integrated disaster risk management (DRM) framework, combining climate change adaptation (CCA), disaster risk reduction (DRR), disaster preparedness, post-disaster relief, early recovery, reconstruction, and disaster risk financing (DRF) goals under a single framework and pursuing them through joint initiatives.

Defining Resilience

Resilience is a relatively new term in the DRM lexicon. It originated in an ecological context. Recently, it has been adopted by a range of other disciplines, including sociology, psychology, structural and engineering science, corporate strategy, and CCA, in addition to DRM (Bahadur, Ibrahim, and Tanner 2010). The term acknowledges "the existence of interconnected and interdependent sets of social, economic, natural and manmade systems that support communities" (National Academy of Science 2012, 179). Moreover, it recognizes that the achievement of resilience involves actions and contributions from a wide range of disciplines and actors at various levels, working together with a shared responsibility and wide mix of tools and methods to balance their various needs and resources, including environmental and social as well as economic resources. It has become particularly popular in describing the intersection between DRM, CCA, poverty, and development (Bahadur, Ibrahim, and Tanner 2010).

Precise concepts of resilience vary among disciplines but typically encompass a number of common characteristics. These include several or more of the following: high diversity in the range of functional groups within a system; effective institutions and institutional structures; the ability to accept uncertainty and change and work effectively in such environments; community involvement and inclusion of local knowledge; preparedness, planning, and readiness; equity; social values and structures as a basis for building resilient systems; nonequilibrium system dynamics, moving to new steady states after a disturbance;

Box 1 **The Foundations of Resilient Development**

All development actions carry certain inherent risk. Some forms of risk are explicitly identified, assessed, and managed. However, potential disaster risk often goes unnoticed, is ignored, or, at best, is misunderstood, leading to avoidable loss of life and assets at some future date. A new approach to development is urgently required, firmly rooted in two key facts:

1. Many development actions potentially carry disaster risk.
2. Many development actions can become instruments for investing in resilience.

learning from experience; and adoption of a cross-scalar perspective (Bahadur, Ibrahim, and Tanner 2010). Achieving resilience is challenging, not least because of its multidisciplinary, multi-scalar nature. An elaboration of a vision of a disaster resilient community and potential paths to its achievement may define precise shared and individual responsibilities, spurring progress toward its achievement.

Based on an amalgam of existing definitions, the term resilience is defined in this report as the ability of countries, communities, businesses, and individual households to resist, absorb, recover from, and reorganize in response to natural hazard events, without jeopardizing their sustained socioeconomic advancement and development (Table 1). Successful investment in resilience embodies principles of integrated DRM, entailing a systematic set of activities that collectively aims to avoid, lessen, or transfer the potential adverse effects of all hazards, specifically through the integration of CCA, DRF, and DRR measures. The term is used in this report to refer not only to physical resilience of the built environment but also to human resilience, social resilience, and physical resilience of the natural environment. Moreover, the selected definition recognizes the highly dynamic, continually shifting nature of the state of resilience as populations grow and move, capital investments expand, and the frequency and intensity of meteorological, hydrological, and climatological events change as a consequence of global warming.

Defining Investment

In the context of this report, the term investment is used loosely, looking well beyond financial outlays on physical infrastructure. It covers the investment of a wide range of resources—including political commitment, human resources, knowledge, know-how, and personal time and dedication—in an extensive array of structural and nonstructural instruments and mechanisms to identify and assess risk, reduce risk, and manage remaining residual risk. It includes investments in, for instance, institutions, legislative and regulatory frameworks, financing mechanisms, incentives for change, and systems of accountability.

Table 1 **Definitions of Resilience**

Source	Definition of Resilience
Department for International Development of the United Kingdom	"The ability of countries, communities, and households to manage change, by maintaining or transforming living standards in the face of shocks or stresses—such as earthquakes, drought, or violent conflict—without compromising their long-term prospects" (DFID 2011, 6).
Intergovernmental Panel on Climate Change	"The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change" (IPPC 2007, 86).
United Nations International Strategy for Disaster Reduction	"The ability of a system, community, or society exposed to hazards to resist, absorb, accommodate to, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions" (UNISDR 2009, 24).
World Bank	"The ability to withstand, recover from, and reorganize in response to crises so that all members of society may develop or maintain the ability to thrive" (Benson et al. 2012, 10).

As long as countries and their development partners continue to consider investing in resilience and investing in development to be two entirely separate issues, disaster risk will continue to accumulate

Potential investors come from both the public sphere and the wider society. They comprise anyone who can potentially create risk as well as anyone who can potentially enhance resilience, whether at a household, individual commercial, community, district, regional, sectoral or national level and whether directly or indirectly.

The Call for Investing in Resilience

As long as countries and their development partners continue to consider investing in resilience and investing in development to be two entirely separate issues, disaster risk will continue to accumulate. To address the trend toward increased vulnerability to natural hazards and to counter additional factors potentially contributing to rising losses—in the form of increasing exposure as physical infrastructure and assets expand, and increasing frequency and intensity of meteorological, hydrological, and climatological hazards as a consequence of climate change—development policies, programs, and individual actions urgently need adjustment to take account of disaster risk.

ADPC

Vulnerable buildings contribute to increased disaster risk in urban areas. Dhaka, Bangladesh

The call for investment in resilience and the call to lead this effort by addressing disaster risk as an integral part of development are by no means new or innovative. Instead, such thinking dates back at least 30 years in the academic literature, and less than a decade later the concept appeared in practical handbooks on the topic. This body of work explicitly recognizes the potential implications of development for vulnerability and of disasters for development. Furthermore, it recognizes development itself as the central key to enhanced resilience (see, e.g., Cuny 1983; OAS 1990, 1991).

International recognition of the links between disasters and development—and international commitment to addressing disasters through development—also dates back almost 2 decades. The United Nations (UN) launched the International Decade for Natural Disaster Reduction (IDNDR) in 1990 to reduce loss of life, damage to property, and social and economic disruption as a consequence of natural hazards. Initiatives undertaken during the decade were somewhat dominated by the scientific community and the technical aspects of risk management. Nevertheless, a notable breakthrough was achieved at the Mid-Decade World Conference on Natural Disaster Reduction in Yokohama in May 1994, when the strategy and plan of action drawn up for the remainder of the IDNDR endorsed a shift in emphasis toward broader risk management strategies and capacity building as integral components of development planning (IDNDR 1994).

In 2000, the UN system was designated to carry on the work begun under the IDNDR by implementing the International Strategy for Disaster Reduction. This strategy continued to emphasize the integration of ongoing risk prevention strategies into sustainable development plans (UNISDR 2000). The integration of disaster risk considerations into sustainable development policies, planning, and programming at all levels also formed the first of the

three strategic goals of the Hyogo Framework for Action (2005–2015). The Hyogo Framework for Action was adopted by the World Conference on Disaster Reduction in January 2005, with 168 nation and multilateral institution signatories, and it was later endorsed by the UN General Assembly.

Within Asia and the Pacific, the same goal has been reiterated in various regional and subregional declarations and action plans since that time, including in the 2005 Pacific Island Countries Disaster Risk Reduction and Disaster Management Framework for Action (2005–2015); the 2006 Pacific Islands Framework for Action on Climate Change (2006–2015); the 2006 South Asian Association for Regional Cooperation Comprehensive Framework on Disaster Management in South Asia; the November 2007 Delhi Declaration on Disaster Risk Reduction, adopted at the Second Asian Ministerial Conference on Disaster Risk Reduction; the 2009 Association of Southeast Asian Nations (ASEAN) Agreement on Disaster Management and Emergency Response; and the October 2012 Yogyakarta Declaration on Disaster Risk Reduction in Asia and the Pacific, adopted at the Fifth Asian Ministerial Conference on Disaster Risk Reduction. The 2009 ASEAN Agreement on Disaster Management and Emergency Response was also the first legally binding agreement in the world to cover disaster risk reduction.

Extensive international dialogue is currently under way on the post-2015 framework for DRR and the precise thrust of future directions is still being determined. However, it will almost certainly continue to emphasize strengthened resilience via appropriate development decisions. The year 2015 marks the deadline both for the achievement of the Millennium Development Goals and the completion of the Hyogo Framework for Action, and efforts are under way to align their respective successor frameworks and goals.

However, despite the plethora of mounting commitments and pledges to strengthen resilience through development actions, substantive practical progress toward this end has yet to be achieved in Asia and the Pacific. As in other regions, efforts to date have focused particularly on raising awareness, together with further strengthening of technical disaster response capabilities. Raising awareness clearly is an essential fundamental first step, and substantial progress has been made in this regard, aided by advances in hazard modeling. Knowledge and know-how on specific actions to strengthen resilience, including DRF instruments to manage residual risk as well as tools and techniques to reduce risk, have expanded enormously. Moreover, there is a growing body of experience with and understanding of the gaps and obstacles to their application and replication on the part of governments, businesses, communities, and individual households. Nonetheless, this awareness; the mounting development of tools, instruments, and guidelines; and the accumulating piecemeal success stories have yet to translate into concerted practical action that actually achieves strengthened resilience on a substantial scale.

Objective and Scope of the Report

This report is primarily aimed at investors in the public sphere, namely governments and their development partners. These investors include policy makers, legislators, national and subnational government officials, private businesses working in partnership with government, civil society organizations, and the international community. The report is also of wider relevance to all public and private investors in development, stretching from the highest reaches of government to individual communities, businesses, and citizens.

The report seeks to encourage its target audience to integrate investments in resilience into its areas of work and to promote, incentivize, and support parallel actions on the part of the private sector and households. It focuses on the steps required to ensure both that investment in resilience happens and that it occurs as an integral part of development. The report offers a structure, an approach, and ideas for reflection, inviting readers to consider how we can ensure that the actions that we know are required to strengthen resilience are actually taken. It is not a manual or handbook and does not present all the answers. Instead, it encourages readers to envisage a resilient future and equips them with a framework and ideas to identify practical actions that will result in the realization of that vision. It seeks to effect change, identifying ways of overcoming key gaps and obstacles in order

Despite the plethora of mounting commitments and pledges to strengthen resilience through development actions, substantive practical progress toward this end has yet to be achieved in Asia and the Pacific

to turn existing rhetoric and commitments on strengthened resilience into responsibilities, accountability, and funded, targeted actions that can be undertaken within the context of a broader development framework.

The remainder of Part I outlines the case for investing in resilience and examines key gaps and obstacles to such investment. It identifies possible opportunities, instruments, entry points, and investors to overcome these gaps and obstacles. Part II presents the five development themes and sectors of particular focus in this report, identifying potential policy, capacity, and investment instruments that could be applied to address risk assessment, risk reduction, and residual risk management needs. Part III considers the scope for increasing investment in ex ante financing instruments for post-disaster relief, early recovery, and reconstruction, an area offering considerable potential for investment in Asia and the Pacific over the next few decades. Part IV returns to the importance of investing in resilience to help ensure a sustainable, prosperous future and identifies a series of critical steps that can help jump-start greater investments of finance, know-how, and human resources in this area.

AFP

Residents commute along a flooded stretch of road as waist-high water inundated the town. Calumpit, north of Manila, Philippines

2 Disaster Losses in Asia and the Pacific

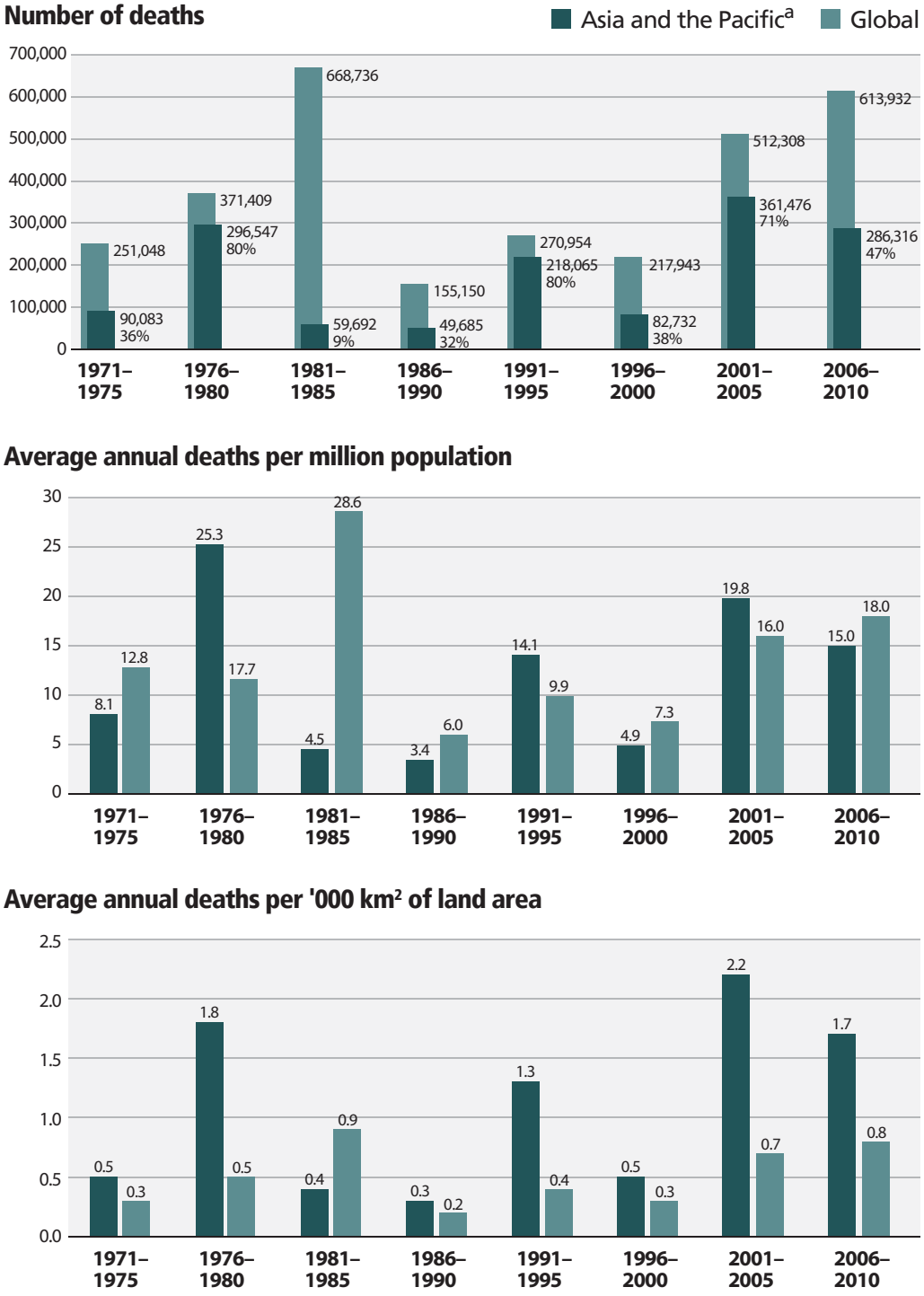
Many development policy makers and practitioners in the public and the private sectors have been witness to the role of development in the creation of risk from natural hazards, whether they have recognized it or not. Greenhouse gas emissions; water, forest, and mineral extraction; and land use and livelihood choices made by governments and the wider society have continued to contribute to growing risk. Risk has been created and accentuated—–be it inadvertently—by economic growth policies, rural–urban migration, infrastructure investments, and consumption of natural resources.

In consequence, natural hazards continue to cause significant loss of life in Asia and the Pacific. From 1970 to 2010, 1.7 million hazard-related deaths were recorded in the region. This accounted for 51% of total global deaths as a consequence of natural hazards, slightly lower than the region's average 57% share of total global population over the same period. Relative to total land area, however, loss of life has been much greater. Average annual deaths per 1,000 square kilometers averaged 0.5 globally from 1971 to 2010 but was double that, averaging 1.1 deaths per 1,000 square kilometers, in Asia and the Pacific (Figure 1). Some progress has been made in reducing loss of life from cyclones/typhoons through the implementation of highly effective early warning systems. However, there has been little apparent progress in reducing overall levels of mortality in Asia and the Pacific, and periodic disasters—including several earthquakes and tsunamis over the past decade—continue to cause major loss of life.

Direct physical losses have followed a gradual upward trend as the region has grown economically and infrastructure and assets have expanded. Total losses were a

Choices made by governments and the wider society have continued to contribute to growing risk

Figure 1 **Loss of Life as a Consequence of Natural Hazards, 1971–2010**



km² = square kilometer.

[a] Afghanistan; American Samoa; Armenia; Australia; Azerbaijan; Bangladesh; Bhutan; Brunei Darussalam; Cambodia; People's Republic of China; Cook Islands; Fiji; French Polynesia; Georgia; Guam; Hong Kong, China; India; Indonesia; Japan; Kazakhstan; Kiribati; Democratic People's Republic of Korea; Republic of Korea; Kuwait; Kyrgyz Republic; Lao People's Democratic Republic; Macau, China; Malaysia; Republic of the Maldives; Marshall Islands; Federated States of Micronesia; Mongolia; Myanmar; Nepal; New Caledonia; New Zealand; Niue; Northern Mariana Islands; Pakistan; Papua New Guinea; Philippines; Samoa; Singapore; Solomon Islands; Sri Lanka; Taipei,China; Tajikistan; Thailand; Timor-Leste; Tokelau; Tonga; Turkmenistan; Tuvalu; Uzbekistan; Vanuatu; Viet Nam; and Wallis and Futuna Islands.

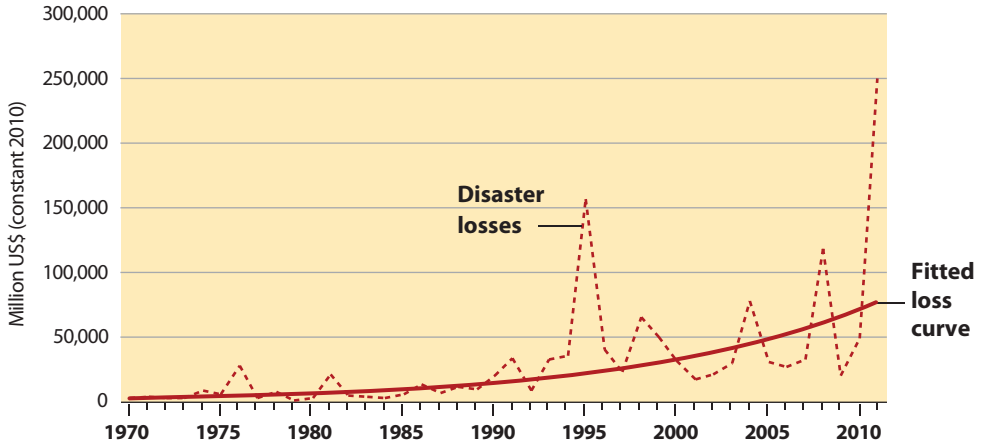
Source: Based on data from the Centre for Research on the Epidemiology of Disasters (n.d.).

marginal 2% lower in real terms in 2000–2009 than during the 1990s. However, data for the earlier period were inflated by record losses in 1995 as a consequence of the Kobe earthquake, an extreme event. A new high was set in 2011, both regionally and globally, as the region suffered unprecedented damage from a series of major disasters in Japan, New Zealand, and Thailand (Figure 2).

Direct physical losses have followed a similar upward trend in the region's developing countries alone (Figure 3). Particularly high losses were experienced in 2008 due to the earthquake in Sichuan Province, People's Republic of China.

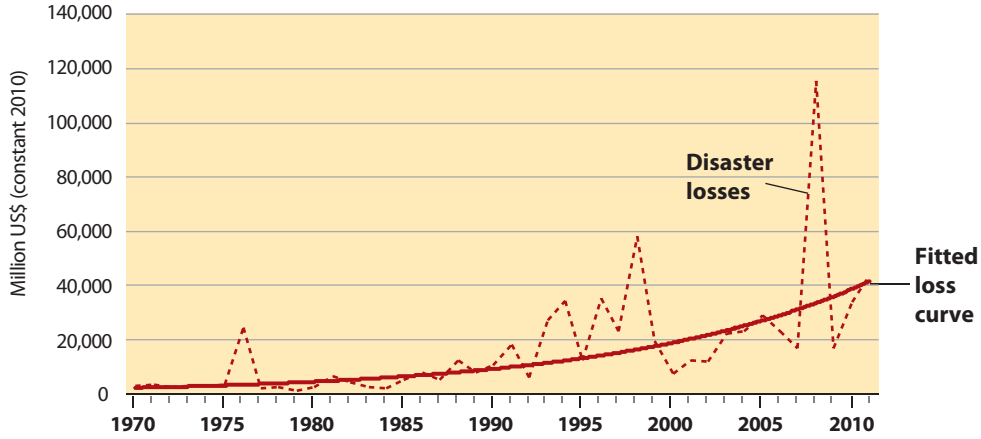
Asia and the Pacific accounted for 40% of total reported disaster losses globally from 1970 to 2010 in real terms, and accounted for 44% of losses over the longer period 1970–2011 (Figure 4). In comparison, it accounted for 29% of global GDP in 2009 (UN ESCAP 2011) and for notably less during the

Figure 2 **Direct Physical Losses as a Consequence of Natural Hazards in Asia and the Pacific, 1970–2011**



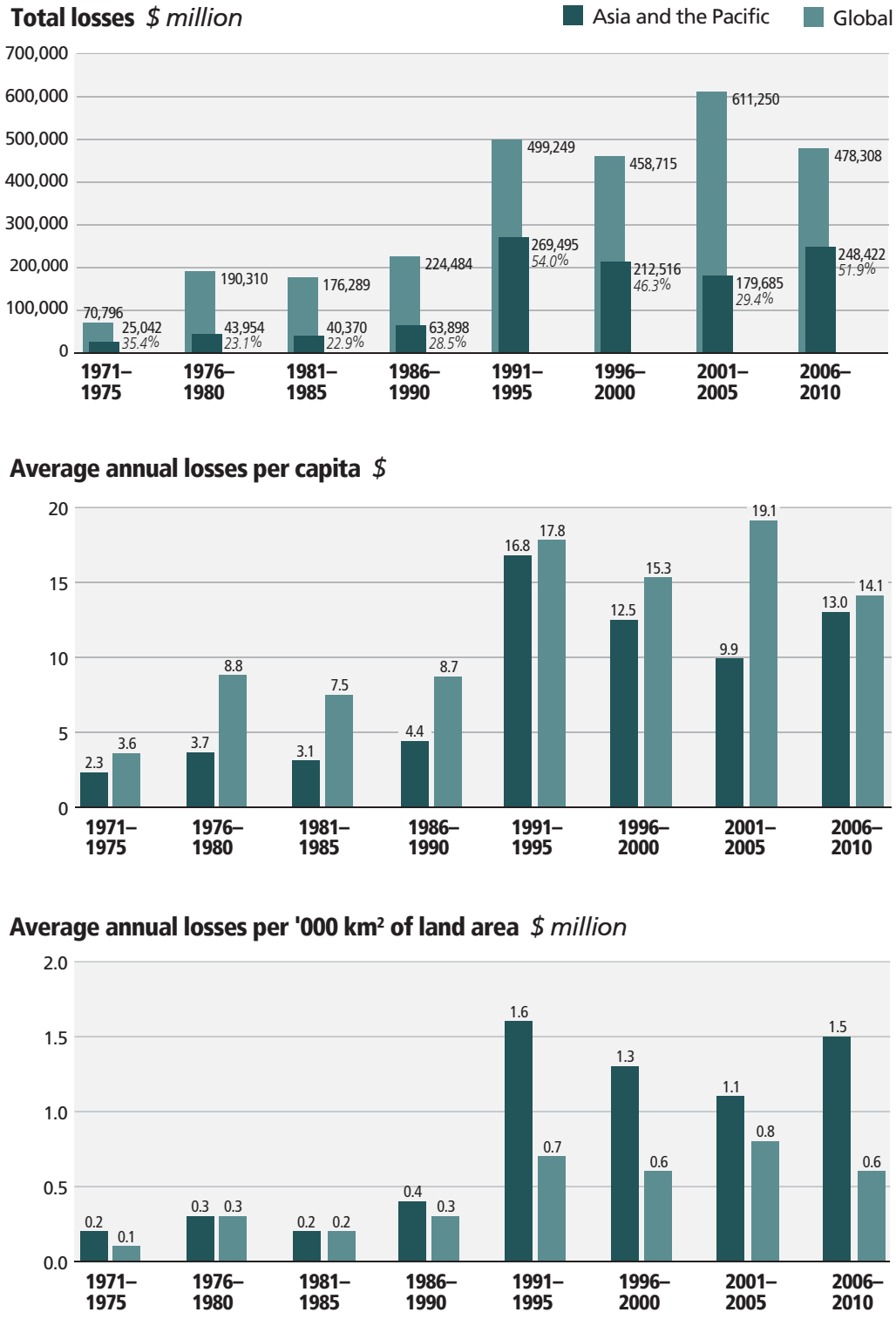
Source: Based on data from the Centre for Research on the Epidemiology of Disasters (n.d.).

Figure 3 **Direct Physical Losses as a Consequence of Natural Hazards in Developing Countries in Asia and the Pacific, 1970–2011**



Source: Based on data from the Centre for Research on the Epidemiology of Disasters (n.d.).

Figure 4 **Direct Physical Losses as a Consequence of Natural Hazards, 1971–2010 (constant 2010 $)**



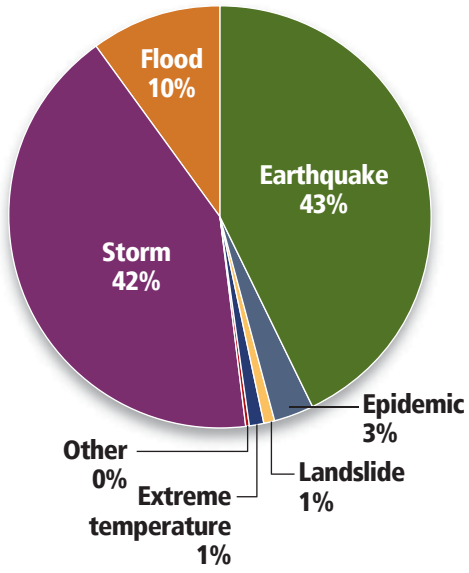
km² = square kilometer.
Source: Based on data from the Centre for Research on the Epidemiology of Disasters (n.d.).

1970s and 1980s, highlighting the fact that the region bears a disproportionately large share of total reported losses relative to its wealth. Moreover, GDP includes economic activities linked to recovery and reconstruction, implying that the ratio of losses to resources channeled for development progress is even greater in this region than it is globally. Average annual per capita losses have been generally lower in Asia and the Pacific than elsewhere, but average annual losses relative to land mass have been higher.

Earthquakes and storms have been the leading cause of hazard-related death in Asia and the Pacific, together accounting for 85% of total loss of life from 1970 to 2010 (Figure 5). Developing countries accounted for more than 97% of total hazard-related deaths in the region. Floods and earthquakes have caused the largest direct physical losses, with floods accounting for 35% of total losses and earthquakes accounting for 32% of total losses in Asia and the Pacific (Figure 6). In the region's developing countries alone, however, floods have accounted for 49% of total losses and earthquakes have accounted for 22% of total losses.

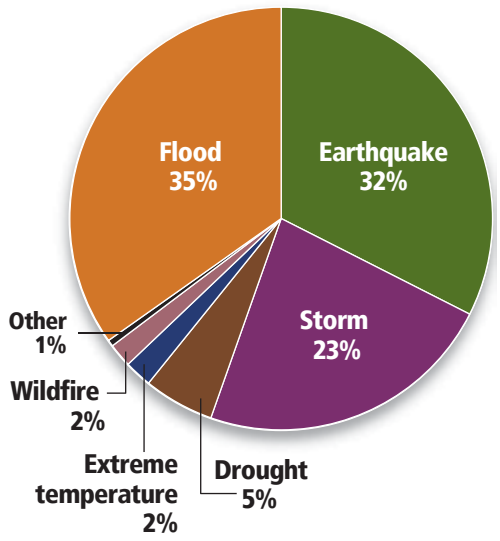
Subregionally, among developing countries alone, Southeast Asia fared the worst on average in terms of loss of life and damage, both per capita and relative to land mass. Annual damage averaged a colossal $4.3 million per 1,000 square kilometers, or $4,285 per square kilometer (Figure 7). Central and West Asia suffered the fewest losses expressed in these terms.

Figure 5 **Loss of Life in Asia and the Pacific by Natural Hazard, 1970–2010**



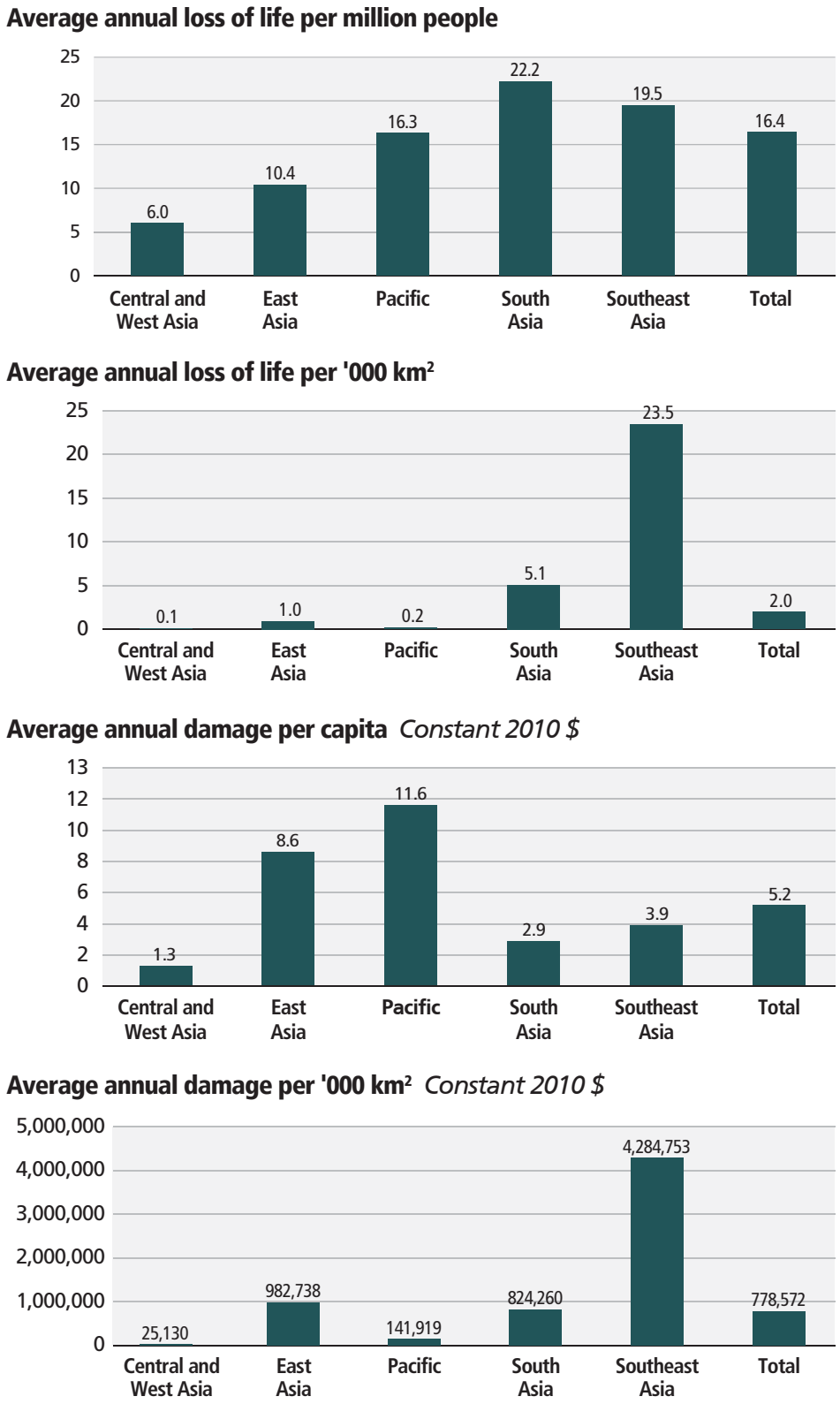
Source: Based on data from the Centre for Research on the Epidemiology of Disasters (n.d.).

Figure 6 **Direct Physical Losses in Asia and the Pacific by Natural Hazard, 1970–2010**



Source: Based on data from the Centre for Research on the Epidemiology of Disasters (n.d.).

Figure 7 **Loss of Life and Damage in Developing Countries of Subregions of Asia and the Pacific, 1970–2010**



km² = square kilometer.
Source: Based on data from the Centre for Research on the Epidemiology of Disasters (n.d.).

Different Perspectives on the Toll of Disasters

Dry statistical data of this sort abound, whether they pertain to global, regional, or national losses, or even to losses from individual events. Reports of one kind or another follow disaster events in Asia and the Pacific, as elsewhere on the globe. These reports come from varying sources and focus on effects at a range of levels. However, they typically paint a static, snapshot picture, in many cases taken in the immediate aftermath of an event. The reports highlight loss of lives and assets, numbers affected, and related humanitarian relief efforts, but they often say little more.

In reality, there is far more to the story than quantitative estimates and monetary sums. The true extent of effects often extends well beyond loss of life and direct physical losses and, over time, well beyond the immediate aftermath of an event. Moreover, behind each disaster, there is a story about the causal factors underlying the losses, the factors determining changes in risk over time, and, by implication, the measures that could be taken to avoid a repeat event.

The real toll of a disaster includes a wide range of indirect impacts and secondary effects as a consequence of the direct human and physical (stock) losses. Indirect impacts take the form of disruption of flows of goods and services stemming from the direct losses. For instance, such effects can include reduced output; higher production costs; disruptions to domestic, regional, or even global supply chains; job losses; and reduced years of schooling. They can also include certain positive effects—in the form of increased demand in unaffected parts of a country, for instance. Secondary effects capture the wider economic and social consequences of a disaster, including the effects on economic fundamentals such as fiscal balance, external reserves, and GDP growth rates; on income and gender inequalities; on poverty levels; and on the nutritional, health, and educational status of a country's population.

Looking at the toll of disasters on specific development themes and sectors can help broaden our understanding of the full potential consequences of a natural hazard event, the need for investment in resilience, and specific opportunities to overcome any gaps and obstacles to that investment. This report places particular emphasis on five development themes and sectors of particular relevance in strengthening resilience: livelihoods, land use, transport, education, and housing. Transport and education have been selected in part because they are representative of, respectively, infrastructure and services more generally. Much of the discussion relating to these two sectors applies to other infrastructure and service sectors as well. The toll on public finance is also considered, leading into an examination of opportunities to strengthen DRF capacity, both to support governments in managing contingent liability and to reduce public contingent liability via greater private use of market-based disaster risk transfer mechanisms.

The Toll on Population: Livelihoods

Livelihoods are an appropriate place to start the discussion, because the degree of livelihood resilience lies at the heart of a natural hazard's effect on a country and thus investment in resilience can lead to a direct reduction in poverty.

Hazard events can exact a toll on all forms of livelihood assets—human, social, natural, physical, and financial—with potentially particularly severe consequences for the poor and

ADB

Extensive damage caused by the volcanic eruption of Mt. Merapi. Indonesia

near-poor. For instance, hazards are more likely to result in the loss of places of work (including homes), tools, livestock, and inventories of the poor and near-poor, and these lower-income groups are less likely to have savings, insurance, or access to formal credit to restore their physical assets. These effects are compounded by the loss of access to predominantly public services—health, education, water and sanitation, transport, energy, and telecommunications—which, together with housing, constitute the spaces and services upon which livelihoods function. Reflecting their smaller asset base, the poor and near-poor are also more likely to face prolonged periods of recovery, during which time they are even more vulnerable to further hazard events.

The Toll on Environment: Land Use

Integration of disaster risk considerations into land use planning represents a fundamental first step in strengthening resilience. The use of land can determine the extent of a natural hazard's damage to the built environment—the megacities, urban areas, towns, and farms that development has brought—and the consequences for the people that live and work in those areas. Disasters can also have implications for future land use. They have aggravated environmental degradation in many countries, destroying trees, vegetation, and coral reefs and contributing to coastal erosion, thereby rendering these countries more vulnerable to future natural hazards. In some countries, disasters have generated large amounts of debris from damaged structures (and ash and pyroclastic flow deposits, in the case of volcanic eruptions), pollution, and even nuclear contamination, leaving parcels of land unusable for many years. Disasters also have exacerbated pressure on urban land by forcing additional migrants into towns and cities in search of work and the influx of even more people into informal settlements in hazard-prone areas.

AFP

Victims of Cyclone Nargis repair their temporary bamboo shelter at a village on the outskirts of Yangon. Myanmar

The Toll on Transport

The siting and satisfactory functioning of transport networks and other infrastructure play a central role in the economic functioning of all countries and determine the location and continuing productivity of many other development investments. However, the transport sector also often suffers some of the highest direct physical losses, with far-reaching indirect consequences. The direct losses often receive particular attention in damage, loss, and needs assessments, but the implied toll on the population is less frequently reported. These indirect impacts can take the form of disruptions to the movement of goods and services, reduced access to schools and health-care facilities, prolonged travel times, increased transportation costs, or reduced competitiveness, all of which can result in particular hardship for lower-income households. This toll is often exacerbated by substantial delays in securing funding for reconstruction and by the reallocation of transport maintenance and investment resources to early recovery and reconstruction, thereby reducing the quality of unaffected sections of the transport network and delaying planned extensions.

The Toll on Education

The effect of natural hazards on the education sector, similar to the effect on health facilities and other public places of assembly, is routinely manifested in loss of life and buildings and translates directly into a reduced investment in

the future of a country. Mortality levels can be especially tragic if sudden-onset hazard events occur during school hours. Less information is normally available on the indirect and secondary consequences of loss of life and damage to schools, colleges, and universities, particularly in the case of more-frequent, lower-intensity hazard events. In practice, these indirect and secondary losses can be far-reaching. Reconstruction of local educational school facilities often takes some time. Meanwhile, schools in a number of countries in Asia and the Pacific already operate on a double-shift system. In some countries, even triple-shift schools are quite common. This implies that there is little spare capacity to absorb additional children into the surviving facilities in the event of a disaster, even assuming that such facilities are located within a reasonable distance of the affected students' homes. The traumatic loss of life of teachers and fellow students as well as family members can have a severe long-term psychological impact as well, causing additional disruptions and affecting academic performance. In sum, lives and livelihoods are interrupted or changed as disasters disrupt education and training, and some students simply never return to education.

The Toll on Families: Housing

Damage to housing—a centerpiece of social fabric and human security—often accounts for one of the largest shares in total reported damage following a disaster. The collapse of a home poses an immediate and obvious threat to human life, particularly when disasters occur during the night and families are asleep at home. Indirect losses are very poorly documented but include effects on livelihoods for those who work from home, such as in a tailoring or bicycle repair business; on community structures; and on psychological health. Indirect losses are commonly amplified further by temporary loss of basic services such as water and sanitation, electricity, health care, and education. For the displaced, housing costs can soar as existing housing shortages are exacerbated. Life in temporary housing settlements also leads to further issues, not least the increased risk of violence, particularly against women.

The Toll on Public Finance

Disasters can place enormous pressure on public finance, resulting in both loss of revenue and higher spending demands. Revenues can decline as economic productivity drops and, more temporarily, as revenue collection systems are disrupted. Demands on the public purse increase as both explicit and implicit contingent government liabilities are brought to bear. These potentially take the form of the repair and reconstruction of public assets; the fulfillment of public guarantees (for instance, in the form of financial backing of insurance schemes or of lending institutions that subsequently struggle because of disaster-induced defaults); and moral, economic, and politically motivated actions to provide relief, early recovery, and reconstruction support to affected households and businesses.

The capacity of government to deal with these pressures depends on a range of factors, including its overall fiscal position, its level of access to international assistance and external capital markets, and its use of ex ante (anticipatory) risk transfer and risk financing instruments. This capacity, in turn, has consequences for the overall pace of recovery and reconstruction, both for the country as a whole and for individual households and businesses, and thus for the final indirect toll of a disaster. The availability of funding will affect how long it takes, for instance, to reinstate fully functioning transport and education systems and to rebuild homes and livelihoods.

The availability of funding will affect how long it takes to reinstate fully functioning transport and education systems and to rebuild homes and livelihoods

AFP

Farmers walk against the back drop of Mt. Merapi volcano. Srumbung village, Indonesia

3 A Potential Future: Rising Losses and Continued Development Setbacks

Hazardscape is a term used to describe the exposure and vulnerability of a particular place, its people, and its assets to the full range of types of hazard that it faces, including natural, environmental, health, and technological hazards. It is useful because it links the dimensions of earthbound atmospheric, hydrologic, and geologic processes and human interventions with the spatial dimension of land use, the built environment, and ecosystems. Most importantly, it focuses on the risk, not the outcome of the risk, and on the unfolding of a hazardous event. This orientation is essential because a natural hazard event does not necessarily become a disaster.

Implicit in the definition of *hazardscape* is the context of development. All development actions carry some potential risks, and many have the potential to spread existing levels of risk, including disaster risk, more widely, whether for better or for worse. In the case of natural hazards, that risk is manifest in the changing relationship of natural events to populations, their built environments, and their related strengths and weaknesses. For instance, development often drives changes in land use, altering existing exposure and, potentially, vulnerability. Thus, all development actions can be considered in light of their potential to serve as instruments to alter risk, and, if the will exists, to enhance resilience.

In practice, development decisions have brought about a considerable rise in disaster risk in Asia and the Pacific, rather than strengthened resilience. Many development decisions by governments, the private sector,

All development actions carry some potential risks, and many have the potential to spread existing levels of risk

the international community, and society at large have been made with little regard to their consequences for the vulnerability of either populations or infrastructure. Some create risk internal to the development itself, such as through failure to consider seismic risk in building design or site selection. Some decisions result in the modification or destruction of naturally occurring hazard defenses supplied by ecosystem structures and functions, as when forests, floodways, deltas, mangroves, wetlands, dunes, or reefs are occupied for development projects. Some encourage populations to move into hazard-sensitive areas by creating public infrastructure and jobs in these locations.

If this pattern continues, the resulting vicious cycle of risk-insensitive development followed by disasters and subsequent risk-insensitive development could pose a considerable impediment to socioeconomic advancement. Mounting disaster risk directly threatens development's two key goals: poverty reduction and inclusive sustainable economic growth. It could even force fast-growing economies into a middle-income trap and impede any sustained progress by slower-growing, low-income economies.

An Impediment to Poverty Reduction

Hazard events can have devastating consequences for the poor and near-poor, reflecting their social, economic, and political circumstances. More-marginalized groups such as women, children, the elderly, the disabled, and minority groups often are particularly vulnerable, mirroring wider socioeconomic and cultural inequalities. As highlighted in Part II in some detail, for instance, the poor are far more likely to have unsafe housing, vulnerable livelihoods, and insufficient disaster-coping mechanisms. Their post-disaster recovery can extend long past the process of physical reconstruction. Disasters can force them into additional debt, into the sale of productive assets, or into the decision to pull children out of school. Such actions have implications for factors such as earning capacity, health, and levels of educational attainment.

The threat of hazard can also influence long-term behavior, in some cases reinforcing poverty via deliberate risk-averting livelihood choices. For example, there is some tendency among marginal rice farmers in the Philippines to cultivate traditional, lower-yielding rice varieties because such varieties are relatively more hazard-tolerant, thereby limiting potential earnings but also reducing the risk of total crop failure (World Bank 2007). Studies of drought-prone areas in Burkina Faso and India indicate that farmers may sacrifice 12%–15% of average income to reduce risk (Hazell and Hess 2010).

Asia and the Pacific has made considerable gains in poverty reduction and progress toward the achievement of a number of the Millennium Development Goals, including reducing the number of people living on less than $1.25 (purchasing power parity) per day. However, these gains may not be sustained in hazard-prone areas unless resilience to natural hazard events is considerably strengthened for the poor and near-poor.

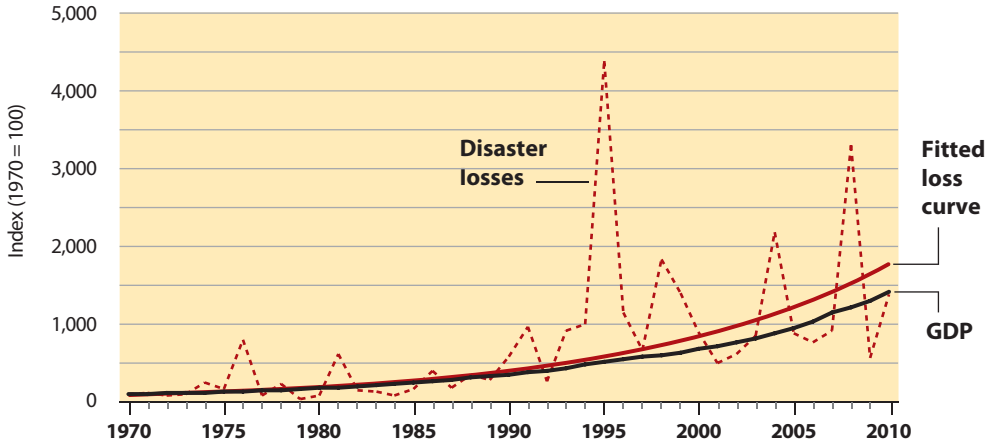
A Threat to Sustainable Economic Growth

Asia and the Pacific has achieved considerable growth over the past 4 decades, expanding by an average of 6.3% per year in real terms in the 1970s, 7.3% in the 1980s, 6.7% in the 1990s, and 7.4% in the first decade of the 21st century. In contrast, reported losses from disasters have fluctuated enormously among years, rendering examination of annual average growth rates or their direct comparison with GDP performance meaningless over a period of just a few years or even a few decades.

Nevertheless, if disaster losses over the period 1970–2010 are smoothed over time (that is, regressed against time—in this case, achieving the best fit by using an exponential function), the resulting fitted line suggests that direct physical disaster losses in Asia and the Pacific not only are following a steady upward path (as already indicated in Figure 2), but are also rising more rapidly than regional GDP (Figure 8). This suggests that the rise in losses is not entirely due to a rise in exposure, assuming the volume of infrastructure and assets increases broadly in line with GDP, but also possibly due to a rise in vulnerability.

If the year 2011—a year of all-time record losses for the region—is included in the

Figure 8 **Comparative Real Growth in Gross Domestic Product and Direct Physical Losses as a Consequence of Natural Hazards in Asia and the Pacific, 1970–2010**



GDP = gross domestic product.

Note: Annual GDP and annual direct physical losses were both set at a base value of 100 in 1970 and growth indices in subsequent years calculated relative to 1970 to facilitate a comparison of growth rates.

Source: Based on data from Asian Development Bank (n.d.) and Centre for Research on the Epidemiology of Disasters (n.d.).

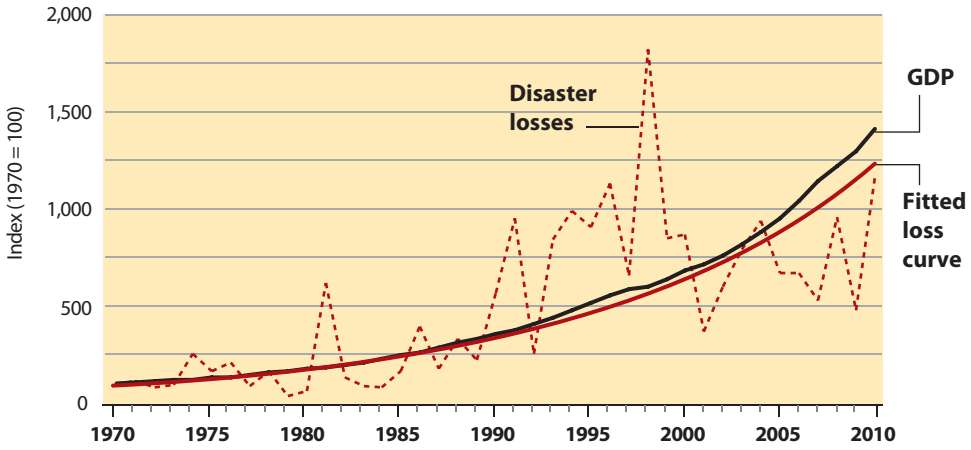
analysis, the emerging gap between disaster loss growth rates and GDP is even wider. It is important to stress that a run of very low losses over the next 5 years, along the levels experienced in 2006, would result in a much lower fitted trend line, more or less matching reported growth in GDP. Regardless, the current evidence points to a potentially alarming trend: the long-term rate of growth in disaster losses in Asia and the Pacific is apparently outpacing growth in GDP, making the need for strengthened resilience ever more urgent.

Loss figures are potentially skewed by the timing of occurrence of major geologic events with very low return periods, such as the 1995 Kobe earthquake, the 2008 Sichuan earthquake, and the 2011 Great East Japan Earthquake. Indeed, available data suggest that growth in GDP has outpaced growth in direct physical losses occurring just as a consequence of non-geologic hazards over the past 40 years (Figure 9). This apparent finding provides no reason for complacency, however, for two reasons. First, the incidence and frequency of climatological hazards are expected to increase with climate change. Second, losses incurred as a consequence of localized, more frequent hazard events often are not reported in national and international disaster statistics, although efforts are under way to address this issue. These localized hazards, almost entirely in the form of weather-related hazards, can have a substantial aggregate impact. Data for 21 countries across the globe over a 40-year period suggest that these weather-related events increase the number of houses destroyed as a consequence of natural hazards by 22% and increase the number of houses damaged by natural hazards by 100% (UNISDR 2011). The "invisibility of such a high proportion of disaster loss is one reason why so many countries find it politically and economically difficult to prioritize investments in DRM" (UNISDR 2011, 36).

Looking beyond direct physical losses alone, it is widely observed that major disasters cause significant short-term economic disruption at a country level. For instance, the economy of Thailand contracted by around 9% in the last 3 months of 2011, following severe flooding and related disruptions to the agriculture and manufacturing sectors (Government of Thailand 2012). Japan's GDP fell by 2.1% year-on-year in the second quarter of 2011 as a consequence of the Great East Japan Earthquake in March 2011(World Bank 2012b). The early September 2010 earthquake in New Zealand had an immediate adverse

The long-term rate of growth in disaster losses in Asia and the Pacific is apparently outpacing growth in GDP, making the need for strengthened resilience ever more urgent

Figure 9 **Comparative Real Growth in Gross Domestic Product and Direct Physical Losses as a Consequence of Non-Geologic Hazards in Asia and the Pacific, 1970–2010**



GDP = gross domestic product.

Note: Annual GDP and annual direct physical losses were both set at a base value of 100 in 1970 and growth indices in subsequent years calculated relative to 1970 to facilitate a comparison of growth rates. Non-geologic hazards include droughts, extreme temperature, floods, wet mass movements, storms, volcanic eruptions, and wildfires.

Source: Based on data from Asian Development Bank (n.d.) and Centre for Research on the Epidemiology of Disasters (n.d.).

impact, reducing economic activity in the Canterbury region alone by 0.8% for the full third quarter of the year and knocking 0.2% off the country's GDP, thereby resulting in an overall economic contraction of 0.2% for that quarter (Government of New Zealand 2011).

Unraveling the longer-term effects of disasters, and thus discovering whether they have influenced longer-term economic growth patterns in the region, either positively or negatively, is more complex. A range of factors determines their ultimate consequences. Most obviously, the nature and extent of direct physical losses play a role, and this in turn is influenced by prior investment in resilience. Partly linked to this, the type of hazard experienced also matters. For example, major floods and droughts typically have negative long-term economic effects, particularly in lower-income countries with large agriculture sectors. However, the widespread devastation caused by severe earthquakes may sometimes be partly offset by positive long-term macroeconomic consequences if large portions of capital stock are rebuilt to higher standards of resilience and technology and a disaster-induced construction boom occurs.

The unit of analysis is also relevant, both in exploring the economic consequences of a disaster and in designing related financing instruments and reconstruction strategies, because consequences for the immediately affected area and wider region or even nation may be very different. Despite the potential prospects of economic gain at a national level, major disasters can have a long-term abiding effect in the immediately affected area, even in high-income countries that are able to access considerable resources for reconstruction. Twelve years after the devastating 1995 earthquake, for instance, per capita GDP in the Kobe region of Japan was estimated to be 13% lower than it would have been had the earthquake not occurred (DuPont and Noy 2012). Thus, what may be good for the country as a whole is not necessarily good for the immediately affected area. Unaffected regions may benefit from a rise in demand for capital goods, consumables, and even labor from the disaster zone. Producers in unaffected areas may also gain additional market share, assuming a preexisting slack in their capacity. However, impacts in affected areas can extend for many years, shifting the balance of prior regional disparities.

Prevailing economic circumstances matter as well. There is evidence that disaster-related GDP losses are higher when disasters occur during periods of expansion and all resources are already fully utilized (Hallegatte and Ghil 2007). Conversely, countries often fare better

if macroeconomic fundamentals such as fiscal balance, level of external reserves, and balance of payments are strong at the outset of a disaster and they are thus better able to finance recovery and reconstruction efforts. Prior redundancies in productive and infrastructure capacity—for instance, in power supply or transportation networks—can also help alleviate the consequences of direct physical losses.

Leading on from this, the ultimate consequences of a disaster are heavily influenced by the availability and timeliness of post-disaster financing, which dictates the pace of reconstruction and thus the extent and longevity of myriad indirect impacts stemming from the direct losses. The scale and timeliness of early recovery and reconstruction financing depends, in turn, both on prevailing economic circumstances and the prior establishment of DRF mechanisms. Higher-income countries typically have higher levels of insurance penetration, better access to international financial and reinsurance markets, and larger budgetary resources in the hands of both national and subnational governments, even in times of recession. As such, they are better placed to support rapid recovery and reconstruction, thereby reducing the indirect and secondary effects of the event and helping to ensure that there is sufficient financing available to upgrade capital stock. Lower-income countries can also put in place comprehensive DRF strategies, should they choose, but at potentially much higher opportunity cost as scarce resources are used to build up contingency reserves, pay insurance premiums, and so forth, rather than invested in new infrastructure and other development initiatives. Post-disaster borrowing is often more costly as well, and post-disaster budget reallocations can carry high opportunity costs in terms of foregone development opportunities.

On balance, however, major disasters in most cases represent adverse economic shocks. They knock economies off course and often force a long-term realignment of investment plans in immediately affected areas, not least because of inadequate financing arrangements for early recovery and reconstruction.

Governments, communities, the private sector, and individual households across Asia and the Pacific must invest far more in risk assessment, risk reduction, and the management of residual risk to lessen both the direct and indirect effects of disasters and to help achieve inclusive sustainable long-term growth.

A preliminary sense of the potential extent of macroeconomic threat posed by natural hazards and the degree of attention national governments should pay to them can be gauged by examining average expected losses and probable maximum losses arising from natural hazards, relative to GDP and total government expenditure. For instance, according to recent analysis, Vanuatu should expect to experience losses equivalent to up to 39.1% of its GDP and 159.3% of its annual government expenditure once every 50 years, as a consequence of a tropical cyclone, earthquake, or tsunami. In contrast, Timor-Leste should expect to experience losses equivalent to up to 7.9% of its GDP and 9.1% of its annual government expenditure over the same return period (Table 2).

Similar analysis has been undertaken for ASEAN member states. Within this region, relatively frequent, lower-impact 20-year natural hazard events would place the greatest burden on Cambodia, causing losses equivalent to up to 3.6% of its GDP and 18.3% of its annual government expenditure once every 20 years (Table 3). In contrast, somewhat lower-frequency, higher-impact 100-year events would place the highest burden on the Lao People's Democratic Republic, causing losses equivalent to up to 11.7% of its GDP and

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Flood water almost reaching the maximum level. Bangkok, Thailand

Table 2 **Average Annual and Probable Maximum Tropical Cyclone, Earthquake, and Tsunami Losses in the Pacific**

	Annual average direct economic losses			Losses from 50-year events			Losses from 100-year events		
	$ million	% GDP	% annual government expenditure	$ million	% GDP	% annual government expenditure	$ million	% GDP	% annual government expenditure
Cook Islands	4.9	2.0	6.3	56.8	23.3	72.9	103.0	42.2	132.2
Fiji	79.1	2.6	10.8	620.1	20.6	84.1	844.8	28.1	115.0
Federated States of Micronesia	8.3	2.9	5.3	75.3	26.2	47.8	150.7	52.4	95.6
Kiribati	0.3	0.2	0.3	0.4	0.3	0.4	4.0	2.6	3.7
Marshall Islands	3.1	2.0	3.0	34.1	21.9	32.8	67.4	43.3	64.7
Niue	0.9	5.8	5.5	9.4	59.7	57.7	22.7	143.4	139.3
Palau	2.7	1.6	3.8	16.8	9.9	23.6	46.7	27.5	65.7
Papua New Guinea	85.0	0.9	3.0	582.9	6.1	20.7	794.9	8.4	28.2
Samoa	9.9	1.7	4.4	109.8	19.4	48.9	152.9	27.0	68.1
Solomon Islands	20.5	3.0	7.2	189.6	27.9	67.0	280.6	41.4	99.1
Timor-Leste	5.9	0.8	1.0	55.7	7.9	9.1	143.7	20.5	23.4
Tonga	15.5	4.3	15.6	140.2	39.2	141.3	225.3	63.0	227.1
Tuvalu	0.2	0.8	0.5	2.8	8.9	6.5	4.8	15.1	11.2
Vanuatu	47.9	6.6	26.8	284.9	39.1	159.3	370.1	50.8	207.0

GDP = gross domestic product.
Source: World Bank (2011).

49.4% of its annual government expenditure over the same return period. In determining indirect and secondary consequences and the related need to strengthen resilience, however, each potential hazard event, both in ASEAN countries and more broadly, must be placed in the context of the affected communities, sectors, and macroeconomy, requiring more detailed analysis on an individual country basis.

Prospects for continued strong economic progress in Asia and the Pacific are in jeopardy if resilience is not strengthened and, instead, the growth in disaster losses continues to outpace economic expansion. This threat holds for countries both individually and collectively. Increasing regional connectivity has contributed to Asia's growth, and governments, together with their international partners, are actively pursuing further integration via investment in infrastructure and enhanced regional cooperation (ADB and ADBI 2009). However, the 2011 floods in Thailand were a stark reminder of potential disaster risks linked to increasing regional integration and just-in-time supply chain management. Without due attention to strengthened resilience, hazard-related disruptions of production, transport of raw materials and elaborated components, and delivery of finished goods could become an increasing problem in the region, extending the impact of disaster events well beyond the directly affected populations and countries.

The Urban Imperative

Asia and the Pacific are undergoing rapid urban growth. One-third of the region's population was located in urban areas in 1990, rising to 38% in 2000 and 43% in 2010 (UN ESCAP 2011). By 2050, Asia's urban population alone is projected to increase by a further 1.4 billion people, almost doubling in size (Kohli, Sharma, and Sood 2010). In many countries, this expansion is occurring in hazard-prone areas, in part reflecting the very facets of geography that attracted settlement and investment in the first place—namely, proximity to rivers and coasts and (low-lying) flat land. A number of other rapidly expanding cities in the region are located, by chance, on major seismic fault

Table 3 **Average Annual and Probable Maximum Losses for Natural Hazards in Association of Southeast Asian Nations Member States[a]**

	Annual average direct economic losses			Losses from 20-year events			Losses from 100-year events		
	$ million	% GDP	% annual government expenditure	$ million	% GDP	% annual government expenditure	$ million	% GDP	% annual government expenditure
Brunei Darussalam[b]	0.4	0.0	0.0	–	–	–	–	–	–
Cambodia	74.2	0.7	3.3	405.5	3.6	18.3	825.0	7.3	37.2
Indonesia	1303.5	0.2	1.0	4,722.7	0.7	3.7	9,865.9	1.4	7.6
Lao PDR	52.3	0.7	3.0	342.6	4.6	19.3	875.3	11.7	49.4
Malaysia	174.6	0.1	0.2	953.8	0.4	1.3	2,332.7	1.0	3.2
Myanmar[c]	184.8	0.9	8.2	–	–	–	9,078.7	45.2	405.1
Philippines	1,602.9	0.8	4.8	4,570.9	2.3	13.6	9,407.4	4.7	27.9
Singapore	2.2	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0
Thailand	255.6	0.1	0.3	1,000.0	0.3	1.3	2,222.6	0.7	3.0
Viet Nam	786.4	0.8	2.4	2,448.5	2.4	7.4	3,718.2	3.6	11.3

GDP = gross domestic product, Lao PDR = Lao People's Democratic Republic.

[a] Geophysical, meteorological, hydrological, and climatological hazards.

[b] Probable maximum losses for Brunei Darussalam were not reported because neither complete historical data nor simulated catastrophic loss data were available.

[c] Due to limited historical economic loss time series data and limited availability of simulated losses from catastrophic probabilistic modes, probable maximum losses were not reported for Myanmar.

Source: World Bank and Global Facility for Disaster Reduction and Recovery (2012a).

lines. The growth of substantial informal settlements in more hazard-prone urban areas is of particular concern. In hazard-prone megacities such as Jakarta, Manila, and Mumbai, at least one-quarter of the population lives in informal settlements. These settlements are becoming more densely populated as the number of new informal settlements grows at a slower pace.

Cities create opportunities for jobs and livelihoods. They are focal points for economic activity; centers of higher education, innovation, and technological development; and engines of economic growth, offering better infrastructure, larger markets, and opportunities for economies of scale and for productivity gains. However, a balance of economic development and resilient urban expansion has been elusive in many cases. The drivers of development have brought to urban growth not unanticipated but certainly undesirable disaster risks in the name of development. These risks carry the possibility that economic and social advancement could be rapidly knocked back should a hazard event occur.

As cities grow and prosper, overall levels of protection could reasonably be expected to improve—a result of, for instance, ever more stringent and enforceable building codes and land use zoning and rising investment in flood and storm protection—and losses associated with higher-frequency, lower-intensity hazard events to decline. However, disasters in excess of hazard-protection design standards will still occur, periodically resulting in excessive losses and implying that average disaster losses could still increase, despite improvements in protection (Hallegatte 2011). Less-frequent experience of losses could also create a false sense of security, resulting in a progressive downplaying of disaster risk by households, businesses, and the public sector and thus resulting in underinvestment in resilience, unless imaginative and deliberate education and awareness programs are initiated. Moreover, unless deliberate action is taken, disparities in relative disaster risk faced by the poor and nonpoor could potentially widen as the middle and upper classes are increasingly protected against natural hazards while informal settlements and informal livelihoods continue to expand in the most hazard-prone, marginal areas of a city. This would create additional challenges in securing inclusive socioeconomic growth.

A balance of economic development and resilient urban expansion has been elusive in many cases

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Densely populated informal settlements in hazard-prone urban areas. Dhaka, Bangladesh

4 Gaps and Obstacles to a Resilient Future

Despite the clear case for greater investment in resilience, a wide range of gaps and obstacles hinders progress. These challenges are linked to the processes shaping and informing development. They can relate to gaps and obstacles linked both to broad public sector plans, legislation, and budgets and also to the more detailed micro processes, contexts, and circumstances that influence individual public and private decisions and actions at an operational, usually local, level. Individually, the micro gaps and obstacles have no discernible effect on national development. Collectively, however, their effect is potentially huge, undermining possible progress toward enhanced resilience.

National Socioeconomic Development Plans

Inadequate risk information. Disaster risk data are unreliable, insufficient, and difficult to obtain in many countries in Asia and the Pacific. Admittedly, there have been notable improvements in the past decade or so as risk modeling capabilities have been improved and related tools have been applied across many countries in the region. In consequence, countries are no longer solely reliant on historical loss data for recent decades or the related inaccuracies and biases pertaining to the actual incidence of disasters over those decades.

Disaster risk data are unreliable, insufficient, and difficult to obtain in many countries in Asia and the Pacific

The passage of disaster legislation reforms has stalled because there is little sense of urgency or interest on the part of legislators, their constituents, and NDMO staff

Modeling generates probable maximum losses and average expected losses for both individual assets and wider sectors or geographic areas. However, modeling capabilities are still far from perfect, particularly in the case of flood risk, which is both complex and, as a consequence of human activity, highly dynamic. Climate change poses a further challenge, particularly with regard to challenges in downscaling broad climate change projections to develop likely scenarios for specific sectors and spatial locations over clearly defined periods of time.

There are also huge gaps in risk information locally, where it can be essential in guiding community planning and where most risk reduction measures are actually conceived and acted upon. For instance, fewer than 20% of cities in Asia and the Pacific have carried out climate risk assessments (Carmin, Nadkami, and Rhie 2012). The number of municipal geologic hazard risk assessments is even smaller. Yet, the integration of that knowledge comes about, first and foremost, in community planning.

Poor conceptual understanding of disaster risk management. The conceptual understanding of resilience in many countries remains relatively poor, manifesting itself in a tunnel-vision approach to the issue. Many governments now have comprehensive DRM strategies in place, covering risk reduction as well as disaster preparedness and response. However, the national disaster management offices (NDMOs) leading their implementation typically are staffed by emergency-response management personnel with limited understanding of development concepts or processes, or with limited knowledge about the intricacies of DRR, and hence are not well placed to promote strengthened resilience. This has resulted in the curtailed treatment of disaster risk concerns in national socioeconomic development plans and a focus on a very narrow range of structural investment, environmental regeneration, early warning capabilities, and reactive assistance to vulnerable groups, rather than the broader integration of resilience objectives into the overall approach to development.

Lack of leadership for disaster risk management planning. DRM interests often have weak political and budgetary standing and remain peripheral to the planning and budget process, leading to missed opportunities to influence change toward a holistic, integrated approach centered on widely supported development action. Even worse, inclusion of a few discrete DRM measures in national plans, budgets, and operational items may be viewed as a job well done. However, even when these measures are implemented, there may be no established assignment of responsibility, accountability, monitoring, or evaluation of disaster losses.

Legislative and Regulatory Frameworks

Limited political support for legislative reform. In many countries, there is growing appreciation of the need to revise disaster legislation to reflect the broad shift from an essentially ex post (reactive) approach to DRM to a more comprehensive approach, with much greater emphasis on ex ante (anticipatory) risk reduction in the context of development. Similarly, there is growing awareness of the need to link DRM and CCA legislation. Related revisions have been implemented in some countries. More commonly, however, the passage of disaster legislation reforms has stalled because there is little sense of urgency or interest on the part of legislators, their constituents, and NDMO staff. Thus, although many countries have drawn up comprehensive national DRM strategies and action plans, progress in implementation has often been limited because there is insufficient legislative and regulatory underpinning

Fragmented disaster risk management legislation. In many countries, aspects of DRM are addressed through a wide range of laws dealing with issues such as emergency preparedness and response, land use planning, building codes, environmental protection, water resource management, financial regulation, and, most recently, climate change. Overarching coordinating frameworks that draw existing legislation together are not common, however, thus potentially undermining the collective effect and coherence of individual laws. This also implies that laws that block enhanced resilience may go unnoticed.

Weak enforcement of key disaster risk management regulations. Building codes and land use zoning have been strengthened in many countries over the past few decades. Extremely stringent building codes are widely acknowledged, for example, as having saved thousands of lives during the 9.0-magnitude Great East Japan Earthquake in March 2011. However, enforcement has lagged in many developing countries due to varying combinations of financial, institutional, technical, and human resource limitations; weak political support; corruption; and insecure land tenure.

Subnational Policy and Planning Processes

Highly limited disaster risk management capacity. Many local governments have extremely limited, if any, DRM expertise. Any existing capability most likely pertains to emergency-response management, and even that may be limited to emergency management pertaining to the most frequent types of hazard experienced in a particular area. Local governments also often have very little planning capacity. Together, this implies that few local governments are adequately equipped to integrate disaster risk concerns into local physical, social, and economic policies and plans. These challenges are exacerbated by extreme budget constraints, shortsighted political focus, and in many cases, very limited assessment of disaster risk on the part of the communities served. Knowledge of risk can be particularly weak in areas of high inward migration to rapidly expanding economic growth areas.

Poor vertical integration. Disconnects between national and local government development objectives and their physical and financial investment plans are common because the respective plans often are formulated independently of one another. Typically, there are several layers of government between national and local governments, building up from local and down from national government priorities and goals. Local government plans should be built on participatory assessments and consultations with local communities and therefore (at least in theory) should be more in tune with grassroots disaster risk concerns than national plans and strategies. At the same time, local plans often lack input from DRM specialists and broader, long-term vision. The national government provides these in the form of national policy, and technical knowledge and know-how. At some point, however, the upward and downward transmission of national and local levels grinds to a halt, resulting in a vertical disconnect. Moreover, local government interests can be easily swayed by lobbying pressures, leading to changes in direction that undo previously agreed-upon policies and plans (SMEC and IID 2006).

Poor horizontal integration. There are parallel horizontal disconnects between various government plans and policies—for instance, between physical and investment plans at both national and subnational levels. A similar gap is emerging between local DRM and local development and investment plans as more and more community, district, provincial, and city DRM plans are developed, often with the support of nongovernment organizations (NGOs). There are yet further gaps between the plans and actions of adjacent local governments and contiguous nation-states facing specific shared natural hazards. Horizontal disconnects can undermine both the individual and the collective achievements of government policies and plans even where they do individually take account of resilience concerns. Coordination is critical given the crosscutting nature of investment in resilience.

National and Subnational Budgetary Processes

Budgetary resources for disaster risk reduction are frequently inadequate at all levels of government

Insufficient funding. Budgetary resources for DRR are frequently inadequate at all levels of government, particularly in low-income states and locally, where much of the responsibility for implementation lies. In the face of limited budgetary resources, policy makers favor investments that generate immediate, tangible outcomes rather than risk reduction endeavors that may not reap benefits for many years and, even then, may generate little political gain. For instance, they prefer to build additional kilometers of roads and

more schools and health clinics today than to construct fewer, more resilient roads, schools, and health clinics that will survive potential hazards tomorrow. This line of thinking fails to acknowledge that DRR actually supports and secures the achievement of those tangible outcomes by reducing vulnerability to hazards.

It is similarly difficult to persuade governments to put adequate financing arrangements in place for post-disaster relief, early recovery, and reconstruction ahead of the occurrence of a disaster. The design of such arrangements is complicated by substantial interannual fluctuations in the scale of disaster losses and by considerable latitude on the part of governments to determine the forms and levels of post-disaster support (Benson and Mahul, forthcoming). Subsequent funding delays in the aftermath of a disaster can result in considerable setbacks in relief, early recovery, and reconstruction efforts, exacerbating the indirect social and economic impact of an event at all levels of society and hampering efforts to rebuild with an eye toward strengthening resilience to future hazard events.

Misplaced reliance on the international community. Contrary to popular belief, international grant assistance accounts for a very small proportion of post-disaster expenditure globally, and much of it focuses on major events (Benson and Mahul, forthcoming). For instance, the United Nations Office for the Coordination of Humanitarian Affairs (2012) reports international aid flows in response to just 60 events in 2010, less than a sixth of the total 373 natural hazard events recorded globally for the same year. Moreover, post-disaster external assistance is not necessarily additional. Rather, it often entails some adjustment of existing aid programs and potentially displaces short- to medium-term flows of new development support.

AFP

Growth of informal settlements contributing to increasing vulnerability is a typical feature of many Asian cities. Sandakan City, Malaysia

Expenditure tracking systems. Very few countries have any form of tracking system in place to monitor spending on either DRR or disaster response and are therefore unable to indicate what percentage of the national budget is spent in these areas. Poor tracking capacity partly reflects certain innate challenges in monitoring disaster-related spending. DRR initiatives may be scattered across a number of sector budgets and in some cases may form just one component (such as seismically strengthened design) or even an indirect benefit of a wider development project (e.g., irrigation of land reduces the effects of drought) rather than an explicit goal (Benson, Arnold, and Christoplos 2009). Meanwhile, post-disaster operations may involve many national and international actors, the reallocation of government and aid resources, and both off-budget and on-budget contributions, creating its own set of challenges in tracking expenditure.

Maintenance budgets. Many governments allocate insufficient funding for maintenance. Ironically, this situation is exacerbated by the diversion—or reservation—of budgeted routine maintenance funds to meet smaller-scale natural hazard event–related repairs, thereby leaving other infrastructure more exposed to future hazard events.

Prevailing Political Economy

Power disparities. The interests and power relations of different stakeholders in a

particular country play a key role in shaping forms and levels of investment in resilience, often acting as a negative rather than positive force. In many countries, disaster risk is concentrated disproportionately on poorer households—that is, on the segment of society with typically very limited political voice. In contrast, the most powerful groups in society are often responsible for creating a significant share of disaster risk.

Misaligned incentives. There are various misaligned incentives that, in combination with weak systems of accountability, encourage insufficient public focus on DRR and an overemphasis on highly visible disaster relief, early recovery, and reconstruction. Political incentives for action are curtailed by limited general public knowledge of disaster risk, of the likely net benefits of many DRR actions, and of the extent to which such actions have, indeed, reduced losses in the event of a disaster. Evidence suggests that, regardless of the extent of prior investments in DRR, citizens are likely to blame public policy failure for disaster losses anyway, except in the event of a major disaster (Keefer 2009). Poor knowledge of the benefits of DRR actions also implies that priority is awarded to physical investments in infrastructure, such as flood defenses, which can at least be seen, and targeted on favored constituencies.

Political costs. Certain DRM actions may damage the popularity of a local or national government, imposing a political cost on incumbent leaders (Williams 2011). For instance, they may require the resettlement of communities and businesses away from hazard-prone areas; the denial of planning permission; or curtailment of certain economic activities, such as logging or saltwater shrimp farming. Political costs can be particularly high if vested interests of powerful individuals are involved. Conversely, politicians may deliberately seek favor through the nonenforcement of certain laws and regulations or through special concessions for politically powerful groups and business interests (Williams 2011).

Investment Identification, Design, and Implementation

Little mandated consideration of disaster risk in investment design. Existing government guidelines and procedures on the identification and appraisal of new investments typically require little consideration of disaster risk. To some extent, these guidelines direct the design of both private and public investments.

Weak voice of resilience proponents. Government agencies working directly in areas that support strengthened resilience—for instance, in flood control departments or hydrometeorological agencies—often have relatively weak political standing. Moreover, they do not have the necessary skills to prepare convincing economic arguments for investment in their field or to communicate effectively with ministries of planning and finance.

Perception of low net return on investment in resilience. The incremental cost incurred in strengthening physical infrastructure against natural hazards is often perceived to be far higher than it actually is. Moreover, there is a preference for immediate returns on investment, implying that the benefits of DRR investment, potentially appearing many years down the line, are highly discounted.

Resilience benefits in the form of reduced losses rather than a short-term positive income stream. Unlike most other forms of investment, investments in resilience often reduce potential future losses rather than generate a direct and more nearly immediate stream of positive income. This limits public and private sector willingness to bring financing or expertise to bear in strengthening resilience, because it requires setting a present value on a future reduction in losses and then monetizing that to create a commercial transaction.

Weak hazard and disaster risk information. In many countries, there is insufficient high-resolution hazard and risk data available to support investment in individual resilient

development actions. Moreover, in the absence of a strong demand for risk assessment information by owners and operators of economic and social infrastructure in the public and private sectors, there is little reason to believe that such information will be seen as a public good worthy of provision or, therefore, that it will be developed and made available free of charge.

Household, Community, and Private Sector Participation

Narrow perception of the private sector's role in resilience. Often, the public and private sectors see the private sector's role in resilience in terms of corporate social responsibility. However, there is a limited understanding or appreciation of potential commercial opportunities in the field of resilience, or even of the importance of protecting a business' own assets and supply chains against natural hazards.

Perverse incentives. Government actions can distort levels of private sector and household investment in DRR. Many governments offer certain post-disaster tax breaks and allow businesses and households to deduct from their tax bills the cost of disaster-related damage, but far fewer offer fiscal incentives for risk reduction. Indeed, household property insurance premiums are even subject to tax in at least one country. In combination, these factors imply that households and businesses may take little direct action on their own to reduce their disaster risk, and may even make decisions that increase their risk. Similarly, expectations of post-disaster public assistance can limit household incentives to purchase insurance, invest in risk reduction, or build up precautionary savings, and governments can find it morally difficult to penalize such behavior after a disaster, a situation referred to as the Samaritan's dilemma.

AFP

Farmers can achieve higher yields from fertile volcanic soils. East Java Province, Indonesia

5 Stimulating, Securing, and Sustaining Investment in a More Resilient Future

There are three basic core needs that must be satisfied to strengthen resilience and provide a solid underpinning for inclusive, sustainable development. These needs, which span the entire DRM spectrum and are repeatedly identified in the literature, entail risk assessment, risk reduction, and residual risk management:

- Risk assessment: Understanding who and what is at risk from what hazard(s), as well as where, when, why, how, and to what extent.
- Risk reduction: Acting to reduce the impact of specific natural hazards on specific targets in specific places to a point that the outcome of those events is acceptable.
- Residual risk management: Acting to minimize further indirect and secondary consequences subsequent to a hazard event via the implementation of adequate and timely disaster relief, early recovery, and reconstruction efforts and building back to a safer condition.

A wide range of instruments and mechanisms have been developed to help satisfy these core needs. They can be categorized as policy, capacity, and investment tools:

- Policy: Setting the legislative, regulatory, practice, and process parameters for managing risk, including definitions of acceptable risk.
- Capacity: Enabling individuals, communities, civil society, businesses, governments, and the international community to act to meet those parameters with appropriate skills, knowledge, and know-how.

There are three basic core needs that must be satisfied to strengthen resilience

- Investment: Ensuring adequate financing, human resources, and commitment to implement policy and to apply capacity.

Strengthened resilience begins to take shape when particular instruments or mechanisms and particular core needs are paired to effect change. For instance, risk assessment is required at many different levels, focusing on national policy through to individual development and private sector initiatives, and across the full range of development themes, sectors, and social and economic activities. A wide variety of policy, capacity, and investment instruments may be required to meet all of these many and varied risk assessment needs. The suitability of individual instruments depends on the specific risk assessment need at hand. The most appropriate risk assessment framework and methodology will also depend on the need under consideration. When repeated again and again, this pairing of specific instruments and specific needs results in a series of measures that collectively stimulate, secure, and sustain investment in resilience.

There are sufficient tools available to ensure that investments in resilience are adequately stimulated, that the necessary investments are acted upon or secured, and that investments in resilience are sustained going forward into the future

Using the Geodesic Sphere to Characterize the Resilience Process

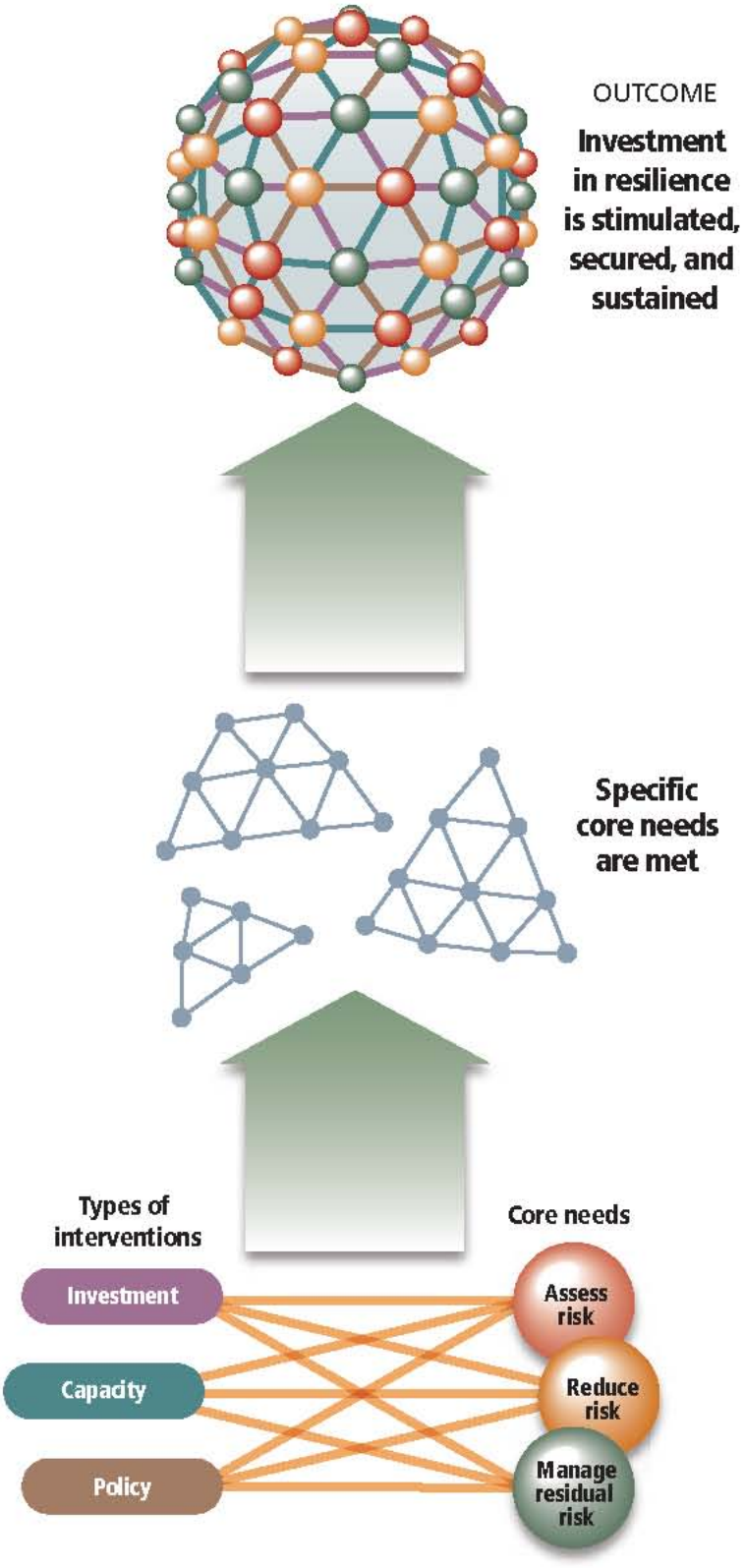
The process of pairing instruments and core needs to strengthen wider socioeconomic resilience can be visualized in terms of the steps required to construct a geodesic sphere (Figure 10). The initial pairing of instruments and core needs creates clusters of triangles. The instruments and mechanisms form the sides or line segments of the triangles. The satisfied core needs are represented by connections positioned at the corners or vertices of the triangles. The line segments fix into these connections.

As more and more instruments and needs are paired, drawing on a wide range of instruments and mechanisms and core needs spanning the entire DRM spectrum, the clusters of triangles join and fold together and a three-dimensional shape emerges. The final resulting structure is made up of the networks of lines or rods connecting circles on the sphere. The individual triangular faces, which can be thought of as development themes and sectors, gain strength from the connections—that is, from the satisfied needs in the form of risk assessment, risk reduction, and residual risk management.

The geodesic sphere also conveys the notion of backward and forward linkages created by the interconnectedness of the different elements in the structure. The linkages stress the power of a coordinated approach whereby planners and policy makers examine the potential interplay between different instruments and mechanisms, both to overcome gaps and obstacles and to build on success. Moreover, the linkages highlight numerous opportunities both to lead and direct change and to spur it from behind. As such, the geodesic sphere delivers the message that there are no fixed rules on the sequencing of application of different instruments and mechanisms to strengthen resilience. Instead, there are many backward and forward linkages between the different tools and outcomes, and, also, many shared entry points and drivers of change.

These instruments and mechanisms are explored in further detail below. A range of both established and innovative tools to strengthen resilience are examined and potential entry points and associated actors identified. No particular instrument or mechanism is necessarily better than another. Their relevance and potential will reflect the context and needs of individual countries and communities and the way in which they are bundled with other instruments and mechanisms. These issues are pursued in further detail in Part II. However, collectively, there are sufficient tools available to ensure that investments in resilience are adequately stimulated, that the necessary investments are acted upon or secured, and that investments in resilience are sustained going forward into the future.

Figure 10 **Building Resilience**



5.1 Stimulating Investment: Policy Change and Innovation

Resilience can be stimulated through initial investments focusing on the incorporation of resilience objectives and incentives into a country's national and subnational development goals, objectives, and overarching planning processes; into its regulatory and legislative frameworks; and into its national and subnational budgetary processes and instruments.

National Development Plans

The goals and objectives laid out in a national development plan drive the focus of public interventions over the life of the plan. The inclusion of disaster risk concerns in these and in longer-term development visions is therefore a critical first step in strengthening investment in resilience.

The preparation of the plan itself creates a natural opportunity, together with resources, to explore disaster risk from a socioeconomic perspective, examining the role of disaster risk in determining development progress.

AFP

Diversion channels being constructed to reduce risk from floods and mudslides. Gansu Province, People's Republic of China

If exploited, this can lead to a development vision and related program of work, incorporating principles of strengthened resilience and stimulating future practical progress in risk assessment, risk reduction, and the management of residual risk (Figure 11). Conversely, if disaster risk is not taken into account, or if plans are not regularly revised to reflect changing risk, national plans can inadvertently exacerbate risks and make future corrections more costly and difficult.

Exploring disaster risk in preparatory scoping work. Analysis of the effects of disasters on recent social and economic performance as part of the initial plan preparation process provides a starting point in integrating strengthened resilience goals into development planning. Such analysis leads directly into an examination of the underlying factors determining vulnerability, possible future trends in disaster risk, and the potential benefits of risk reduction, including gains in poverty reduction. It also helps identify points of entry for initiating specific resilience projects and/or resource allocations. If undertaken at an early stage in plan preparation, this analysis can play an important role in determining broad development directions, objectives, and sector initiatives, seeking both to strengthen resilience and to ensure that the plan does not create new forms of risk. A holistic approach works best, acknowledging the complex, multifaceted nature of vulnerability to natural hazards and supporting analysis and solutions from environmental, social, economic, institutional, and technical perspectives.

Setting resilience goals. Building on the analysis of disaster risk, goals and objectives for strengthening resilience can be established. Reflecting the potentially wide, multisector range of factors contributing to vulnerability, these goals and objectives can be integrated across the full development plan, rather than being dealt with in a more compartmentalized manner. In more hazard-prone countries, resilience can warrant treatment as one of the plan's key crosscutting issues.

Encouraging private sector participation in resilience. The private sector can play a pivotal role in strengthening resilience. National development plans can include a wide array of measures aimed at encouraging and guiding private sector participation.

Figure 11 **Stimulating Resilience through National Development Planning**

Possible actions include the formation of more appropriate legislative and policy frameworks; the introduction of risk reduction technology research and development grants; the establishment of public–private partnerships, incentives, and other financial mechanisms to encourage private sector provision of products that enhance resilience; the establishment of resilience goals for public service provision in which the private sector may play a role, such as the development and operation of roads, ports, airports, power grids, water and sanitation systems, telecommunications, health facilities, and schools; and awareness-raising activities to promote corporate social responsibility engagement. The most promising options can be determined in collaboration with the private sector, learning from and building on solutions to existing obstacles and constraints.

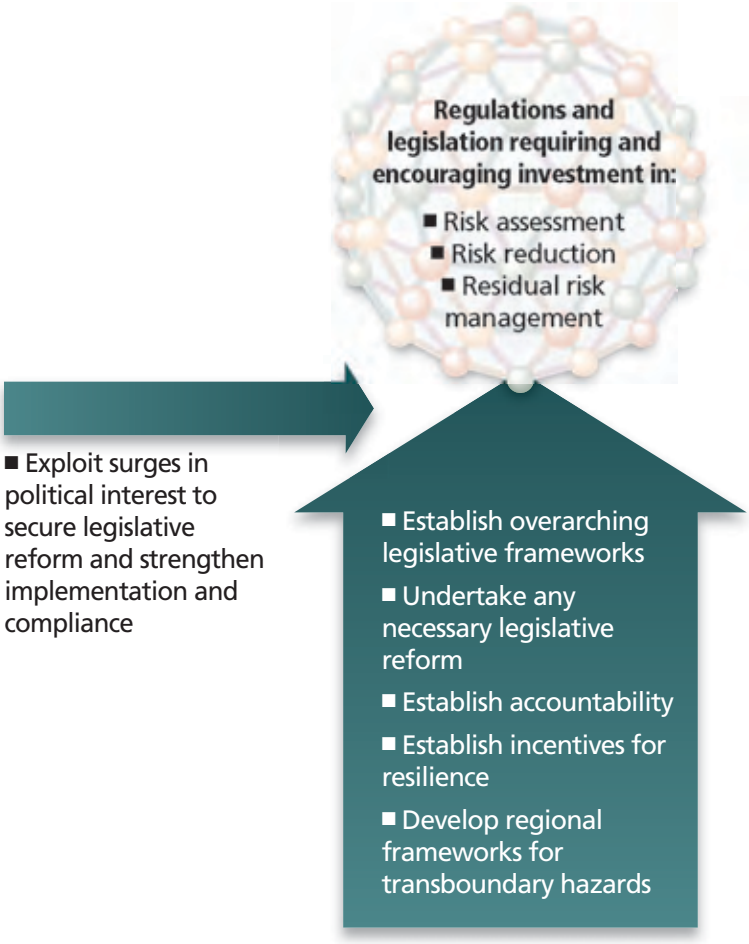
Joining forces with climate change adaptation proponents. Government units working on the overlapping issue of CCA are also working to integrate resilience to natural hazards into development planning. Although typically located in ministries of the environment, which often are not particularly powerful, these units have secured far greater political standing and support than NDMOs over the past few years. Collaboration between the two units—pooling resources, capabilities, know-how, and contacts; working on joint initiatives in areas such as infrastructure and agriculture; and collaborating on the development of a culture of safety and resilience—can accelerate mutual progress toward shared goals for improved management of extreme climate events. Within this longer-term framework, DRR interventions take the form of "no-regrets" minimum levels of adaptation to climate risk, seeking to address immediate risks and thereby, to some degree, alleviating future ones (Box 2).

The private sector can play a pivotal role in strengthening resilience

Box 2 **No-Regrets Strategies and Actions**

No-regrets resilience strategies and actions are strategies and actions that are justified based on current economic, social, and/or environmental costs, benefits, and hazard probabilities, and that help enhance resilience against future climate extremes without requiring any certainty of knowledge about their precise frequency or intensity. Thus, "adding climate change scenarios to 'no-regrets' adaptation is simply a way to make an already solid investment more robust in face of increasing uncertainty" (Bettencourt et al. 2006, 9). No-regrets strategies and actions can be undertaken at any level and by any player, from individual households and businesses, local communities, and nongovernment organizations to subnational and national government agencies and the international community. They can be encouraged through the introduction of various legislative and regulatory changes and incentives.

Figure 12 **Stimulating Resilience through Regulatory and Legislative Frameworks**



Tracking progress in strengthening resilience. The national development plan framework and related results-based management systems provide an important opportunity to track progress in strengthening resilience within a broader development context and to foster accountability for potential disaster losses among a wide range of stakeholders. Ideally, indicators focusing on outcomes will be established, relating to reductions in a particular form or level of disaster loss rather than focusing on inputs. For instance, the Government of the People's Republic of China (2012) has set itself the goal of reducing disaster-related economic losses to less than 1.5% of annual GDP over the course of implementation of its Comprehensive Disaster Prevention and Reduction Plan (2011–2015), compared to a reported average of 2.4% over the previous 20 years.

Regulatory and Legislative Frameworks

Regulatory and legislative frameworks play a vital role in stimulating investment in resilience (Figure 12). Comprehensive DRM legislation, covering issues of ex ante risk reduction as well as ex post response, and reflecting the latest multi-hazard risk assessments, empower national and local governments to implement resilience strategies. In addition to their more obvious roles in establishing the necessary institutional arrangements and resources to implement these strategies, such frameworks also offer important opportunities to establish accountability for different forms and levels of disaster loss across all sectors of society. In addition, they not only require but also incentivize the wider society to take certain measures and actions to protect their individual lives, homes, productive assets, and livelihoods against hazard events.

Establishing overarching legislative frameworks. Overarching DRM legislative frameworks can be developed, coordinating all relevant laws under a single, cohesive structure. Such frameworks may cover a wide array of laws dealing with issues such as emergency preparedness and response, land use planning, building standards, environmental protection, water resource management, financial sector regulation, and climate change.

Undertaking legislative reform. Some reform of existing legislation may be required to remove potential obstacles and proactively promote strengthened resilience. Existing legal and regulatory systems covering insurance markets provide an obvious example. Reforms may be required to strengthen trust in risk transfer products, to improve solvency, to remove obstacles to access to reinsurance markets, and to provide greater incentives for investment in DRR.

Establishing accountability for unacceptable losses. Legislative and regulative frameworks can be used to require regular assessments of risk; to establish acceptable levels of risk; to define clear roles and responsibilities for

reducing risk, preparing for hazard events, providing emergency relief, and undertaking early recovery and reconstruction efforts (shared as appropriate across different levels and sectors of government, the private sector, and individual households); and to establish unambiguous accountability for any losses in excess of acceptable limits.

The assignment of responsibilities and accountabilities should reflect both roles in the creation of risk and DRM service delivery capabilities. For instance, NDMOs often have little capacity for direct implementation of DRR projects and limited funding under their direct control for such actions, regardless of their official DRR mandate. As such, they cannot be held singly responsible for performance in strengthening resilience. Other government agencies can also face difficulties in meeting their resilience-strengthening and other responsibilities, particularly in countries with significant decentralization, where accountability for service delivery may not be supported with adequate operational capacity. Such arrangements can hamper the progress of programs to promote more resilient crop management techniques among farmers, for instance, unless obstacles are clearly recognized and appropriate steps are taken to overcome them.

Under certain circumstances, additional legislative changes are required to ensure that designated roles and responsibilities are accepted. For instance, individual households may require title to their land and property before they are willing to invest in structural risk reduction. Similarly, rent controls may need to be lifted to allow landlords to recoup retrofitting costs before they are willing to comply with building codes (World Bank and UN 2010). Alternatively, tenants may need to be given the legal authority to make changes to their buildings' structure.

Establishing legally binding incentives for enhancing resilience. Legislative and regulatory frameworks can be used to establish mandatory incentives that promote strengthened resilience. For instance, national and local government agencies and individual businesses and households can be required to meet certain DRM standards, such as compliance with building codes and insurance of assets, before being permitted access to post-disaster relief, early recovery, or reconstruction funding. Land use and zoning requirements can be shaped to reward property developers, for instance offering easements on height restrictions and floor area ratios to property developers that adopt strong resilience features. Financial lending institutions can be obliged to require compliance with building codes and disaster insurance before approving mortgage and business loan applications. Related technical assistance can be allocated for capacity development to ensure that financial regulators are appropriately trained and have the requisite technical resources to enforce compliance requirements. Insurance companies can be required to file premium rate and deduction differentials for properties on which DRR measures have been employed; this has been the case, for instance, for residential property insurance in Florida in the United States since 1994 (Ward et al. 2008).

Legislative and regulative frameworks can be used to require regular assessments of risk; to establish acceptable levels of risk; to define clear roles and responsibilities; and to establish unambiguous accountability for any losses in excess of acceptable limits

Developing regional frameworks for transboundary hazards. Regional frameworks can play a key role in managing transboundary hazards. Several relevant nonbinding agreements are already in place, including the 1995 Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin, to which Cambodia, the Lao People's Democratic Republic, Thailand, and Viet Nam are signatories, and the international Hyogo Framework for Action 2005–2015. In 2010, the first binding agreement on the regional management of disasters in Asia and the Pacific came into effect in the form of the ASEAN Agreement on Disaster Management and Emergency Response. This agreement seeks to strengthen cooperation among the 10 ASEAN member states in disaster risk identification, monitoring, technological and scientific research, reduction, preparedness, relief, early recovery, and reconstruction.

Exploiting surges in political interest to secure legislative reform for resilience and to strengthen implementation and compliance. Political interest in resilience in a particular country periodically increases, for instance following a major disaster or a wider rise in international focus. Such moments can be

seized upon to secure the passage of legislative reform, where required, and to strengthen regulations and other implementation and compliance instruments, particularly in countries where previous efforts have stalled. In the Philippines, for instance, work on a long sequence of DRM bills over more than a decade finally came to fruition in 2010, following two severe typhoons that struck the country's capital. In Indonesia, the devastating 2004 Indian Ocean tsunami underlined the urgent need for legislative reform, spurring on a process begun several years earlier and resulting in new DRM legislation in 2007 (Government of Indonesia and UNDP 2009). The current international dialogue on the successor frameworks to the Hyogo Framework for Action and the Millennium Development Goals after 2015 may also create political space for legislative reform and strengthened implementation and compliance in some countries.

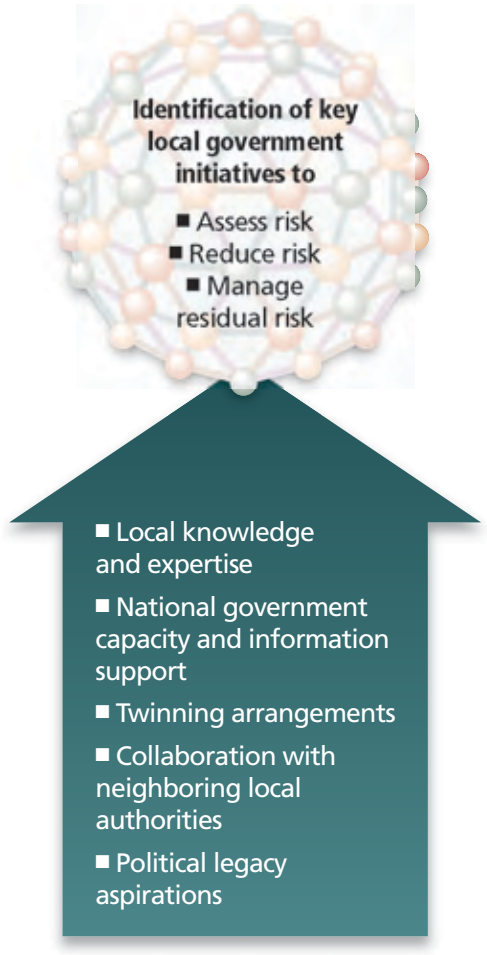
Subnational Policy and Planning Processes

Local governments operate on the front lines of disaster, dealing with localized hazards as well as less-frequent large-scale events. They also bear significant responsibility for implementing DRM policy and central government–initiated legislation, both directly through their own actions and by guiding, encouraging, and enforcing appropriate actions on the part of businesses and households.

In some respects, local governments are well placed to play these roles because they have firsthand knowledge of and experience with disaster risk in the communities they serve. Drawing on this, with national government support, they can stimulate long-term gains in strengthened resilience both for themselves and for their neighbors and hence for the overall national good. However, local governments in hazard-prone areas may have resource and capacity limitations, are sometimes uncertain how much funding they will ultimately receive from the central government, and are less equipped to undertake detailed risk assessments or develop local DRM strategies. In these cases, in consultation with local communities and national experts, local governments can still identify a few key initiatives that are consistent with national policies and targets and local needs and that integrate disaster risk concerns into spatial and development planning. Meanwhile, regional, provincial, citywide, and other administrative units that sit between national government and the lowest level of local government have an essential intermediary role in linking and coordinating national development goals and objectives with locally identified priorities, including those related to DRM (Figure 13). They also provide steady guidance of both public and private (property) development toward greater resilience, influencing ongoing investment in local development.

Drawing on local knowledge and expertise. Local governments have direct access to a

Figure 13 **Stimulating Resilience through Subnational Policy and Planning Processes**



rich pool of knowledge (including indigenous knowledge), experience, capabilities, and perspectives on disaster risk within their local communities. This pool provides a firm foundation for the development of local resilience initiatives. It can be drawn upon through a series of multi-stakeholder and multisector consultations, including discussions with marginalized groups and businesses. Consultations can be important not only as a learning process for local government but also for establishing common understanding, mutual assistance, and shared commitment to moving resilience initiatives forward (UNISDR n.d.). Subnational institutional arrangements for DRM provide access to a wide base of knowledge in many countries as well as to DRM committees typically comprising representatives from all departments of local government, providing a multidisciplinary body with broad collective expertise and experience.

Securing national government capacity and information support. National government agencies can support subnational authorities in translating government objectives into initiatives to strengthen resilience by providing hazard information; by providing training and technical expertise in areas such as hazard mapping and risk assessment; by encouraging the development of local disaster databases; and by establishing financial incentives for subnational government progress in this area. For instance, under its Comprehensive Disaster Prevention and Reduction Plan (2011–2015), the Government of the People's Republic of China intends to establish a disaster information clerk in every rural and urban community and to strengthen disaster reporting and verification systems and the dissemination of disaster information.

Collaborating with neighboring units of subnational government. Horizontal consultation and collaboration among adjacent units of subnational government can play a vital role in the management of shared, cross-boundary hazards and vulnerabilities. Such initiatives can help ensure that individual units of government do not simply transfer disaster risk to their neighbors—by evicting squatters from hazard-prone areas, for instance, which can result in their relocation to hazard-prone locations in neighboring jurisdictions, or by investing in upstream structural flood controls that increase the risk of flooding for downstream jurisdictions. Instead, they can pool resources, know-how, and expertise to address disaster risk for their mutual benefit. They can also help identify cross-boundary issues that may require support from a higher level of government.

Encouraging twinning arrangements. Twinning options—linking hazard-prone cities, municipalities, or provinces with other localities that have relevant resilience expertise, technical solutions, or resources—whether locally or internationally, can help stimulate investment in resilience. For instance, twinning arrangements have already been successfully established to support post-disaster reconstruction efforts in the People's Republic of China, following the 2008 Sichuan earthquake. In that case, financial resources, personnel, and moral support were provided by other parts of the country (International Recovery Platform 2010). International twinning arrangements in a post-disaster context have been promoted more generally by Sister Cities International, under its Humanitarian Assistance Program. Twinning arrangements supporting innovation in ex ante risk reduction and the replication of successful risk reduction policies, instruments, and actions should also be encouraged.

Creating resilience legacies. The formulation of long-term development visions, coupled with aspirations to leave an enduring political legacy, can play a fundamental role in stimulating investment in resilience. The analysis of strengths, weaknesses, opportunities, and threats underlying the development of a long-term vision provides an obvious opportunity to examine disaster risk concerns and develop a subnational government's broad approach to the issue, in tandem with economic and social development considerations. In disaster-prone communities, successful initiatives to strengthen resilience can also constitute a substantial political legacy, benefitting a community for many years to come by, say, reducing loss of life; protecting homes, livelihoods, and community assets; and limiting indirect losses and the secondary effects of disasters. Nationally, such legacies might take the form of land use zoning, revised building codes, or resilient lifeline infrastructure.

Local governments have direct access to a rich pool of knowledge, experience, capabilities, and perspectives on disaster risk within their local communities

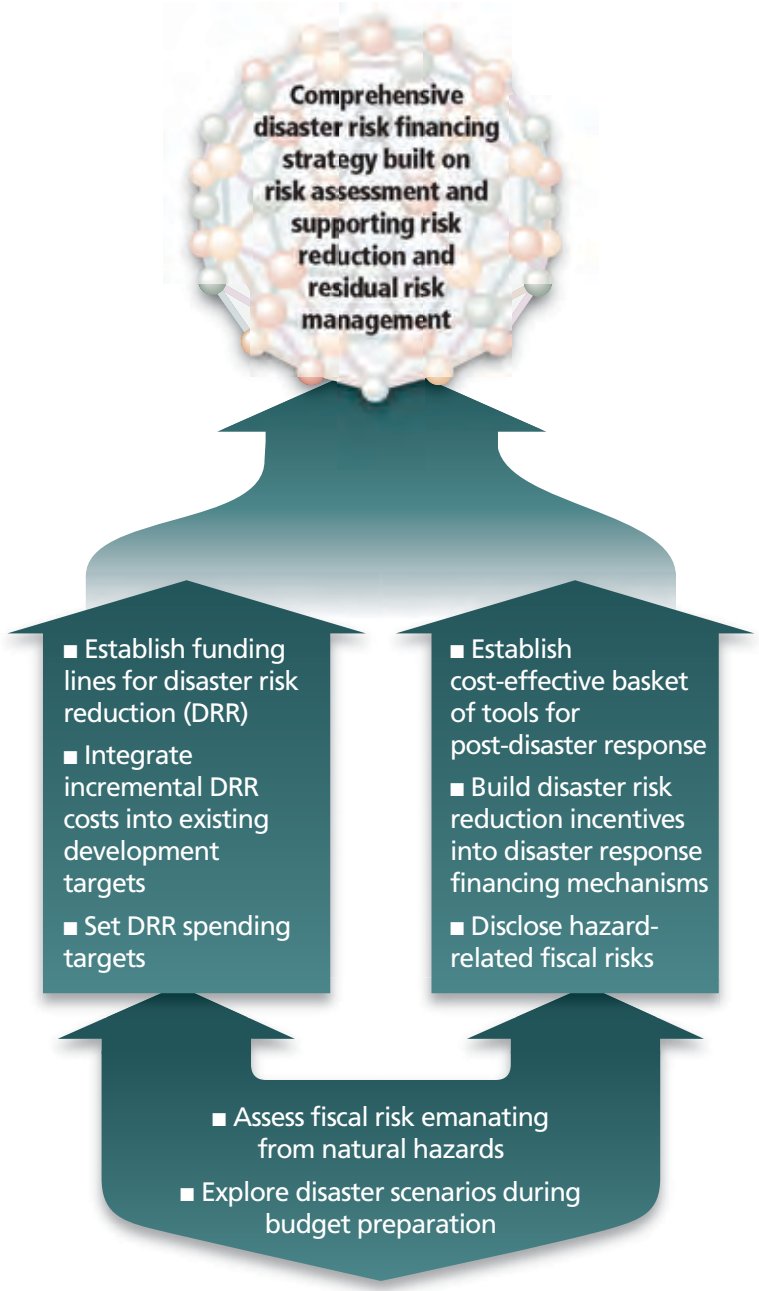
UNDP: Funding is "the ultimate litmus test of government commitment to disaster risk management"

National and Subnational Budgetary Processes

Funding is "the ultimate litmus test of government commitment to disaster risk management" (UNDP 2005, 6). The precise level of commitment (subject to expenditure tracking issues) can be further gauged by the degree to which it adheres to three key principles (Benson 2009; Benson and Mahul, forthcoming):

- Levels of public expenditure on risk reduction are sufficient, relative to the level and nature of risk faced, the expected social and economic returns to risk reduction, and the reasonable responsibilities and obligations of government.
- There are adequate financing arrangements in place to manage the residual risk, manifested in the form of post-disaster relief, early recovery, and reconstruction costs, thereby limiting the indirect impacts to the maximum extent possible.
- Fiscal instruments are used effectively to encourage private sector and household investment in DRR and disaster risk transfer, reducing the contingent liability borne by the government.

Figure 14 **Stimulating Resilience through National and Subnational Budgetary Processes**



Successful performance relative to these three key measures can be secured by developing a comprehensive DRF strategy that incorporates financing instruments to reduce risk and to provide adequate and timely post-disaster support to strengthen the management of residual risk. This, in turn, requires an assessment of the potential hazard-related fiscal risks faced by a government, leading to the development of financing instruments both to limit that risk through ex ante risk reduction measures and to manage the residual risk, thereby limiting the direct and indirect losses and secondary effects incurred as a consequence of natural hazard events (Figure 14).

Assessing fiscal risk emanating from natural hazards. The development of a comprehensive DRF strategy begins with a quantitative assessment of disaster risk, ideally based on probabilistic disaster risk models rather than historical data alone. Models generate estimates of average expected loss and probable maximum losses over defined return periods. National and subnational government contingent liabilities (incorporating "build back safer" principles) can then be set in law, providing clarity on the share, scale, and nature of potential losses borne by government and on the precise

division of responsibilities for disaster risk between national government and local government, on one side, and individual businesses and households (differentiated by income group) on the other. From this, governments can design suitable bundles of financing instruments to support different layers of disaster relief, early recovery and reconstruction efforts, and risk reduction programs.

Exploring disaster scenarios as part of the budget preparation process. The assessment of fiscal risks emanating from natural hazards and related management strategies can be further refined by building disaster scenarios into regular government forecasting exercises. This enables governments to explore in further depth the potential consequences of disasters for macroeconomic performance and budgetary envelopes and to identify potential opportunities to manage disaster risks more effectively via capital investment decisions and DRF arrangements.

Such analysis is rare in Asia and the Pacific but has, for instance, been undertaken by the World Bank for Ethiopia. The World Bank's (2006) macroeconomic forecasting model for the country replaced smoothed average rainfall data with data on interannual variations in rainfall, based on historical records. This adjustment resulted in a doubling of the predicted growth and poverty reduction return on investment in irrigation.

Establishing funding lines for disaster risk reduction. The establishment of dedicated budget lines for DRR initiatives, linked to performance-based incentives where possible, can play a central role in kick-starting investments in this area. At first glance, their creation appears to fly in the face of efforts to integrate risk reduction concerns into development. However, progress in risk reduction has been very poor to date in many developing countries, and short-term incentives leading to the demonstration of the benefits of risk reduction (including retrofitting) can help lead to the ultimate absorption of incremental DRR costs into regular line agency development budgets (Benson, Arnold, and Christoplos 2009).

There are a range of potentially relevant instruments, dependent in part on the extent of devolution of responsibility for DRR activities in a particular country:

- **Dedicated multisector disaster risk reduction budget lines for use by national agencies.** This funding can be used to provide additional resources to strengthen the hazard resilience of approved investment projects. Subsequent demonstration of the net returns to this incremental expenditure, should a disaster occur over the life of the investment, could potentially eliminate the need for such budget lines as sector agencies could become willing to meet such costs directly.
- **Centrally held disaster risk reduction budget lines for use by local government.** Access can be limited to local governments that have established sound DRM initiatives and that are willing to provide matching funding to demonstrate their commitment to risk reduction. Straightforward application procedures and clear guidelines on eligible uses are required to maximize effectiveness.
- **Additional discretionary resource allocations to more hazard-prone areas as part of the annual budget transfer from central to local governments.** Again, this incremental transfer can be linked to performance, requiring evidence of DRM initiatives or strengthened resilience to qualify for support.

In many cases, the creation of dedicated budget lines for local resilience activities is unrealistic, in view of very limited local government resources. However, the use of local contingency funds for DRR purposes is permitted in a few countries. This practice carries the danger that it may leave insufficient funding for disaster relief, early recovery, and reconstruction as and when it is needed, but it could ultimately result in significant savings in post-disaster expenditure in the long term. The Philippines has bypassed this potential problem by establishing a law whereby annual local government disaster relief, early recovery, and reconstruction appropriations can only be used for DRR purposes following the completion of the fiscal year. Unutilized

resources are placed in special trust funds for this purpose, rather than reverting to general government coffers.

Setting national and subnational disaster risk reduction public spending targets. The establishment of spending targets can be a useful tool to promote investment in risk reduction. Delegates at the 2009 session of the Global Platform for Disaster Risk Reduction called for at least 1% of both national development funding and international development assistance to be allocated for risk reduction (UN 2009), and the Fourth Asian Ministerial Conference on Disaster Risk Reduction (2010) called for 2% of development assistance to be assigned for DRR by 2015. Many participants at both meetings also supported the allocation of 10% of humanitarian relief funds for DRR (UN 2009). Whether these goals are reached is in part a question of labeling. DRR spending requirements also vary between countries, implying that different targets may be appropriate in different contexts. Nevertheless, the establishment of global and regional targets can provide extremely useful mechanisms for drawing attention to the often considerable underspending on DRR and for rallying support for increased expenditure. Similar mechanisms can also be explored by local governments.

The establishment of global and regional targets can provide extremely useful mechanisms for drawing attention to the often considerable underspending on disaster risk reduction and for rallying support for increased expenditure

Establishing a cost-effective set of financing tools for post-disaster relief, early recovery, and reconstruction. Both national and subnational governments can establish a range of financing instruments to cover public liabilities associated with the residual risks arising from low-impact/high-frequency, medium-impact/medium-frequency, or high-impact/low-frequency events. These instruments may include an array of tools, linking each layer of risk to the most cost-effective bundle of instruments and combining both ex ante and ex post instruments.

Ex ante instruments entail some form of forward planning and related budgetary allocation in anticipation of a disaster. They include various risk transfer mechanisms, including indemnity and parametric insurance and catastrophe bonds, together with contingent loans and disaster reserves. Ex post instruments involve financing arrangements that are put in place only after a disaster has occurred. Examples include post-disaster budget reallocations, tax increases, deficit financing, or international assistance. Each instrument (with the exception of international grant assistance) comes at some cost, in the form of direct premium or loan repayment costs and/or opportunity costs. The most appropriate bundle of instruments for each layer of loss depends on

- the scale of resources to which each instrument can facilitate access;
- the marginal cost of each instrument;
- the speed with which each instrument can be activated; and
- individual country circumstances, including prevailing macroeconomic circumstances; government economic, fiscal, and monetary goals and objectives; access to international finance markets; and the market-based cost of borrowing.

A more timely response limits the indirect and secondary consequences of disasters. It has even been suggested that governments that adopt a countercyclical response, increasing total public expenditure to support more rapid post-disaster recovery, may limit the long-term indirect and secondary impacts of an event (Melecky and Raddatz 2011).

National governments can explore ways of shifting some of the financial burden of post-disaster spending to their local counterparts, the private sector, and individual households via greater use of loans, enabling governments to fulfill moral and economic obligations to provide post-disaster support while limiting the ultimate public cost. For instance, extensive reconstruction loans were provided under the Government of Japan's Fiscal Investment and Loan Program following the March 2011 Great East Japan Earthquake.

Building disaster risk reduction incentives into disaster relief, recovery, and reconstruction financing mechanisms. Principles of DRR can be embedded in post-disaster financing instruments to reduce future contingent liability. For instance, sovereign contingent credit facilities offered by the World Bank (or the Inter-American Development Bank, in the case of Latin America and the Caribbean) incorporate this principle, with access to financing conditioned

on the establishment and implementation of adequate DRM programs. Similarly, central governments can limit post-disaster support to line agencies or local governments that have made insufficient progress in risk reduction or that do not carry insurance. In Mexico, for instance, only insured public assets are eligible for indefinite repeat reconstruction funding from the Fund for Natural Disasters (World Bank 2012a).

Disclosing disaster-related fiscal risks in budgetary statements. Over the past 2 decades, there has been increasing emphasis on efforts to improve the management of all forms of fiscal risk, through identification and disclosure in public budgeting and accounting and the development of related international standards, codes, and sound practices. Natural hazards pose two basic forms of fiscal risk. First, they have the potential to cause unanticipated changes in the expected performance of key variables upon which public revenue forecasts and spending plans are based. Second, they can trigger contingent liabilities. These can take the form of government obligations with regard to the realization of related public guarantees (most obviously, of insurance programs), reconstruction of public assets, provision of humanitarian assistance, and facilitation of economic stability and recovery.

In practice, full quantification of fiscal risks from natural hazards is a huge task, and the results are probabilistic in nature. Thus, for instance, although the Government of New Zealand is a world leader in accrual budgeting and accounting and the disclosure of fiscal risks— recognizing revenues and expenditure when they are due and consumed rather than when they are received and paid—it only discloses its natural hazard–related obligations to meet any financial shortfalls faced by the Earthquake Commission and specific contingent liabilities relating to disasters that have already occurred. However, even qualitative disclosure combined with a clear articulation of accepted forms and levels of contingent liability represents a big step forward, clarifying the potential cost to the state of natural hazards and giving greater attention to related risks as they are accrued rather than simply when they come to bear (Benson and Mahul, forthcoming).

5.2 Securing Investment: Implementing Resilience

Investment in resilience can be secured by incorporating resilience-strengthening criteria and analysis into the identification, design, and implementation of individual development investments; by fostering household, community, and private sector participation in strengthening resilience; and by harnessing private financing to help fund investments in DRR and to share post-disaster relief, recovery, and reconstruction costs.

Investment Identification, Design, and Implementation

At the heart of efforts to strengthen resilience are investments in individual dedicated initiatives to reduce risk—for instance, in structural flood defenses or in school retrofitting programs. Other development investments can also take disaster risk into account in their design and implementation, to ensure that assets are adequately protected against natural hazards and that the investments themselves do not create new forms of risk.

At the heart of efforts to strengthen resilience are investments in individual dedicated initiatives to reduce risk

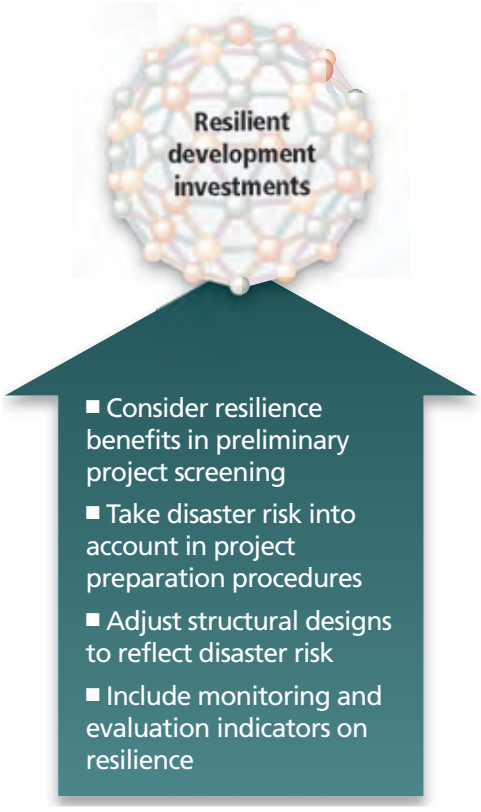
The project cycle includes a number of entry points to explore and act on potential opportunities to strengthen resilience, particularly relating to the initial screening of investment proposals, the detailed feasibility and design phases, and subsequent monitoring and evaluation (Figure 15).

Exploring resilience benefits in preliminary project selection. Most governments screen preliminary public investment project proposals according to a standard set of criteria relating to factors such as cost and employment generation before moving onto

ADPC

Diameter of the reinforcing bar, bending method and joint detailing are all crucial for seismic resistant construction. Dhaka, Bangladesh

Figure 15 **Incorporating Resilience in Individual Development Investments**



fuller feasibility studies for selected initiatives. This process offers an early opportunity to determine which projects contribute to or detract from resilience, if relevant questions are included in the screening criteria. The potential benefits of considering resilience at an early stage of project preparation can be further enhanced by strengthening knowledge and understanding of the risks posed by natural hazards to actual performance against other screening indicators, such as poverty reduction and gender equality.

Taking disaster risk into account in project preparation. Both disaster risk and potential for enhanced resilience can be explored in further depth as part of the detailed feasibility studies for selected projects—for instance, while undertaking an economic appraisal, environmental assessment, social impact assessment, or broader risk analysis (which also covers financial, political, and other risks). The following are some potential options:

- **Stand-alone disaster risk screening and assessment.** Stand-alone disaster risk screening and assessment tools can be established to evaluate risk and to identify any related project design requirements (Box 3). The private sector can also be required to apply such tools.
- **Environmental assessment.** The environmental assessment process can include an examination of the effect of proposed investments on vulnerability to natural hazards in the project vicinity (e.g., the effect on drainage of the construction of a road) and of the potential effect of hazard events on proposed investments.
- **Economic appraisal.** Disaster risk concerns can be integrated into standard economic appraisal procedures, and related training and technical support can be provided, covering analysis of dedicated DRR initiatives and the risk reduction features of other development projects. Guidance is particularly useful on challenges relating to the fact that the estimated flow of benefits will be probabilistic, with actual benefits dependent on the number and scale of hazard events occurring over the life of the investment; that many of the benefits will

Box 3 **Incorporating Resilience into Project Appraisal in India**

In 2009, the Government of India amended the formats for the detailed project report (DPR) and the Expenditure Finance Commission (EFC) memorandum, both key elements of the public investment project approval process in India, to incorporate resilience concerns. DPRs are prepared after proposed projects have secured in-principle approval from the Planning Commission. Accompanying EFC memorandums are also prepared for all public investment projects costing in excess of Rs1 billion ($18 million) and which therefore require EFC appraisal (Government of India 2010).

Following the 2009 amendment, DPRs are now required to include a natural disaster impact assessment (Government of India 2009). EFC memorandums must include an assessment of disaster risk management concerns, should the proposed project involve the creation or modification of structural and engineering assets or a change in land use plans, and must include any related risk reduction costs in the total project cost. All EFC memorandums should also indicate whether the project design is "secured" against natural hazards such as floods, cyclones, earthquakes, and tsunamis (Government of India 2012).

relate to direct physical and indirect losses that will not ensue should the related hazard occur, rather than to expected streams of positive benefits; and that comprehensive risk assessments may not be available for the project locality (Benson and Twigg 2007).

There is an additional challenge relating to the limited appraisal requirements and procedures for many subnational projects, particularly at the lowest level of government and even for smaller-scale national projects, implying far fewer entry points to encourage consideration of resilience concerns. This issue can be tackled to some extent by raising local awareness of the importance of ensuring that investments are both adequately protected against disasters and do not exacerbate existing risk.

Adjusting engineering designs and standards to reflect disaster risk. Community structures such as schools, hospitals, roads, and publicly supported low-cost housing often are built according to standard, one-size-fits-all nationwide design templates. These templates can be adjusted to reflect site-specific considerations, including the local hazard environment.

Including monitoring and evaluation indicators on resilience. Project monitoring and evaluation indicators can be established to gauge progress on the implementation of resilience measures and their degree of success. In an ideal world, particular emphasis would be placed on the degree of success, measuring the outcome of investments in terms of tangible evidence of reduced loss of life, direct physical losses, indirect losses, and adverse secondary effects. However, the design hazard event (for instance, a 100-year flood) may not occur during the life of a project. Therefore, process indicators capturing enhanced though unproven resilience in the form of project outputs and activities may take on more significance. These could measure, for instance, the number of schools constructed or retrofitted to withstand winds or earthquakes of a certain magnitude, or the rates of growth and survival of trees in a mangrove planting scheme intended to provide protection against sea surges (Benson and Twigg 2007). Use of proxies and alternative indicators also may assist in measurement. For instance, the progress of a project aimed at strengthening the drought resilience of poor households may be easier to gauge by monitoring fluctuations in livestock sales or school enrollment than movements in household income.

Fostering Household, Community, and Private Sector Participation

Households, communities, and businesses can play a significant role in strengthening resilience by taking disaster risk into account in their investment behavior and by supporting the public sector in financing investments in resilience (Figure 16). Indeed, they play a role in the creation of risk and therefore bear direct, partial responsibility for its management. They can be encouraged to

become more proactive by strengthening their knowledge and understanding of the business continuity resulting from strengthened resilience and the potential commercial gains from the development and marketing of goods and services that strengthen wider resilience. Tax breaks and incentives can provide further motivation, and financiers can also promote resilience via lending conditions, introduced either by choice or by legislative requirement.

Developing the business continuity case for strengthened resilience. There are a number of opportunities to protect a company's workforce, assets, and supply chains (including power and water supplies) adequately against natural hazards. Individual businesses, ranging from multinational corporations to small enterprises, can take various steps to strengthen resilience, for instance, by ensuring that their physical assets are suitably protected, by maintaining larger input inventories, by installing alternative power supplies (e.g., solar options), and by securing disaster risk insurance. Collaborative public–private forums can be established to map out the potential effect of disasters on business operations and trade in general; to identify key public actions and investments that could be taken to minimize post-disaster disruption to the business sector; and to encourage take-up. Efforts to protect a company's profit margins against disaster can also have wider fringe benefits.

Figure 16 **Fostering Household, Community, and Private Sector Engagement in Strengthening Resilience**

Identifying commercial opportunities in strengthened resilience. The private sector can play a critical role in securing investment in resilience, not only bringing in funding but also an understanding of the market, operating efficiencies, and products and services that will sustain the latest technology and innovative, flexible capacity (Intellecap 2010). There are a wide range of potential commercial opportunities, including infrastructure development, service provision, financial services, and information and communication technology (Box 4).

Governments and the international community can support the private sector in identifying potential commercial opportunities. For instance, they may jointly research and map out the types of companies and sectors in which strengthened resilience is most likely to emerge as a business opportunity. They can also undertake measures to encourage private sector engagement in lower-income segments of the market and in geographically more remote areas, where profit margins may be much smaller and risks much higher but where the need for strengthened resilience may also be much greater. Analysis of likely future growth in these markets as incomes grow may be helpful in attracting commercial interest. In Mongolia, insurance companies continue to participate in the World Bank–supported Index-Based Livestock Insurance program, despite net overall losses to date, because their engagement has resulted in strong brand recognition in rural areas and because the companies have identified considerable growth potential in these markets (Benson 2011a).

Public and community support can also play a useful role in identifying opportunities to link investment in resilience with the immediate generation of household income.

Box 4 Business Opportunities in Strengthening Resilience

In the context of urban climate change resilience, but also of relevance to disaster risk management, a study by Intellecap (2010) identified particular business opportunities in the following areas:

- Microinsurance, including products providing life, asset, and crop coverage
- Waste and sanitation, with particular opportunities in integrated waste management operations, which in part would reduce risk of flooding by unclogging urban drainage systems
- Water management, including provision of water conservation technology such as recycling, rainwater harvesting, and drip irrigation, to provide better protection against drought
- Affordable, hazard-strengthened housing
- Off-grid backup energy solutions, providing individual homes and businesses with alternative energy supplies to overcome disaster-related power grid failures
- Microfinance, helping to build resilience and overcome disaster shocks
- Information and communication technology, facilitating the collection and dissemination of data for use in strengthening disaster resilience and shorter-term preparedness pertaining to, for example, short- and long-term weather forecasts, river levels, and crop, market, price, and job information
- Livelihood promotion, providing services such as vocational education and training and job market information to support vulnerable groups in building skills, thus increasing earnings

For instance, investing in ducks rather than chickens may increase the resilience of income streams in the case of floods. Likewise, switching to more hazard-tolerant crops or seed varieties can increase resilience. Complementary private sector initiatives, such as the establishment of related credit facilities and marketing infrastructure, may be needed to encourage changes in household behavior.

Providing tax breaks and other incentives. Governments can encourage private and household efforts to enhance resilience by establishing an attractive investment climate, including suitable legislative and regulatory frameworks and fiscal incentives. Governments can provide financial grants, subsidized loans, or tax breaks to stimulate the development, marketing, and adoption of risk reduction measures in selected sectors. For instance, they can assist households in securing land tenure by providing land purchase loans or supporting lease negotiation or, as in Pune, India, they might provide property tax incentives to encourage households to recycle wastewater and store rainwater runoff to reduce the risk of severe flooding (UNISDR 2012b). Conversely, penalties and sanctions can be applied to households and businesses that, for example, increase risk by contributing to environmental degradation.

Governments can also provide public goods, such as hazard data and risk models, to reduce start-up costs in developing insurance and other products; to reduce first-mover market research costs; and to boost solvency, for instance, by improving risk assessment. Public sector financial backing of some early products may also be required to demonstrate profitability, and, in the case of insurance products, to ensure financial viability during their early years. For instance, public backing in the form of reserves, contingent loans, or credit guarantees may be required to encourage the development of insurance products. Public incentives to encourage the development of the insurance industry can trigger further incentives for both homeowner and commercial investment in resilience, because insurance often offers one of the most transparent and speedy paybacks on such investment. For instance, moving inventory to an upper floor can be rewarded with an immediate reduction in premiums.

Packages of incentives that seek to encourage small, local businesses as well as large corporations to engage in strengthening resilience can be important. Large corporations are better able to absorb first-mover and start-up costs and often have greater technical expertise. However, local businesses have a strong understanding of the context-specific nature of disaster risk faced by the individual communities in which they live and work; a long-term commitment to those communities, including potentially greater willingness to support community-based DRM efforts, such as clearing drains and waterways, which

Governments can encourage private and household efforts to enhance resilience by establishing an attractive investment climate, including suitable legislative and regulatory frameworks and fiscal incentives

will benefit both themselves and the wider community; and a willingness to persevere in fine-tuning products and marketing arrangements if initial efforts reap too little financial return (Benson 2011b).

Supporting financial institutions in promoting resilience. Investors and financial institutions can potentially play a significant role in promoting DRR and can be encouraged and supported in this capacity. The following are some examples:

- Lending institutions can be obliged to require compliance with land use zoning, design, and building codes, and with disaster insurance requirements before approving mortgage and business loan applications. Homeowners may be unwilling to incur the high up-front cost relative to the small premium discount associated with these DRR investments, but this issue can be overcome by bundling long-term insurance policies and home improvement loans with mortgages, if the reduction in insurance premiums exceeds the annual home improvement loan repayment (Kunreuther and Michel-Kerjan 2010).
- Governments can guarantee loans to low-income households to, for instance, strengthen homes or livelihoods against natural hazards.
- Insurance companies can be required to apply differentiated risk-based premiums and deductibles and to cap coverage below 100% of the value of insured assets.
- Investors can require disclosure of disaster risk by the companies in which they invest, compelling such companies to identify and address risks, minimize them, and ensure appropriate arrangements are in place to manage residual risk (Box 5).

Harnessing Private Financing

Rapid economic and demographic growth has placed enormous pressure on infrastructure in Asia in recent years, potentially limiting future growth and threatening competitiveness, stability, and poverty reduction if the effects of growth are not addressed (ADB and ADBI 2009). A recent paper focusing on 32 ADB developing member countries indicated that these countries alone are expected to need almost $8.22 trillion (in 2008 dollars) for national infrastructure investment in areas such as energy, transport, telecommunications, water, and sanitation between 2010 and 2020, and that an additional $320 billion is required for investment in regional transport, energy, and telecommunications infrastructure (Bhattacharyay 2010). These financing needs are huge and pose an enormous challenge for many developing countries, not least in translating such needs into "bankable," commercially viable, profitable projects that will attract private sector financing. Investments in resilience are no different. Governments must harness considerable private financing to help meet the funding gap for DRR and to share post-disaster relief, recovery, and reconstruction costs.

A number of opportunities to harness funding for resilience are highlighted below, focusing on public–private partnerships,

Box 5 Incorporating Disaster Risk into Corporate Credit Risk Analysis and Disclosure

In 2006, a group of leading institutional investors from around the world released the Global Framework for Climate Risk Disclosure, outlining the climate risk information that investors require companies to disclose in order to analyze their business risk; the commercial opportunities in the form of new products and markets presented to them by climate change; and their efforts to address those risks and opportunities (Climate Risk Disclosure Initiative Steering Committee 2006). The framework contains an assessment of the physical risks posed by climate change, including changes in the frequency and intensity of natural hazards, and related opportunities for adaptation.

Certain initiatives also have been undertaken at a national level. In Bangladesh, for instance, a public–private initiative has been launched to develop environmental risk management guidelines to support financing institutions in assessing environmental risk as part of their credit risk analysis (Asian Tiger Capital Partners 2010).

instruments for accessing financial capital markets and diaspora incomes and savings, and the development of private insurance markets (Figure 17).

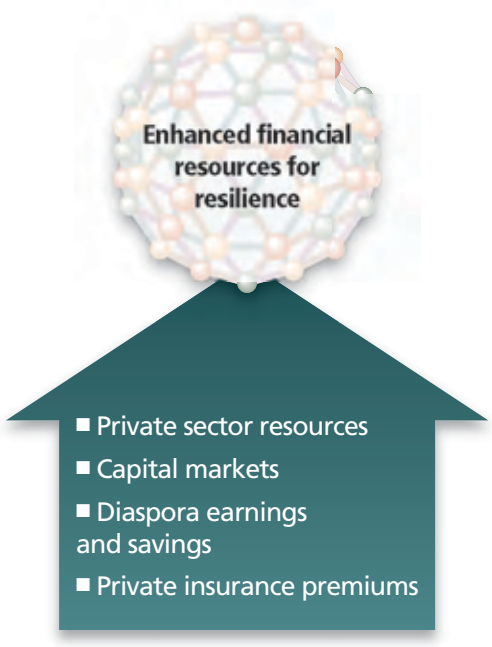
Promoting public–private partnership opportunities in the field of resilience. Significant financing for investment in resilience can be raised through public–private partnerships. Indeed, Asia-Pacific Economic Cooperation ministers and senior government officials, meeting in Hawaii in November 2011, specifically pledged to increase private sector engagement in their resilience agenda through the development of public–private partnerships (APEC 2011).

With a little lateral thinking and consideration of indirect rather than direct opportunities to increase resilience, there is considerable potential for public–private partnerships to generate income in areas supporting strengthened resilience. Opportunities to generate direct revenue exist, for instance, in areas of solid waste management and drainage, which help to address issues of flooding; provision of clean water via seawater desalinization and wastewater treatment plants, which can provide freshwater to drought- and flood-prone areas; and irrigation (including drip irrigation and hydroponics), which supports improved drought and typhoon risk management (by supporting earlier cultivation of crops, ahead of the main typhoon season, as happens sometimes in the Philippines) (Benson 2011b).

Risk reduction and revenue-generating investments can also be combined in a single infrastructure development. This was demonstrated, for instance, by the Stormwater Management and Road Tunnel in the center of Kuala Lumpur, Malaysia, for which a user toll is charged, and the construction of roads on top of dikes in Viet Nam.

As the private sector becomes more generally involved in the development of a significant and increasing share of public infrastructure, it is essential that the public and private sectors work together to ensure that resilience features are incorporated into all infrastructure built through public–private partnerships, where relevant; that risk management plans are put in place over the operating life of these core assets; and that the additional financing required to facilitate these activities is made available. It is anticipated that the private sector will meet around 40% of national and regional infrastructure investment requirements from 2010 to 2020, in part via public–private partnerships (Bhattacharyay 2011).

Figure 17 **Harnessing Private Financing for Investment in Resilience**



Accessing financial markets. Financial markets can provide additional private financing for investment in resilience. Indeed, both ex ante catastrophe bonds and, in high-income countries, ex post reconstruction bonds are already being used to finance post-disaster spending requirements, providing access to international and domestic financial markets. There has also been some discussion about the development of more explicit linkages between disaster risk transfer and risk reduction. For instance, financing raised through the issue of catastrophe bonds could be onward-lent for public investment in DRR. Should the trigger event subsequently occur, investors would be required to forgive the debt and the onward loans would be forgiven, freeing up public resources for post-disaster reconstruction. Should the trigger event not occur during the life of the bond, the principal would be repaid to investors and the lending

With a little lateral thinking, there is considerable potential for public–private partnerships to generate income in areas supporting strengthened resilience

turned into, for instance, a regular multilateral development bank loan.

Further options of potential relevance to investments in resilience are being explored in the context of infrastructure investment more generally. These may take the form of bonds that include guarantees or enhancements to protect investors against various risks (e.g., fluctuating exchange rates, inflation, commodity price risks, credit risk, demand risk, and economic risk); that insulate borrowers from adverse changes in servicing costs; and that are customized to fit the specific needs of lenders and borrowers (Bhattacharyay 2011).

Tapping into diaspora earnings and savings. Diaspora earnings and savings can provide a significant source of financing in support of both risk reduction and post-disaster response. Total developing country remittances are huge, reaching three times the level of official development assistance in 2011, and are expected to rise by at least a further 65% from 2011–2014 alone. Remittances already contribute, indirectly, to strengthened resilience through investments in education, health, higher-quality housing, and livelihood diversification. Remittances also provide a key source of post-disaster financing for many lower-income households, smoothing income and reducing reliance on informal, often highly detrimental coping mechanisms such as the sale of productive and domestic assets and informal sector borrowing. An analysis of 129 countries over the period 1970–2006 found that, in countries where migrants represent around 10% of the origin country's population, total nationwide inflows of remittances increased by $0.50 for every $1 in direct physical disaster losses during the year of a disaster and, during the following year, by a further $1 for every $1 of losses (Mohapatra, Joseph, and Ratha 2009).

Mechanisms supporting the speedy transfer of remittances help maximize their benefits in a post-disaster context. The growth of mobile money accounts—a form of virtual banking with money transferred via mobile phone—is a particularly promising development, overriding difficulties and delays created by the physical destruction of banking infrastructure.

There are potential opportunities to tap diaspora earnings and savings to provide further resources to strengthen the resilience of individual families and the wider community in migrants' countries of origin. Possible products could be developed along the following lines:

- **Migrant disaster risk insurance products.** The fledgling insurance market for migrants, offering coverage against disruptions in flows of remittances (e.g., as a consequence of loss of job or death) and shocks faced by migrants' families in their country of origin (e.g., as a result of illness), could be extended to include products providing cover against natural hazards in a migrant's home country (Powers, Magnoni, and Zimmerman 2011).
- **Diaspora reconstruction bonds.** In the wake of the 2010 Haiti earthquake, there was some discussion about the extension of diaspora bonds for reconstruction purposes (see, for example, Ketkar and Ratha 2011; World Bank and UN 2010). Diaspora bonds are already used by some governments—including the Government of India—for development purposes, enabling governments to access a relatively cheap source of external borrowing in the form of patriotic nationals' wealth accumulated overseas (Ketkar and Ratha 2007). Overseas nationals are willing to purchase these bonds due to a combination of patriotic sentiment and a desire to contribute to the development of their country of origin while simultaneously diversifying their personal assets and improving their risk management. The potential value of such bonds in a post-disaster reconstruction context would depend in part, however, on the speed with which they could be issued.
- **Diaspora catastrophe bonds.** Diaspora securities along the lines of catastrophe bonds could be issued prior to a disaster event, offering higher rates of interest than those available under more traditional diaspora bonds.
- **Community disaster risk reduction funds.** Mechanisms could be established to secure flows of remittances for DRR initiatives that would benefit migrants' communities back home. For instance, remittances could be transmitted

through migrant organizations such as hometown associations, which are formed by migrants from a specific region or town in the country of origin. Hometown associations already facilitate the flow of collective remittances to support infrastructural and community-development projects as well as social purposes in the community of origin (Adams et al. 2012).

Encouraging the growth of private insurance markets. Increased penetration of private disaster risk insurance can be encouraged and supported to spread and smooth the cost of disaster recovery and reconstruction over time and to reduce public contingent liability in the event of a disaster. Parametric products can overcome some of the problems associated with traditional indemnity insurance, such as moral hazard, adverse selection, and high administrative costs. However, they still carry potential challenges related to affordability and covariant risk, and also present issues of basis risk.

5.3 Sustaining Investment in Resilience: Strengthening Capacity and Capabilities

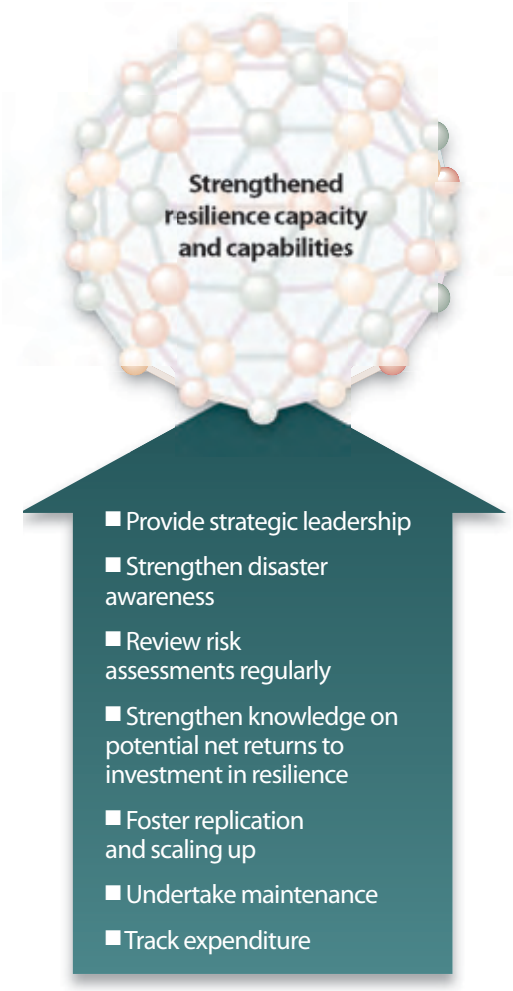
There are various instruments and mechanisms that can be applied to ensure that efforts to stimulate and secure investments in resilience result in sustainable outcomes and that resilience remains a key focus of governments, civil society, and the private sector (Figure 18). They include efforts to position DRM leadership strategically within government; to maintain and strengthen disaster awareness; to ensure that resilience strategies and initiatives are informed by up-to-date analysis and data on disaster risk; to strengthen knowledge on potential net returns on investment in DRR; to foster replication and scaling up of successful resilience initiatives; to keep public and private infrastructure in a good state of repair; and to track expenditure on both DRR and relief, early recovery, and reconstruction.

Providing strategic disaster risk management leadership. NDMOs can be strategically positioned to strengthen their capacity to spearhead the drive for enhanced resilience across all relevant sectors and levels of government. In many countries, the ministry of planning may provide a good platform for this purpose. However, this may make NDMOs less effective in performing their other key role in emergency response. A compromise could be to place NDMOs in the ministry of planning, but with the provision that the office of the prime minister (or the equivalent), which is one of the more traditional homes for NDMOs, would assume command during disaster periods. Such changes in institutional arrangements can take many years to implement, however. In the shorter term, disaster risk focal points can be created in individual agencies to guide sector-specific resilience initiatives, to provide related technical support, to share information, and to help facilitate a coordinated approach across the government. For instance, disaster focal points have been established in key national government departments in Nepal (Benson, Gyanwaly, and Regmi 2009).

ADPC

Capacity building and strengthening disaster awareness among communities is essential for sustaining investment in resilience. Bangladesh

Figure 18 **Sustaining Resilience via Strengthened Capacity and Capabilities**



Well-placed high-level political champions can play a key role in galvanizing commitment

Looking beyond formal institutional structures, well-placed high-level political champions with relevant expertise and knowledge and a deeply ingrained passion for strengthening resilience can play a key role in galvanizing commitment to the issue. To date, such champions are few and far between, reflecting the wide-ranging, multidisciplinary demands of the position.

Strengthening disaster risk awareness. Continual public education and awareness-raising initiatives can be conducted to improve levels of knowledge and understanding of disaster risk and thus to foster commitment to resilience-strengthening measures. A four-pronged approach is particularly effective, combining campaigns, participatory learning initiatives, informal education, and formal school–based interventions, using a wide range of tools, publications, curricula, modules, presentations, e-learning, performing and cultural arts, games and competitions, audio and video materials, web pages and activities, and social media and telecommunications (IFRC 2011).

In localities that have not experienced a major hazard event for many years and where memories of the last event have faded, the very real prospect of a future event needs to be kept firmly in mind. This helps ensure that the purpose of land use zoning, building codes, insurance, and other resilience-enhancing measures is firmly understood and supported. Indeed, awareness-raising initiatives are likely to become ever more important in countries where disasters occur less and less frequently, as a consequence of overall success in strengthening resilience, but where major disasters will still periodically occur. These endeavors need to strengthen societal knowledge of both local and national risk.

The frequency and intensity of high-frequency local risks also need to be carefully monitored. Changes in frequency and intensity may be almost imperceptible year on year, but if watched over a period of several years may reveal an underlying upward (or downward) trend. If any such trends are identified and understood at an early stage, they can be redressed accordingly.

Reviewing risk assessments regularly. Risk assessments, including local vulnerability and capacity assessments, individual business risk assessments, and public disaster-related fiscal risk assessments, can be reviewed and, where necessary, revised and re-disseminated on a regular basis to ensure that DRM and DRF strategies, legislation, and individual risk management actions reflect the best available information. Vulnerability exposure and, due to climate change, hazard intensity and frequency are changing over time, altering disaster risk and thus the most appropriate forms of intervention. Scientific modeling capabilities are also improving, enabling better estimation and thus better management of disaster risk.

Strengthening knowledge about potential net returns on investment in resilience. Knowledge about the cost of measures to enhance resilience and their potential net returns can be considerably expanded and strengthened to encourage the uptake of resilience measures. Existing cost–benefit analyses can also be collated and placed in the public domain. Ex post analyses can be undertaken to examine how more- and less-hazard-resilient structures performed in the event of a disaster, and to compare the cost of ex ante strengthening with the cost of post-disaster reconstruction.

The cost of strengthening individual development investments against natural hazards may be as low as an additional few percentage points on the baseline cost of construction. For instance, much of the cost of earthquake design is incurred in making the structural frame more robust through the use of additional materials, such as extra reinforcing steel and concrete. In East Asia and the Pacific, this is estimated to add only around 2%–4% to the overall cost of construction (Global Facility for Disaster Reduction and Recovery 2010). The cost of longer-term "climate proofing" may be a little higher. Internal evaluations by ADB suggest that the costs of longer-term climate risk management on projects subject to climate change risks are likely to range from 5% to 15% of total investment costs.

Little can be categorically stated about the net returns on various types of resilience investment, because the existing body of evidence is too limited to draw basic rules of thumb. Net returns vary according to a host of local demographic, socioeconomic, geographic, and other factors and, of course, are relative to the frequency and intensity of the natural hazard(s) faced (Benson 2010) (Table 4). The choice of discount rate is also critical in determining the results of the analyses. However, further research, backed by the development of simplified methodological tools for this purpose, would generate some broad yardsticks, providing a more solid basis for rational decision making about investment in resilience during preliminary project design and development.

Fostering scaling up and replication. Scaling up and replication of successful initiatives can be encouraged and supported through documentation and dissemination campaigns, coupled with suitable financing mechanisms and legislative reforms. Local governments, community-based organizations, and NGOs have accumulated numerous local success stories about strengthening resilience, but they often need support to expand into new communities.

The power of demonstration, showing how particular interventions have reduced losses from subsequent disasters, is enormous. Even before an event occurs, there are opportunities to encourage sharing and replication. The steps followed in the identification, design, and implementation of an initiative, including how funding was secured, and the methods employed to overcome barriers and obstacles, can be documented either on paper or by camera, and lessons learned and (expected) benefits can be clearly detailed.

Undertaking routine maintenance. A country's resilience to natural hazards can be considerably enhanced by increasing levels of funding for routine maintenance. For instance, maintenance funding could be increased by raising annual budget appropriations for this purpose, by setting aside for subsequent maintenance purposes a portion of international development partner support for a particular project or, where appropriate, by drawing on user fees, tariffs, and other mechanisms. Poorly maintained infrastructure—whether homes, factories, or public assets—are far more vulnerable to natural hazards, potentially escalating post-disaster reconstruction costs far beyond the ex ante cost of minor repairs. Adequate maintenance is particularly paramount in the case of schools and other community facilities that double as evacuation centers in the event of a disaster.

Tracking disaster-related public spending. National and subnational governments and the international community can establish tracking systems to monitor and coordinate expenditure on DRR and relief, early recovery, and reconstruction response; to help facilitate structured, evidence-based decision making with regard to the relative balance and nature of risk reduction and post-disaster expenditure; to compare patterns

The cost of strengthening individual development investments against natural hazards may be as low as an additional few percentage points on the baseline cost

Table 4 **Benefit-to-Cost Analysis of Investments in Resilience in Asia and the Pacific**

Country	Hazard	Intervention	Benefit-to-Cost Ratio	Notes on Benefit-to-Cost Ratio
Fiji	Flood	Warning system for the town of Navua	3.7–7.3	Exact ratio depends on the frequency of major floods on the scale experienced in 2004 over the 20-year life of the warning system
Indonesia	Flood	Strengthened resilience of housing	2.7–6.73	Exact ratio depends on assumed life span and rate of discount
Indonesia	Flood	Integrated water management and flood protection scheme for the city of Semarang	2.5	
Nepal	Flood	Range of community-based interventions	3.49	Retrospective benefit-to-cost ratio
Philippines	Flood	Hanging footbridge over river connecting two communities, sustaining economic activity and access to schools and health centers during floods	24	
Samoa	Flood	Improved flood forecasting system for a river catchment	1.72–1.92	Exact ratio depends on the choice of discount rate
Samoa	Flood	Strengthened resilience of homes	4–44 and 2–28	4–44 for the construction of new wooden homes with elevated floor heights; 2–28 for cement block homes
Thailand	Typhoon/ flood	5- to 7-day typhoon forecasts, facilitating the early harvest of crops	1.76	Based on ex post analysis of crop losses arising from floods in 2006 alone
Viet Nam	Typhoon	Mangrove planting program in eight provinces	55	Based on direct comparison of cost of planting program and reduced annual cost of dike maintenance over the period 1994–2001
Multi-country	Multi-hazard	Swiss Agency for Development and Cooperation spending of around $10 million per annum in recent years on activities covering the five Hyogo Framework for Action 2005–2015 priorities	4–to–7	Estimates based on benefits in terms of increased safety

Source: Hochrainer-Stigler et al. (2011); Holland (2008); IFRC (2002, 2009); Mechler (2005); Subbiah, Bildan, and Narasimhan (2009); Swiss Agency for Development and Cooperation (2011); White and Rorick (2010); Woodruff (2008).

of expenditure against national, subnational, and local DRR and relief, early recovery, and reconstruction priorities; to identify any critical gaps in funding; to help evaluate the performance of mechanisms for raising financing; and to hold governments and the international community accountable for their actions (Benson 2011b).

Simplified tracking systems that provide a broad gauge of disaster-related spending are perfectly adequate and help overcome some of the complexities of recording relevant expenditure down to the last dollar across many government departments. All development initiatives can simply be tagged as dedicated DRR projects, projects that incorporate DRR

features at some additional cost, projects that contribute to DRR at no additional cost, and other projects (Benson, Gyanwaly, and Regmi 2009).

Various initiatives are already under way to determine public spending on DRR, including pilot work undertaken with ADB and UNISDR support in India, Indonesia, and the Philippines. In parallel, in 2005, the Development Assistance Committee of the Organisation for Economic Co-operation and Development introduced a new subcategory on disaster prevention and preparedness in its official development assistance reporting system and, in 2010, introduced a CCA marker against which donors will assess new aid activities.

There also has been some progress in tracking post-disaster expenditure and building related national capacity, notably by the United Nations Development Programme, in consultation with ADB and others, in Indonesia, Republic of the Maldives, Sri Lanka, and Thailand following the 2004 Indian Ocean tsunami, and by the Government of the Philippines following two devastating typhoons in 2009. These initiatives need to be institutionalized into more permanent systems, as is already planned in the Philippines (Benson and Mahul, forthcoming).

Part II

Visions of the Future: Overcoming Gaps and Obstacles

Part II embeds the largely theoretical discussion and ideas presented in Part I into on-the-ground realities in much of Asia and the Pacific through the use of a series of hypothetical stories of successful investment in resilience. The stories are developed using a backcasting approach. Each story begins with a vision of a desirable resilient future. This vision is translated back into possible steps and measures that could be taken to realize the vision. The approach draws individual instruments and mechanisms suggested in Part I together into broader packages of action designed to overcome specific gaps and obstacles and to strengthen resilience.

The first chapter focuses on strengthened resilience for a nation, a city, and a household. It presents a series of fictitious first-person narratives written from the perspective of the head of a national disaster management office (NDMO), a city resident, and a poor farmer. Each person reflects on their disaster experience and the steps taken to strengthen resilience over a 20-year period. The second chapter considers five development themes and sectors where efforts to strengthen resilience are crucial: land use planning, transport, livelihoods, education, and housing.

The backcasting approach, combined with the related analysis of existing gaps and obstacles, reveals a wide variety of potentially useful instruments and mechanisms that could be applied to strengthen resilience. It also highlights an intricate network of backward and forward linkages between the different instruments and outcomes, and many potential pathways toward strengthened resilience. No particular instruments or pathways necessarily are better than others. Choices must be made in the context of desired outcomes; prevailing circumstances, including key gaps and obstacles; resource availability; and specific opportunities to effect change. The advantage of this approach is that it encourages planners, policy makers, and international development partners to explore this bigger picture, examining the potential interplay between individual actions. It thereby supports the design of broader resilience strategies and mutually supportive bundles of actions that collectively enhance the sum of parts.

AFP

Raised rural roads can keep transport networks functioning during heavy rains. Manipur, India

6 Introduction: The Backcasting Approach

Part II examines the seemingly simple but as yet largely unanswered question posed at the start of this report: How can we ensure that the actions that we know are required to strengthen resilience are actually taken? We know the gaps and obstacles to investment in resilience and we have many instruments and mechanisms at our disposal to overcome them. Yet, in reality, progress in strengthening resilience has been far too slow.

The answer to this question is explored through a series of hypothetical stories of successful investment in resilience. These stories are told from the perspective of a range of development themes and sectors and levels of administration, based on a backcasting approach. Each story is based on a vision of a desirable resilient future. This vision is then translated back into the steps and measures that had to be taken in order to achieve it. This backcasting approach is applied in an extremely loose sense. It is used to explore what could hypothetically happen if some of the most fundamental gaps and obstacles to strengthened resilience were overcome. The fact that the stories tell of no failure, which is perhaps an issue for some, reflects not a lack of failures in reality but, rather, an abundance of opportunities.

The backcasting approach is intended to stimulate more unified thinking and action. Individual instruments and mechanisms are often designed to address a particular gap or challenge but may encounter other gaps and challenges during implementation that limit their success. Backcasting helps planners and policy makers to explore the bigger picture and to examine the potential interplay between

How can we ensure that the actions that we know are required to strengthen resilience are actually taken?

Box 6 **Defining Backcasting**

The backcasting approach seeks to determine how to attain desirable ends or visions of the future. It focuses on these visions, rather than on present conditions and current trends, seeking to work backward from visions of the future to the determination of their feasibility and the policy measures required to achieve them (Robinson 1990). Unlike the more traditional forecasting approach, which is based on an extension of dominant trends to determine futures, backcasting assumes a potential break in existing trends and may even actively encourage such a break, analyzing and determining how undesirable futures can be avoided (Dreborg 1996; Robinson 1990).

Differences between Forecasting and Backcasting Approaches

	Forecasting	Backcasting
Philosophical views	Causality Determinism Context of justification	Causality and intentions Partial indeterminacy Context of discovery
Perspective	Dominant trends Likely futures Possible marginal adjustments How to adapt to trends	Societal problem in need of a solution Desirable futures Scope of human choice Strategic decisions Retention of freedom of action
Approach	Extrapolation of trends into the future Sensitivity analysis	Defining of interesting futures Analysis of consequences and conditions for these futures to materialize
Methods	Various econometric models	Partial and conditional extrapolations Normative models System dynamics models
Techniques	Various mathematical algorithms	Delphi methods Expert judgment

Source: Dreborg (1996).

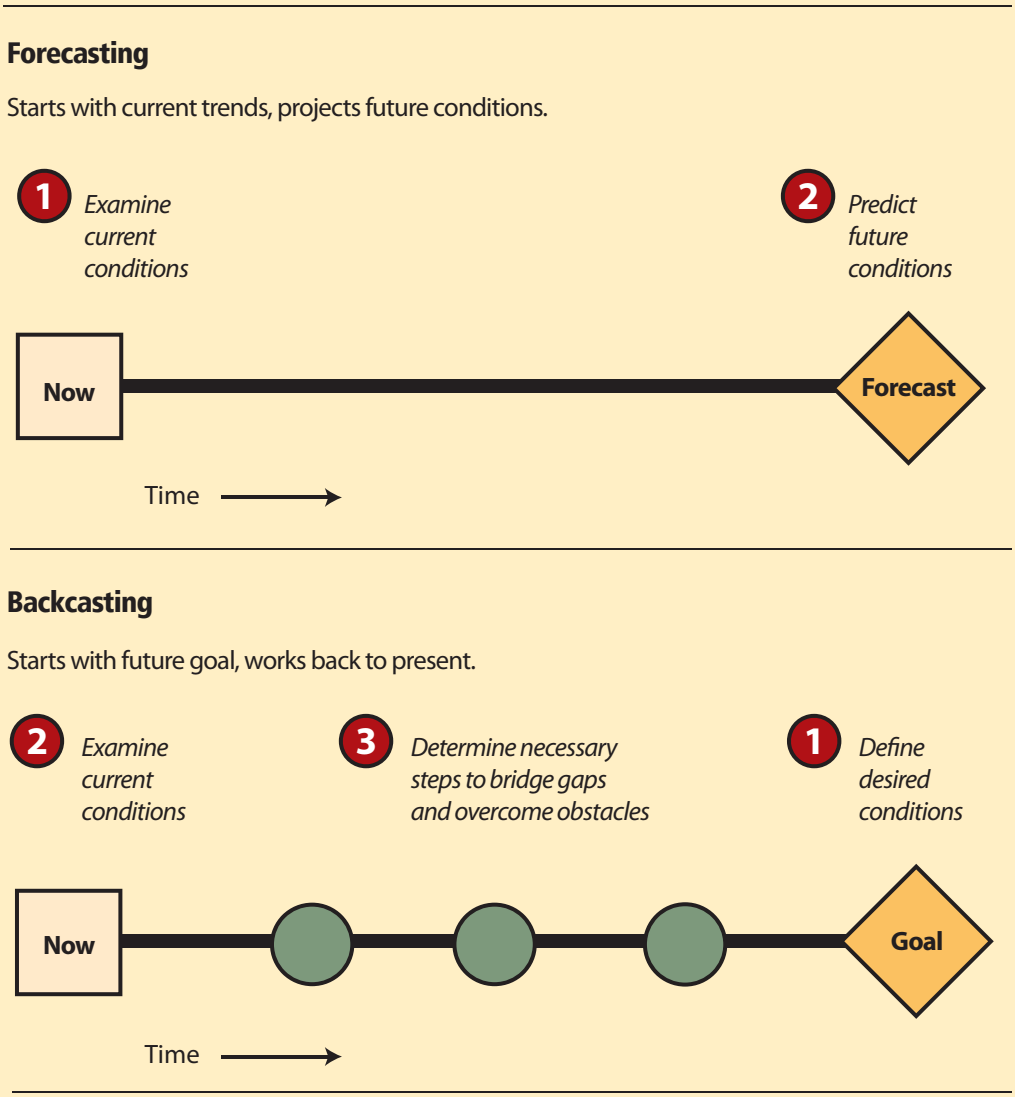
The backcasting approach may call into question some existing assumptions by providing new information and may thereby open up new options for resolving existing problems and obstacles. It should largely be judged in the context of discovery and the generation of new ideas rather than in the context of justification, in which ideas are employed and scientific results are validated (Dreborg 1996; Geurs and van Wee 2004).

Backcasting is typically applied to complex and important long-term issues involving many aspects of society, together with technological innovations and change (Dreborg 1996). The following situations favor a backcasting approach (Dreborg 1996):

- The problem at hand is complex, affecting many sectors and levels of society.
- Major change is necessary.
- Dominant trends form part of the problem.
- Externalities that the market cannot treat satisfactorily form a central part of the problem.
- A sufficient time horizon is available to allow considerable scope for deliberate choice.

different instruments and mechanisms (Box 6). This facilitates the development of bundles of mutually supportive tools, which together can overcome key gaps and obstacles and create synergies that enhance the sum of parts. In other words, it supports the design of wider resilience strategies as well as individual tools and mechanisms of relevance (Figure 19).

Figure 19 **Backcasting Approach**



AFP

High embankments built to prevent overflow of water from the Chao Phraya River. Thailand

7 Journeys to Resilience: The X Stories

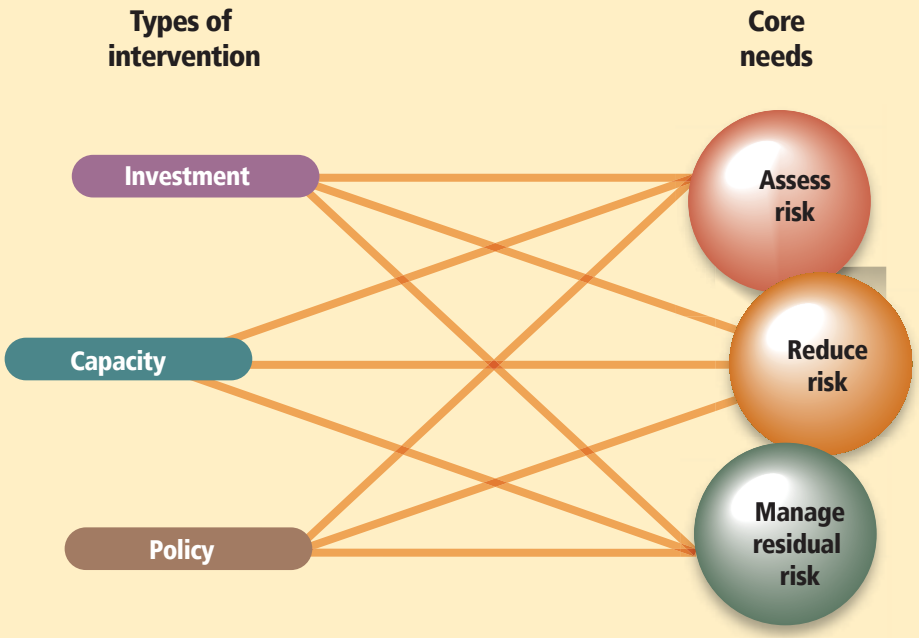
Looking back on success in investing in resilience can help reveal not only what happened but also why and how. Hypothetical stories of change are developed below, focusing on varying geo-administrative scales and told by imaginary actors. The stories capture progress in strengthening resilience at the country, city, and family levels. Various gaps and obstacles to strengthened resilience are identified and each, in turn, is overcome through successive actions and interventions. The backcasting approach is applied, translating visions of the future into the steps and initiatives that needed to be taken for them to be achieved.

Seeing the way forward by looking back is good. Countries, cities, and families have had and will continue to have success in strengthening their resilience by using a combination of their own and outside resources. These resources are packaged as policy, capacity development, and investment interventions. They address requirements relating to the three core needs in investing in resilience: risk assessment, risk reduction, and residual risk management (Figure 20).

In practice, individual governments, local authorities, and households may have far less capacity and far fewer financial and human resources to implement the measures needed to strengthen resilience than is suggested in the stories presented below. They will have to prioritize limited resources, also taking other, non-disaster–related demands into account. They may have to overcome a range of indirect challenges to strengthening resilience created by weak national or local governance, including poor policy formulation, weak implementation of approved physical and development plans, inadequate institutional structures, limited

The backcasting approach translates visions of the future into the steps and initiatives that needed to be taken for them to be achieved

Figure 20 **Matching Core Needs and Interventions**



transparency, and poor budget management. Moreover, they may have to contend with issues of political disincentives, corruption, and illegal economic activity, all of which can directly challenge efforts to reduce disaster risk.

Mechanisms for addressing some of these gaps and obstacles are explored further below in the context of specific development themes and sectors. Ultimate progress in overcoming them will depend on the existence of sufficient formal and informal political and economic incentives for strengthened resilience at all levels of government and wider society. The role of different stakeholders in creating risk, the extent and precise nature of interest of different stakeholders in strengthening resilience, and their relative positions of power will influence outcomes. In the shorter term, charismatic leadership will be important too, be it, say, at the forefront of government or the helm of a concerned citizen group.

The stories presented below also provide just a few brief glimpses, or vignettes, of potential paths of change. The actual choice of actions and their order of sequencing are likely to vary between one context and the next, in part dictated by the specific opportunities that arise to shift interests, to incentivize key players, and to alter the workings of government and wider society. These opportunities may take many shapes and forms. They may arise in the guise of, for instance, a disaster event itself, an electoral campaign, policy reform, the overhaul of a government's budgetary management system, or a socioeconomic research initiative. Whether or not each opportunity results in change will also depend on capabilities at many different levels of government and society to recognize potential opportunities and to act upon them.

7.1 A Country's Journey to Resilience: A National Disaster Management Office Director's Experience

I have been the director of the National Disaster Management Office in Country X for many years. It is an extremely challenging, often highly rewarding job. My country is one of the top 10 most disaster-prone countries in the world. It experiences a wide range of natural hazards, including floods, tropical typhoons, droughts, landslides, and earthquakes. The largest city and major center of economic activity is located on the coast, whereas our capital city is located inland, on a major fault line. We have experienced rapid urbanization in recent years, and the urban population is expected to double again over the next 50 years. One-quarter of the urban population is already located in informal settlements. Growth in these settlements is outpacing total urban growth.

The Hazardscape Today

After much hard work on the part of the NDMO and some colleagues in key agencies, my country adopted a comprehensive disaster risk management (DRM) strategy 3 years ago, just a year after a major flood event caused significant socioeconomic disruption (Box 7). When the strategy was adopted, I was euphoric, believing that this marked the beginning of an entirely different approach to DRM in Country X. However, 3 years have passed and the supporting legislative and regulatory framework still has not been approved because it is simply not regarded as a political priority. We did manage to get the need for strengthened resilience mentioned in the latest medium-term national development plan, but only at the 11th hour and in the form of a few stand-alone actions, mainly covering structural flood and storm control and post-disaster support to vulnerable groups. It was not the integrated approach across the full spectrum of development that we had envisaged in the DRM strategy. Our disaster risk financing (DRF) arrangements are very weak, too, relying largely on ex post budget reallocations in the event of relatively frequent lower-impact events, and on the international community for support in the aftermath of major disasters. Meanwhile, public expenditure on risk reduction is low across all levels of government.

The NDMO is located in the Ministry of Home Affairs. It is still only staffed by emergency responders, despite the fact that we have made a number of requests to create some disaster risk reduction (DRR) positions. A climate change adaptation (CCA) unit has been established in the Ministry of Environment, but despite some clear overlap with our own agenda, we have very little engagement with them, operating instead along parallel structures. The local authorities have extremely limited DRM or CCA expertise beyond what has been gained from our disaster response training programs.

Compliance with building codes and land use planning is poor, and in all honesty, neither set of regulations is sufficiently rigorous with regard to disaster risk. A system of accountability for disaster losses is nonexistent. Environmental regulations require consultation of hazard maps in designing new investments, but this requirement is only partly observed at the local level. According to a Ministry of

AFP

A construction worker reinforces a school building. Hefei, People's Republic of China

Box 7 **Recent Flood Experience**

I recall vividly how nonstop heavy rains submerged low-lying areas and floodplains in a number of provinces during a major flood that my country experienced 4 years ago. Our emergency center received numerous calls from people stranded on the roofs of one-story dwellings after floodwaters rose too rapidly for them to evacuate. The floodwaters reached almost 2 meters in some areas. Roads were impassable in many areas; shops and stores were flooded; potable water, food, and medicines were all in short supply; and daily lives were severely disrupted.

Recovery from the flood was a struggle, too. Requests for relief and reconstruction assistance poured into our office from regional governments but we were simply unable to meet them in full. Instead, the government's capital investment budget had to be realigned over a period of several years to accommodate the reconstruction needs. The reconstruction program has only just been completed. These funding issues have substantially prolonged the effects of the flood.

More generally, our country is struggling to meet certain Millennium Development Goals, in part because of the intermittent effects of disaster events. For example, loss of school facilities, livelihoods, and income has compelled a number of parents to pull their children out of the education system following disasters. In some cases, children were pulled out to help supplement household earnings and to save money by avoiding schooling expenses (transport, uniforms, books, and other fees); in other cases, it was simply because there is no access to any school within a reasonable distance. The subsequent decline in the total net enrollment ratio in primary education has set back progress toward achievement of the Millennium Development Goal of universal primary education. The losses caused by intermittent disasters are also hindering our progress toward other Millennium Development Goals, including those on poverty reduction and access to clean water and primary health care.

Planning colleague I spoke to recently, disaster risk is hardly mentioned in any of the other government guidelines and procedures on the identification or appraisal of new investments.

Incentives to invest in resilience are not as good as they could be, either. Although we do not have sufficient funding for post-disaster relief, recovery, and reconstruction, expectations of such assistance are limiting household, community, private sector, local government, and even national government investment in resilience, together with the use of risk transfer and other DRF tools.

The private sector has supported post-disaster relief in a corporate social responsibility capacity but has little apparent appreciation of potential commercial opportunities in the field of resilience. We have not had the resources to encourage private sector involvement in resilience nor to scale up some apparently very successful community-based resilience initiatives.

The Hazardscape, 15 Years On

Fourteen years ago, tragedy struck our country again. A moderate earthquake with a shallow epicenter killed thousands of people, damaged houses and buildings, and led to significant economic losses. The earthquake was a powerful driving force that finally compelled my country to enact comprehensive DRM legislation, reform certain aspects of existing legislation touching on aspects of DRM, bring all disaster-related laws under a single framework, and establish clear accountability for disasters, shared across the national and local governments, the private sector, and individual households.

We finally saw the emergence of a resilience champion who drove these changes—a dynamic legislator whose district had previously worked with an international nongovernment organization (NGO) to implement an affordable earthquake-safe housing program. The benefits of this program were amply demonstrated when the earthquake struck; many lives in her district were saved. Along with getting the new disaster law through 3 years later, the legislator promoted a successful campaign to replicate the retrofitting program nationwide and to build back safer in the earthquake-affected areas. The campaign has received considerable financial and technical support from several local building supply companies that, in turn, have benefited from government endorsement and free promotion of their products. It has received considerable public support as well

because the potential benefits have already been so clearly demonstrated.

The legislator also spearheaded a cross-party investigation to determine why so many lives were lost in schools and other community facilities as a consequence of the earthquake. This resulted in a major schools and hospitals retrofitting program with international support.

Looking to achieve yet further change in strengthening resilience to all types of natural hazard, placing it firmly within the context of development policy and practice in our country, the legislator sought collaboration between my office, the CCA unit, and the Ministry of Planning. She enlisted the help of the secretary of the Ministry of Environment, a bright, highly experienced, and forward-thinking man. Several years later, both the NDMO and the CCA unit were relocated to the Ministry of Planning to help strengthen coordination. A joint action plan for resilience and CCA was developed and a network of DRR focal points was established across agencies and local governments.

Following these changes and the much stronger political voice that it has given the NDMO, we managed to drum up support for a detailed analysis of the social and economic effects of recent disasters as part of the preparation work for our country's latest medium-term national development plan. Over the course of the plan's preparation, we also held lengthy stakeholder dialogues on potential resilience-strengthening approaches and actions. These efforts have led to a much greater emphasis on strengthened resilience under the new development plan. Resilience considerations are integrated right across the plan. The plan, moreover, includes a number of measures aimed at encouraging and guiding private sector and community engagement in strengthened resilience. It also sets appropriate monitoring and evaluation indicators to measure achievements and to contribute to informed decision making. As an offshoot of the stakeholder dialogues, a series of local partnerships among at-risk communities, the private sector, civil society, and public agencies also has emerged, focusing on strengthened resilience.

To support the implementation of the resilience goals outlined in the latest development plan, the government has also established a multisector budget line for resilience initiatives. This budget line is overseen by the Ministry of Finance for use by national line agencies. A parallel budget line for use by eligible local governments has also been created and is overseen by the Ministry of Local Government. A significant portion of the latter funding has been used to help support community-based initiatives.

In parallel, the Ministry of Finance has sought to avoid yet another major episode of funding-related reconstruction delays. Based on the clear statement of forms and levels of public contingent liability in the event of a disaster, detailed in the new legislation, and with subsequent technical support from the international community, the government has established a comprehensive package of DRF instruments for disaster relief, early recovery, and reconstruction. The package combines reserves, insurance, contingent loans, ex post domestic and international borrowing, post-disaster tax increases, and post-disaster reallocations to address different layers of risk.

National and subnational public spending targets for DRR have also been established, alongside related tracking systems to monitor actual expenditure on DRR, preparedness, relief, early recovery, and reconstruction. Moreover, our government has recently reached a relatively late stage in the adoption of a public financial management program to improve the management of fiscal risk more generally and, as part of this, has

The legislator spearheaded a cross-party investigation to determine why so many lives were lost in schools and other community facilities as a consequence of the earthquake

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Multi-stakeholder consultation is important in identifying disaster risk reduction priorities. Bangladesh

Disaster risk profiling has been institutionalized as an integral part of the preliminary screening process for all public investments and has been incorporated into statutory investment appraisal guidelines and procedures

just begun tackling the tricky issue of disclosure of disaster-related risks in its annual budget accounts.

Disaster risk profiling has been institutionalized as an integral part of the preliminary screening process for all public investments and has been incorporated into statutory investment appraisal guidelines and procedures. A mandatory stand-alone disaster risk screening tool has been introduced for all new public investment proposals. Relevant training activities have reinforced its application. Engineering design and construction standards for publicly funded structures such as schools, hospitals, roads, and low-cost housing have also been adjusted to address potential risk from natural hazards. Another big step forward is the current application of risk-sensitive land use planning.

Private sector interest in resilience has picked up too. A number of both small and larger-scale commercial ventures have emerged. These have been partly stimulated by a joint venture between the NDMO and the CCA unit to identify potential commercial opportunities in the resilience arena and by the provision of related international grants for research and development. Many firms have also developed business continuity plans and taken measures to strengthen their own resilience, in part because the country's leading lending institutions now require disaster risk disclosure by the companies in which they invest.

Disaster insurance is also increasing, in part due to some changes to the laws and regulations governing insurance as part of the wider legislative reform process that I have already mentioned. These changes include the introduction of stricter requirements to ensure adequate capitalization of insurance providers and mandatory risk-based insurance premium pricing. These changes, together with clearer, legally binding statements on the government's roles and responsibilities in the event of a disaster, have encouraged individual households and the private sector to invest more in risk reduction and insurance.

Finally, 5 years ago we decided to take a lead in strengthening regional coordination and planning with our neighboring countries. To do this, we invited representatives from their NDMOs to come and review our resilience initiative, giving them an opportunity to learn from our experience and also to highlight areas where we could further improve our systems. This has led to an annual regional scenario exercise and consolidated our regional vision for mutual support in risk assessment, risk reduction, and residual risk management.

Acknowledging Residual Risks

As Country X continues to become increasingly prosperous, we expect levels of protection to improve and losses associated with higher-frequency, lower-intensity hazard events to decline further. Although we will remain vulnerable to disasters, we have established DRF arrangements to help us manage those and to limit the extent of socioeconomic consequences.

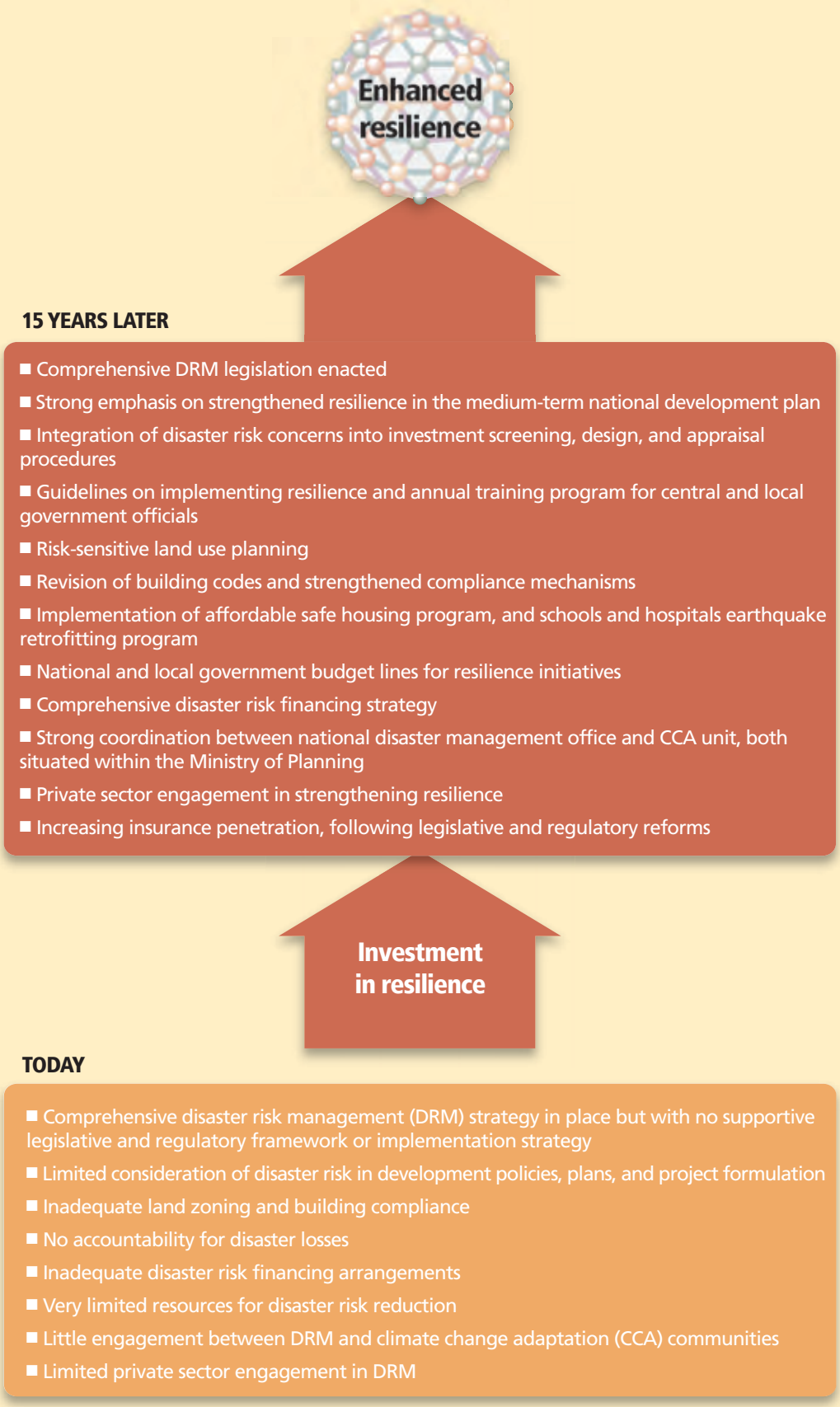
Two years ago, we experienced another major flood but losses were far lower than those experienced 19 years ago and the recovery process was much faster (Box 8). This disaster highlighted how much we have achieved in strengthening resilience and has galvanized public support to invest yet further in resilience (Figure 21). On balance, I think we have come a very long way. I am confident that a resilient future is no longer a distant reality for us. It is now within our reach.

Box 8 Recent Flood Experience, 15 Years On

Our country experienced a flood 2 years ago, yet human and physical losses were lower than losses caused by comparable events almost 2 decades ago, despite the fact that the population had expanded by 26% and the economy had more than doubled. Indirect losses and secondary effects also were stemmed, thanks to a more rapid early recovery and reconstruction program, which is now nearing completion.

The disaster highlighted how much we have achieved in strengthening resilience, thereby reducing our national dependence on international disaster assistance, local government dependence on federal disaster support, and private sector and household dependence on public support.

Figure 21 **Strengthening Resilience—Progress of a Nation**



7.2 A City's Journey to Resilience: A Story from a Long-Term City Resident

I have been a resident of City X all my life. For more than 30 years, I have served as a professional staff member at the city administrator's office, which is under the city mayor's supervision. Our city is a bustling coastal city in the tropics. Its powdery white sand beaches and scenic dive spots attract tourists from all over the world. I love its mix of low-lying areas and uplands, with streams lining its breathtaking landscape. Home to about 3 million people, the city draws its main income from tourism; processing of marine products for food, cosmetic, and pharmaceutical uses; manufacture of diving paraphernalia; trading of processed and unprocessed products; and provision of information and communication technology services. Microbusiness enterprises exist side by side with larger enterprises.

The Hazardscape Today

Our city, sad to say, faces multiple natural hazards—earthquakes, typhoons, storm surges, landslides, and floods. Ill-planned urbanization, rapid population growth, and inward migration of poor families from neighboring municipalities and beyond have contributed to the massive growth of informal settlements. About 30% of the population lives in densely populated informal settlements, many of them in makeshift housing and in low-lying, flood-prone areas with limited access to water, sanitation, education, and other basic services.

ADPC

Community consultation is crucial to identify high risk areas and develop and update disaster risk maps. Jamalpur, Bangladesh

The city government has very limited DRM or CCA expertise and very few related resources. Although we have a decentralized system of government, the city's mandate and institutional arrangements for DRM and CCA have not been clearly spelled out, and enhanced resilience is not an integral part of the city's development agenda. When disasters occur, we rely heavily on national government support. However, the bulk of this financing takes many months to arrive, and we often receive far less than we need.

Little use is made of hazard maps in land use planning, and compliance is poor even with the relatively weak building codes that do exist. It breaks my heart to see this shortfall leading to vulnerable patterns of land use, construction of structures and facilities in hazard-prone zones, adoption of substandard building materials and practices, and environmental degradation. People also built residential and commercial establishments along a major fault line, which—as we found out in the worst possible way—were at risk of collapse and severe damage in the event of even a moderate earthquake with a shallow epicenter.

Rapid urbanization is contributing to the progressive loss of forest cover in the upland areas where we used to go for picnics when I was younger. The forests are giving way to the construction of new structures, access roads, and buried water and sewer pipes. This degradation has triggered soil erosion and landslides, in one case tragically destroying a newly constructed luxury condominium that had just been completed. On the coast, increasing construction of new commercial and industrial structures is intensifying mangrove deforestation, reducing our city's natural buffer against

strong waves and storm surges. Upland erosion, sediment transport, and destructive fishing practices are destroying the coral reef, threatening sustainable tourism and marine production. Rainfall patterns seem to be becoming more erratic as well, and problems of flooding are growing, exacerbated by clogged drainage systems, inadequate solid waste management, and the effects of construction on natural drainage systems. Earlier this year, heavy and prolonged rains submerged about 60% of the city in floodwaters, causing a number of deaths from diarrhea and respiratory infections as well as physical damage and disruption.

The private sector provides very generous cash and in-kind donations following disasters, even relatively minor ones, but does not seem to have much interest in boosting resilience. Local NGOs are interested, but tend to focus on specific issues, which makes coordinated action a challenge. The city government has not tried very hard to engage either group in dialogue on this issue and, as I mentioned already, is not on top of it.

Reflecting our relatively poor performance in addressing disaster risk, we suffered considerable loss of life and damage to property as a consequence of an earthquake a few years ago (Box 9). If considerable action is not taken to strengthen resilience and to ensure that all new developments take adequate account of disaster risk in their design and location, we will experience even more devastating losses in the future.

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Loudspeakers installed as part of actions to strengthen community early warning systems. Thailand

Box 9 **Recent Earthquake Experience**

A few years ago, my country experienced an earthquake of intensity 6.3 on the Richter scale. The epicenter was almost below us. I will never forget that day. It was 4:00 in the afternoon. I was resting at home after an exhausting series of visits to far-flung city districts. Suddenly, I was jolted by intense shaking. I was terrified! I dove under a sturdy table and waited for the shaking to subside. It seemed to take an eternity, although the quake only lasted 50 seconds. Afterward, I rushed down the stairs of my low-rise condominium building as fast as I could. I felt a strong aftershock even before I got out of the building.

We lost 5,000 people that day in our city alone. A further 30,000 were injured, and 100,000 were left homeless. The earthquake's epicenter was relatively shallow, causing intense shaking on the surface, which resulted in the collapse of houses, schools, and other buildings that had not adhered to basic earthquake-resistant construction methods. Those along the earthquake fault and on unstable slopes suffered severe damage. In other areas, some hotels, restaurants, and other facilities were damaged, including water, wastewater, and electric facilities. Some sections of roads and highways cracked. However, the airport, shipping ports, and other sturdy facilities remained intact.

The tourism industry experienced a sharp downturn and livelihoods were disrupted. Delays in the flow of reconstruction financing exacerbated the problems. The percentage of the population below the poverty line rose from 19% before the disaster to 21% after it, and our progress toward other city-level Millennium Development Goals was set back as well. It took almost a decade to complete the reconstruction efforts in full.

The Hazardscape, 15 Years On

The national legislature amended the decentralization law to provide local governments with a clear legal mandate for disaster risk management and climate change adaptation

The trauma and destruction brought about by the earthquake 17 years ago provided a wake-up call and a historic turning point for us. The earthquake caused considerable economic loss and dislocation as well as deep grief among those who lost family members, relatives, colleagues, and friends. However, it also created an opportunity to implement bold changes to strengthen our resilience. I remember our city mayor's call to action: "This recent earthquake has been disastrous. Never again will we allow ourselves to be unprepared and distraught when natural hazard events strike us. I call on everyone to join our effort to make our city safe. Our financial resources and expertise may be limited at present, but we will not be daunted. Together, we will forge ahead with strengthening our capacity to resist, absorb, and recover from the effects of natural hazards. In line with this, we will seek and develop partnerships with local, national, and international groups."

National developments associated with the overall legal and regulatory framework favored the new path that our city was about to take. The national legislature amended the decentralization law to provide local governments with a clear legal mandate for DRM and CCA. It also approved a supporting framework for DRM and clarified institutional arrangements, financial responsibilities, and accountability at various levels. In charting a new journey to resilience, our city embraced the national government's DRM and CCA protocol, along with the post–Hyogo Framework for Action principles, which aim at the effective integration of disaster risk considerations into development policies, planning, and programming at all levels. The city government also reviewed the 10-point checklist for making cities resilient, published by UNISDR (Box 10). City officials, together with utility providers and other associations dealing with local public risk management, adopted the 10 First Steps checklist, moving toward an International Organization for Standardization (2009) ISO 31000 framework for efficient risk management.

In line with the UNISDR checklist, the city government created a city disaster management office to organize and coordinate DRM and CCA actions. The disaster management office is run by permanent staff and is funded by the city's regular budget. It has received strong support from all successive city mayors since its creation, regardless of their political persuasion.

Box 10 Ten-Point Checklist for Making Cities Resilient

1. Put in place organization and coordination to understand and reduce disaster risk, based on participation of citizen groups and civil society. Build alliances. Ensure that all departments understand their role in disaster reduction and preparedness.
2. Assign a budget for disaster risk reduction and provide incentives for homeowners, low-income families, communities, businesses, and the public sector to invest in reducing the risks they face.
3. Maintain up-to-date data on hazards and vulnerabilities, prepare risk assessments, and use these as the basis for urban development plans and decisions. Ensure that this information and the plans for your city's resilience are readily available to the public and fully discussed with them.
4. Invest in and maintain critical infrastructure that reduces risk, such as flood drainage, adjusted where needed to cope with climate change.
5. Assess the safety of all schools and health facilities and upgrade these as necessary.
6. Apply and enforce realistic, risk-compliant building regulations and land use planning principles. Identify safe land for low-income citizens and develop upgrading of informal settlements, wherever feasible.
7. Ensure education programs and training on disaster risk reduction are in place in schools and local communities.
8. Protect ecosystems and natural buffers to mitigate floods, storm surges, and other hazards to which your city may be vulnerable. Adapt to climate change by building on good risk reduction practices.
9. Install early warning systems and emergency management capacities in your city and hold regular public preparedness drills.
10. After any disaster, ensure that the needs of the survivors are placed at the center of reconstruction with support for them and their community organizations to design and help implement responses, including rebuilding homes and livelihoods.

Source: UNISDR (2012b).

To boost collective responsibility for resilience and to augment existing resources, the office has also successfully nurtured close links with various government agencies, civil society organizations, the private sector, and international development partners.

The integration of DRM and CCA into our city's policy-making, planning, implementation, monitoring, and evaluation processes makes perfect sense to me. To help start the process, a risk assessment was undertaken, with funding from an international partner and technical support from two of our local universities, to identify high-, medium-, and low-risk areas. Some experts were then brought in to help us prepare and implement a strategic master plan to strengthen resilience against earthquakes, floods, and other major hazards and to design a related implementation strategy. Various participatory consultations and interactive meetings were conducted as part of this process, to help us explore and understand our vulnerability, analyze potential physical and socioeconomic consequences, and contribute to the development of a coherent DRM approach.

A relative of mine who also works for the city government told me that new budget lines have been created for DRR and CCA, in addition to the existing budget line for disaster response. Some national government funding has been secured to boost resources. The city government has also obtained some international grant funding for several DRM initiatives and some technical support to strengthen DRM capacity across local governments.

The director of the city disaster management office recently gave a presentation to all the city government departments, covering progress to date, as well as a short press conference afterward. I managed to get to the meeting and was really impressed with what he had to say. He raved about the long-awaited strengthening of early warning systems and of DRM and CCA capacities. Regular education programs and training on resilience have been conducted, complemented by public preparedness drills, in which I myself have been involved. Hazard risk maps and other relevant information have been updated and placed on a newly created city disaster management office website. Building codes have also been revised, compliance mechanisms have been strengthened, and risk assessments of critical public facilities such as hospitals, schools, bridges, and evacuation centers have been undertaken. A large-scale retrofitting program is currently under way, with assistance from several international development partners and jointly coordinated by the disaster management office and the local office of the national public works department.

The chief city urban planner spoke at the same event. He outlined how strengthened resilience has been carefully integrated into the city's new 10-year urban development plan. Shifting to risk-sensitive land use planning, the city has disallowed new construction in hazard-prone areas—near earthquake faults, riverbanks, floodplains, and erosion-prone areas. Safe zones for the installation of utilities and urban services have been prioritized, to encourage industries and residents to locate there. The city government eventually intends to convert extremely high-risk areas into no-occupancy zones and public parks and has already begun to transfer some of the informal settlements to safer areas. The chief planner mentioned that the relocation program met with some fierce initial opposition, which I had read about in the media, but people eventually agreed to move after they were assured that they would be supported in acquiring and leasing land; in accessing low-cost housing, community facilities, and services; and in improving their livelihood opportunities.

After the presentations, I chatted with the director of the city engineer's office. He was happy about the repair of damaged road transport infrastructure, along with stricter

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Periodic preparedness drills play an important role in strengthening community resilience. Cambodia

quality enforcement for all construction works. Procurement systems, according to him, have been made more transparent and competitive, to reduce corruption risks, and third-party monitoring of road projects has been introduced. He thinks this should have a notable benefit when hazards strike, considerably reducing levels of loss and annual maintenance bills.

The city government intends to invest considerable additional resources in resilience over the medium term, particularly to tackle the issue of flooding. It is developing a number of public–private partnerships for this purpose and is also hoping to access CCA funds that have recently become available.

A Green the City community campaign has just been launched by a local NGO. This should help as well—and is certainly being met with great enthusiasm. The campaign aims to engage residents in planting trees across the city, particularly on slopes, to help reduce runoff and flooding and to put pressure on the government to ensure that forest protection laws are fully enforced. The city government has also entered into a partnership with insurance companies to replant mangroves along stretches of coastline within the city's jurisdiction. This should help protect human lives and property against strong waves and storm surges.

The tourism association is also doing its part, actively advocating the protection of coral reef ecosystems. In cooperation with the city government, the diving association, and the fishers association, it has supported the establishment and management of marine protected areas in designated zones, to boost tourism and other livelihoods. These efforts have stimulated renewed interest in the diving sites of City X, attracting a stream of ecologically minded tourists. They also have boosted the sustainable supply of products for processing and are contributing to more stable ecosystems.

I should mention our annual disaster preparedness day as well, an event in which I regularly participate. A number of years ago, our city government approved a resolution that established this event, with the intention of keeping disaster risk firmly in people's minds. The day includes street parades, television reports on past disasters, posters, exhibitions on safe construction, and earthquake simulation drills. It also includes interactive open meetings with DRM and CCA practitioners and experts, who share their experience in dealing with earthquakes, floods, and other hazards. Spearheaded by city officials and supported by various stakeholders, observance of this event has become a milestone in our calendar and, remarkably, has transcended electoral cycles and changes in political leadership.

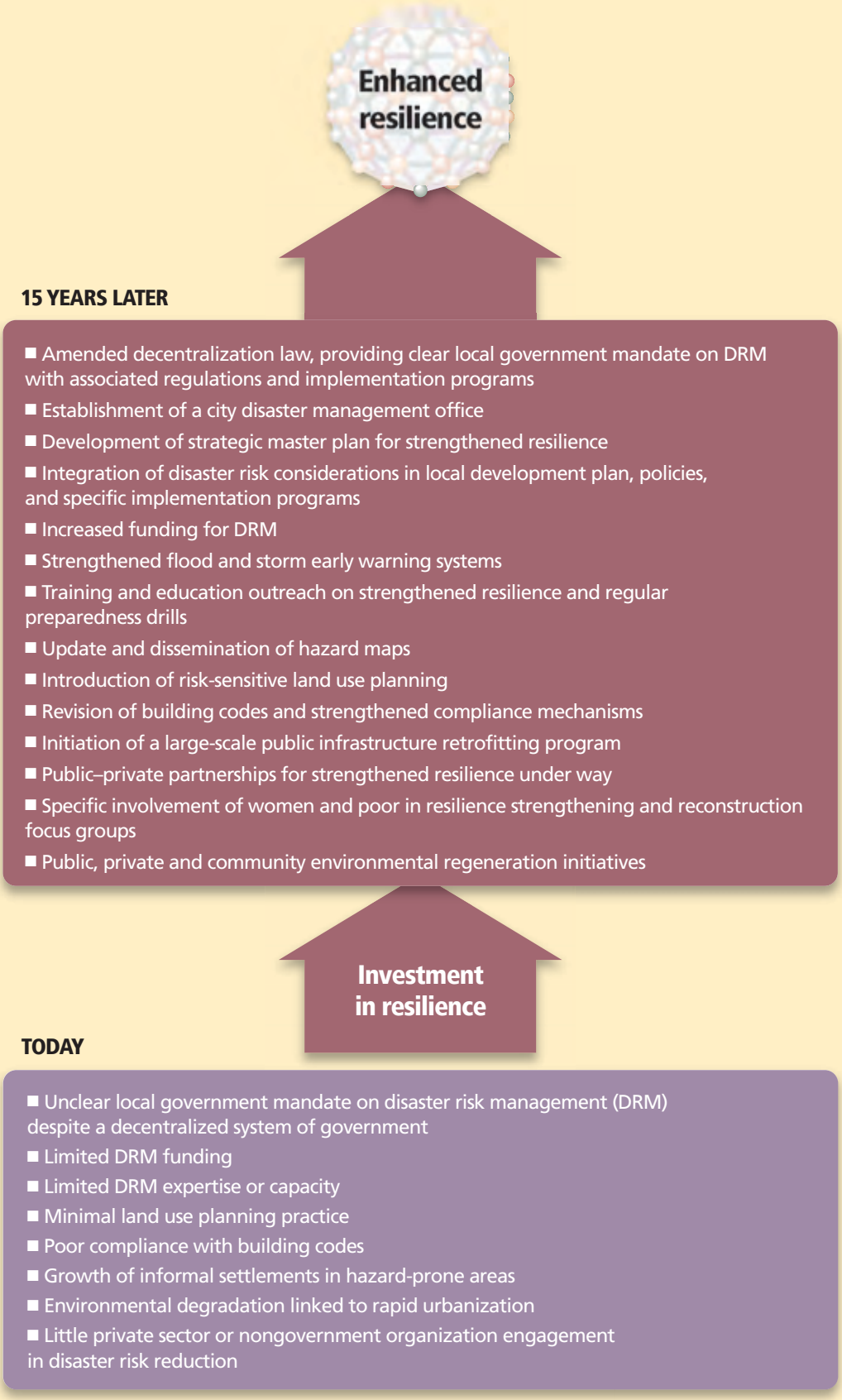
Acknowledging Residual Risks

As City X continues to improve its capacity to manage risk, losses from hazard events are expected to fall, despite continuing urban expansion. Challenges remain, but I think that the strong partnerships that the city government has developed with civil society organizations, international development partners, and the private sector augur well for the future. Indeed our city experienced a strong typhoon a year ago, which demonstrated that, unlike other cities affected by the same event, we are well prepared for typhoons at least and relatively capable of withstanding such events (Box 11). I think I can speak for all in saying that we are extremely proud of City X and the journey we have embarked upon (Figure 22).

Box 11 **Recent Disaster Experience, 15 Years On**

Our city experienced a strong typhoon a year ago, which was accompanied by strong winds, wave surges, and heavy rains. Unlike other cities affected by the same event, City X was well prepared. The community-based early warning system worked extremely well and those in potential danger moved swiftly to their designated evacuation centers. Consequently, our casualty rates were much lower than those experienced in other cities. The damage to infrastructure and other assets was also much reduced, thanks to various actions to strengthen resilience over the past 15 years. Moreover, gender focus groups were established to take the special needs of women into account in the relief, early recovery, and reconstruction process and to help lessen existing inequalities; and informal settlement focus groups were established to enable the most marginalized in society to participate in the rebuilding and, particularly, relocation of their homes, taking their livelihoods, welfare, and social support networks into account. We really have come a very long way.

Figure 22 **Strengthening Resilience—Progress of a City**



7.3 Pursuing a Path to Resilient Livelihoods: A Family's Story

I am a farmworker living on a river embankment. My family and I have just survived the worst floods to hit this reach of the river in more than 30 years. Although our situation is still not ideal, we have made major progress over the past few years, without which we would have suffered much greater losses.

We shifted to this location just 5 years ago, after abandoning the land I grew up on and trying a few other locations that did not work out along the way. The annual monsoon floods had swelled the river to the point where it eroded away what was left of our old small plot of land in my home district. No amount of rocks or sandbags could stop the relentless undercutting of the torrent as, meter by meter, our land slumped into the water and was washed downstream. When I went to the district administration for assistance, I learned that the land records had not been updated for many years. I also learned that, before we could get any compensation, our land tax arrears needed to be brought up to date—including arrears for land claimed by the river in my father's time. I was crestfallen. I felt that it was easier to move my family elsewhere and try to start again.

ADB

Women making gabion baskets. Makira, Solomon Islands

The spot where we eventually resettled was vacant for a reason—it too was vulnerable to river erosion and flooded every monsoon. Although I found daily wage work on the surrounding farms, each year I lost around 2 months of income when my employers' land flooded. Access to the nearest towns (and the daily laboring jobs that could sometimes be found there) was also cut off until the waters receded. My children could not get to school, despite the bicycle the government provided my eldest daughter as an incentive to finish her secondary education. Food ran out quickly and prices skyrocketed as crops everywhere were ruined. Sometimes the government provided emergency rations, but more often than not, by the time my wife or I got to the collection point, all the food had been handed out. To add to our misery, the goats in which we had invested our scanty savings sickened and died because we could not collect enough fodder for them. My family was often sick during the floods, and purchase of medicine was a further drain on our resources, forcing my wife to sell her jewelry piece by piece.

Our situation started to turn around when the provincial government, with funding and technical support from a bilateral donor agency, started to implement an integrated flood and river risk management project. The project not only tackled the infrastructure side of things—physically improving the river embankments, thus greatly diminishing the erosion and flooding problems—but also improved the capacity of the government agency responsible for planning and implementing flood and river erosion prevention programs. The local government called a community meeting and explained to us that part of the program would involve some kind of science to predict the river's movements, enabling early planning for bank protection works as flood and erosion risk zones change with the ever-changing river course. They would also help our village and some of the other most-at-risk communities along the river strengthen our capacity to manage the flood and erosion risk and to implement some

coping strategies. And they would give some funding to a local NGO to help people like me, living in extremely vulnerable locations, to improve our livelihoods and, at the same time, to strengthen our resilience.

At first, I was not convinced that all these grand plans would really help, but I began to change my way of thinking when a woman from a local NGO urged me to come to a meeting with all my neighbors at my daughter's school. I still vividly recall what she said, "All of you could join a project that would teach you how to prepare yourselves better for flood events. Everyone living in this area is welcome. It doesn't matter if you are landowners or informal settlers or men or women. There are lots of simple things you can do as a community that will help increase everyone's resilience." This was the catalyst for me. I began to realize that since floods and erosion were going to happen every year, my family and I had to start formulating a plan to reduce our risk.

Perhaps our first tangible benefit from the government program was that we actually got to know our neighbors. Because they came, like us, as refugees from various other localities, we had been wary of each other. Where we come from, our neighbors are our relatives. We were not used to having friends who spoke different languages, practiced different rituals, and ate different food. Personally, my suspicion was compounded by my own guilt about squatting on what is essentially government land. I felt like other people might try to displace us or compete for the same work. There was no natural sense of community. The NGO highlighted the fact that, despite our differences, my neighbors and I faced common challenges. By working together, we could improve the situation for everyone. In addition to organizing the community to implement practical measures, such as a monsoon fodder bank, raised cattle platforms, and raised block steps to form key access routes to the school, the program has given my family another extremely important benefit—a network of friends to support each other during difficult times.

The NGO told us how we could get early warning about floods from the radio—and that soon this would evolve into an automated "text burst" system for a small monthly fee. I had recently bought a cheap mobile phone, like many of the other men in the village, making payment in installments. Initially, I used my phone to find out who was hiring workers, thus saving valuable time in going to various places to inquire. The NGO helped us to set up a phone tree for the village. Now, when anyone gets information about a weather threat, they send this information on to three contacts, who send it to three contacts, and so on down the tree. When I received information about heavy rain this July, my wife and I made sure our tools and animals were secure, got everything up high in our house, and ensured we had enough food, fuel, and water to last at least a week. This was not easy to do, and I still marvel at how the advanced warning information we received and the new feeling of having a greater sense of control spurred my family on.

One of the most important tools we had secured a while back was my wife's loom. She began participating in a self-help group about 4 years ago. With some help from a livelihoods project targeting flood- and river erosion–affected people, my wife has been able to turn weaving, which has always been a part-time activity, into a small but steady income stream. The self-help group has given her access to credit with which to buy cocoons, and she spins these into thread. The project has connected her to a company operating with an inclusive business model. This company has provided some training and designs, and it buys her products at an agreed-upon price,

My neighbors and I faced common challenges. By working together, we could improve the situation for everyone

AFP

Year-round access to community facilities supports resilience. Ha Noi, Viet Nam

provided the quality is good. It also was willing to subsidize the purchase of an improved loom, but after discussions with other members of the weaving collective, she decided to stick with the simple loom she already has, because it is very easy to pack up and lift when we get flood warnings. My wife has taken out a microinsurance policy, however, to protect her tools and inputs in case of a major event. Our neighbor's wife used her credit from the self-help group to buy a solar panel, which she uses to keep a truck battery charged. With this, she provides lighting for us and for two neighbors and also charges mobile phones for a fee. Our lighting is free, in return for my wife's services in looking after the neighbor's baby when our neighbor runs errands. Our neighbor also plays a radio, which my wife listens to while she weaves.

My wife's steady income from weaving has slowly replaced the money she used to earn for participating in a government work scheme about 3 months each year. This scheme requires the state to provide each household with a minimum of 100 days of manual employment annually at the statutory minimum wage. It aims for 33% participation by women and equal wages for women and men. Through her involvement in the scheme, my wife helped repair flood-damaged embankments, although she found the heavy manual labor rather tough. Most of her workmates were women as well, because quite a few of the men around here seek work in the cities during the agricultural lean season, leaving the women to look after their children and houses.

The livelihoods project also has a subproject that targets educated youth. When my daughter finished secondary school 2 years ago, we did not have enough money to pay for any further education or training. However, the livelihoods project helped us, subsidizing her participation in a technical skills class with a work-experience component. Now she is working as a nurse aide. I am so proud of her. The extra income from my wife and daughter has enabled us to slowly accumulate some savings. I am a sharecropper now, not a day laborer, and this year, for the first time, I have been able to lease my own land.

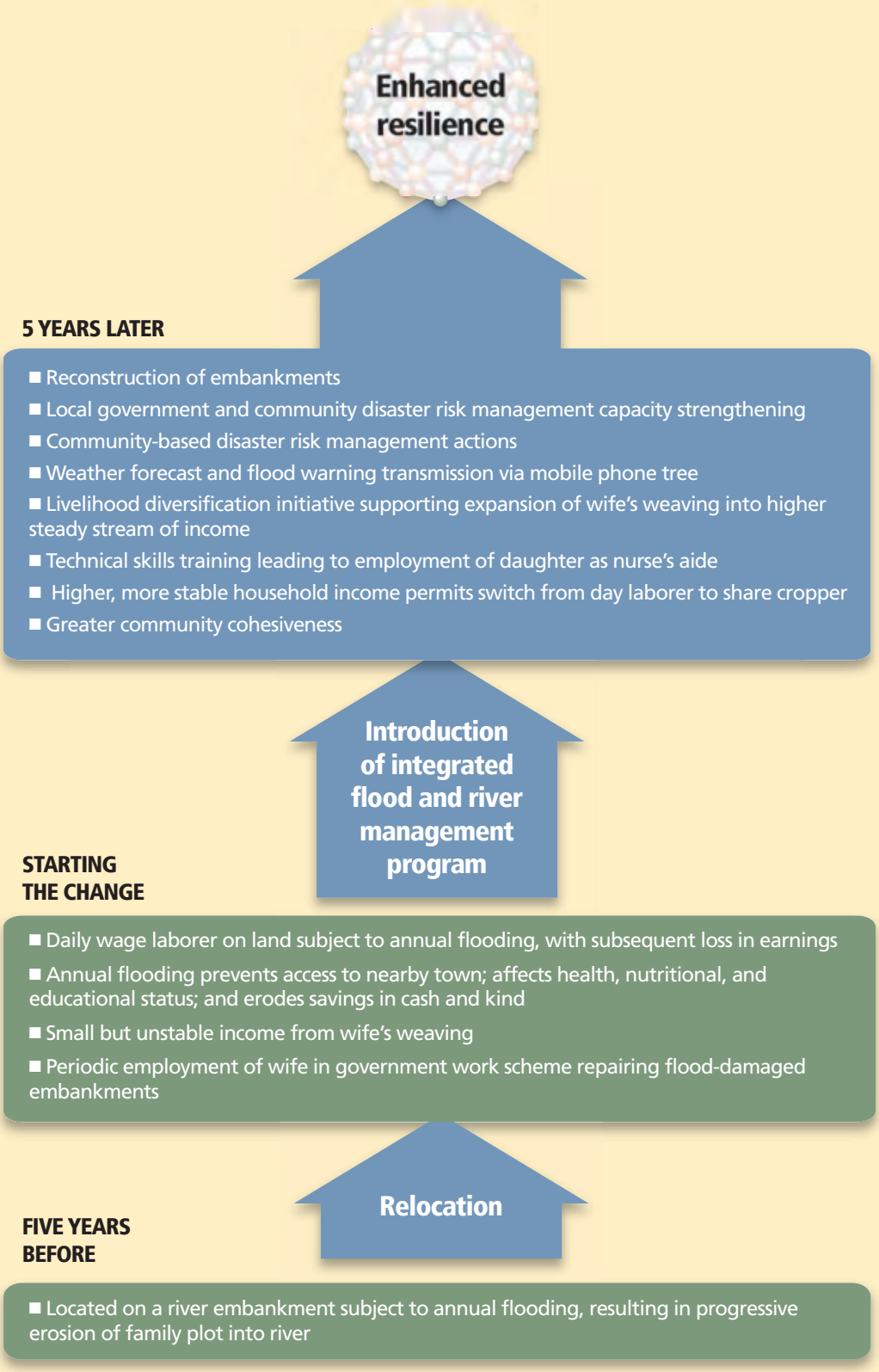
Last year, I saw the benefits of crop insurance when my neighbor suffered crop loss in a storm. He did not have to wait for an assessor or pay a bribe—verification was done based on weather data and the agreed sum was paid immediately. I was really impressed and have signed up for the same weather index–based insurance product. With this insurance in place, I think I may try out a higher-value crop next year. We could end up losing more if there is a flood or storm, but the insurance will cover those losses. And if the weather is kind, we will make more money. Another neighbor has started growing a variety of rice with high flood tolerance. I may think about that option a bit more, too.

The land I have leased is farther from the river and less flood-prone than the land I used to work on. Over the next 2 years, we want to relocate our house there. We are waiting until we can afford to construct a house with disaster-resilient features, such as high ground clearance and roof water collection. The NGO that provided our village with flood risk reduction training also provided some training to local builders on this, gave them some sample plans, and spoke to the whole village about how we could better protect our homes.

Friends who have lived in our new village for many years tell me that the physical improvements to the river embankments that I mentioned earlier have definitely reduced the incidence of flooding and waterlogging in the area behind the embankments. Private investments are now increasing in that area, including new industries providing jobs. My son has his sights set on a building apprenticeship in the near future. I hope those embankments really do prove adequate over time, though.

To wrap up, in relatively few years my family and I have taken advantage of several programs that have targeted our geographic vulnerability (Figure 23). We have made enormous progress, increasing our savings, diversifying our income, leasing our own land, investing more in our own lives, and securing insurance. I worry much less now, and I think we face a much brighter future.

Figure 23 **Strengthening Resilience—Progress of a Family**



AFP, ADPC

There are opportunities for investing in resilience across many development themes and sectors.

8 Thematic and Sectoral Opportunities for Investing in Resilience

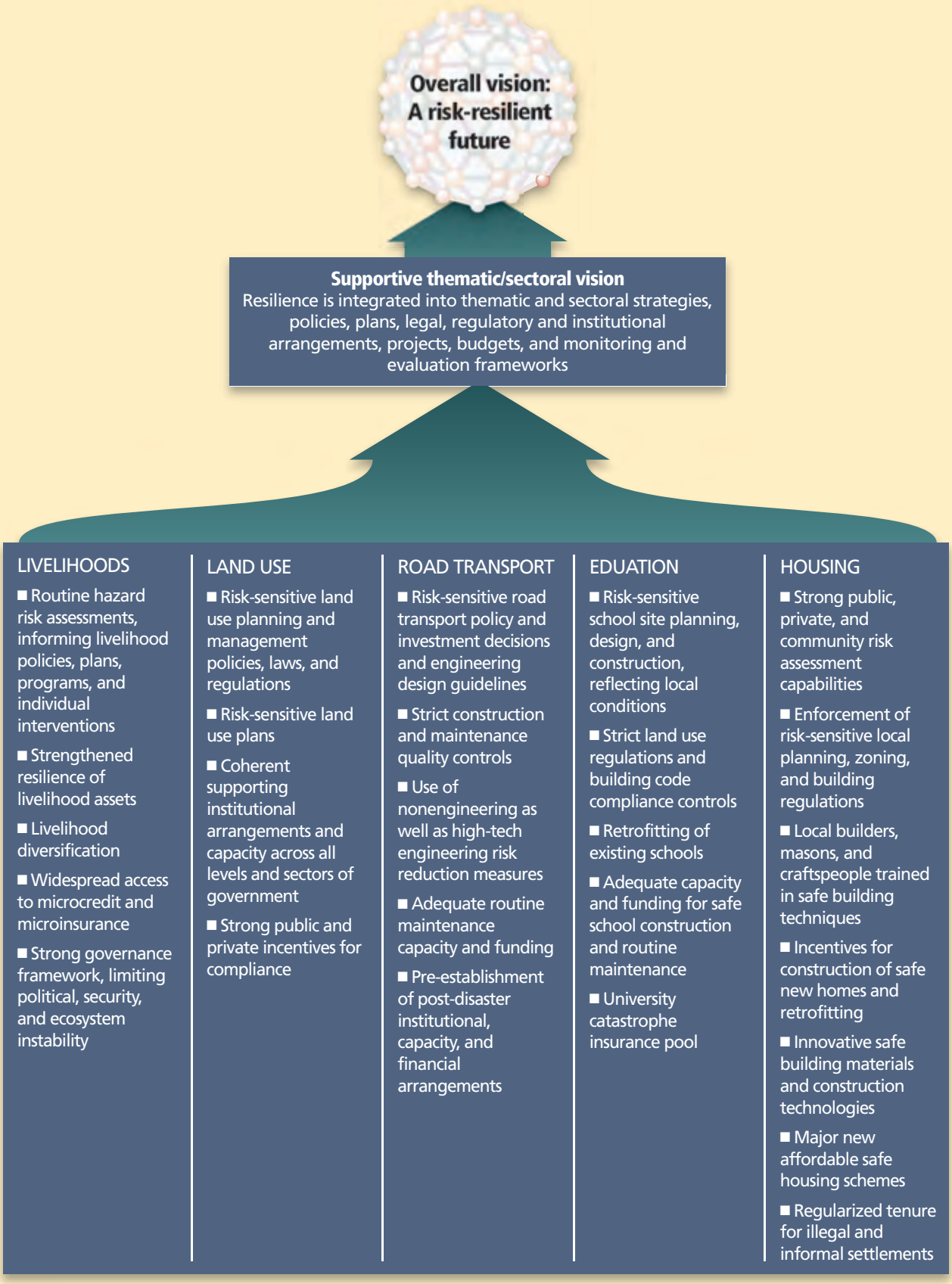
Efforts to strengthen resilience are particularly crucial in the context of five development themes and sectors: livelihoods, land use, transport, education, and housing. These are each considered in turn below and a sixth theme, disaster risk financing, is examined in Part III. Each discussion begins by examining general and specific vulnerability issues and key gaps and obstacles to strengthened resilience. Potential macro and micro entry points for overcoming these gaps and obstacles and related policy, capacity development, and investment interventions are also considered.

A vision of a resilient future is then set and potential paths to the achievement of that vision are explored, employing the backcasting approach. In these visions, resilience is integrated into thematic and sectoral strategies, policies, and plans; legal, regulatory, and institutional arrangements; projects; budgets; and monitoring and evaluation frameworks, together contributing to risk-resilient national and subnational economies, societies, and households (Figure 24). The actions described do not provide an exhaustive list of options. They do, however, emphasize the report's focus on DRM as an integral element of development. These thematic and sectoral visions, if achieved, will contribute toward risk-resilient economies and societies.

The presentation of development opportunities for investing in resilience begins with livelihoods, a key development issue and one that encompasses both the macro and micro scales in economic, social, political, and physical terms; the multisector issues of development; and investing in resilience. Livelihoods refer to the capabilities, assets (both material and social resources), and activities required to procure a means of

These thematic and sectoral visions, if achieved, will contribute toward risk-resilient economies and societies

Figure 24 **Visions of a Resilient Future Viewed through a Thematic and Sectoral Lens**



living. For the lower-income segments of the population, livelihoods are generally at the center of poverty reduction efforts in developing countries. The vulnerability of livelihoods to natural hazard events stems from the lack of information about hazards and risks, which can undermine informed decision making; the destruction of livelihood assets crucial for sustained production of goods and services for income; a lack of livelihood choices that are hazard-resistant or are pursued in risky locations; and the disruption of livelihood processes and networks after a disaster. Most often, poor families without savings, with low skill levels, and with only very basic shelter are the most vulnerable. Families lose their income when lives are lost and injuries occur, dwellings are damaged or destroyed, market connections are broken, local prices escalate, and disaster relief and recovery to restore livelihoods are inadequate or misguided.

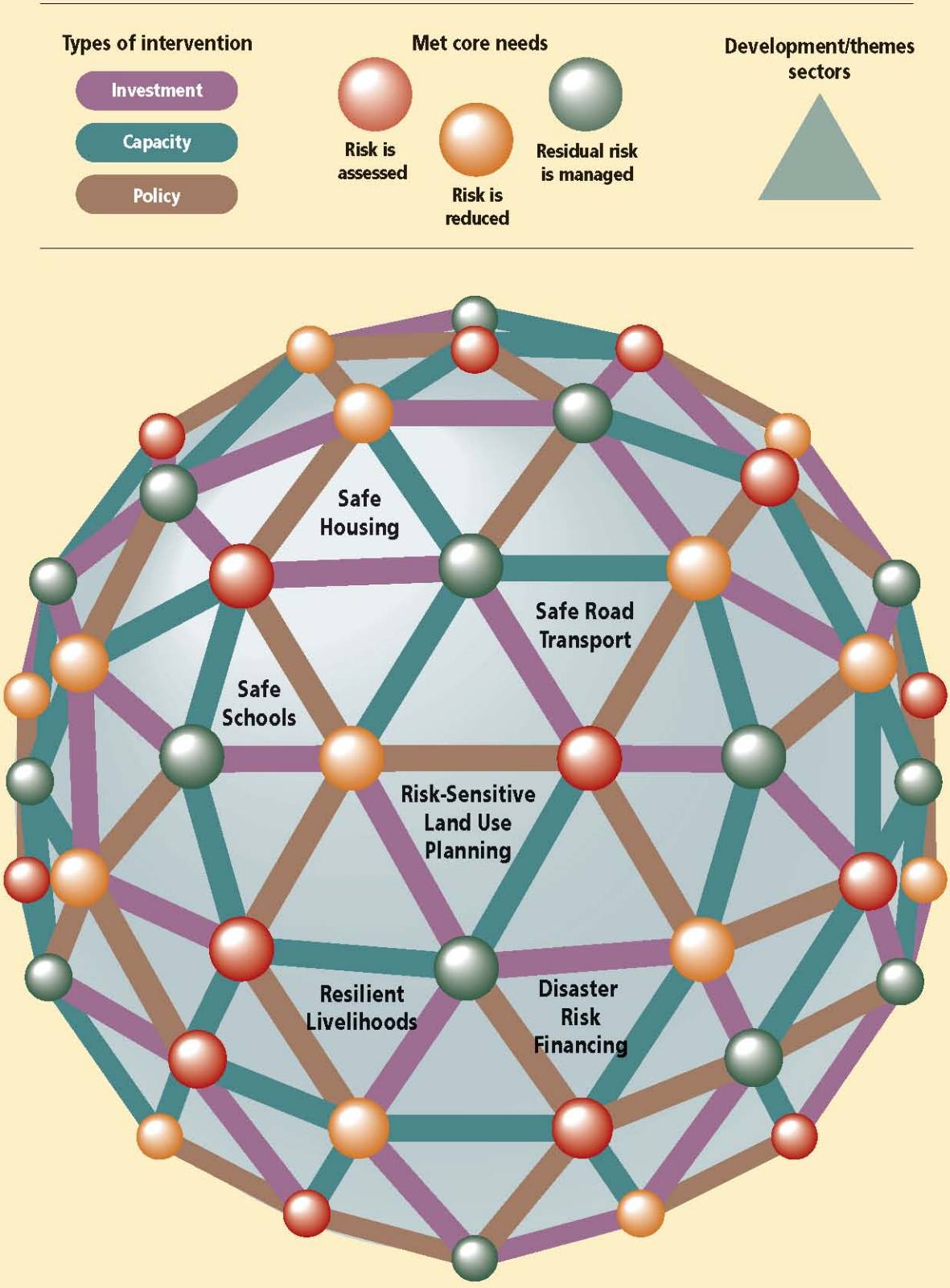
Land use is the real-time spatial manifestation of all of society's values, efforts, and decisions. This manifestation comes about primarily through land use planning and management. The development process focuses on management of land resources, wherein the land is used in accordance with society's wants and needs and the land's natural qualities and is made productive to yield benefits. Land use, however, is vulnerable to natural hazard events due to a faulty land management system (including equitable access to land to support broad-based growth); environmental degradation; rapid, ill-planned, or unplanned urbanization at all scales; weak enforcement of zoning, construction codes, and regulations; poverty and disparity; and accelerated land use management conflicts arising from natural hazards, including climate change effects.

Transport, and specifically road transport, defines and ties livelihoods to land use in a physical sense, shaping the nature and spatial location of social and economic investments. The region needs safe, reliable, affordable, and environmentally sustainable transport to support economic growth, rising incomes, expanding populations, increasing trade, and urbanization. However, natural hazard events are undermining efforts to meet this need. They are causing significant damage to transport infrastructure in both ever-growing cities and peri-urban provincial and rural areas in Asia and the Pacific. There are insufficient resources to keep up with the demand for new roads and also to build and maintain roads in accordance with appropriate risk management practices. The road network is also increasingly responsible for creating and increasing the vulnerability of surrounding areas, particularly of poor coastal ecosystems and river valleys at all elevations.

Schools, like other public and private sector facilities, are the physical manifestation of the educational, economic, social, and cultural presence of society in the community as well as the seat of the education sector. They come in various shapes, sizes, and materials and are managed in as many ways. They come about through numerous complicated processes involving multiple stakeholders in both the public and private sectors. Many, if not most, school facilities—old and new, large and small, urban and rural—in a number of countries in the region are vulnerable to natural hazard events. This vulnerability is often a result of ignorance, errors, or omissions, in turn leading to inappropriate or poor choices of physical structures and locations. They manifest in a lack of readily accessible technical information or capacity to manage natural hazard risk, and the creation of risk where none existed before, due to land use changes.

Housing is the micro complement to livelihoods, set in the context of land use, and is attached to the road network and to schools and other community facilities. The majority of housing is built by individuals in the informal sector or by private developers in the formal sector, in some cases with minimal and in some cases with substantial government involvement. Perhaps one-third of the urban population in the region lives in informal settlements, and a further 10%–15% live in substandard housing in need of repair, renovation, or replacement. Many more should be relocated because they are in harm's way. Thus, perhaps one-half or more of the urban and rural population of the region lives in unsafe housing. Households are driven into hazard-prone areas by poverty, lack of access to affordable land and dwellings, and lack of awareness of natural hazard risks. Weak enforcement of land use planning and building regulations, the use of substandard housing materials in construction, poor maintenance of completed housing structures, and inadequate preparedness for hazard events exacerbates their vulnerability.

Figure 25 **Strengthening Resilience by Meeting Core Needs through Policy, Capacity, and Investment**



Ensuring Wider Socioeconomic Resilience

This report covers just six development themes and sectors (including DRF in Part III) in some detail. A fully-functioning, sustainable, inclusive economy and society comprises, of course, a wide array of additional development themes and sectors. Many of these also play an important role in determining resilience and, likewise, need to integrate measures to strengthen resilience into their policies, investments, and capacity-building programs.

Within this wider context, the six development themes and sectors of particular focus in this report can be thought of as six faces of a geodesic sphere (Figure 25). The resilience of individual themes and sectors is essential in contributing to sustainable, equitable socioeconomic advancement. However, their contribution to national resilience depends not only on internal resilience within each theme and sector but also on resilience in other areas—that is, on a geodesic sphere comprising a complete set of rods denoting the use of policy, investment, and capacity-building efforts to promote resilience. A geodesic sphere is an inherently stable structure if all rods are in place but is weakened if any rods are missing or broken. Each and every join between the rods and nodes must also be secure—that is, the selected policies, investments, and capacity-building efforts to address resilience must be both appropriate to the issue at hand and properly implemented. If they are not—for instance, due to insufficient incentives or corruption—then, again, the sphere—and disaster resilience—will be weaker.

8.1 Strengthened Livelihood Resilience to Disasters

Put simply, a livelihood is a means to support an existence. A livelihood comprises the assets, capabilities, and activities required for a means of living. These activities flow from a household's stock of assets and capabilities, in turn in effect a form of human asset. Thus, livelihoods are built on assets, whether physical (access to infrastructure, services, tools, and technology), social (access to support, advice, and assistance from one's community or networks), financial (access to savings, credit, insurance, and markets), human (one's practicality, health, education, and ambition), or natural (land, water, forests, and biodiversity). Livelihoods are complex systems. They are holistic in that they are non-sector-specific and recognize multiple influences, multiple actors, multiple strategies, and multiple outcomes. Livelihoods build on families and their communities' inherent potential. They connect macro and micro, local and global. Working connections across these multiple dimensions make livelihood systems resilient through four primary stakeholders: the livelihood owners; the community, with its formal and informal groups and organizations; the private sector, both formal and informal; and the government.

ADB

Modern technology helps farmers communicate with suppliers and markets and access weather and crop information services, supporting strengthened livelihood resilience. India

Livelihoods and Vulnerability

Livelihoods sit within a context of vulnerability comprising

- the political and economic environment, in which policy changes and economic upswings and downturns affect livelihoods;
- the security environment, in which disasters, civil disturbances, or restrictions such as access to water can cause major disruption to supply chains, markets, and even labor availability; and
- the ecosystem, in which alteration, damage, and destruction of the environment, as well as its very makeup, constantly have varying consequences for livelihoods.

Overreliance on certain assets, particularly natural and physical livelihood assets, as exemplified in agriculture endeavors, can mean greater vulnerability to shocks. These shocks include natural hazard events, because droughts, erosion, floods, storms, volcanic eruptions, earthquakes, and tsunamis all have great potential to destroy, damage, or alter natural resource–based livelihoods or disrupt the supporting infrastructure. Similarly, one's physical location—in relation to earthquake fault lines, sea and river coastlines, wetlands, floodplains, mountains, transport routes, and remote or disputed land (whether formal or informal, homogenous or disparate settlements)—is also a key factor determining livelihood risk.

Realizing Livelihood Resilience: A Vision of the Future

Finding entry points for strengthening resilience begins with an analysis of livelihood assets and vulnerability to natural hazards. To enhance sustainability, the analysis can also factor in the range of opportunities that could be accessed either by strengthening livelihood assets or by minimizing vulnerability (Table 5). For the poor, securing a resilient livelihood is often the most direct route out of poverty. For governments, investing in the livelihood resilience of poor households makes sound economic sense because millions of people are assisted to become more regular producers and consumers of goods and services rather than recipients of welfare. It also makes sound social sense because more-resilient individuals, families, and communities can become regular participants and beneficiaries of educational, health, cultural, and civic actions rather than desperate, disenfranchised victims of natural hazard events with ever-deepening dependency.

Households and communities with strong and varied endowments of livelihoods assets are more resilient to shocks. The extent of resilience, the most important types of action required to strengthen it where necessary, and appropriate entry points can be ascertained by scoring a household's or community's endowment of each of the five principal types of asset on a score of 1 to 5 and plotting those scores on a web (Figure 26). Households or communities that score well across all five types of asset will have large, evenly-shaped shaded areas in the center of the diagram. More vulnerable households or communities will have relatively smaller, or perhaps highly irregular, central shaded areas. For example, for a community scoring 3 for social, physical, human, and financial assets, but just 1 for natural hazards would need to place particular emphasis on, perhaps, enhanced environmental management or improved access to natural resources to enhance its resilience.

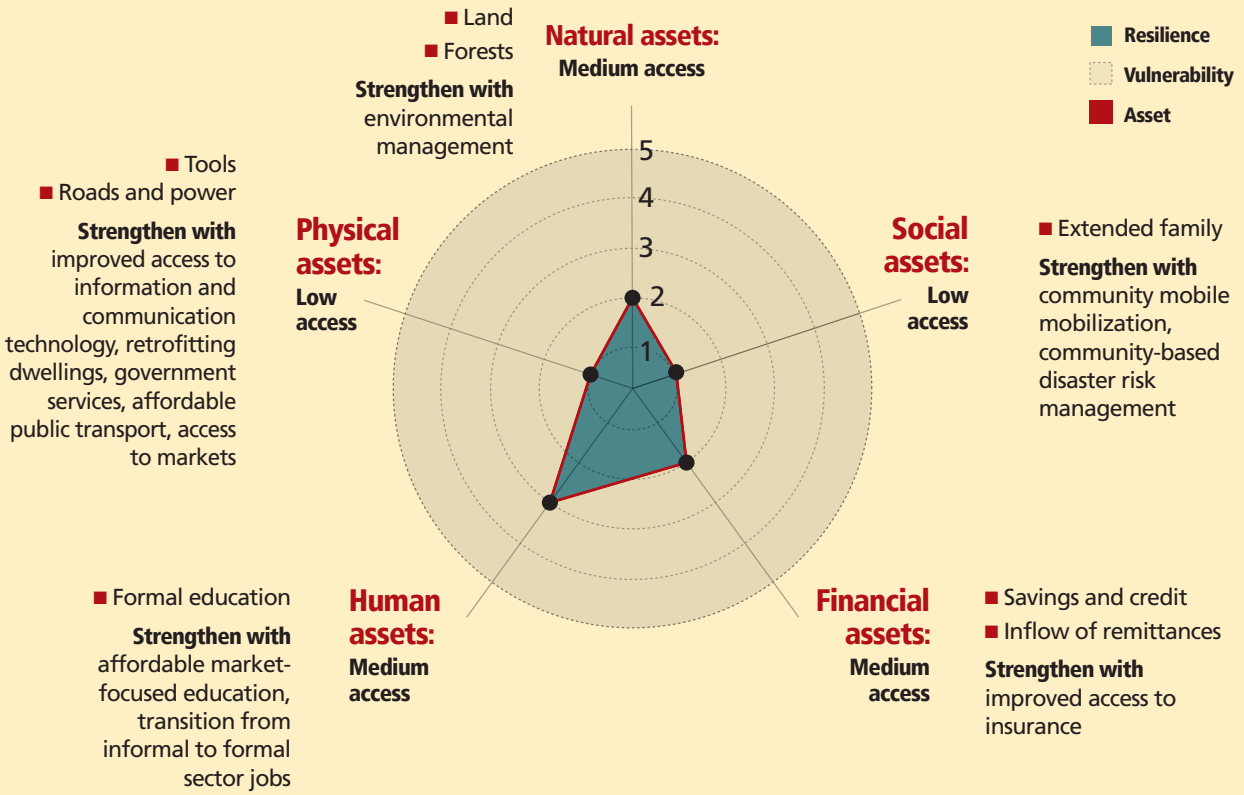
The backcasting approach is applied below, using assets as entry points to explore how some of them could, indeed, be exploited to strengthen investment in resilience. It is written in the past tense, looking back from a vision of a resilient future 20 years hence and telling a hypothetical story about how that vision might have been achieved. The vision paints a picture of strengthened livelihood resilience built on several key accomplishments that collectively result in strengthened resilience of physical, social, financial, human, and natural assets:

- Hazard risk assessments are routinely undertaken to inform livelihood policies, plans, programs, and individual interventions.
- Initiatives to strengthen livelihood assets and support livelihood diversification are being undertaken with the support of

Table 5 **Policy, Capacity, and Investment Actions for Risk-Sensitive Livelihood Development**

Core Needs	Policy	Capacity	Investment
Assessing risk	Require the use of risk-sensitive land use plans/ risk maps to identify hazard-prone areas and link risk-related information to livelihood planning.	Train community members in vulnerability and risk assessment as means of supporting goals of risk reduction in local livelihoods. Build capacity of agriculture and related extension workers in using weather information for agriculture planning.	Identify and assess highly vulnerable areas and the livelihoods within those areas. Improve the collection and analysis of local and regional hazard data.
Reducing risk—avoid, eliminate, and reduce	Ensure that eligibility for training programs, microcredit, and local government assistance are not dependent on landowning status or gender. Promote development and use of disaster-resilient food crops, such as flood-resistant rice, drought-resistant maize, etc. Design government social protection programs (such as minimum employment guarantees, education assistance, and emergency food assistance) for the poor in at-risk areas and for the disaster-affected, to reduce the risk of asset sale and indebtedness. Review the mobile phone network coverage in high-risk areas and consider allocation of at least one phone per village. Consider relocation of communities in high-risk areas. Develop long-term livelihood diversification strategies for highly vulnerable areas where people cannot be relocated and where livelihoods are overly dependent on one asset (e.g., land or fisheries)	Build community and local government capacity in high-risk areas in organized disaster preparedness, response, and recovery, including protection of assets. Conduct national-level awareness-raising campaigns on community-based disaster risk management (DRM) and resilient livelihood via radio, print, or television, directing people to resources and programs and informing them about self-help in the absence of a formal program. Integrate disaster risk reduction (DRR) elements into local credit, livelihood, and self-help group capacity development curricula. Encourage formation of livelihood groups, cooperatives, youth groups, self-help groups, and credit groups to build social capital and engender formation of a social safety net.	Invest in programs for community-based DRM and resilient livelihoods in identified at-risk zones and disseminate the results. Invest in vocational training, particularly for women and youths and particularly in rural areas, to increase the number of income earners and diversify the sources of income in at-risk families. Encourage the formation of savings with banks and credit companies, rather than through accumulation of physical assets. Invest in community-based ecosystem management for DRR.
Managing residual risk—share and transfer	Ensure national policies regulating insurance providers allow for microinsurance delivered by a second party, such as a microcredit organization.	Build local knowledge about available microinsurance products. Encourage the accumulation of savings as a buffer against times of interrupted income earning and unexpected expenses. Train schoolchildren and adults so that they understand the content of a radio or text-based civil defense warning. Reduce disaster-related morbidity through training in first aid and good hygiene practices.	Seek public–private partnerships in provision of micro asset protection and weather index–based insurance. Implement government social protection programs for the disaster-affected, to reduce the risk of asset sale and increased indebtedness. Improve hazard monitoring, and early warning systems

Figure 26 **Strengthening the Resilience of Livelihood Assets**



government, civil society, and the private sector.

- There is widespread access to microcredit and microinsurance.
- A strong governance framework is in place, limiting vulnerabilities caused by political, security, and ecosystem instability.

Access to safe building sites through purchase or negotiation using consents, tax advantages, purchase, barters, donations, and/or zoning easements benefited tens of thousands of households

Strengthened Physical Assets

Interventions to strengthen physical assets began with access to safe building sites. Households were empowered over several years to take the initiative to reduce their risk by physically relocating to areas more suitable for a sustainable livelihood. Whether through government, NGO, or private sector–based initiatives, access to safe building sites through purchase or negotiation using consents, tax advantages, purchase, barters, donations, and/or zoning easements benefited tens of thousands of households. When social housing schemes were included as part of slum upgrading projects, the preservation of existing livelihoods and social networks was paramount during the planning, design, and construction process. Structural risk reduction works, financed by international development partner loans and grants, permitted local governments and households to significantly decrease the primary physical risk to livelihoods, such as overcrowding and reliance on inadequate infrastructure. These settlement dwellers became more stable, enfranchised citizens. Meanwhile, municipal governments captured savings from reduced demand for disaster relief, security, and social services, and these savings were reinvested in other settlements and in provision of improved urban services.

In settings where relocation was not possible, the most viable action was to reduce risk through retrofitting dwellings. Given that affected livelihoods were intrinsically linked to existing locations that would continue to remain hazard prone, such as coastal fisheries, local and provincial governments specified housing designs and community infrastructure, using hazard mapping and

zoning to minimize loss of productive assets. The necessary technical studies and funding for retrofitting came about through targeted DRM, CCA, public sector small business and low-income housing programs, and loans and grants supported by the international community, whose assistance priorities shifted from reactive to proactive investment in resilience. Discounted insurance for retrofitted housing and redesigned community infrastructure enhanced the incentive for public and private infrastructure service providers and households to provide the necessary qualifying investments.

Another important part of the investments made by the government and the private sector, which significantly enhanced livelihood resilience, was in the area of information and communication technology. Access to dependable and continuous information on a variety of subjects as broad as livelihoods themselves expanded opportunities for remote communities and urban households alike. Information on disaster preparedness and response was integrated into formal and informal education systems. The expansion of mobile phone technology at increasingly affordable prices meant farmers could receive text messages on such topics as weather forecasts and market prices. Technical assistance and investment to expand information and communication technology networks, develop useful information portals, disseminate user information, and increase access came about through public sector policy and investment as appropriate for market-driven pricing in telecommunications and equipment access.

Strengthened Social Assets

In areas identified as disaster prone due to chronic or extensive exposure to natural hazards, community-based DRM proved to be an essential investment in livelihood resilience. The community-based DRM approach, conducted by NGOs well versed in working with communities on economic and social development needs, brought flexible, multi-objective programming and project funds. Initial community awareness-raising was followed by facilitation of community risk assessment capacity building. Risk assessments included community mapping to better understand the spatial nature, severity, and frequency of natural hazard risks; evacuation pathways; and the expected effects of disasters on local economic and social infrastructure. This enabled the identification of assets, needs, and coping strategies. Most importantly, the risk assessments identified residual risks that would not be reduced in the short term, particularly risks beyond the control of individual households. Addressing the management of residual risks at the community level was undertaken by local government and included provision of understandable warning information by radio, evacuation shelters, and disaster-resistant transport routes. Local community-based DRM committees and voluntary working groups drew up pre- and post-disaster activities, such as continuing public awareness, periodic risk assessment updates, local early warning systems, own-account risk reduction activities, and evacuation protocols, and linked these with urban, district, or provincial plans, resources, and funds. In addition to NGO resources, local government funds and private grants and donations were used to support these activities.

Participation in livelihood interest groups, self-help groups, and civil society also reduced livelihood vulnerability by using knowledge gained from the experience, practices, and technology employed by others facing similar risks. Linking these groups with community-based DRM programs promoted the introduction to group members of specific livelihood resilience enhancements. These included strategies for protecting key documents and productive assets. Piloting, demonstration, scaling up, and replication of successful local group-based activities, including training of trainers, enhanced the resilience of more at-risk communities and the nongovernment sector. These activities also transferred social capital among communities, districts, and provinces. Support for linking these groups with community-based DRM programs, and the ensuing activities, was underwritten by own-account cost sharing.

Increased Financial Security

In the past, it was far too common for an insurable loss—such as death or incapacitation, prolonged illness, or total or near-total loss of shelter or the means of livelihood—to push a family into permanent

poverty. Surveys would later show that, among small-scale farmers, illness or accidents of family members from all causes cost those under the poverty line about 25% of annual household income. Natural hazards, especially floods, caused losses equivalent to a further 23% of annual family income—similar, for instance, to levels of loss observed in Viet Nam (Central Institute for Economic Management 2012). Insurance coverage at the household level was very low, leading to further indebtedness after a disaster, and further impoverishment. Traditionally, insurance had been provided through qualified brokers linked to formal companies and had largely failed to reach the poor or near-poor.

However, improved access to insurance was identified as a key factor in increasing livelihood resilience. Insurance products accessible to the poor were therefore reformulated to be easily understood, to be more affordable, and to provide quick payouts. The insurance products offered became straightforward and claim procedures were simplified. To stimulate their development, the government also provided guarantees to insurance companies and developed partnerships with organizations such as microfinance providers, which already had trusted relationships with low-income households. Microinsurance already had a very high demonstration effect—people would purchase an insurance product after seeing others being compensated for losses. As such, pilot programs were an important element in encouraging participation.

One example of addressing vulnerabilities to natural asset–based livelihoods was weather index–based insurance. Payouts were triggered by a weather-calibrated index based on a predetermined threshold, such as an excess or shortage of rainfall or other weather variables affecting selected crops. The threshold was determined through risk modeling that as closely as possible correlated crop loss patterns with weather variables to identify expected crop losses. Index insurance greatly reduced the prospect of fraud and solved three of the most difficult challenges of agricultural insurance: moral hazard, adverse selection, and cost of loss adjustment.

- **Moral hazard:** Farmers cannot influence an index that is based on weather.
- **Adverse selection:** Farmers opting in or out of the insurance program have no impact on the risk or therefore the cost of provision.
- **Cost of loss adjustment:** No visit to the individual farm is needed to calculate losses.

There were three action areas for this insurance scheme. First, it was necessary to update the policy and regulatory framework of the insurance industry to eliminate impediments and distortions in its development and promotion. This included development of regulations and guidelines, legal bases, and consumer protection protocols. Legislation required updating to allow partnerships between insurance companies and microfinance organizations, thus facilitating access by the poor.

Second, it was required to upgrade the national meteorological infrastructure and analytical capacity to use the data captured in a timely and accurate manner. Activities included installation and maintenance of functional weather gauging stations and the training of technical staff of governments, community-based DRM groups, and private institutions to collect, relay, analyze, and apply the information. Advanced technology such as remote sensing and geographic informa-

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Livelihood diversification and raised homes can strengthen resilience.

tion systems complemented the information generated locally through community-based DRM programs. In many cases, this was undertaken with financial assistance from the international community.

Third, technical assistance through private sector partnerships was required to develop and pilot viable insurance products. This included use of weather data to create models that determined area-based risks and therefore prices, thresholds for payout, and so on. It also included facilitation of appropriate marketing strategies and models of partnership among insurance companies and rural banks, microfinance operations, and public agencies. These were supported by national policy and legislative initiatives and budgets for proactive risk reduction. There also was expansion and improvement of public sector climate hazard analysis, in cooperation with the international and national agriculture industry. Much of this was achieved through governments identifying these requirements as essential components in their respective national development plans and negotiating with the international community to have them included in respective country partnership strategy negotiations.

Access to savings and credit was strengthened to enhance livelihoods. Savings was encouraged to facilitate access to credit. This developed financial literacy, built financial and social capital, and promoted access to a network of business information and services. Accumulation of savings or access to credit enabled families to invest in other livelihood asset improvements and to ride out the income downturns invariably caused by seasonal or labor force fluctuations, without selling tools or income-producing assets or borrowing at unattractive terms.

Strengthened Human Assets

A Millennium Development Goals campaign had previously prompted government efforts to improve enrollment and retention of youth in formal education, but with only partial success. Those who could afford further education and those who could attract scholarships moved on to tertiary education, facilitating access to a professional, administrative, or technical livelihood. The rest of the working-age population faced fierce competition for jobs requiring only a secondary education, which were most likely to exist in urban areas. Those in rural areas or whose performance or attendance resulted in minimal academic preparation were less competitive and often confronted less lucrative livelihood choices, thus heightening vulnerability for those who were often already the poorest.

Technical assistance and investment by the government, NGOs, and the international community had an effect on income diversification and job creation, leading to localized economic growth and resilience. This was accomplished by developing affordable or free market–focused, short- and medium-term education programs such as vocational skills training, in some cases provided as block courses involving just a few days of intensive training per month. Vocational training was often paired with infrastructure investments to ensure that required regular maintenance could be undertaken locally. The government incentivized the private sector to provide jobs and training by formalizing and subsidizing apprenticeship programs. Supporting the transition, particularly of educated youth, from informal to formal sector jobs increased livelihood resilience because formal sector employment not only provided regular, predictable income but also often came with social protection benefits such as paid annual and sick leave, preferential access to group insurance, and maternity leave for women.

Where opportunities for income diversification were scarce and existing livelihoods were unsustainable, migration was common. The government was aware of the growing receipt of remittances by low-income families, sometimes including as many as 50% of households nationally—similar to levels observed in, for instance, Nepal (Central Bureau of Statistics 2011). However, only a fraction of the remittances were used for capital formation, compared with the much larger expenditures for daily consumption. Such migration locations became priority targets for raising awareness about ways to leverage the transformative potential of using remittances for disaster-resilient job creation, savings, and purchase of income-producing assets. This was carried out by community groups and government agencies, using own-account budget funds, and by the international community, which supported information and discussion to enhance financial literacy for both migrants and recipients.

Migration locations became priority targets for raising awareness about ways to leverage the transformative potential of using remittances for disaster-resilient job creation, savings, and purchase of income-producing assets

Strengthened Natural Assets

Environmental management was another entry point for both public and community disaster-resilient livelihood enhancement initiatives. Protection and enhancement of the environment was based on site-specific natural hazard risks and targeted the needs and opportunities of the vulnerable population. Experience had shown that, following disasters, survival of tidal surges and flooding was greater in coastal areas with reefs, dunes, and good mangrove cover that broke the force of waves. Thus, protection of reefs, control of sand mining, and reforestation of mangrove areas was undertaken in coastal areas. This included programs to build local knowledge of and capacity for the preservation and sustainable use of these naturally occurring ecosystem structures and functions. Propagation of mangrove plants became a viable business for local groups and individuals. In the same way, improved watershed management practices were used to reduce the damage associated with erosion and flash floods while improving aquifer recharge. At the same time, livelihoods were enhanced through improved supply of animal fodder, enhanced water productivity, and less damage to agricultural land from flooding.

The government, the private sector, the international community, local community groups, and NGOs increased the effectiveness of such programs through responses simultaneously covering policy and information, capacity building, infrastructure and insurance, community participation, and diversification of livelihoods. Investments in the form of both post-disaster assistance and newly formed risk reduction technical assistance grants, loans, and lending took a long-term view by factoring in the potential avoided disaster assistance costs of displacement, loss of life, loss of income-earning assets, and reduced expenditure on disaster relief. In this way, disaster-resilient livelihood development assistance utilized earmarked disaster-driven outlays by explicitly integrating risk reduction into poverty alleviation programs, with little additional cost over previous, reactive programs. The result for the local population was improved income diversification, sustainability, and the ability of the poorest to invest in their own futures.

Reducing the Context of Vulnerability

The targeted strengthening of physical, social, financial, human, and natural assets for livelihood resilience was made sustainable by an improved governance framework that limited vulnerabilities caused by political, security, and ecosystem instability. This was achieved in part by an NGO instituting a community scorecard system, whereby they very publicly rated the services received by various local and regional government agencies and encouraged members of the community to expect better. After some initial public inquiries, service providers started to work with communities to actively improve both their services and the transparency with which they were provided. This type of improved regional and local governance gave families and communities the confidence to plan and invest with more certainty. Incidences of strikes, riots, and demonstrations went down. Knowing that policies would be upheld, infringements would be penalized, services would be available without the need to pay bribes, and institutions would be accountable for the funds and responsibilities with which they were entrusted also built the level of business confidence. Thus, the private sector also prospered, offering yet more areas for employment and investment, and so further diversifying sources of livelihood.

8.2 Risk-Sensitive Land Use Planning

Land use planning is a complex, formal, and bureaucratic undertaking. The process of land use planning takes place with nested and interweaving levels of authority and responsibility in its implementation. Consequently, the development of a land use plan for a metropolitan urban area or city could take several years and include many steps, with an anticipated implementation life span of at least a decade and sometimes longer. Risk-sensitive land use planning is a new concept for planners and development professionals. It adds two new considerations to the conventional approach to land use planning (Figure 27):

- **Disaster risk reduction parameters and objectives.** Hazard, vulnerability, risk, and capacity parameters, together with the disaster/emergency management requirements, are identified, collected, and integrated with traditional land use planning information (e.g., socioeconomic profiles, demographics, and transport networks), and DRR goals and objectives are formulated.
- **Integration through formal government activities.** Measures are taken to ensure understanding, acceptance, and support for the plan; to improve the competency and knowledge about risk-sensitive land use planning among planners and other professionals; and to raise the awareness and support of all stakeholders.

These two additional considerations require a series of information analyses, reviews, and evaluations gathered from government, the targeted communities, nongovernment entities, and the private sector, which are then incorporated as the plan is formulated. The plan implementation and enforcement processes are indicated in rules and regulations typically embodied in a zoning ordinance. Plan monitoring and evaluation are the responsibility of the plan's administrators.

Land use planning involves an interactive and continuous process to regulate the use and development of land, allowing feedback among government planners and other stakeholders, who may have multiple and sometimes competing interests (Box 12). The resulting consensus and trust is manifest in the ownership of and support for implementation and enforcement of the resulting land use plan. Land use management provides regulatory tools that enable the government to establish its mandate on land use (Table 6).

Land Use and Vulnerability

In developing countries, land use planning and land use management have resulted in challenges and failures when the formal process has been inadequately or improperly administered. The informal process has produced slums and substandard informal settlements and has given rise to significant land use inefficiencies, both of which require significant and long-term investments to reestablish a more sustainable built environment in the face of risk. The juxtaposition of natural hazards with inadequate land use and land management practice is a major cause of increased loss of life and property in all sectors. The following are the specific roots of vulnerability:

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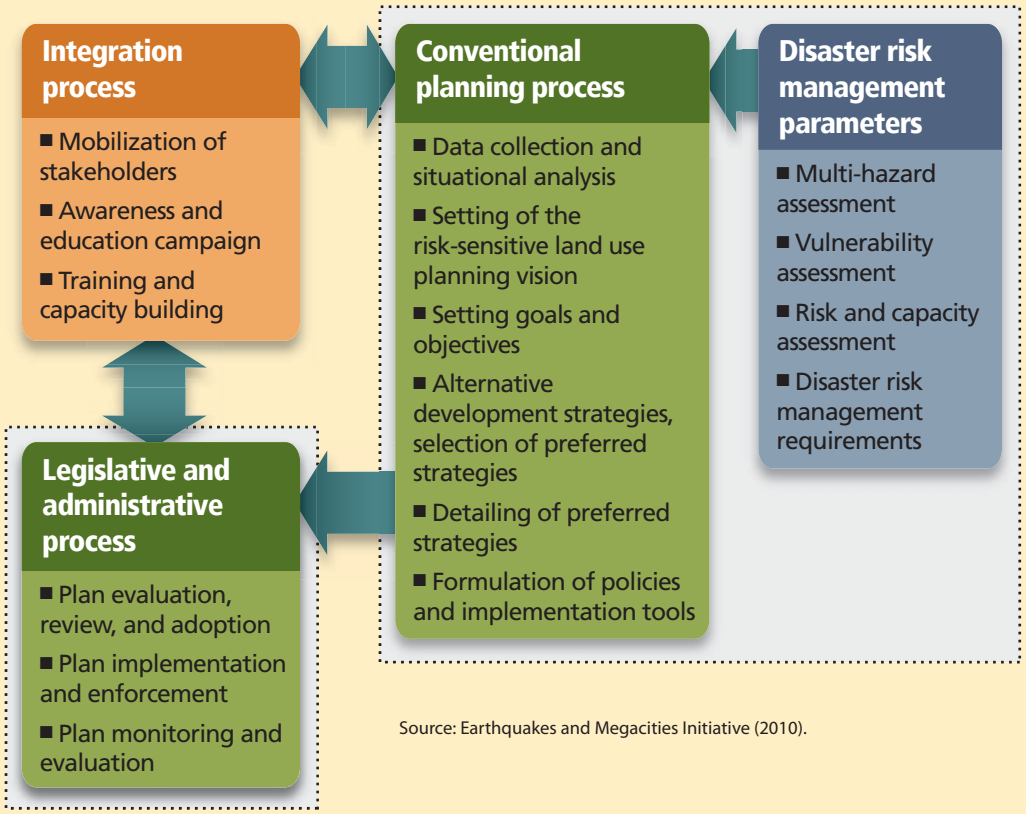
Community consultation is an important part of risk-sensitive land use planning, supporting the identification of high-risk areas and prioritization of risk reduction measures.

Box 12 Kathmandu Risk-Sensitive Land Use Plan

For highly vulnerable cities such Kathmandu, Nepal, the development of a risk-sensitive land use plan offers an opportunity to incorporate risk reduction into development and spatial plans through a participatory process that engages government institutions, the private sector, civil society, international development partners, and other key stakeholders, such as academia and the media. The Kathmandu Metropolitan City Risk-Sensitive Land Use Plan is a 15-year guide (2010–2025) for realizing the city's desired spatial pattern of development, with due consideration to the city's seismic risks, emergency response, and disaster risk management capabilities, through different land use policies and urban renewal schemes. It addresses specific risk and vulnerability reduction strategies; restores and protects cultural heritage sites; improves the private investment environment; and elaborates sustainable development strategies that are predicated on more efficient transport systems, sustainability of environmental and natural assets, and better living conditions for inhabitants.

Source: Earthquakes and Megacities Initiative (2010).

Figure 27 The Content of Risk-Sensitive Land Use Planning



Source: Earthquakes and Megacities Initiative (2010).

- **Deficient land use planning and land management.** The rapid growth of cities has not been supported by appropriate levels of investment in infrastructure, basic services, and habitable settlements. Inadequate and insufficient infrastructure, typically poorly maintained, coupled with uncontrolled urbanization often feeds the growth of informal settlements and slums, reinforces poverty, and diminishes a city's ability to deal with disaster events.
- **Deficient environmental management.** The inappropriate exploitation of natural resources; occupation of naturally vulnerable ecosystem areas such as floodplains, seismic fault easements, marshes, wetlands, dunes, and forests, whether by choice or by force; and inadequate

Table 6 **Processes and Tools for Risk-Sensitive Land Use Management**

Processes and tools for risk-sensitive land use management	
Regulatory, location-based	Zoning and microzoning
	Subdivision regulation
	Buyouts
	Eminent domain
	Taxation
	Special economic zones
Regulatory, design-based	Building codes
	Retrofit standards
	Hazard-reduction standards
	Environmental standards
	Standalone ordinances
	Easement (to trade for other resilience features)
Non-regulatory	Public information
	Training programs
	Information and awareness
	Low cost loans and subsidies
	Other incentives

Source: Earthquakes and Megacities Initiative (2010).

disposal of solid and liquid waste increase vulnerability to recognized natural hazards.

- **Lack of compliance with and enforcement of construction codes and regulations.** Schools, hospitals, essential facilities, housing, commercial and institutional property, and major infrastructure may be poorly constructed or designed without satisfying minimum safety standards. Even when construction standards have been adopted, enforcement of these standards is often lacking.

Realizing Resilience through Land Use Management: A Vision of the Future

Risk-sensitive land use planning can be achieved by applying the three basic groups of instruments of intervention—policy; capacity development, particularly at the local level; and investment—to support enhanced risk assessment, risk reduction, and management of residual risk. Table 7 outlines sample policy, capacity building, and investment actions that can be taken to address risk assessment, risk reduction, and residual risk management needs and thus to achieve risk-sensitive land use planning.

The backcasting approach is applied below to determine how some of these instruments could indeed be applied to achieve a vision of resilient land use management 20 years hence. This vision is built on several key accomplishments:

- Policies, laws, and regulations on risk-sensitive land use planning and management are in operation.
- Risk-sensitive land use plans are in place.
- Institutional arrangements for risk-sensitive land use planning and management are coherent and effective across all levels and sectors of government.
- There is adequate capacity for risk-sensitive land use planning and management.

Table 7 **Policy, Capacity, and Investment Actions for Risk-Sensitive Land Use Planning**

Core Needs	Policy	Capacity	Investment
Assessing risk	Adopt policy to develop hazard, vulnerability, and risk assessments for urban areas.	Build capacity in undertaking hazard, vulnerability, and risk assessment. Train engineers in rapid assessment of building vulnerability.	Develop risk assessment information technology platforms for data sharing. Identify highly vulnerable buildings and infrastructure.
Reducing risk—avoid, eliminate, and reduce	Adopt policy to mainstream disaster risk management (DRM) and climate change adaptation in planning processes. Decentralize the process for risk-sensitive land use planning and strengthen its linkages with local investment planning process. Adopt policy to make urban redevelopment projects risk-sensitive. Amend planning laws and regulation to make them risk-sensitive. Strengthen land use control regulation to restrict and control development in hazardous areas. Strengthen laws and regulations related to building control and building code compliance.	Train planners in risk-sensitive land use planning. Develop the capacities of local governments to improve project planning and project execution. Establish peer-to-peer sharing programs in land use planning. Develop ownership through participatory processes, training, and capacity building. Develop capacities of local government staff to better enforce zoning and building regulations. Undertake extensive educational campaigns on risk-sensitive land use planning and the importance of community participation in the planning process.	Develop industry standards, guidelines, and case studies for risk-sensitive land use planning. Update planning guides for various government agencies to make them risk sensitive. Based on risk-sensitive land use plans, develop site-specific and scenario-specific participatory DRM plans for vulnerable areas. Establish a system for prioritizing substandard infrastructure and public buildings for public action. Support priority funding for upgrade of vulnerable infrastructure and housing. Invest in retrofit and rehabilitation of critical facilities. Seek public–private partnerships in risk-sensitive urban redevelopment programs. Buy-back land and property in high-risk areas and transform into buffer zones.
Managing residual risk—share and transfer	Develop long-term vulnerability reduction programs for highly vulnerable areas that cannot be relocated.	Undertake emergency drills and exercises.	Promote options for risk protection and insurance.

- Strong public and private incentives for compliance with risk-sensitive land use plans have been established.

The story is told in the past tense, looking back in time from that point 2 decades in the future. In each case, the entry point for applying the instrument, the protagonists in its application, and their motives for seizing the opportunities for investing in resilience are noted. The stories are hypothetical stories, but in some cases are based in part on actual achievements, and all are considered well within plausible grasp.

An Enabling Policy Environment

An expanding population, coupled with weak public planning institutions, lack of knowledge of hazard risks, and a lack of skills, which led to decades of misuse of land resources, had to be overcome. The international community considered the country and several of its major cities to

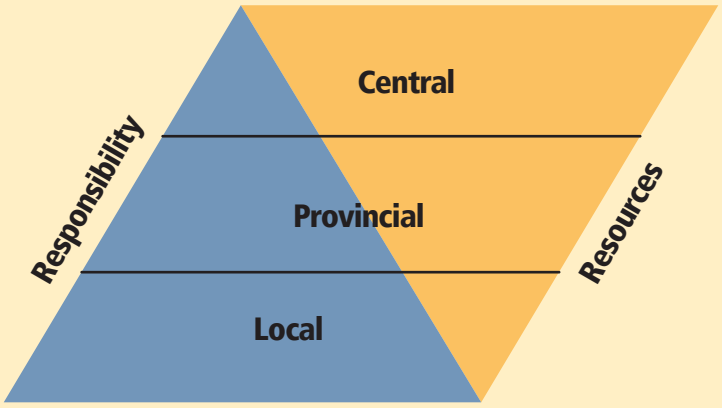
be repetitive disaster states, stimulating the government and private sector to take action to develop more sustainable land use policies.

The government gained support for the development of a network of sustainable economic and social infrastructure as part of its effort to develop a common natural hazard risk reduction agenda among the relevant stakeholders. With this support behind it, the government then adopted various policies to improve its approach to risk-sensitive land use planning and land management. These included a comprehensive national policy integrating risk parameters in land use planning and land use management processes at the local level. This policy denied requisite legal addresses for development in designated no-build hazard zone areas where development controls and land transformation initiatives had failed, but recognized such stature for areas formally declared to meet acceptable levels of risk. In the urban sector, a policy linking public sector project funding to integration of risk parameters and reduction of risk was established, again denying support for projects in hazardous zones and, to the extent possible, placing all future critical infrastructure outside of these zones. Local DRM and land use planning laws mandating risk-sensitive land use planning and management processes, including zoning and building code regulations, were also put in place. Finally, a comprehensive national policy following regional guidelines for good governance and anticorruption benchmarks, monitoring, and enforcement of applicable laws was adopted.

Institutional arrangements were strengthened as well. The distribution of responsibility and authority in the country had been such that the central government controlled a much larger share of authority and resources than local governments, while the latter struggled with increasing responsibility and declining resources (Figure 28). Support from international development partner technical assistance programs was used to foster decentralization as a key condition for solving inter-institutional structural problems and effectively aligning the practices of land use planning and management, DRM, and CCA. The country strengthened institutional arrangements and improved efficiency through the following actions:

- Adopting a policy of decentralization, enabling more efficient inter-institutional and intersector coordination mechanisms and integration of DRR and CCA with land use planning, using scientific approaches and international standards such as the ISO 31000 framework (ISO 2009), thus minimizing regulation and confusion for business development interests.
- Making central government funding for DRR and CCA competitive among local governments, based on substantiated

Figure 28 **Reverse Pyramid of Resources and Responsibility in Governance**



Source: Bendimerad (2003).

progress in risk reduction, tied to local adoption of indicators to monitor and measure progress toward enforcement of land use and building code regulations.
- Making information on risk a public resource, open and freely available among disciplines, institutions, and agencies, to facilitate its integration into planning processes and to motivate investment in DRR.

Capacity Development

DRM, CCA, and land use planning had been poorly coordinated in the past. The central government instigated a more coherent and effective approach, strengthening the linkages between the three areas with support from academic and education partners by

- developing an improved educational curriculum for planners, covering risk identification and assessment, including climate risks;
- developing planning guides containing explicit and clear explanations of the concepts and practice of DRR and CCA;
- securing the participation of professionals, researchers, and practitioners from the public and private sectors in studies and discussions of policy implementation and regulatory regimes and their effects, using both research and technical assistance projects as the basis for the exchange; and
- disseminating sound case studies demonstrating the integration of DRM and CCA in land use planning and land management.

The central government, in conjunction with the academic community and local governments, also developed step-by-step guidelines and manuals for development professionals and planners at all levels. These guidelines and manuals covered hazard, vulnerability, and risk data collection, processing, and analysis; and urban planning and design methodologies. They supported the transition of risk-sensitive land use planning practice from concept to implementation. Case studies were documented as well and guidance was provided on the preparation of risk profiles for major cities and their environmentally sensitive areas. Risk-sensitive zoning ordinances were prepared to provide a legal environment for enforcement.

In addition, work-study programs were created in academic institutions and government agencies by the central government, with support from the private sector, public and service infrastructure entities, and the insurance and finance communities to strengthen risk assessment capabilities in the field of land use planning. Actions initiated through these programs included

- the promotion of the use of computing, remote sensing, and geographic information system technology to effectively analyze and disseminate risk identification and assessment parameters;
- the formulation of communities of practice around these technologies, to support further training, methods development, and sharing of outcomes so that studies were more broadly disseminated, understood, and improved upon; and
- the engagement of local research capacity in undertaking risk assessments, vulnerability analyses, and hazard profiling, including multiple approaches where data resources skill levels were improving.

Finally, local governments received considerable technical support in project planning and project execution capabilities from the central government and specialized NGOs to ensure that DRR goals were not diluted or ignored due to lack of experience or knowledge. Through monitoring and evaluation, the participating professionals showed successful implementation of plan components, including assigned budget expenditures, thus reinforcing international community interest in the country's risk reduction initiatives.

Investing in Urban Resilience

The policy and capacity building activities required investments to support their implementation. Financial resources were limited, especially among local governments. However, technical assistance grants increasingly became available from the international community to underwrite governments' risk-sensitive land use planning.

Box 13 **Risk-Sensitive Redevelopment Planning for Barangay Rizal**

The Risk-Sensitive Urban Redevelopment Plan of Barangay Rizal in Makati City, Philippines, demonstrates how a long-term plan can be developed to guide future development with the ultimate goal of reducing exposure to hazards. Barangay Rizal is a low-income neighborhood that sits on an active earthquake fault and is subject to frequent flooding. The goal is to transform this high-risk community into a safer, disaster-resilient neighborhood while simultaneously enhancing its urban fabric, economic vibrancy, social cohesion, public safety, and environmental quality. The challenge is to work with the stakeholders to develop options to reduce these risks and to have these options understood, accepted, and supported on the basis of compromise. The redevelopment plan is designed for a 10-year period with short-term, medium-term, and long-term actions. The priorities in the action planning were driven by input from the stakeholders and were chosen based on their ability to secure community acceptance while also developing the conditions to stimulate public expenditure and attract private investment.

Source: Earthquakes and Megacities Initiative (2010).

Such planning encompassed many sectors and affected natural resource exploitation, enabling the government to tap funding and investment instruments from a wide range of sources.

Independent of the source of funding, risk-sensitive land use planning provided tangible financial returns to government, private investors, communities, and individuals. Redevelopment focused on risk reduction increased the economic and social potential of at-risk settlements and transformed informal settlements and slums into viable neighborhoods with enabled infrastructure that attracted private investment (von Einsiedel et al. 2010). The government stimulated investment in transport, water, sanitation, and DRR. The private sector—developers, private individuals, and service providers—found viable investment opportunities for developing housing, utilities, and services. Communities participated by engaging in housing and livelihood preparedness and risk reduction (Box 13).

Government concentration of much of its infrastructure investment in less hazard-prone areas also helped direct private sector, community, and household investments toward these areas. In some cases, a property tax surcharge was placed on less vulnerable land where public infrastructure investments had taken place, and a portion of this revenue stream was put back into public infrastructure risk reduction measures in areas where the government wanted to direct growth. Other benefits captured from investing in less hazard-prone areas came from more attractive infrastructure financing and lower insurance costs.

The government optimized private investments through various debt instruments, including municipal infrastructure bonds. To further encourage private investment, the government used instruments such as build–operate–transfer, build–operate–own, and private sector participation projects for road transport, water, and sanitation infrastructure. The location of businesses and homes in less vulnerable areas permitted continued access to credit as loan approvals became in part dependent on the level of disaster risks faced. In addition, areas with less vulnerable public infrastructure were monitored and evaluated for private sector–induced increases in risk, which triggered offsetting surcharges to cover financing of increased contingent liabilities, thus making visible the benefits of private and public investments in resilience.

The government used legal and planning instruments to improve private and individual investment and to improve access to land and property for the lower- and middle-income populations. Eminent domain laws, purchase development rights, and buyouts enabled governments to acquire land for the purpose of development and/or conservation of risk-prone areas. Land use planning instruments included land pooling, land consolidation, and other land management techniques that enabled a more efficient approach to land use and an opportunity for investing in resilience.

8.3 Safe Road Transport

Transport networks, including land, sea, and air travel networks, enable the economic development of a society. As is true of any sector, road transport infrastructure is delivered through a combination of policies, planning, and implementation initiatives. Countries usually develop transport policies and related tools that are put into practice and financed through a variety of instruments and mechanisms, such as regulations and guidelines, detailed operational plans, projects, special purpose vehicles, program support, budget support, private sector investment, or foreign direct investment. The term *project* in the context of transport is used here to refer to any action that aims to improve transport services, such as stronger policy formulation, increased capacity, the construction and rehabilitation of roads, maintenance, and so forth. In reality, many projects comprise a combination of policy development, capacity development, and physical works.

Most countries have crosscutting policies and regulations in place that must also be considered when implementing sector policies. These policies and regulations cover issues such as DRM, climate change, gender equality, poverty eradication, environmental safeguards, and anticorruption protection. However, these are not always adhered to.

National policies, planning, and implementation guide equivalent processes subnationally and locally, where the national road network is present and connects to other jurisdictions' networks. Acting on strengthened resilience requires simultaneous improvements of policy, planning, and implementation across all levels of a road network.

ADB

New high-level bridge in the village of Maepua. Makira, Solomon Islands

The Road Transport Sector and Vulnerability

Natural hazard events can have far-reaching consequences for transport infrastructure, especially for road networks. Direct physical damage can disrupt the transportation of people, goods, and services, with consequences for livelihoods, commerce, and trade. It can hamper relief efforts and the rehabilitation of livelihoods and broader economies as well.

Decisions on the location of road networks can also influence levels of disaster risk more widely. The construction of a road can disrupt natural drainage patterns, potentially increasing the risk of flooding in their immediate locality, or can increase landslip potential, especially in hilly areas with seismic or high rain aspects. The siting of roads can also influence settlement patterns, potentially resulting in population concentrations in more hazard-prone areas if hazards are not taken into account in the design of transportation networks.

Much of the damage and destruction of roads by natural hazard events is a result of insufficient application of financial resources to construct to higher standards of resilience, lack of regular maintenance, environmental degradation, poor coordination among the various participating professional disciplines and agencies, and, often, simply high exposure

to natural hazard events. The main challenges to strengthening resilience across the road transport sector briefly are

- poor existing baseline capacity and resources for designing and maintaining existing infrastructure;
- high cost and environmental management challenges of building roads in high-risk areas;
- insufficient data, knowledge, and skills for consistent application of engineering guidelines, and lack of qualitative decision support tools for considering risk;
- poor intersectoral coordination and skills for considering and implementing the broad range of measures required to strengthen resilience;
- insufficient input of risk information into upstream transport network planning; and
- lack of long-term monitoring and evaluation of the effect of actions to strengthen resilience.

Strengthening Road Resilience: A Vision of the Future

The road transport sector can be made more resilient by

- improving structural engineering to better manage the effects of natural hazard events;
- improving management and planning (i.e., integrated land use management, targeted operations, and maintenance programs); and
- establishing plans and funding arrangements to restore functioning transport systems as rapidly as possible in the aftermath of a disaster (Figure 29).

Table 8 outlines some potential policy, capacity building, and investment instruments and mechanisms that support progress along these avenues. These variously contribute to enhanced risk assessment, risk reduction, and management of residual risk.

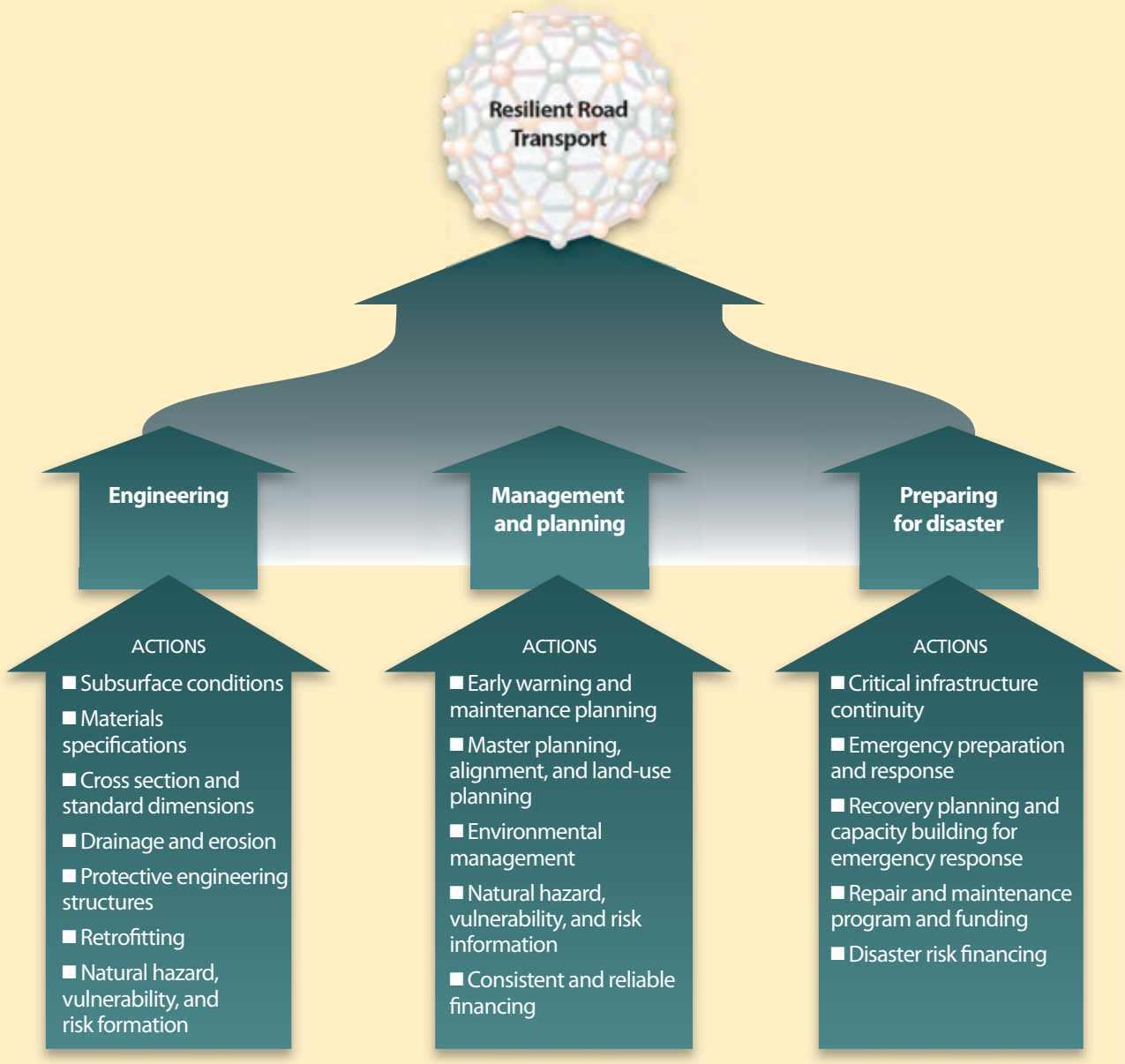
The backcasting approach is applied below to determine how some of these instruments could indeed be applied to achieve a vision of a resilient road network 20 years hence. It is written in the past tense, looking back from that vision and telling a hypothetical story about how it might have been achieved. The vision paints a picture of strengthened resilience built on several key accomplishments:

- Disaster risk concerns are taken into account in road transport policy and investment decisions.
- Road engineering design guidelines incorporate natural hazard considerations.
- Strict quality controls are in place for construction and maintenance.
- A wide range of nonengineering and high-tech engineering risk reduction solutions has been developed and related training has been provided to government officials, road construction contractors, and local communities.
- There is adequate capacity and funding for routine maintenance, and at-risk roads are prioritized for maintenance work.
- Institutional, capacity, and financial arrangements are in place to support rapid restoration of the road network following a disaster.

Engineering and Structural Measures

Actions for investing in resilience began with a review of road transport design guidelines. Existing guidelines contained provisions for the consideration of flood and seismic risk, but the data and knowledge of local hydrology and geology in the country were insufficient to undertake the extended analysis required. The Ministry of Transport therefore adopted guidelines more appropriate to local needs, while also requiring the preparation and incorporation of hazard information into transport master planning, and the strengthening of capacity for expanded data collection and analysis. The ministry also required stricter quality controls in construction and maintenance contracts. This was done by prioritizing road projects with DRR actions to be taken with international development partners, who built

Figure 29 **Road Transport Sector Interventions for Increasing Resilience**



Source: Adapted from ADB (2011).

Table 8 **Policy, Capacity, and Investment Actions for a Resilient Road Transport Sector**

Core Needs	Policy	Capacity	Investment
Assessing risk	Mandate risk assessment in developing the transport master plan and designing individual transport projects. Seek the contribution of academia to the development of risk-based decision-making support tools.	Run work-study programs with national and academic institutions for analysis of at-risk road assets. Strengthen interdepartmental coordination to identify and address underlying factors that contribute to vulnerability. Make risk modeling and decision-making techniques available to decision makers. Provide training in geographic information system mapping and scenario building and interpretation.	Make data on hazard frequency and intensity available in designing investment projects. Make hazard monitoring and forecasting data available in developing maintenance schedules. Expand hazard and vulnerability data collection and risk analysis.
Reducing risk—avoid, eliminate, and reduce	Incorporate hazard and resilience considerations in policies and plans, including in transport master plans, and integrated road transport planning. Provide economic incentives for proactive risk reduction. Mandate attention to life safety in road design. Integrate risk-sensitive land use, development, and transport planning. Provide sufficient project funding to meet agreed standards of resilience.	Ensure equipment and contractors are in place for early road damage detection and repair. Strengthen capacity to integrate natural hazard information into transport planning and design. Strengthen intraregional exchanges between areas of similar hazardscapes and disaster risk management issues.	Implement a hazard-sensitive transport master plan in coordination with other line agencies and local government. Incorporate consideration of hazards and related measures to strengthen resilience in transport design guidelines. Strengthen existing transport network via retrofitting and improved environmental management. Ensure that routine maintenance of existing transport networks is adequate and occurs on schedule. Enforce strict quality controls in construction and maintenance contracts.
Managing residual risk—share and transfer	Mandate contingency planning to identify lifeline transport infrastructure and determine alternate transport networks. Establish contingency budget lines for disaster repairs and reconstruction. Provide an enabling environment for the development of disaster risk financing instruments.	Ensure availability of appropriate transport sector equipment for emergency response. Run work-study programs on the management and implementation of risk-sensitive road maintenance, repairs, and emergency response.	Protect critical transport infrastructure necessary for emergency response systems. Introduce performance-based funding for disaster repair and reconstruction, linked to prior standards of resilience and upkeep. Establish risk transfer and contingent credit options to support rapid reconstruction of transport network in the aftermath of a disaster.

these actions into their country development strategies, lending, grant, and technical assistance documents. The country also called for strengthened regional exchange of data and experience among countries dealing with similar hazardscapes and risk management issues, and for academia to contribute to the development of risk-based decision-making support tools that could be used to assess risk levels and solutions qualitatively, rather than relying only on data-driven tools.

A sectorwide capacity review and follow-up training program was undertaken with international technical assistance to address the lack of skilled staff with a broad understanding of risk assessment. The training program included integrating into transport design the natural hazard information from other government agencies responsible for hydrology and water resource management, geology, environmental management, forestry, wetlands, and climate change. It also covered maintenance monitoring and emergency reconstruction.

The country also called for strengthened regional exchange of data and experience among countries dealing with similar hazardscapes and risk management issues

In terms of implementation, the cost of high-tech risk reduction solutions was balanced with priority use of nonengineering solutions. Pilot projects undertaken with the support of the international community demonstrated a broad range of resilience strategies. To overcome some of the challenges in implementing higher engineering standards in remote and marginal areas, the Ministry of Public Works and the Ministry of Transport trained local populations in resilient construction methods, with the help of engineers.

The Ministry of Public Works and the Ministry of Transport increased maintenance resources and design standards in regions of the country with the greatest road infrastructure vulnerability. Resources were raised by reallocating funds from other road projects and by taking advantage of increased international grants and loans for strengthened resilience. Performance-based contracts were increasingly used as a tool to strengthen the sustainability of road network resilience, with incentives linked to the achievement of lower disaster-related losses.

Local governments were encouraged to set up performance-based arrangements with maintenance contractors for the upkeep of local, district, and, in some cases, provincial roads. This work included clearing debris from drainage, managing roadside vegetation, and making small repairs. Protocols were set up with communities to alert officials to larger problems that needed to be addressed so that damage would be minimized in the event of regular natural hazards in particular. These actions all contributed to increasing the structural integrity of the roads in the case of natural hazard events and to increasing employment opportunities in rural areas.

Management and Planning

In the past, the approach for construction and development of road infrastructure (the project) would be handed over to a technical assistance team, which would be given certain predetermined parameters such as location and technology, but with DRM issues typically left to the discretion of the project team. This was changed by mandating the incorporation of resilience considerations into the policy and planning stage. Later, when the project was handed over for implementation, more emphasis was put on adhering to stipulated resilience parameters. Financing for the development and implementation of risk-sensitive road transport planning was made possible by the fact that disaster risk considerations had been integrated into the transport master plan. Although this strategy was complex to implement, the country asked the international community to support the approach through the use of resilience planning tools and strategies. As a sign of national support, the country increased coordination across ministries by requiring that the land use management and road sector master plans be complementary. Opportunities also arose to increase secondary benefits of transportation infrastructure by maximizing the flood control potential of elevated roads and underpasses.

The country's transport assets had been poorly inventoried, due to a lack of skilled professionals and technical analysis equipment. The Ministry of Transport, through a work–study program formed in cooperation with academic institutions, implemented a program to monitor at-risk road assets regularly. From this, an inventory was developed that was used to prioritize and direct maintenance and

investment resources to strengthen resilience. Local capabilities were also strengthened to ensure that this inventory would be regularly updated and that there was adequate local capacity to prepare maintenance programs and develop capacity for construction and maintenance using newer road technology. Mechanisms were also put in place to support continuing improvements in knowledge and know-how (data generation, information sharing and learning across regions, monitoring, and evaluation) and informed decision making (cost–benefit analysis, integrated risk assessment, and integrated multisector planning).

Actions also were taken beyond the transport sector to increase the resilience of the road network. These actions entailed greater multisector cooperation and planning—integrated land use planning, for instance. These actions were most easily coordinated at the level of local, district, or provincial governments.

The principal action focused on improved environmental management, including upstream watershed management initiatives to reduce debris flows and flash flooding. The road transport sector, in turn, contributed to improved environmental management—and hence its own resilience—by adjusting road design and construction and maintenance practices to limit the effects on the surrounding environment.

Close coordination and negotiations with various government agencies at different levels were required throughout the road development process, to avoid any duplication of efforts and to ensure that resilience measures would be successful. Increasingly, multimodal and multisector programs were used as the vehicle for directing construction financing.

Managing Residual Risk

Retrofitting existing road infrastructure and building more resilient new road infrastructure led to a significant reduction in hazard-related damage. Plans were needed, however, to manage the residual risk, the largest risk management challenge facing the road transport sector, in view of the large existing inventory of vulnerable road infrastructure and the extended time—up to 50 years—that it would take to replace that infrastructure.

The transport master plan developed by the Ministry of Transport not only addressed risk reduction but also laid the basis for the management of residual risk. Investment parameters such as location, preferred technologies, designs, and alignments were determined based in part on the identification of highly vulnerable populations and the related need to ensure that these populations had secure evacuation routes and access to post-disaster relief assistance. In view of its fundamental economic and social roles, the plan also required the development of public DRF instruments to help meet the costs of post-disaster repair and reconstruction of the road network and thereby to help ensure that a fully functioning road network could be restored as rapidly as possible.

The Ministry of Public Works and the Ministry of Transport also strengthened staff capacity to manage residual risk. Professionals in the central and local governments participated in work–study programs that gave them the tools to use emerging risk assessment information to design and implement strategies to prioritize and act on vulnerable infrastructure and to prepare for and respond to emergencies. This capacity building initiative was undertaken in conjunction with other ministries that were undertaking similar efforts to strengthen staff capabilities. Support for the program came from public sector budgets focused on a comprehensive DRM program, in partnership with technical inputs from national and regional DRM institutes and relevant university departments.

Several DRF tools were developed to help cover contingent financial liabilities for emergency response, rehabilitation, and reconstruction in the road sector. The Ministry of Public Works and the Ministry of Transport increased their annual maintenance budget to ensure that some funding could be readily accessed for minor emergency repairs without derailing routine maintenance operations. Any remaining funding at the end of the fiscal year was rolled over into a trust fund for post-disaster repair and reconstruction of the road network. Some contingent funding for post-disaster reconstruction support was also included

as part of a larger multilateral development bank road sector project, thus supporting rapid access to financing in the aftermath of a disaster. In the event of a major disaster, the road transport sector would receive a share of the payout from a parametric sovereign disaster risk insurance policy taken out by the government.

To help facilitate a speedy operational response, the Ministry of Transport also adopted an approach that draws on preapproved local private sector contractors for emergency response, rehabilitation, and reconstruction efforts, as previously pilot tested in other countries of the region. The government negotiated retainers with local contractors hired for medium-sized to large-scale construction contracts, ensuring their rapid mobilization for emergency response, utilizing their heavy equipment to help secure access to affected communities; for emergency rehabilitation, such as undertaking temporary repair to critical damaged roads; and for reconstruction.

8.4 Safe Schools

Schools, the physical manifestation of the education sector, come about and are managed through a complicated process. Schools and other community facilities present a vast array of shapes, sizes, materials, and complexity in how they come into existence, are managed, and relate to natural hazard risk. These other facilities include those for health care, water and sanitation infrastructure, as well as facilities for religious observance, culture, and the arts. In most societies, however, educational facilities, from preschools to universities, are the major focus of sorrow and lament when lives are lost and great damage occurs in the wake of a disaster.

ADPC

Concepts on natural hazards and disaster risk management introduced as part of school curriculum. Lao People's Democratic Republic

Schools and Vulnerability

The vast majority of school facilities in use today, whether public or private, came into existence during the modern development period, which began in the mid-1960s. Many of these school facilities—old and new, large and small, urban and rural—are vulnerable to natural hazards. Even the newest schools and schools that have been rebuilt and repaired following a disaster are not necessarily safe.

School plans for emergency response, beginning with life safety actions (monitoring, alerts, evacuation, and search and rescue), are increasingly common. Such plans come about because knowledge of the prevalent hazard and exposure of the structure is sufficient to warrant basic life safety actions. However, the precise extent of risk of damage and destruction is often unknown to the communities they serve, the school administration hierarchy, and the government in general. Indeed, there is precious little available detailed information covering school facilities and the particulars of hazard, vulnerability, and risk characteristics associated with each school. If risk information is known, it is often not made public until damage or loss occurs or a risk reduction initiative is undertaken.

Cursory review of school construction history indicates that, on average, no more than 2% of the existing building stock is added

Box 14 **The ABCs of School Vulnerability Reduction**

Three basic steps are required to enhance the resilience of school facilities:

- **A:** Act on assessments of the risk to life, safety, and physical structures.
- **B:** Build to lessen risk to acceptable levels, through retrofitting and new construction.
- **C:** Continue to monitor, evaluate, and manage residual risk through risk finance, repairs, and maintenance.

in any given year in any given country. The implication is that the vulnerable classrooms and other facilities of today comprise upwards of 98% of the vulnerable buildings of tomorrow. It will take up to 50 years to replace the existing stock, not counting the need for additional schools to meet population growth. Even assuming that all new schools are safe, a period of 50 years to build toward a totally safe school inventory is unacceptable. This underlines the need for a systematic and sobering approach to building new schools and highlights the importance of retrofitting the existing building stock. Under present circumstances, it is also unlikely that a 100% safe school inventory (assuming life safety but not continuity of operation standards) would be created during those 50 years.

The vulnerability of school buildings has often been the result of errors, omissions, or ignorance, and a reflection of past and current approaches to school safety on the part of the public and private sectors alike. These factors contribute to the poor quality, inappropriateness, and/or absence of the conditions necessary for proper policy, programming, budgeting, project preparation, site selection, design, contracting, and construction of school facilities as well as for the retrofitting, reconstruction, repair, and maintenance of existing schools. Faulty execution of any of these steps in the school development process has the potential to compromise the resilience of school structures. Three, in particular, are associated with significant obstacles that make dealing with school vulnerability very difficult: an absence of knowledge about hazards, vulnerability, and risk, to use in shaping investment in resilience during project design; the absence of due diligence in the design and construction of school facilities; and a lack of financial resources to manage residual risk in existing school facilities.

DRR and emergency management begins with the identification of hazards, the evaluation of vulnerability, and the analysis of risk (Box 14). Without such assessments, there is little likelihood that an investment will be made to reduce expected damage or ensure continuity of service in either new or existing buildings. Risk assessment is particularly important during project design, when the site is selected and the building is designed. It is during this step that decisions on the acceptable level of risk, including choices between human safety and continuity of service, should be made. Due diligence during the construction phase can ensure compliance with codes, regulations, permits, and professional and building trade sound practices to reduce risk. Adequate maintenance and repair and the establishment of adequate DRF arrangements support the management of residual risk. The precise actions an institution takes to address these three needs are in part determined by the resources at its disposal. Nevertheless, the stark reality is bleak: these needs are currently only partially met in many countries.

Realizing Safe Schools: A Vision of the Future

Safe schools can be achieved by applying the three basic groups of intervention instruments, focusing on the creation of an enabling policy environment, capacity development, and investment, to help address some of the challenges faced in assessing risk, reducing risk, and managing residual risk. Table 9 presents some potential instruments, according to type of intervention and core DRM need.

Three specific opportunities for investment in resilience, combining a range of instruments, are explored in more

Table 9 **Policy, Capacity, and Investment Actions for Resilient Schools**

Core Needs	Interventions		
	Policy	**Capacity**	**Investment**
Assessing risk	Mandate use of hazard information as a public good, free of charge during site selection for new schools. Require vulnerability assessment of both public and private schools, especially in hazard-prone areas.	Strengthen local community hazard awareness and capacity to assess risk while selecting sites for community-built schools. Build capacity of engineers to undertake vulnerability assessment of existing school buildings.	Assess the vulnerability of individual school buildings, both public and private, especially in hazard-prone areas. Make hazard and vulnerability data and risk analysis available to agencies responsible for school construction.
Reducing risk—avoid, eliminate and decrease	Mandate compliance with and enforcement of applicable zoning and construction regulations. Mandate the coordination entity responsible for school building program and project oversight to look into aspects related to disaster risk. Mandate incorporation and use of funds for structural risk resilience features in school construction.	Provide training to masons and engineers in retrofitting and risk-resilient school construction techniques. Strengthen decision making on retrofit program priorities. Enhance capacity and capabilities to monitor and evaluate construction projects and enforce compliance with zoning and construction regulations.	Incorporate resilience features in the construction of all new school buildings. Undertake a school retrofitting program in hazard-prone areas.
Managing residual risk—share and transfer	Mandate institutional and financial planning for reconstruction of schools to higher standards of resilience. Provide an enabling environment for the development of disaster risk financing instruments for the education sector.	Conduct regular disaster preparedness drills in schools.	Establish a university risk reduction fund covering retrofitting and contingent liabilities.

detail. They have been developed using the backcasting approach, based on a vision of safe schools 20 years hence. The hypothetical stories are told in the past tense, looking back from that point 2 decades in the future to explore possible paths to achieving that vision. The opportunities focus on the three steps in the school facility development process as entry points and describe how investment in resilience came about, who accomplished it, and with what support. The achievement of this vision rests on several key accomplishments:

- Natural hazard maps and risk assessments guide decisions on site planning, design, and construction of new schools in accordance with local risk.
- Strict controls are in place to ensure compliance with land use and building code regulations.
- Risk assessments have been conducted for all existing schools and a retrofitting program is under way.
- Adequate capacity and funding is available from government and private sector institutions for safe school construction and routine maintenance.
- A university disaster risk insurance pool has been established through a public–private partnership.

Retrofitting Existing Schools

Retrofitting existing vulnerable schools nationally involved all the development process steps, in one way or another. Education sector development policy and

mandates, programming, and funding set the retrofit project in motion, and following the programming and design of the retrofit project, the succeeding construction and facility operation steps were followed correctly.

Critical to the successful creation and implementation of a school retrofit project was the risk assessment, which involved analyzing the prevalent hazards and the characteristics of the school. In fact, the absence, improper execution, or disregard of the findings of a risk assessment was the origin of the vulnerability issues that led to the need for a retrofit. As a financial cost, the risk assessment represented less than 1% of the total cost of the retrofit project when spread out over the thousands of candidate schools whose risk was addressed. This was a necessary but not sufficient step for investing in resilience. Also needed was investment in capacity building to facilitate the risk assessment.

Almost without exception, the retrofit program had to address the lack of information about which schools needed attention, why, how, and at what cost and priority. Determining an answer to those questions enabled an understanding of the level of risk so that resources could be brought to bear on the retrofit program (Vishokarma 2012; Vishokarma et al. 2012). Addressing this core need included the following:

- **Natural hazard assessment.** Information on natural hazard type, zones (location), severity, and frequency was collected or generated. The Ministry of Education designated a particular hazard type, school construction type, or geographic area as the target of the retrofit program. The ministries of education, environment, and others, as well as universities and international development partners, supported professional salaries and fees for research, training, and analysis of hazard risk.
- **Complementary school information.** At the same time, information was collected on the location, building type, technical regime under which the school buildings were constructed, education level, size, and number of candidate schools. The Ministry of Education mandated annual inventories of school building information, and the Ministry of Education and universities cooperated to encourage students and faculty from a variety of disciplines to carry out the surveys.
- **Correlation and analysis.** The natural hazard and school building information were correlated and analyzed to identify the technical, administrative, economic, social, and political profile of the vulnerable schools meeting the retrofit criteria. The Ministry of Education and affiliated public sector school administration entities and universities participated in the preparation of the retrofit program with the participation of students and faculty of various disciplines.
- **Decisions.** After the group of vulnerable schools was identified and their related student populations and costs of retrofitting were determined, schools were selected to be included under the retrofitting program and the schedule of work was determined. The Ministry of Education, universities, and local stakeholders held joint consultations on this process. University faculty and students were invited to observe and subsequently prepared related case study materials for use in academic courses.

After the program design step was completed, the construction and administration steps followed, with a residual risk management focus. The result was an investment in resilience for selected primary and secondary schools and a greater awareness of DRM among project participants and stakeholders.

Regulatory Compliance and Enforcement

The majority of new primary and secondary school projects were executed through formal government channels, with designated public institutions playing various, significant roles. The government was involved in the development of new school facilities up to the point of project design, in line with the policies and mandates of the education sector. Even in the case of new schools that were funded in part or entirely by the community or the private sector, government agencies were involved in sponsoring, endorsing, and supporting the project.

A problem had arisen, however, in compliance with and enforcement of site planning, zoning, and building codes, ordinances, and regulations, and with occupancy permits during construction. This is perhaps the most significant obstacle to safe primary and secondary schools in the region. The building design provided by the government was quite adequate for a generic site, but the challenge came in adapting that design to actual site conditions, including natural hazard risks, and complying with and enforcing location-specific site and construction requirements. These activities often fell on local authorities, specialized public institutions, consultants, or a combination of all three; on the owner/operator; or on no one at all. In some cases, these activities were undertaken by individuals and institutions with no previous working relationship with the entity that provided the building design, funding, or site.

To overcome this challenge, various actions were instituted to support proper compliance and enforcement. These actions necessitated investment in policy, capacity, and financial support. Actions taken included the following:

- Compliance and enforcement of all applicable regulatory measures covering school construction by responsible national and local government officials were mandated.
- A local coordination entity was created for the overall construction process, in conjunction with those responsible for individual components.
- Expenditures related to risk management were not isolated as discretionary spending nor cut if construction costs became an issue.
- Budgeted funds, including funds related to building to the acceptable level of risk, were disbursed in accordance with the construction contract.
- Strict construction and maintenance quality controls were introduced.
- There was full accountability for proper installation of all specified materials and all workmanship during these constructions.
- Competency was built in monitoring and evaluation of the construction, in accordance with all regulations.

Strict construction and maintenance quality controls were introduced for new schools in order to support proper compliance and enforcement

The opportunities for public sector investment came through stipulated government functions, typically supported by budget allocations. Where possible, public sector actions were coordinated with the participation of private sector entities as builders, owners, and operators of school facilities, supported by in-kind or financial resources and technical assistance. Depending on the private sector relationship to the project, the private sector could be legally obliged to pay for certain professional services related to compliance with and enforcement of regulations.

Establishing a University Insurance Pool

Many universities fund, build, and operate facilities in much the same way as private, for-profit corporations. They want a return on capital improvements and faculty salaries that will cover normal operating expenses, loan payments, and continuity of operations. However, higher education and university facilities in both the public and private sectors were always seen as extremely complex and costly to design, build, and maintain. In general, there were few universities that operated under comprehensive risk management plans, and their approaches to risk were as diverse as the institutions themselves. Although hazards and some vulnerability and risk may have been identified, investments in resilience were generally undertaken on a building-by-building basis, and then only after significant loss due to a natural hazard event.

Risk assessments were prepared for the four major national universities and over 20 public institutes offering professional and trade-related degrees, with a total student population of over 320,000 students. These assessments focused on expected human capital losses and economic impacts, including the loss and disruption of research endeavors, to prioritize risk reduction needs. They were based on criteria such as potential loss of life and building damage, usage and downtime, available internal resources for reconstruction, the effect on influence in education circles, and image. Given that laboratory, office, and library facilities accounted for 75% of the campus inventory,

the estimated loss of buildings and contents totaled from tens of millions to billions of dollars. More than 50% of facilities required more than 20 months for repair (Comerio 2000; University of California, Berkeley 2000). These estimates played a role in prioritizing risk reduction initiatives, based on Nathe and Dimond (2005) highlighting

- the effect on the human capital resource base and the value of physical losses;
- estimated downtime due to damage and destruction of buildings and their contents;
- the need for business interruption plans based on worst-case scenarios; and
- the need for maintaining a functioning primary service network—energy, communications, water and sanitation, and road transport.

The design and implementation of a facilities risk reduction plan to address existing vulnerability and risk was built on existing policies and implementation mechanisms, but invariably the plan had to be modified and strengthened. The plan was considered within the framework of institutional planning and budgeting. In the process, financial stability was a fundamental concern for sustainable improvement of the physical infrastructure, including natural hazard risk reduction. Disaster risk financing for infrequent but high-impact events was determined to be an additional expense that was well beyond the reach of individual institutions, whether public or private, acting independently.

Risk transfer plans were prepared to achieve maximum protection against residual risks at the least cost and were based on estimates of frequency and severity of loss. To handle higher-frequency, lower-intensity effects, the institutions chose to plan and budget for possible losses through self-insurance. To handle scenarios with greater effects—and until significant risk reduction could be carried out—a minimum level of coverage for recovery and continuity was needed to avoid total or partial collapse of institutional functions. A regional university insurance pool was created to cover higher-impact, lower-frequency losses. Participating institutions were considered good candidates to form such a pool because of their uncorrelated but high exposure to infrequent loss.

Existing regional and subregional political, development, and financial organizations played a role in creating the insurance pool with participating institutions and national governments. The pool was built around the following:

- A long-term commitment to investing in resilience.
- Legislation mandating the registration of a special purpose vehicle and the creation and administration of a framework agreement with support from existing sovereign state organizations. The pool was large enough to capture sufficient institutional participation but small enough to reflect shared economic, risk management, and educational continuity goals and objectives, on a regional, subregional, or national basis, as appropriate.
- A legally binding commitment to participate in the framework agreement for a minimum of 20 years.
- A format that allowed for participation of both public and private institutions.
- Institutional planning and budgeting that supported continuing investment in risk assessment and risk reduction to agreed-upon levels, as well as managing (declining) residual risk within an agreed-upon time.
- Ongoing individual institutional contributions to their respective contingency funds to facilitate continuity of function and recovery functions, if needed.
- A national government role in sustaining in-kind contributions (such as hazard information or support for technical services) and budgeted contributions to the contingency fund, together with in-kind contributions from the institutions themselves, in the form of research and technical services to the pool, overseen by an advisory group, in return for insurance premium credit.
- Formal corporate risk management partnerships with framework universities, funding their participation in teaching, research and development, and fund management.
- International development partner participation through sustained contributions for risk analysis and risk reduction

technical support, and grants to support the pool's administration and reserves during the first 5 years of existence.
- Private sector investment initiatives with public sector participation in the creation, marketing, and purchase of risk-based financial instruments to cover contingent liabilities—the cost and return to investors reflected the institutions' commitment to investment in resilience, verifiable physical risk reduction, and sustainable financial risk reduction resources for continuity of operations.

8.5 Safe Housing

Across Asia and the Pacific, making housing safer is a major concern. The issue has two dimensions: the exposure of existing dwellings to natural hazards, and the likelihood that future housing units will be located in places that put their occupants at risk.

Improving safe housing involves taking actions to ensure that dwellings are capable of withstanding natural hazards—tropical storms, floods, earthquakes, landslides, and fire. If houses are not located, designed, and constructed to take account of local hazards, they are unsafe. Increasing the resilience of housing requires attention not only to the construction of new homes but also to retrofitting the existing stock of vulnerable dwellings.

AFP

Traditional construction technique saved the house from the massive earthquake that hit Nias Island. Indonesia

Housing and Vulnerability

Four principal gaps constrain retrofitting dwellings and construction of resilient housing:

- **Knowledge and skills.** The site planning, design, and construction know-how of owner-builders, contractors, and developers may be too limited to meet local building codes and zoning regulations or to build safe housing. Moreover, when dwellings are modified, or when households or governments become aware of exposure to natural hazards, there may not be the know-how to retrofit houses for hazard resilience. Skills upgrading at all levels is needed. However, solving the problem is complicated by low wages and job instability. The difficulties of investing in skills training make matters worse.
- **Awareness.** Many homeowners, developers, and contractors are unaware of the vulnerability of certain locations or the standards to which housing structures should be built. This applies to families in middle- to high-income residential areas as well those living in low-income, informal, and slum areas.
- **Planning, regulation, and enforcement.** Inadequate and inappropriate planning, zoning, and building regulations for housing or to address natural hazard risk lead to vulnerability. A lack of proper governance, institutional capacity to enforce compliance, and risk transfer mechanisms also leads to vulnerability.
- **Secure dwellings.** Families seeking to acquire safer housing, particularly

poorer households, face problems related to security of tenure, if investments in resilience are hampered by fear of eviction; problems of location, where existing vulnerability, land use changes, and changing natural hazards can threaten a site; problems with quality of construction, when an owner or renter is ignorant of or powerless to ensure continuity of operation or even life safety; and the inability of the majority to afford safer housing. In addition, limited access to safe land, poor governance, lack of access to finance and insurance, substandard building materials, bad designs and shoddy construction, and poor maintenance all contribute to insecure dwellings.

Low incomes can mean that many families are left with no alternative but to live in hazard-prone areas in substandard housing, often without services, and in many cases on land that is illegally occupied.

Realizing Safe Housing: A Vision of the Future

The gaps constraining investment in safe housing reflect the need for improved risk assessment, risk reduction, and management of residual risk. Four specific areas of interventions are necessary to bridge these gaps (Table 10):

- **Capacity to strengthen knowledge and skills.** Improve house design and construction know-how by training masons and home builders.
- **Policy and capacity to strengthen awareness.** Provide better education and information to enhance community awareness about likely disaster scenarios, risk reduction options, individual and household preparedness measures, and response procedures when natural hazard events strike.
- **Policy and capacity to strengthen planning, regulation, and enforcement.** Incorporate and enforce necessary building regulations and construction compliance provisions that take into account natural hazard and associated risks.
- **Policy, capacity, and capital outlays to incentivize safer housing.** Adopt measures that encourage house owners and occupants to incorporate appropriate disaster-resilient features, covering technical measures, including retrofitting houses, and financial arrangements such as insurance coverage.

There are a number of potential entry points to introduce these interventions relating to land, governance, finance and insurance, training, building materials, and design and construction (Figure 30).

The backcasting approach is applied below to explore how these interventions could be utilized to strengthen resilience. As before, it is written in the past tense, looking back from a vision of a resilient future 20 years hence to explore possible paths to the realization of that vision, including the role of various stakeholders. The vision rests on a number of key accomplishments:

- Hazard maps and data are widely and freely available.
- There are strong public and private risk assessment capabilities.
- There is strong community awareness of disaster risk.
- Risk-sensitive local planning, zoning, and building regulations covering housing sites, building materials, design, and construction are enforced.
- Local builders, masons, and craftspeople are trained in safe building techniques.
- Incentives to construct safe new homes and invest in retrofitting are available for both developers and individual households.
- Cost-effective, innovative safe building materials and construction technologies are widely used.
- Major new affordable safe housing schemes are in place.
- Municipalities have regularized tenure for illegal and informal settlements.

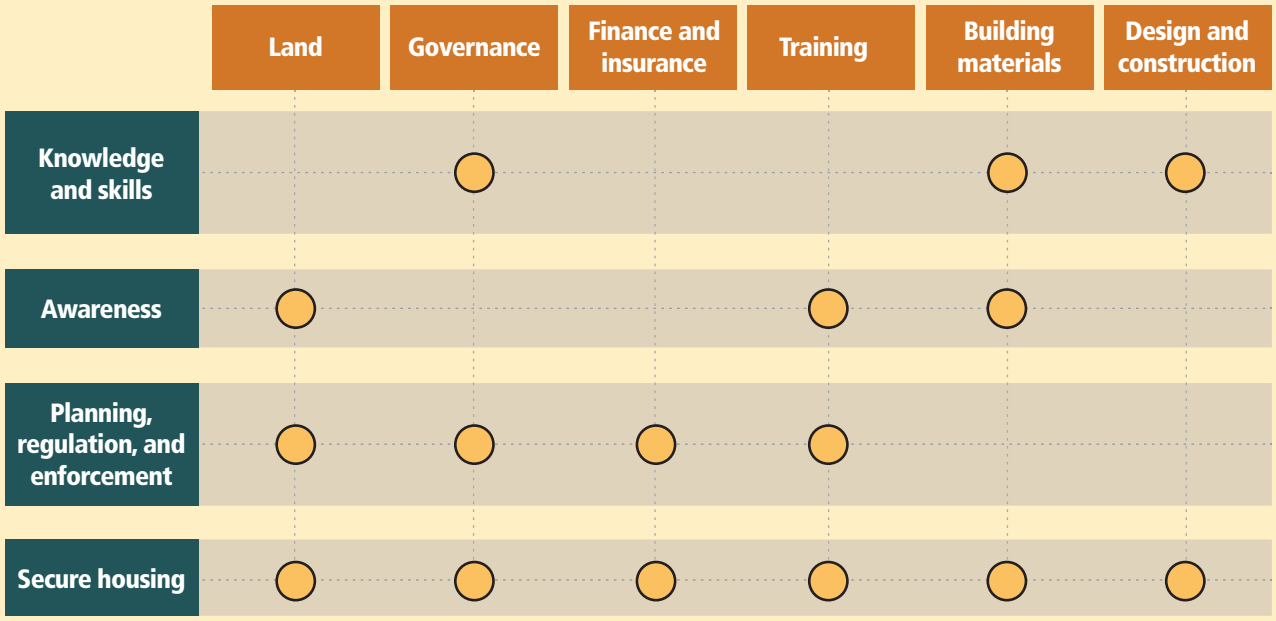
Knowledge and Skills

Better education, skills training, and knowledge to support construction and renovation were seen by government, NGOs, the private sector, and householders as basic building

Table 10 **Policy, Capacity, and Investment Actions for Resilient Housing**

Core Needs	Policy	Capacity	Investment
Assessing risk	Mandate relevant housing approval agencies and housing finance institutions and banks to require property disaster risk assessments before issuing approvals and housing loans.	Build capacity to use results of risk assessments during housing approvals and loans.	Encourage local governments to undertake risk assessments with the participation of the community. Provide technical assistance for risk identification and analysis, with support from the international community and the construction industry.
Reducing risk—avoid, eliminate, and reduce	Mandate the use of hazard information in site selection for housing construction. Enforce risk-sensitive land use plans, zoning, and building regulations covering housing sites, materials, design, and construction. Support municipal regularization of land tenure within informal settlements. Enforce local government accountability in planning and building compliance and enforcement in regard to disaster-resilient standards. Mandate housing finance institutions and banks to require compliance with zoning regulations and resilient construction standards before approving housing loans.	Involve local governments in using hazard, vulnerability, and risk information to inform awareness, compliance, and enforcement of housing design and construction processes. Provide technical assistance to local governments to strengthen their capacity to enforce policies on disaster-resilient housing. Provide training in safe building techniques to local builders, masons, and craftspeople, supported by local public–private partnerships. Implement joint programs for development, production, and application of cost-effective, innovative, building materials and construction technologies, and involve stakeholders in the standardization and adaption of building materials. Provide technical guidance and community organization support for self-build housing schemes. Build industry and local government partnerships to strengthen capacity for monitoring and inspection services related to resilient housing construction.	Purchase properties at risk and implement in-city relocation of residents through land swaps. Provide technical guidance on safe housing construction. Provide tax exemptions on resilient house construction. Provide microfinance for investments in retrofitting housing. Provide incentives in the form of tax relief and insurance premium reductions for retrofitting.
Managing residual risk—share and transfer	Mandate housing finance institutions and banks to require disaster insurance before approving housing loans.	Build local knowledge about available housing insurance and microinsurance products.	Implement property insurance, community-based microinsurance and mutual aid schemes, supported with public and private sector microenterprise funding.

Figure 30 **Entry Points for Safe Housing—Where and How to Bridge the Gaps**



blocks for safe housing. These were provided through public and private trade schools, supported by trade associations and public and private housing construction groups that incorporated upgrading in each discipline to focus on specific hazards, building types, and hazard-resistant construction. The planning, regulation, compliance, enforcement, design, construction, and insurance communities, represented by public agencies and private enterprises, provided additional knowledge on hazard and vulnerability reduction to attain safe housing. Partnerships were also formed with public and private agencies, providing better spatial and time-based data on natural hazards.

Training programs involved local builders, masons, and craftspeople and highlighted the increasing demand for knowledge about safe building techniques. They were supported and developed by local public–private partnerships comprising enterprises in the building materials and construction industry, trade and labor organizations, and higher education and vocational schools (Box 15). Apprenticeship training increased the supply of skilled labor in certain professions—plumbers, electricians, carpenters, bricklayers, and the like. Programs were delivered through national research institutes and supplemented by trainers from engineering and technical colleges that served as resource institutes. These focused on prevalent hazard risk management, building regulations, codes, and safe construction.

The government, with support from the construction industry and the international community, enhanced the capacity of public sector technical agencies to identify and analyze disaster risks. The capacity of local governments to incorporate hazard and risk assessment information, strategies, and approaches into housing development, planning, and implementation was strengthened as well. After much public discussion and at the insistence of local governments and private sector advisory groups, public agencies involved in planning, building compliance, and enforcement were charged with increased accountability. Local government partnered with the building industry to strengthen monitoring and inspection services as building materials and trade associations improved their practices and products. Under joint programs dealing with housing and poverty, the development, production, and application of low-cost, innovative building materials and construction technologies was sponsored by the government, with

Box 15 Training for Masons under a Public–Private Partnership

Masons were trained in safe construction methods under a public–private partnership arrangement in Uttar Pradesh, India (UNISDR 2008). The partnership involved Tata Steel, India's largest private sector steel company, which, using funds available for market development and promotion, had a program for orientation of masons and home builders, showing customers the benefits of using the company's products. In 2008, some 10,000 masons were trained—more than would have been possible under the government budget. The model was adopted by the Indian government for replication in other provinces.

Public agencies involved in planning, building compliance, and enforcement were charged with increased accountability

private education and industry participation. This was part of engaging stakeholders in the standardization and adaption of building materials.

Owner self-building schemes for permanent housing gained access to technical guidance and community organization support through NGOs acting in coordination with government and the building industry to benefit homeowners, contractors, and skilled labor. These participants were sponsored by local building materials suppliers and distributors. On a larger scale, tax exemptions and product endorsement by the public sector were considered, to encourage similar business groups to get behind national housing schemes.

Awareness

Complementing knowledge and skills upgrading, there was a broadening and deepening public awareness of hazards, vulnerability, risk, and actions to build resilience (Box 16). Taking the lead from public sector initiatives—made increasingly visible through planning, budgeting, approval, and implementation processes for the use of public revenues—the private sector responded by marketing resilient housing as a proper investment providing long-term financial benefit and continuous security to householders. People were made more aware of the potential dangers where they live, and how they could respond to known potential natural hazards.

Community awareness was also strengthened through formal and on-the-job training and support, and through written or visual material tailored to various literacy levels. Although local governments initiated these programs with international community and NGO support, private entities, including vocational and education institutions, played a major implementing role.

Planning, Regulation, and Enforcement

Local governments became visibly more committed to safe housing and more willing to control development and prohibit occupancy of structures in high-risk areas. With private sector participation, major new affordable safe housing schemes were introduced to increase the supply of safe new dwellings and reduce the need for illegal land occupation and informal settlements. Enforcement of an array of technical, regulatory, compliance, legislative, and judicial rules was carried out objectively. Local governments amended housing and land tenure regulations and incorporated appropriate provisions for DRM in the implementation of laws and regulations. Adopted measures focused on updating and enforcing zoning and building code regulations and incorporating natural hazard information into land registration processes. They provided for close and continual joint effort on DRR initiatives between emergency management and local public service infrastructure entities. Inventories of formal housing were also gradually developed as full public disclosure of natural hazard risks in all real estate offerings and transactions became mandatory.

Local land use plans, zoning, and regulations covering housing sites, building materials, design, and construction were developed and implemented, using processes that included financial lending and insurance measures. For instance, building resilience certificates were required in order to secure mortgages and insurance cover. To enhance quality control in housing construction, a limited number of norms, standards, and rules were provided for basic dwelling design and construction, along with design advice and quality control. Independent inspectors, using both public and publicly recognized private

Box 16 **Awareness and Education Campaigns**

Public awareness and education turned available knowledge into local actions that encouraged safer housing in Aceh and Nias, Indonesia, after the 2004 tsunami; in the Philippines after typhoons Ondoy and Pepeng in 2009; in Pakistan after the 2005 earthquake; and under the development workshop program in Viet Nam since 1999. In these countries, nongovernment organizations and the government conducted community-based awareness and education campaigns, and plans were prepared that enabled people to build their housing back to higher standards of resilience. Households responded after they learned what was required, were convinced that the actions would be effective, and came to believe in their own ability to undertake them.

mechanisms, verified compliance, which was systematically enforced with budget support.

Developers also were offered incentives such as lower fees, tax waivers, and exemptions to adopt higher standards than those required by law. These allowed for exemptions from other planning and building regulations, such as, for example, a relaxation of height limits and density requirements.

In the planning arena, governments and housing finance institutions took a stake in collecting needed risk assessment data. Data sharing and joint financing of hazard maps were encouraged. This initially was undertaken through public–private partnerships but ultimately was placed in the public domain as a public good.

Secure Dwellings

The benefits from investment in knowledge and skills, awareness, and regulations encouraged the construction of more-secure new dwellings and the retrofitting of existing ones. Locally mandated land use plans, zoning, and regulations covering housing sites, building materials, design, and construction strengthened resilience against subsequent natural hazard events. When these events occurred, fewer losses were suffered and less expensive insurance coverage ensued. These savings were passed on to homeowners.

In the case of illegal and informal settlements, the mandated controls were applied in conjunction with the regularization of tenure by the municipality, building on ample evidence from other countries that the poor are willing to invest in improved housing when they have an assurance against eviction, whether through formal title or simple occupancy rights. These controls were built around risk assessments, with the help of the local government and through community participation. At each step of the formalization process of land settlement, natural hazard risk information was incorporated into related legal documentation, programs, and project formulation. International development partners provided financial support and technical assistance for this process, which in turn catalyzed local public agency and housing and insurance sector participation. Additional technical support and community data were provided to the local government to develop housing policies that met the varying needs of the population to build more-resilient structures. These actions facilitated access to financing and insurance coverage, and prompted further investment in retrofitting and modification of previously unsafe dwellings.

Secure housing also resulted from government purchase of at-risk properties and relocation of residents to safer, in-city sites. Qualifying households were offered less vulnerable home sites together with a government commitment to provide continued investment in needed service infrastructure in these locations. Where possible, the secure housing program was financed partly through land swaps as part of large-scale transportation, commercial, and industrial development. It was also financed through long-term development loans for new and improved service infrastructure.

Measures to improve the resilience of new dwellings required relatively little additional expenditure. Families used savings to make modest investments in resilience over time. Quality materials, design, and construction practices became increasingly available because of demand. Retrofits often were financed through microfinance, and small

Measures to improve the resilience of new dwellings required relatively little additional expenditure

AFP

Traditional circular construction of huts is safer in seismic areas, Gujarat, India'

housing loans were taken out as mortgage-style debt, secured against either homeowners' equity or revenues from home-based income-generating activities (Box 17). This was particularly important for poorer families, whose dwellings played a significant role in their noncash, imputed, and cash income streams.

Premium reductions were offered for the insurance of more-resilient structures. Formal housing finance institutions and banks used natural hazard risk information in their appraisal process for evaluating and mandating loans. Some insurance companies began linking coverage and premiums to actual risk levels, thus encouraging investment in risk reduction and industry competition. In the informal settlements, community-based microbusiness loans that incorporated insurance were supported with public and private sector microenterprise grants, after tenure regularization. National governments provided incentives for reducing risk and acquiring adequate hazard insurance through tax relief based on insurance cost and interest payments on retrofit loans.

Box 17 **Partnering with the Private Sector to Improve Housing for the Urban Poor**

In 2002, the Asian Development Bank approved a $3.6 million grant under a pilot project called Strategic Private Sector Partnerships for Urban Poverty Reduction in Metro Manila. The project involved post–land acquisition development that focused on communities and was privately led. Components included establishing revolving funds for housing improvement and reducing and managing risk in communities vulnerable to disasters. Funds for housing improvement were provided to homeowners' associations, and these were attractive to informal workers, who rarely before had access to formal bank loans. The project created a revolving fund for housing improvement that involved loans for new construction, home improvement, and services such as electricity connections.

Part III

Financing Residual Risk

Part III considers the potential role that disaster risk financing (DRF) can play in strengthening resilience in Asia and the Pacific. It takes up several aspects of DRF raised in Part I and, drawing once again on the backcasting approach applied in Part II, considers how DRF capacity could be developed more fully in the context of new investment opportunities

Part III begins by considering how DRF supports an integrated approach to disaster risk management (DRM) and how a robust DRF capacity can strengthen resilience. The second chapter focuses on the present state of DRF in Asia and the Pacific and the insurance industry's perspective on the market. The following chapter shifts attention to the path forward, exploring what types of DRF investment are necessary and feasible. The final chapter identifies obstacles and challenges to the further development of DRF and identifies investments that may assist in overcoming those challenges. It closes with a discussion of the potential consequences of a more vibrant DRF market and why it is important to ensure the sustainability of those benefits.

AFP

Financing is a crucial element of disaster risk management. Philippines

9 The Role of Disaster Risk Financing in Building Resilience

Supporting Resilience through Disaster Risk Financing: A Vision of the Future

In 20 years, DRF is an accepted, institutionalized, and routinely employed part of DRM policy and practice. In the same way that governments, businesses, and households employ financial instruments and practices to manage their affairs, financial tools and analysis are a basic element of the DRM tool kit. Developing countries in Asia and the Pacific have a much higher level of understanding of sovereign, commercial, and household vulnerability to natural hazards, including the fiscal vulnerability of state budgets—and that enhanced capacity now routinely drives budgetary, fiscal, development, and investment decisions. DRF is built into DRM, such that a new constituency of DRF users, including local governments and cities, are continuously innovating and fine-tuning the deployment of financial tools against disaster risks. We also see the transfer of some of these risks to reinsurance markets or to capital markets through securitization and other means, as well as international and domestic and risk-sharing arrangements through active partnerships between the private sector and public authorities. Finally, we see increased resilience to natural hazards that, in the event of a disaster, manifests itself in faster response times, reduced fiscal impacts, moderated macroeconomic effects,

In the same way that governments, businesses, and households employ financial instruments and practices to manage their affairs, financial tools and analysis are a basic element of the disaster risk management tool kit

The financial consequences of disasters require financial solutions, and such solutions are within reach of most countries in the region

and more prompt recovery of infrastructure and livelihoods.

With this enhanced state of DRF, certain preconditions have been met. For example, risk assessment capacity has been expanded to the point where disaster data have been systematically tracked, are accessible, and are more reliable. Risk reduction investment has been developed, driven in part by financial incentives. The DRF community, including stakeholders from the public and private sectors, has also developed new financial approaches to deal with residual disaster risk, including new forms of public–private partnerships.

At a minimum, these are the critical elements that will need to precede the arrival of a future DRF environment that delivers on its promise. Some of this critical path is laid out in further detail below and both obstacles and solutions identified.

Why Disaster Risk Financing Is Fundamental to Building Resilience

Governments and their development partners in the private sector, civil society, and the international community have come to realize the need to develop more integrated and holistic approaches to DRM. In doing so, it has become evident that developing financial resilience to disasters plays a central role in that framework. Stated succinctly, the financial consequences of disasters require financial solutions, and such solutions are within reach of most countries in the region. Developed economies have implemented these programs through national disaster risk reduction (DRR) and insurance and capital market solutions as well as through regulatory support to enable stable and solvent risk transfer markets to serve local governments, businesses, and homeowners. However, Asia and the Pacific has lagged behind other regions of the world in developing similar innovative financial solutions and capacities, and this has diminished the region's resilience

It is also quite clear that DRF will not live up to its full potential without renewed efforts by governments, the international community, and the private sector to overcome institutional and political obstacles to the further development of DRF capacity. Part of this renewed effort must come in the form of new investment in the field of DRF by governments, multilateral development banks (MDBs), bilateral donors, and the private sector, but the principal impetus and energy for the effort must come from governments themselves This investment can range from government contributions of time and resources and appropriate legal and regulatory frameworks to build financial resilience, to MDB and bilateral donor support for catalytic investments in DRF strategy development and mechanisms, to private sector investment in public–private partnerships and risk assessment, risk reduction, and risk modeling (Box 18). Significant capacity exists within the commercial finance and insurance market, as well as the alternative risk transfer market, to bring expertise, technology, and capital to this task. Much has already been accomplished in developing partnerships and synergy with the private sector, but the disappointing results to date suggest that new approaches are required.

What Is Meant by Disaster Risk Financing?

Terminology used throughout Part III generally aligns with accepted practice within the DRM profession and the world of finance; nevertheless, it may help to explain more fully how these terms have been employed within the context of this report.

Disaster risk financing is used here to describe the application of financial instruments as part of a systematic approach to managing disasters in order to anticipate, plan for, reduce, transfer, and respond to natural hazard events. As such, the term is intended to capture various financial mechanisms and policy options that enable greater financial resilience to natural hazards. Because of the interconnected nature of DRF—brought about through an integrated DRM framework—DRF is considered to be a component of a resilience paradigm. It includes budget and reserve mechanisms, contingent emergency liquidity, various insurance solutions, capital market instruments, and various forms of financing for immediate response, recovery, and reconstruction.

Box 18 **The Role of Multilateral Development Banks in Building Financial Resilience to Disasters**

Multilateral development banks (MDBs) will continue to play a significant role in developing a more active and productive disaster risk financing (DRF) environment in Asia and the Pacific. Along with bilateral donors and the private sector, MDBs form a diverse support team for national and subnational governments wishing to enhance their DRF capacity. Reflecting their dual roles as financial institutions and development organizations, MDBs have a unique opportunity to act as catalysts to spur governments to take leadership and ownership of DRF issues and programs.

By acting as catalysts, not long-term market participants, MDBs have an opportunity to shape and accelerate DRF capacity development among governments without becoming permanent fixtures on the DRF landscape. Ultimately, governments in Asia and the Pacific need to assume ownership of their own financial resilience.

There are many opportunities for MDBs to play this catalyst role:

- Support and promote the development of DRF products that also act as an inducement or incentive for disaster risk reduction.
- Intermediate between governments and private insurance markets as part of a broader effort to develop closer partnerships between government disaster risk management agencies and global risk transfer markets.
- Support the creation of innovative risk transfer vehicles, such as captive insurance vehicles and capital market mechanisms, and serve as catalysts to establish them firmly in the risk management landscape.
- Lay the groundwork for regional DRF solutions, engaging in consensus building, assessing disaster risk, assessing technical capacity, supporting risk pools, and assisting governments to access global reinsurance markets.
- Support knowledge development, acting as a think tank to develop technical data and assess disaster-related public contingent liability; to research the fiscal, economic, and social impacts of DRF products and to develop national DRF strategies
- Encourage legal, regulatory, and institutional reforms to allow developing country insurance markets to interface competitively with global insurance and reinsurance markets.
- Assess the effectiveness of DRF mechanisms, both prospectively through stress testing budgets and retrospectively through post-disaster assessments of effectiveness in easing fiscal pressures and supporting timely recovery and reconstruction.
- Support disaster data standardization and data sharing, including by helping to end the patchwork system of data collection that often results from MBD's own development projects.
- Access reinsurance markets directly to leverage MDB's own DRF capability.

Risk transfer instruments are considered integral to the DRF framework. To build a more grounded understanding of DRF, it may be helpful to think of risk transfer in terms of spreading risk over space and time, rather than merely shifting the risk to others. Most forms of insurance, at heart, involve renting someone else's capital to support potential losses that the insured cannot or chooses not to retain because of the size or unpredictability of the losses. This is true at the household, business, and state levels. In the case of disaster risk insurance, in particular, the risk is not so much being shifted as it is spread more evenly over time. One who is risk averse will ordinarily be prepared to pay a sum (premium) in excess of their annual expected loss in exchange for the avoidance of potentially ruinous losses in any one period, in effect financing the most severe losses over time. In return, the insurer will put its capital at risk to absorb the uncertainty of large losses.

Ex ante and *ex post* are terms that are used in the field of DRM to create a distinction between actions taken in anticipation of disaster events (such as risk analysis, prevention, awareness, reserving, and insurance), which collectively are components of DRR, and those taken in consequence of an actual disaster event (such as relief, response, and post-disaster construction). Within the context of DRF itself, a division exists between ex ante finance (e.g., reserving; establishment of contingent credit; various kinds of risk transfer products, including insurance; and capital market solutions) and ex post finance, or post-disaster response funding (e.g., covering response and reconstruction

costs via fiscal measures, new borrowing, or foreign assistance). Although the whole spectrum of finance is considered to be DRF, including financing for ex ante risk reduction, the focus of this report is ex ante finance for post-disaster relief, early recovery, and reconstruction.

How Enhanced Disaster Risk Financing Moves Us toward the Vision of Greater Resilience

The main principle running through the concept of integrated DRM is that governments should adopt an approach that captures all key elements of DRM and brings them together in a cohesive and systematic framework. However, in order to function, DRM systems require a high level of ownership and commitment from governments that cannot be readily substituted by support from MDBs and bilateral donor agencies. DRM systems only become truly integrated when governments themselves invest in making this happen. Progress on further integrating the various elements of DRM into a holistic framework is perhaps the single largest determinant of whether the DRM community attains the imagined state of DRF in 20 years (Box 19).

There has been a gradual recognition among governments in Asia and the Pacific that effective DRM must be more comprehensive in scope and more systematized if it is to cope with the increased exposure brought about by economic growth, urbanization, increased interconnectivity and climate change. By considering DRM as a broad continuum that includes several DRR components, beginning at risk assessment and prevention, passing through risk transfer, and ending at reconstruction, it becomes more apparent how to efficiently allocate scarce resources, establish synergies between and among components, and devise a true DRM system that can be relied on by national and local governments. The development of enhanced financial protection is a continuous thread that runs along this risk management continuum and that enables other compo-

Box 19 **Role of Government in Disaster Risk Financing**

Governments in Asia and the Pacific play a key role in stimulating the development and ensuring the successful implementation of disaster risk financing (DRF) instruments and mechanisms. Their role can include the following:

- Take ownership of disaster-related public contingent liability.
- Provide leadership in the development and implementation of comprehensive DRF strategies.
- Provide an enabling legal and regulatory framework to support a stable and solvent risk transfer market.
- Establish preconditions for ensuring access to quality reinsurance, such as a system of risk-based premium, sound capital requirements, and rigorous insurance regulation and enforcement.
- Undertake legislative reforms and policy changes, where required, that would allow local government to exploit DRF opportunities.
- Provide institutional leadership to establish common methodologies, definitions, and metrics for assessing exposure and losses.
- Provide public goods, such as hazard data and risk models, to reduce start-up costs in DRF product development.
- Collect and maintain accurate data on disaster relief, early recovery, and reconstruction expenditure; on disaster risk; and on public responsibilities in the event of a disaster to inform annual reassessment of public contingent liability.
- Adopt a liberal system for cross-border data collection and sharing.
- Engage with the private sector and international community to share data, draw on technical expertise, and leverage resources.
- Encourage the development of domestic credit and export credit insurance capacity.
- Formulate public policies that stimulate demand for insurance products—for example, enhancing financial literacy and risk awareness, and making commercial and property loans conditional on insurance of assets.

nents, such as funding risk assessment, or that serves outright as a financing instrument (e.g., risk transfer insurance).

DRF is not solely the domain of national governments. Although national governments can and do set policy, allocate funds, and manage much of a country's allocation of disaster resources, local governments operate with their own microeconomies and budgets and should manage their own contingent liabilities arising from natural hazards. The same characteristics that can make DRF an opportunity at the national level—in terms of reserving for contingent losses or transferring those losses to others—also present an opportunity for local governments, which may have an equal need for immediate liquidity, a need to compete with other local governments for scarce funding, and be subject to even higher popular expectations for quick action. In fact, it can be argued that, in some ways, local governments' financial management of disaster losses is even more complex than national management, because local governments must cope with the uncertainty of how—or even whether—national disaster support funds will arrive as intended.

Linking certain DRF instruments to the implementation of risk reduction activities can leverage resilience. As was noted briefly in Part I, the availability of ex ante financing instruments at the sovereign level can be linked to the undertaking of new risk reduction activities. The effect of this is not only to provide the added resilience of financial protection but also to foster concurrently the added resilience brought on by risk reduction. Among MDBs, for instance, this linkage has occurred in the context of policy matrixes agreed upon as part of specific DRF programs (such as the World Bank's Catastrophe Deferred Drawdown Option program) or as part of more comprehensive DRM facilities (such as the Inter-American Development Bank's [IDB] Integrated Disaster Risk Management program). In both of these cases, the availability of incremental disaster liquidity was seen as an inducement to undertake other DRF initiatives as well as new investments in DRR.

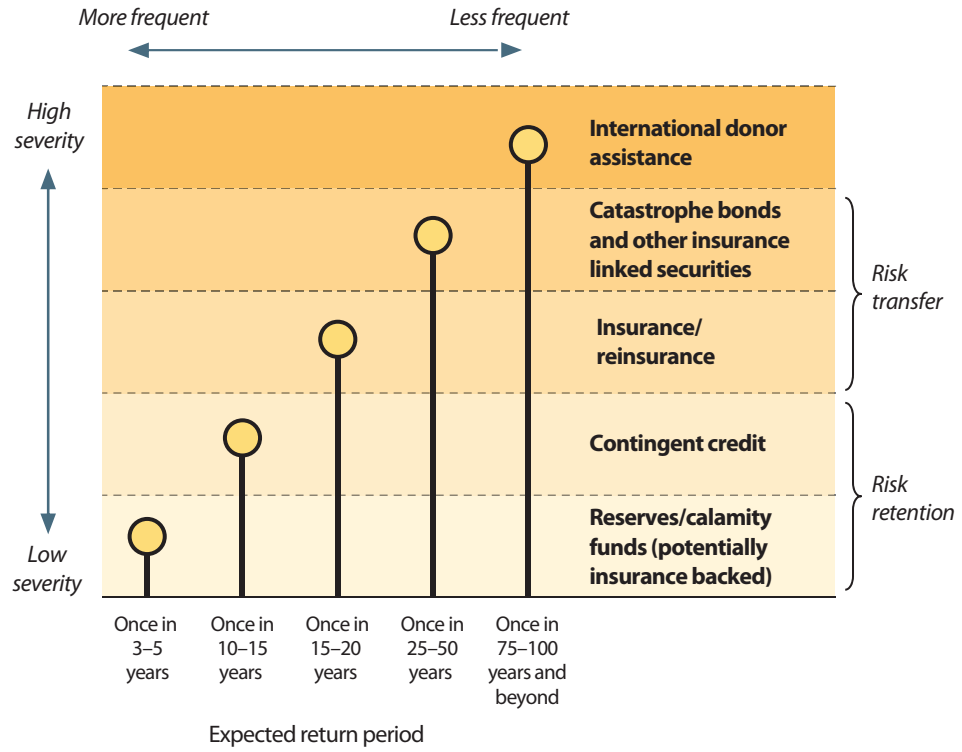
DRF can be a key component of community risk management. Spreading risk equitably within a community—whether a local, national, or even regional community—is an established method through which a society can reflect its shared solidarity and common values. Public disaster contingency funds accomplish this by pooling taxpayer funds, and traditional insurance products accomplish the same result by including as many at-risk people and assets as possible and spreading those risks as broadly as possible over space and time. The effect of this on national or local resilience is to reduce actual individual disaster event losses to manageable and predictable proportions (i.e., the net risk retained by the insured), which permits the nation, city, and individual to carry on with the least economic impact.

DRF can also provide helpful price signals to guide other resilience investment decisions. Risk transfer transactions, when done at arm's length and with adequate risk rating, put a price tag on the risk and provide valuable benchmarks to determine when it is economically justified to invest to reduce or prevent loss and when the marginal costs of further prevention or reduction exceed the cost of risk transfer. Although not a substitute for a cost–benefit analysis on risk reduction investment, risk transfer costs do make it clear that risk reduction should not be undertaken at a cost that exceeds the cost of risk transfer and vice-versa. In this context, price markers serve as a linkage across the DRM continuum. At each point along the continuum, the marginal cost of building financial resilience should serve to direct the next level of investment in resilience. Risk transfer pricing also creates a virtuous cycle because the incentive to lower premium costs can encourage and steer resilience investment into efforts that yield the greatest savings.

Segmenting disaster risk by degrees of severity and frequency enables the most effective application of financial solutions. DRF brings an added element of discipline to DRM by calling for a rigorous analysis of the underlying hazard, its frequency, and its severity and then matching those risk characteristics with the most cost-effective financial instrument. Figure 31 demonstrates how this process is applied. More importantly, this process carries with it two important principles: that the effectiveness of DRF tools improves with the underlying risk assessment directing the application of those tools; and that by determining the break points for

Disaster risk financing is not solely the domain of national governments. Local governments operate with their own microeconomies and budgets and should manage their own contingent liabilities arising from natural hazards

Figure 31 **Risk Layering and the Application of Financial Instruments**



Source: Adapted from Cummins and Mahul (2009).

frequency and severity of loss, it is possible to deploy finance mechanisms more selectively and strategically.

The risk layering described in Figure 31 is only indicative of the process of layering financial solutions in proper order and in the right degree. In reality, one would want to engage in probabilistic risk analysis and establish loss thresholds to know where various instruments would be most effective. Nonetheless, the diagram helps demonstrate that DRF is a multifaceted mechanism involving a range of financial instruments, and that great care must be taken in deciding when a particular DRF mechanism is an appropriate solution.

What the diagram does not demonstrate readily is the proper balance between ex ante and ex post finance. The answer for any given country likely revolves around determining the point at which natural hazards can derail long-term development. At the upper end of the scale, there is a point at which long-term sustainable development is knocked off course, but there is also a point at which risk transfer solutions become impractical because of the cost of insuring high aggregate losses. Whether this occurs at the 500-year return period or at a more frequent interval is less important for the purposes of this report than to establish the existence of such a methodology to support this type of analysis.

AFP

Economic growth increases potential commercial opportunities in disaster risk financing. Xi'an City, People's Republic of China

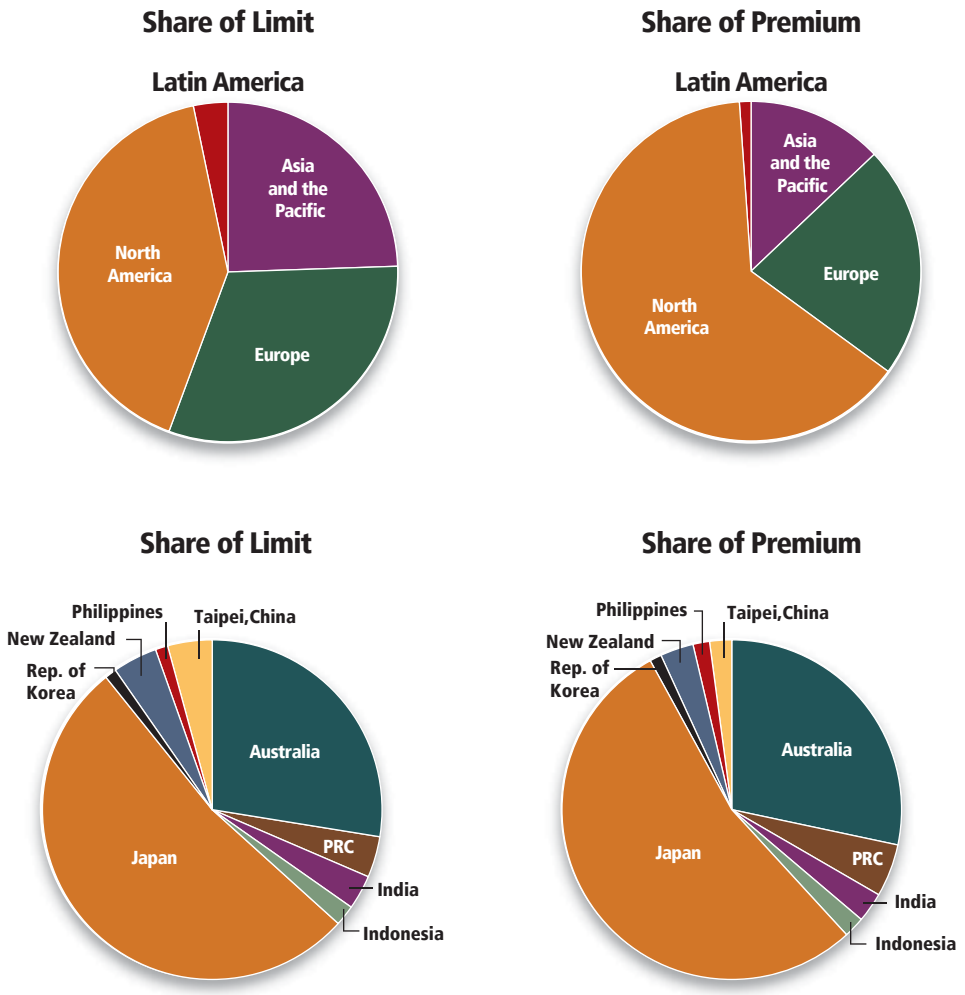
10 Commercial Market Perceptions of Disaster Risk Financing in Asia

The disaster risk insurance market in the emerging economies of Asia and the Pacific is still quite small relative to other regions, and even when the region's developed economies are included, its disaster risk insurance market is substantially smaller than the markets of North America or Europe (Figure 32). In terms of the market's capacity to insure disaster risk (i.e., the capacity "limit"), the small size of the market (excluding Australia, Japan, and New Zealand) creates issues of its own. Insurers must cope with inadequate insurance infrastructure; a lack of awareness about DRM techniques on the part of corporations, regulatory authorities, and households; and a lack of market breadth, which gives rise to concerns of adverse selection. In this sort of environment, adverse selection can arise when insurers are left with a relatively narrow band of higher-risk assets that produces insufficient premiums to support higher losses. Although a relatively undeveloped market for disaster risk insurance offers obvious attractions in terms of commercial opportunity, the relatively immature nature of the market brings with it a series of challenges, such as the lack of quality historical loss data or data relating to exposure and vulnerability of assets. Some insurers also have also been deterred by the concentrations of risk being presented (especially within urban areas) and the consequential threat of unbalanced risk portfolios. The high cost of risk modeling also has also been noted as a deterrent, in addition to the models being proprietary and often beyond the reach of local insurers.

The cost of capital is a major driver of disaster risk insurance and reinsurance

In terms of the market's capacity to insure disaster risk, the small size of the market creates issues of its own

Figure 32 **Disaster Risk Insurance Market by Region**



PRC = People's Republic of China.
Source: Guy Carpenter and Company Ltd. (2011).

capacity and pricing. Because disaster risks—even those with distant return periods—can place a call on an insurer's or reinsurer's capital at any time, these firms must allocate and pay for the requisite capital to backstop those risks. To the extent that reinsurance is relied upon in lieu of capital, the cost of capital to the reinsurer is similarly reflected in the underlying risk premium and thus becomes a driver of premium costs. For the reasons noted, the uncertain landscape for disaster risk insurance in Asia has in the past given some insurers and reinsurers pause before committing such levels of capital.

More recently, however, firms with the capacity to invest in the Asia and Pacific market have been more prepared to explore opportunities and to begin the process of expanding disaster risk insurance awareness and penetration and building the necessary infrastructure to develop this market more fully, such as attracting local partners, injecting capital and building distribution systems. Paradoxically, the rise in interest on the part of insurers and reinsurers follows 2 years of exceptionally high disaster losses. In 2011, a record 77% of global disaster losses occurred in Asia and the Pacific, and the region's economic losses resulting from natural hazards amounted to $260 billion, or more than 2% of gross domestic product. Total insured disaster losses within the region amounted to $49 billion, or 19% of total economic losses (Swiss Re 2012). The record losses within the region—and the record insurance payouts—have spurred demand for both insurance and

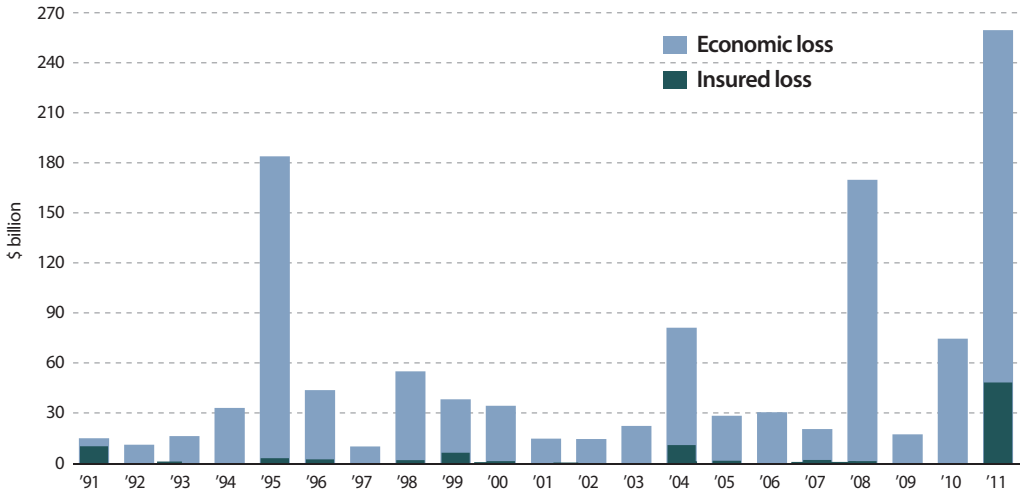
reinsurance, with greater attention than ever being paid to the strength of the reinsurer backstopping the policy, due to heightened concerns about counterparty risk.

Insurers across the region face issues stemming from the adoption of more sophisticated regulatory requirements on solvency, risk management, governance, and disclosure. Global efforts are under way to increase insurer solvency standards, improve governance, and increase disclosure and transparency of insurers' financial condition. New reporting requirements, both internal and external, will require insurers to address data quality and reporting frequency. General efforts to reform insurance solvency and accounting regimes among emerging economies in Asia, including pressure to align with rigorous risk-adjusted capitalization standards, will have implications for the insurers' capital management. It is anticipated that many insurance firms will have some difficulty complying with the enhanced capitalization requirements, as was witnessed in 2012, when Philippine insurers requested a postponement of the new capital requirements being implemented by the Philippine Insurance Commission. Capital scarcity is an issue for many companies across the region and, given their finite resources, some companies will find it difficult to meet the new standards; others will find it impossible. With limited options and limited ability to raise new capital to reduce disaster exposures, firms may need to look to reinsurance as a means of meeting the new requirements. Yet, with scarcer disaster risk insurance capacity and weak risk rating regulation and enforcement such reinsurance and capital market alternatives may remain out of reach for these countries, thereby challenging the potential growth of the DRF market. Firms interested in developing the disaster risk market in Asia acknowledge that governments are now more attuned to people's rising expectations about the state's capacity to manage and respond to disaster risk—and to the political price to be paid for getting it wrong. However, despite the trend toward rising utilization of insurance and greater risk management capacity, the amount of uninsured losses continues to grow (Figure 33) and the extent of government liability keeps rising. The widening gap between economic and insured losses is a reminder of the rising disaster trend line in Asia, but the gap should also alert us to the magnitude of the DRF capacity deficit in the region.

Some insurance firms believe that if emerging economies are to make more progress on managing residual disaster risk, they must adopt more iterative DRM schemes—that is, risk management systems that can reliably and consistently bring the full array of DRM solutions to bear. These would be mod-

Despite the trend toward rising utilization of insurance and greater risk management capacity, the amount of uninsured losses continues to grow and the extent of government liability keeps rising

Figure 33 **Economic and Insured Losses from Natural Catastrophes in Asia, 1990–2011**[a]



[a] Loss amounts indexed to 2011.

Source: Swiss Re Economic Research and Consulting (2012).

ern, integrated risk management systems that rely on consistently applied methods, including risk identification, assessment, prevention, reduction, and residual risk management, including risk transfer. The insurance market acknowledges that this is a long-term process, but the increased disaster risk brought on by climate change, economic growth, higher interconnectivity, and urbanization can rapidly outstrip the progress achieved to date. In addition, as was demonstrated in Japan and Thailand, the amplification of risk arising out of the interconnectivity of hazards should focus governments' attention on the task of putting in place integrated risk management systems capable of adapting to a globalized economy and rising risk.

Shortage of capital, low premium retention levels, and failure to cooperate with competitors to establish appropriate market practices act as a deterrent to reinsurers with high credit standing

Although low insurance penetration rates can equate to commercial opportunity for international insurers, they can also signal fundamental problems with the development of efficient and effective risk transfer markets. Insurance penetration rates measure a country's total premium as a percentage of gross domestic product, and within emerging markets in Asia and the Pacific as a whole, this amounted to approximately 1.1% for nonlife insurance (mostly property and auto coverage) in 2010, compared to 3.6% in industrial markets and 1.5% in Latin America (Swiss Re 2011). Low insurance penetration matters because it can be a barometer of a population's low risk perception and its mistrust of insurance, the unaffordability of insurance, or simply poor regulation, less-sophisticated distribution systems, or missing incentive structures for individuals to take out insurance. Whatever the reason, rising insurance penetration is one of the key indicators pointing to an improving risk transfer environment. Many countries in the region are in either the early growth or sustained growth phase, suggesting significant potential for increasing insurance penetration as wealth increases.

Public policy and regulation can be potent drivers of changes in demand, creating the necessary preconditions for insurance (such as appropriate insurance laws) and influencing the operating environment of the industry. Public policies not directly linked with insurance can also remove constraints and provide the building blocks for increased demand by, for example, encouraging investment in insurable assets (such as property, through property rights), facilitating a stable economic environment, enhancing financial literacy and risk awareness, building human capacity (including professional actuarial education), disseminating risk information, enhancing capital markets, and creating stable and effective legislative regimes and consumer protection.

The demand for and availability of reinsurance capacity within Asia and the Pacific has grown in recent years, and market participants expect this trend to continue. For developing economies of Asia and the Pacific, access to high-quality reinsurance is a gateway to price-efficient risk transfer. However, like much else in the world of DRF, access to reinsurance markets is dependent on other reforms and changes within a country's commercial insurance and regulatory system. For example, it has been noted that a significant concentration of risk and adverse selection can arise in a poorly developed domestic insurance market. Shortage of capital, low premium retention levels, and failure to cooperate with competitors to establish appropriate market practices act as a deterrent to reinsurers with high credit standing. Similarly, in a poorly regulated nonlife insurance market, the inability to set insurance premiums using a risk-based approach within a competitive business environment, the failure to consider periodic revision of tariff rates based on loss experience, or the inability to enforce those tariff rates also may preclude attracting quality reinsurance support.

The key message is that, although reinsurance can be a resource for effective DRM, assured access to quality reinsurance does not happen without certain preconditions, including the ability to produce a diverse portfolio of risk, a system of risk-based premiums, and sound capital requirements and enforcement (Box 20). Governments should also be aware that substituting inferior reinsurance for contingent disaster risk is no bargain. The contingent liability reverting to government from a failed reinsurer—whether domestic or international—can have the same fiscal impact as the disaster itself.

Box 20 **CLIMBS–Cooperative Life Insurance and Mutual Benefit Services Microinsurance, Philippines**

In 2011, Cooperative Life Insurance and Mutual Benefit Services (CLIMBS) entered into a public–private partnership with Munich Re and with German development cooperation through GIZ to strengthen the loan portfolios and sustainability of member microfinance organizations in the Philippines. Acting as an umbrella cooperative of over 1,600 individual member cooperatives and microlenders, CLIMBS has established an extreme weather event insurance product that is based upon a parametric index for each municipality, categorizing wind speed and rainfall into 10-, 15-, and 20-year recurrence events. Using these benchmarks as payout triggers, CLIMBS makes payments to local cooperatives based on an agreed percentage of their loan portfolios. The payment is meant to strengthen loan portfolios and keep microlenders actively lending at a critical time for local disaster recovery. With stronger loan portfolios, the cost of microcredit should also be reduced. The microlenders have also agreed to share the insurance benefits directly with the microfinance members.

Acting as an aggregator of individual cooperatives, CLIMBS provides a preexisting relationship and distribution network that offers an efficient and low-cost method to enroll lenders and develop a large critical mass of downstream beneficiaries. Munich Re acts as the reinsurer to the project providing high-quality reinsurance capacity to enhance the long-term sustainability of the program. Severe weather events will be monitored in real time via satellite across the entire country and will be made available online to all member cooperatives.

Although the results of the CLIMBS project have yet to be assessed, it does offer an opportunity for a public–private partnership that enhances disaster resilience by bringing advanced DRF tools and technology to bear on behalf of individual farmers and landholders. Ordinarily, access to global reinsurance markets and the development of parametric triggers are not feasible for microinsurance products given the prohibitive costs. However, because of the resources and capacities of each of the partners, the CLIMBS microinsurance product may achieve sustainable results through quality reinsurance, broad market reach and penetration, and efficiency through a large umbrella organization providing affordable insurance benefits to individual cooperative members via their preexisting credit relationships. Such partnerships and connectivity are one of the defining characteristics of a more disaster-resilient future.

Source: Munich Re (2010).

AFP

Use of technology and knowledge is an important component of disaster risk financing capacity building. Nepal

11 The Path Forward for Disaster Risk Financing in Asia and the Pacific

Many obstacles to developing DRF capacity can be mitigated with new investment. To reach the 20-year vision of DRF becoming a routine and effective tool of DRM, capacity gaps must be identified, intervention points defined, and solutions devised. Doing this effectively will require an honest appraisal of the DRF landscape today and an acknowledgment that Asia and the Pacific has not lived up to its potential, either relative to other parts of the world or relative to its need. In fact, the region has been more ready to adopt the language of investing in proactive DRM—and the DRF options that form a part of that approach—than it has to take actual action on making the hard choices needed to invest in future security rather than alternative spending opportunities that generate more immediate benefits.

In any representative government, the transition from the adoption of an idea to its execution is not often a linear process. In the case of DRF, this process is further complicated by the fact that this is a technically complex subject, not readily grasped by either elected officials or the bureaucracy without significant investment of time and effort. In addition, DRF spending decisions can involve large sums with distant paybacks, in the case of infrequent disaster events. These decisions also normally take place in an environment of fiscal constraint, which can pit current needs against future safety. These are practical challenges that must be acknowledged and resolved by all those with a stake in building financial resilience.

To reach the vision of disaster risk financing becoming a routine and effective tool of disaster risk management, capacity gaps must be identified, intervention points defined, and solutions devised

Built-in tensions exist within government about how disasters are financed—whether in advance of the event or after. In effect, all disaster losses must be financed in one form or another. At the sovereign level, disaster losses can be financed out of current revenue, new revenue, new borrowing, or financing instruments such as insurance. At the household level, losses can be taken up by government programs, financed out of savings or future income, taken up by community resources, or financed with insurance. The natural tension in the system arises from inexorable efforts to shift burdens in all directions. National governments will be inclined to shift costs to local governments and vice versa. Within the government, agencies will attempt to shift costs laterally to better-funded units in order to preserve programs. Within households, there will be a tendency to push costs back to government.

Governments need to view risk transfer as a long-term investment. They must accept the primary responsibility to develop ex ante structures that deliver rewards today for investments that also produce benefits tomorrow and beyond

A dilemma for government leaders is that investing in proactive DRM normally requires both forethought and a willingness to defer receiving real, measurable benefits. In this context, "doing the right thing" requires decision makers to articulate to key constituents the present value of future benefits, in terms that have practical meaning and relevance. For example, justifying the expenditure of scarce public funds for strengthening of public schools provides an immediate, valuable, and readily grasped benefit to families. However, other types of ex ante disaster expenditures, especially ex ante expenditures for disaster response, require justifying trade-offs of present needs for future security. Such decisions are anathema to politicians because they do not fit into the time horizon of the normal political cycle. For example, frequent natural hazards normally fall neatly within political election cycles and represent relatively easy trade-offs for those making spending decisions and being judged by the electorate on the wisdom of those expenditures. It is quite another thing to prepare for the potentially cataclysmic effects of a 100-year disaster event on a generation not yet voting—and to be able to defend that decision to the voters paying the bill today.

There is a tendency for governments to view DRF costs as expenditures rather than investments. The problem this presents is that expenditures typically require evidence of value received within the same budget period. If risk transfer instruments can only be justified by same-period paybacks, then insurance can never address more severe, less frequent events. Aside from the obvious difficulty of judging insurance in this manner, the more damaging effect is the risk that insurance will be used in the least appropriate and least cost-effective manner—that is, for relatively frequent, low-level losses. Although such an outcome is perhaps improbable because of the implied costs, the point is that viewing insurance purely as an expense makes it more difficult to employ advantageously.

This is quite different from businesses' or individuals' perception of the value of insurance. Typically, individuals are not anxious to see an annual "return" on insurance because of the personal harm that implies. Businesses and households tend to view insurance as protecting them against losses that they would have difficulty sustaining, not from losses that they can relatively easily absorb. Governments need support to adopt a similar perspective and to begin to invest in DRR to manage high-frequency losses and view risk transfer as a long-term investment.

It is probably not constructive to simply criticize the tendency for short-term thinking in most political systems. The attraction of quick demonstration of the effects of public investment is not about to diminish, and the willingness of elected officials to make decisions on behalf of future generations is not likely to improve. Therefore, the inevitability of the short-term political calculus needs to be accepted and respected. However, that does not mean that political systems cannot accommodate long-term disaster planning. Rather, the alternative is to find mechanisms to accelerate DRF investment paybacks and bring the benefits of DRF forward into current political cycles.

To achieve the 20-year vision of DRF, governments must accept the primary responsibility to develop ex ante structures that deliver rewards today for investments that also produce benefits tomorrow and beyond. Such structures can involve incentives and linked benefits—not to produce long-term dependency or subsidies but to energize a risk management framework that not only tolerates long-term thinking but also rewards it:

- Governments can employ their taxing power to provide short-term tax credits to individuals and firms for insurance costs or to provide tax incentives for other DRR initiatives.
- Premium taxes on property insurance can be eliminated, where they exist, at the commercial and household levels, thereby eliminating a disincentive to investment in resilience.
- Risk pools formed among local governments can bring forward benefits by demonstrating a tangible benefit to the regional economy—even though the disaster may have occurred in a single locality.

DRF instruments linked to investments in risk reduction can also produce short-term benefits while supporting long-term financial resilience. In this vein, the IDB has supported development of captive insurance vehicles in Latin America to serve as efficient conduits of disaster risk into global reinsurance markets. Captive insurers, in this context, are independently managed, dedicated self-insurance entities used to more efficiently manage and transfer risk to reinsurance markets. These vehicles effectively provide long-term benefits to these countries, because the most meaningful benefits from the captive will not accrue until risk reserves accumulate and reinsurance costs moderate. Nonetheless, the IDB has been able to advocate these captive vehicles in the context of supporting more immediate ex ante benefits, such as contingent credit facilities provided at concessional rates of interest (Box 21). As noted, care must be taken to guard against designing DRF mechanisms to deliver short-term benefits that can be delivered by more cost-effective methods. For example, parametric insurance triggers can be designed to respond to frequent, less severe events. Doing so may produce a "payoff" in political terms but at an excessively high premium cost.

The effects of short-term government planning are especially pernicious in times of economic uncertainty. It is ironic that investments in ex ante DRF mechanisms should become more difficult during times of economic stress, when the capacity to bounce

Box 21 **Inter-American Development Bank's Contingent Credit Facility**

The Inter-American Development Bank (IDB) launched the Contingent Credit Facility for Natural Disaster Emergencies (CCF) in 2009. The facility was designed under the premise that to be effective, contingent credit lines must be disbursed promptly following a disaster and the lending terms must be affordable. The CCF was envisioned as a bridge finance vehicle capable of providing urgently needed funds until other financing sources could be accessed. Originally established as a pilot effort with an overall loan capacity of $600 million, the facility was expanded in 2012 to a limit of $300 million per country or 2% of gross domestic product, whichever is lower with no overall aggregate limit.

The CCF operates with a parametric trigger allowing disbursements for severe, sudden, and unexpected disaster events with a recurrence rate of not more than once every 5–10 years, and affecting a significant number of the population (usually at least 2%). This "population-based" trigger is a distinguishing feature of the CCF compared to other facilities that use empirical measures of hazard severity (such as wind speed) as proxies for disaster losses. As a condition of establishing a CCF program, a member country must first put in place an integrated disaster risk management plan that includes measures on risk analysis, risk reduction, emergency preparedness, and disaster response, in addition to a sustainable financing plan for the residual risk, including risk transfer solutions. An additional feature of the CCF allows the member country the option to access the facility through new borrowing or, because of IDB lending constraints, through the "redirection" of available undisbursed balances from a specific list of IDB loans already approved. The choice of new borrowing or the redirection of approved loans provides a more efficient use of the IDB's contingent lending capacity and provides the borrower with options on how to access the emergency liquidity.

The CCF represents a useful example of how disaster risk financing instruments can be used as the basis for encouraging more integrated disaster risk management practices and systems. Emergency liquidity and the bridging capacity it provides often fulfill a basic need of emerging economies to respond adequately and quickly to natural disasters. As such, it offers an opportunity to link other aspects of risk reduction and disaster risk financing to the contingent credit as a means to develop more systematized disaster risk management. It further represents a flexible source of DRF that conserves both borrowing and lending capacity and makes maximum effect of multilateral development bank resources.

If businesses and households are to invest in their own disaster finance resilience, there must first be in place an accessible, affordable, and credible insurance infrastructure

back from disaster effects is at its lowest level. In effect, this is precisely the moment when disasters can exact their highest toll—when the economic resilience of an economy is at low ebb and the economic damage inflicted by disaster can be the most lasting.

The knowledge component of DRF capacity building should not be underestimated. Although much work has been done in this area, with key decision makers far better equipped with training and technical data than ever before, much more work must be done to expand the DRF knowledge base within government. The international community, for example, can be instrumental in providing public agencies and legislatures with access to technical data; support to interpret technical data; and fiscal, economic, social, and political arguments about how such new DRF investments can be shaped to satisfy constituent demands. These organizations can also engage a broader range of opinion leaders on the tools and resources potentially available to enhance resilience. In this respect, the international community could do a better job of addressing the people directly, enhancing their understanding of what they can reasonably expect from government and what they can do personally to make their households and businesses more secure.

MDBs, in particular, could develop the capacity to assess both the hypothetical and the real-time effectiveness of DRF mechanisms. For example, fiscal stress test tools can be developed to hypothetically measure the effect of various DRF instruments on different disaster scenarios. Such tools already exist (such as catastrophe simulation from the International Institute for Applied Systems Analysis), but more investment is needed to refine them, support their integration into government planning, and make such resources applicable and available to local governments. Investment in the capacity to promptly assess the post-disaster effectiveness of DRF instruments also should be considered. Prompt feedback can provide politically useful information as well as guidance for program corrections. Such impact analysis is occasionally produced for ex post response spending, providing documentary evidence as positive feedback to decision makers. The capacity to provide similar feedback on DRF spending can be developed.

Many governments in Asia and the Pacific cannot reliably gauge their ability to fund hypothetical disaster losses—that is, to compare public contingent liabilities with readily available financing. As a starting point, the availability of accurate historical data on disaster expenditures is itself often weak and would need to be improved before reliable gap analysis is achievable. Such analysis can be mainstreamed into budgetary analysis and thereby routinized and institutionalized. Doing so would hopefully lead to a narrowing of the gap and to a situation where ex post and ex ante finance options are brought into more efficient balance. It is also highly likely that such analysis would reveal aspects of contingent liability that had gone unrecognized. MDBs, acting as "DRM think tanks," can contribute significantly to this effort.

If businesses and households are to invest in their own disaster finance resilience, there must first be in place an accessible, affordable, and credible insurance infrastructure (Box 22). In other words, the insurance community must have a viable distribution channel, it must have the stature and reputation to market disaster insurance to an often-skeptical public, and it must have the capacity to prudently underwrite the risk while bringing insurance within the reach of a majority of households. At present, too many countries in Asia and the Pacific lack one or more of these elements for DRF to take root.

In addition, full access to high-quality external reinsurance will remain problematic for some countries as long as their insurance markets remain relatively protected through, for example, regulations that discourage ceding premiums to nonnational reinsurers or that limit foreign investment in domestic insurers. This will continue to be a handicap to building resilience among the population as a whole.

Accessibility to quality reinsurance is a bellwether of the soundness and sustainability of the underlying insurance market. The value of a well-regulated and open reinsurance market was demonstrated following the 2010 Chilean earthquake. It was one of the largest earthquakes to occur in the past 60 years, with insured losses of $8.5 billion (approximately 28% of total economic losses); however, the internalized loss to the domestic insurance market (its net retained loss) was only 5%

Box 22 **New Zealand Earthquake Commission**

The New Zealand Earthquake Commission (EQC) and its antecedent, the Earthquake and War Damage Commission, was conceived in 1944 as a hybrid social policy and insurance framework that balances the obligations of government to absorb the costs of disaster reconstruction with the ability to transfer disaster risk to private insurance markets. Since 1993 in its current form, the EQC acts as an agent of the government, but administers the country's Natural Disaster Fund at arm's length from the government. Its principal mandate is to engage in disaster risk management by overseeing the insurance of residential property and facilitating research and education in fostering enhanced disaster resilience.

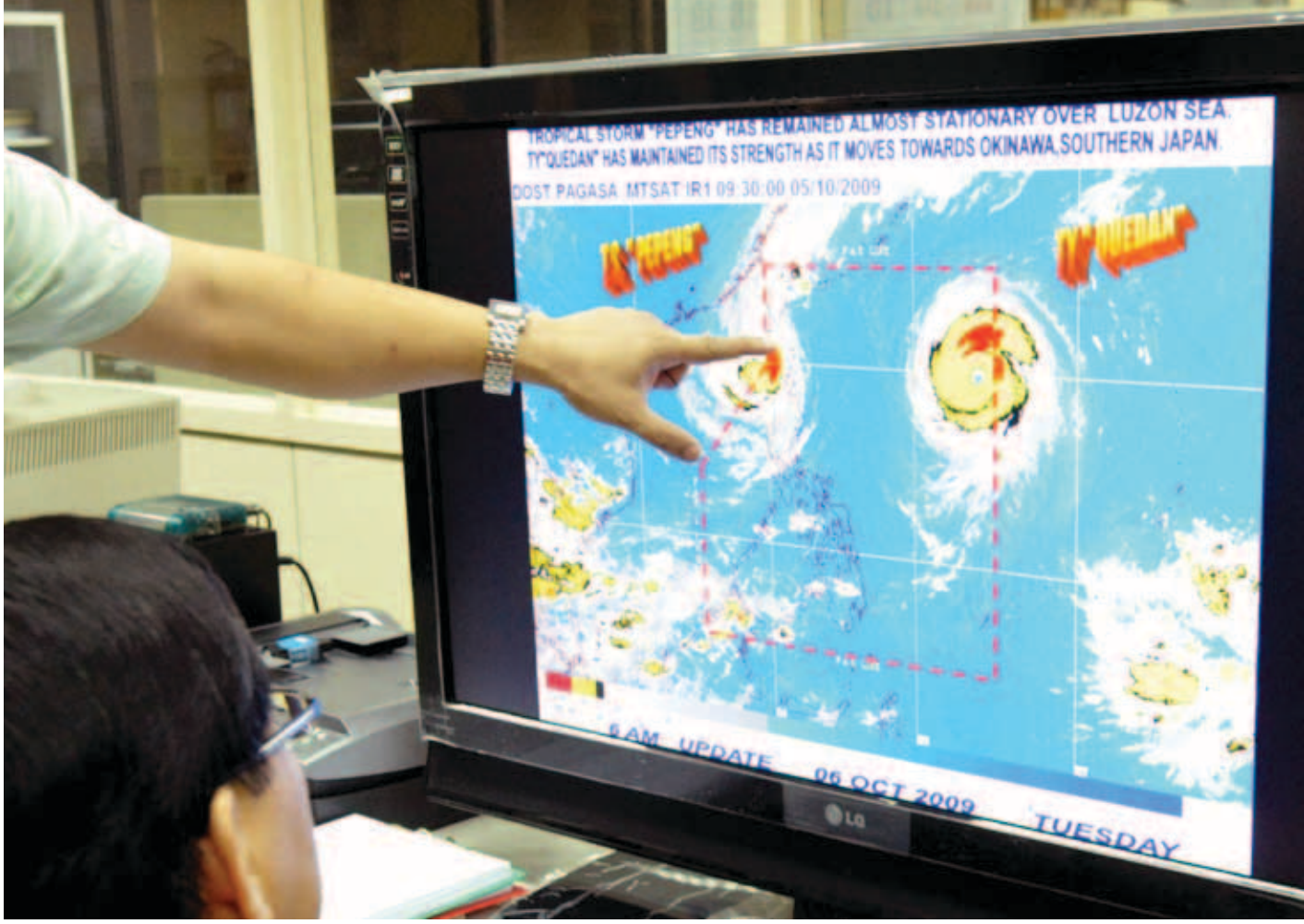
All residential property owners purchasing fire coverage also purchase EQC coverage on a compulsory basis. Residences and contents are covered up to a maximum of NZ$120,000 ($100,800) on a first loss basis although additional coverage may be purchased from the private market. With this framework, the EQC insures about 90% of New Zealand's housing stock against earthquakes, volcanic eruptions, tsunamis, landslides, and other natural hazards. To protect the solvency of the Natural Disaster Fund, the EQC has purchased a NZ$2.5 billion reinsurance program, with the government stepping in—excess of the reinsurance protection—to guarantee the fund's obligations in the event its resources are exhausted. Underlying policies are not individually rated so every homeowner pays the same premium rate regardless of location or type of construction.

The EQC offers valuable lessons on how governments can blend a public commitment to support disaster reconstruction with the ability of global reinsurance markets to provide added capacity and thereby leverage limited public resources. The EQC model also demonstrates the ability to employ a preexisting distribution network (fire insurance policyholders) to distribute and enforce the mandatory coverage. The value of the EQC framework has been demonstrated through the years, but was especially put to the test during the 2010/11 Christchurch quakes.
By December 2012, the EQC had received more than 460,000 claims and paid out more than NZ$4 billion ($3.3 billion). The EQC's total Canterbury liability is NZ$12 billion ($10 billion). Taking into account reinsurance and investment returns, an estimated NZ$600 million–NZ$1 billion ($500 million–$840 million) contribution from the government will be needed to cover the shortfall in ECQ assets.

Source: Cowan and Simpson (2012).

(Aon Benfield 2011). Because of strict regulatory requirements that Chilean insurers cede minimum amounts of earthquake exposure to well-rated reinsurers, the net cost of insured losses to the economy was small. Equally important, however, was the fact that the reinsured portion of the earthquake portfolio was sufficiently large that it greatly influenced the pricing of earthquake risk by the primary insurers, thereby strengthening the claims-paying ability of the primary insurers. Chile's experience offers a lesson on the positive effect that healthy reinsurance markets can have by upholding underwriting standards and externalizing large-disaster probable maximum losses.

Within Asia, it appears that, despite advances and significant investment in this area, the quantification of loss largely remains a weak link in the DRM chain and the accessibility of data remains relatively limited. However, data collection and exposure mapping work undertaken by the Asian Development Bank (ADB), the Secretariat of the Pacific Community, and the World Bank—the Pacific Catastrophe Risk Assessment and Financing Initiative—has demonstrated one approach to accomplishing this. There are numerous weaknesses in the system, but overall, one must ask whether the lack of quality data or a reliable system to produce and maintain it is an outright barrier to implementing DRF programs or just a complicating variable driving costs up and sustainability down. Clearly, anything that tends to raise costs will tend to make the creation of DRF instruments more difficult and will render their sustainability more problematic. Of equal concern is the design of finance solutions with inferior risk assessment data, which handicap their effectiveness from inception.



AFP

Capacity to collect, analyze and model disaster risk data is crucial for disaster risk financing product development. Philippines

12 Policy-Based Investment Opportunities to Support Disaster Risk Financing Capacity Development

Although the DRF record in Asia and the Pacific remains somewhat meager, it is vital to recognize those efforts that have shown promise and to sustain them with new resources and energy. For example, legislative reform efforts to reorganize and redirect disaster funding toward local government initiatives and to open up avenues of risk transfer need to be encouraged, as has been already noted in the case of the Philippines. Lessons from the Philippines and from Indonesia, where significant efforts have been made to streamline and devolve DRM toward local government, must be supported, studied, and replicated where appropriate.

For example, policy changes to permit local governments to exercise greater management and oversight of national disaster fund allocations, together with the latitude to invest in DRR and DRF, may be a necessary step before local governments can better exploit DRF opportunities. Such efforts to develop comprehensive national and subnational DRF strategies need to be led by the governments themselves, with assistance from MDBs and with support from the private sector.

However, governments in Asia and the Pacific still have a persistent bias in favor of ex post disaster response financing. Despite the advances over the past 10–15 years,

Governments in Asia and the Pacific still have a persistent bias in favor of ex post disaster response finance

and despite the apparent consensus that has been built around the Hyogo Framework for Action, there remains a tendency to rely excessively on disaster response and ex post DRF. The principle that, first and foremost, it is the risk and not the disaster that needs managing remains paramount. Perhaps the biggest cost to a country of an excessive dependence on ex post finance, however, is the opportunity cost of lost resilience. Response and rebuilding fulfills a major government responsibility, but other than instances where reconstruction actively incorporates resilience features ("build back safer"), earlier opportunities to reduce disaster effects tend to be lost.

Emerging economies often have viewed DRF as having zero-sum effects. Some economically and geographically larger developing countries can argue against the need to develop enhanced DRF capability, due to their greater ability to absorb shocks by diversifying risks over population and time. However, some states, less able to cope with disaster shocks, also resist adopting ex ante DRM policies and altering the status quo for fear of jeopardizing a known benefit (post-disaster aid) for an unknown one. This mind-set can prevail even when the shortcomings of post-disaster response finance are well known. Nonetheless, governments often have looked at ex ante DRF as having a neutral net effect on overall disaster funding. Such a zero-sum analysis assumes that international development partner support for risk transfer or disaster liquidity mechanisms is designed to offset international support after disasters have occurred. When viewed this way, ex ante finance can appear to be a risky trade-off for governments because some ex ante instruments, such as insurance, are untested in many emerging economies. Ex post finance, by comparison, can look more secure. Such thinking has colored government DRM policies and priorities and can be counteracted by sharing practical experience, case studies, and modeling of comparative DRF mechanisms (e.g., the comparative direct and indirect costs of contingent credit versus new ex post borrowing).

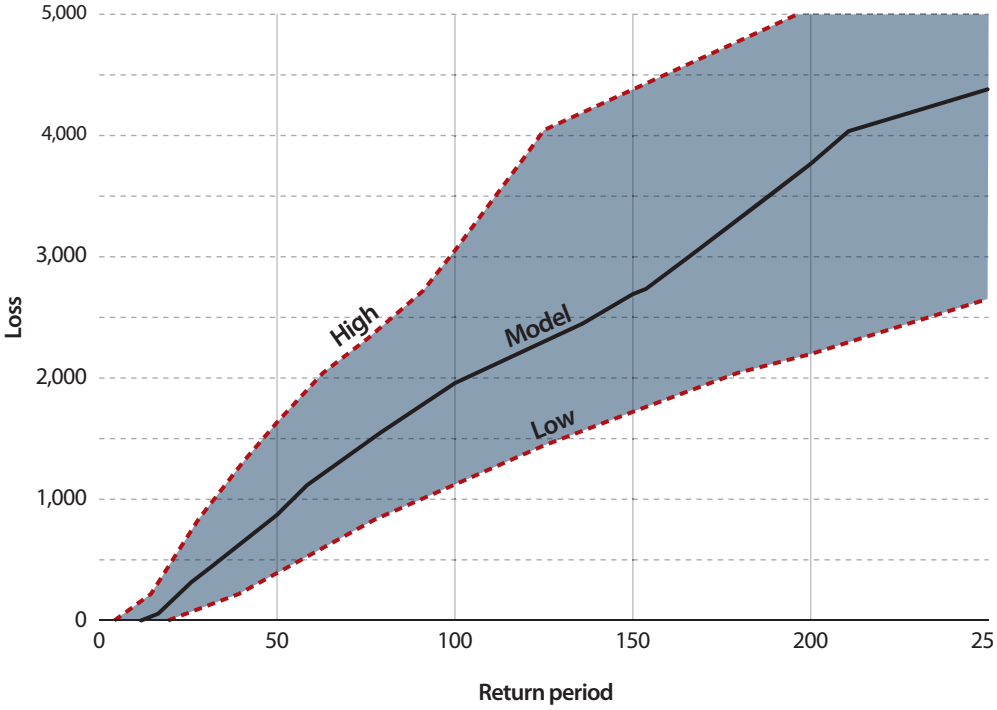
Aspects of Asia's Risk Assessment Capacity Limit the Growth of Disaster Risk Financing

Given that many Asian countries have only recently begun to actively manage disaster risk as a government priority, it should not be surprising that the collection and analysis of disaster loss data also needs significant upgrading. It also follows that, in many respects, this new investment must precede other investments in risk management, risk reduction, and risk finance. What is clear is that the absence of the capacity to collect, analyze, and model this data inhibits further DRF product development or at the very least drives up the cost of risk transfer.

The absence of sound risk assessment can also encourage governments to opt out of ex ante risk management responsibilities. In other words, it may become too easy for a government to claim that they know too little about the risk landscape to undertake active risk management activities. Likewise, poor risk assessment can drive up the cost of risk transfer because, in the absence of tested data, insurers will need to make more cautious assumptions about average annual losses and maximum probable losses. In turn, the higher-risk premium can deter governments from engaging in risk transfer to begin with—or can render a demonstration project unattractive and unsustainable—thereby undermining further investment in DRF.

As seen in Figure 34, the science of disaster risk modeling is still striving for greater precision and certainty. As has been noted, the 2010–2011 period provided further reminders (if any were needed) of the need for the continuous revision and challenging of risk modeling assumptions. Updated scientific data and new lessons learned require reliable funding to be consistently and continuously incorporated into existing models. Thus, it is imperative that catalytic investment in risk assessment occurs—and that it occurs early in the development of a DRF strategy. Asia's risk assessment capacity deficit has many causes that can potentially be addressed with new investment.

Figure 34 **Catastrophe Modeling—An Imprecise Science**



Source: Risk Management Solutions and Guy Carpenter, presented in Guy Carpenter and Company Ltd. (2011).

Lack of Data Collection Resources

The collection and assessment of natural hazard data—including the historical record of losses and financial effects—are currently underfunded, poorly coordinated, restricted from public access, and conducted very unevenly across Asia and the Pacific. Too often, these risk assessment efforts occur on a piecemeal basis without being anchored in a comprehensive DRM system. As a result, the development of integrated and holistic national DRM strategies suffers for lack of timely, relevant information produced on a consistent, reliable basis. Data collection and risk assessment require significant resources, provided continuously over a long time, for the practice to become institutionalized. Risk assessment also requires investment in trained personnel capable of employing the most up-to-date assessment tools and techniques at the national level.

Lack of Data Standardization

The absence of common standards for data collection and analysis of losses impedes the transfer of knowledge, makes cross-border cooperation more difficult and costly, and can raise the cost of risk transfer instruments. Improved standardization would be a major advance in efficiency and capacity building. At a basic level, different valuation measures of assets and property can lead to wide discrepancies in estimates of disaster impacts and thereby can affect the apportionment of response funding. Variances in accounting for victims (whether accounts include the missing, injured, or homeless, for example) and even of the dates on which disasters occur are not uncommon and can affect insurance rates. Insurers and reinsurers, too, can use different metrics for assessing disaster events, leading to substantial variations in loss estimates. Such industry losses often estimate only insured losses, potentially underreporting losses in areas with low insurance penetration rates. Databases such as the Centre for Research on

The private sector, must undertake significant investment to establish common methodology, definitions, and metrics for assessing exposures and losses

the Epidemiology of Disasters International Disaster Database (EM-DAT) can report uninsured losses, but not always with a consistent methodology. Governments, with the support of the international community and in partnership with the private sector, must undertake significant investment to establish common methodology, definitions, and metrics for assessing exposures and losses. This will require significant institutional leadership and consensus building, but in the absence of a common understanding of how we measure disaster impacts, the solutions will continue to be a mosaic of ad hoc efforts.

Lack of Funding for Data Maintenance

The shelf life of disaster data is limited by the occurrence of new events, new exposures, climate change variables, and altered vulnerability factors. Although quality historical data always remain valuable, the functionality of hazard and exposure mapping, for example, requires periodic updating and maintenance, including continuous real-time collection and analysis. The relevance of this data to new probabilistic modeling is also limited by the extent and quality of ongoing maintenance. To accomplish this, these efforts must be supplied with continuous new investment—eventually in the form of recurring appropriations from governments, but initially in the form of catalyst funding from MDBs and bilateral donors. In the long term, risk assessment capacity requires a form of endowment funding that ensures that the existing database investment is not jeopardized by volatility in funding support.

Lack of Cross-Border Data Collection and Sharing

At a sovereign level, disaster data often tend to be defined, collected, and interpreted in a manner unique to the country and the national institutions administering the process. Not only does this contribute to diverse standards and data heterogeneity, but it also inhibits the cross-border sharing of data and the regional cooperation that might otherwise be undertaken. Because natural hazards fail to respect national boundaries, the management of those hazards will inevitably benefit from regional or subregional cooperation. Until there is a more liberal system for sharing data, however, that cooperation will be limited. Some governments remain sensitive to releasing certain categories of data, for national security reasons. Others have tended to take a proprietary view of their national DRM programs and resources, which tends to render the sharing of outputs relevant to neighboring countries more difficult.

Lack of Risk Assessment Capacity at the Local/Urban Levels

Increasingly, risk assessment tools are being developed and applied at the subnational and local/urban levels. The development of geographic information systems mapping technology has permitted granular exposure analysis of small, defined geographic areas, and downscaling has, in some cases, permitted the use of probabilistic models in localized areas. In many emerging economies of Asia and the Pacific, however, local and city governments have minimal access to these tools. If DRF is going to be made accessible and more widely adopted by local government, the means to track, measure, and project disaster losses must be improved. The dramatic urbanization trend within Asia should be sufficient reason in itself to direct new investment toward subnational risk assessment. The growing economic importance of cities and the vulnerability of populations and infrastructure to natural hazards warrant special attention to this need. Climate change further raises the stakes for cities because they must contend with unique climate impacts arising from weather extremes.

Nonetheless, models of integrated DRM systems that capture local and urban risk assessment needs do exist. For example, Mexico's Fund for Natural Disasters (FONDEN) program operates a risk assessment platform (R–FONDEN) that provides both static and probabilistic assessments of various hazards affecting states and localities. Using a database of infrastructure and public assets, the program can make projections about fiscal effects on local government and support the design of DRF mechanisms.

Cities of varying size in Asia and the Pacific require access to similar tools, whether these are provided via a national system, as in Mexico, or are developed locally. Local governments have a contingent liability burden not unlike that of national governments, but with the added complication that funding support from national government sources can be unpredictable in degree and timing. Also, people may have higher expectations that local governments will respond to immediate disaster needs, thereby placing greater demands on government preparedness. Armed with tools that help quantify the financial effect of disasters, governments can begin building greater financial resilience into their current systems.

Duplication and Inefficiency of Ad Hoc Data Collection

Much like small-scale DRM projects, which often fail to link up with a national DRF framework to demonstrate their sustainability, risk assessment efforts are also often project-driven, one-off efforts, the benefits of which are reserved for the entity that undertook the data collection, thus becoming stranded at the project level. As a result, Asia and the Pacific is left with an overlapping, patchwork system of data collection efforts that are undertaken with a particular outcome in mind and lack the means to convey the benefits to a wider audience of practitioners. Because so many of these efforts are ad hoc in nature, they also have no means to update and perpetuate themselves. This, in turn, leads to duplicate efforts and lost opportunities to leverage existing work against new risk assessment demands. In the commercial market, investments are being made in the creation of risk models built as standing resources and then marketed and adapted as needed. Outside the commercial modeling world, however, the current risk assessment work undertaken appears to lack the connectivity necessary to create a common store of knowledge to aggregate and provide a foundation for future work.

Lack of Open-Source Data

The fragmentation of data collection goes beyond just the lack of common definitions and standards. Differences in methodology among countries, states, research universities, reinsurers, and government agencies themselves contributes to the balkanization of disaster data management and makes access and use of that data ever more limited. This leads the region farther from an open-source data repository capable of providing transparent, high-quality information to all users. The effect of such a resource would likely be to draw a wider range of interested constituencies into the work of DRM by lowering entry costs and other barriers. Pioneering efforts, such as the multi-risk CAPRA GIS–based platform led by the IDB, the World Bank, the Center for Coordination of Natural Disaster Prevention in Central America, and the United Nations International Strategy for Disaster Reduction in Central America or the OpenGEM web-based platform for analyzing seismic risk and consequences, have presented open-source models to replicate as appropriate and to study for the benefits of broad accessibility.

Other Areas Where Further Disaster Risk Financing Investment Is Needed

Aside from the major areas already discussed, new investment is required to build financial resilience through innovative application of existing DRF instruments, developed and supported by new vehicles. As noted, although progress has been made, the modest results of DRF to date suggest that the international community must do more than just double down on existing strategies. Alternative approaches for developing DRF programs, especially those that have the capacity to bring the benefits from investment in resilience forward into current budgetary and political cycles and those capable of reaching the poor, are needed to supplement the work done to date.

Regional organizations can serve a vital function in terms of exercising the leadership necessary to convene, coordinate, and facilitate the development of DRF solutions. The Association of Southeast Asian Nations (ASEAN) has provided these services in the context of DRF over the past several years. The ASEAN Agreement on Disaster Management and Emergency Response contains a 2010–2015 work program that includes

several aspects of DRF. More recently, ASEAN has worked to develop a Disaster Risk Financing and Insurance Program under the auspices of the Taskforce on the Future Priorities of ASEAN+3 Financial Cooperation. The work of ASEAN in this regard is just beginning, but it has gathered the support of ADB, the Government of Japan, and the World Bank. In addition to these organizations, significant investment from all ASEAN member states will be necessary to develop national and regional initiatives that fill capacity gaps and build experience within the region.

Laying the groundwork for regional DRF solutions such as risk pools can be extremely difficult and time-consuming. Consensus building requires institutional leadership and credibility, and technical capacity is necessary to project national budgetary and economic effects and to design finance mechanisms that deliver results as advertised. Perhaps the most difficult consensus to achieve, however, is the notion of investing in a long-term shared solution to a mutual problem. Risk pools can derive benefits from the diversity of uncorrelated risks that smaller, more exposed countries cannot produce individually. The diversity of risk facilitates market access, reduces national capital contributions, and lowers shared operating costs overall; yet, that same diversity produces concerns about self-interest, sovereignty, and popular acceptance. These are real obstacles that must be acknowledged and addressed. For example, where risk pools are thought to be viable, MDBs can support feasibility studies and start-up costs and can even consider short-term premium financing, in return for concrete actions taken to reduce risk (Box 23). MDBs can also be instrumental in forming offshore captive entities—as the IDB has done—to assist with the formation, capitalization, and initial operation of the entity. Although MDBs are not in a position to provide reinsurance capacity directly, they can nonetheless help build channels through which national and local governments can begin to access additional capital through various risk transfer mechanisms, including reinsurance and guarantees.

At all levels of local government, including cities, building financial resilience requires significant new investment. There is a vast need for awareness and capacity development in this area. Many DRF tools typically

Box 23 **Caribbean Catastrophe Risk Insurance Facility**

The Caribbean Catastrophe Risk Insurance Facility (CCRIF) is a regional disaster risk pool spanning 16 Caribbean Community island nations. Begun in 2007, the pool is organized as a mutual insurance company controlled by its participating governments. The principal objective of the pool is to provide short-term liquidity to governments to better respond to emergency needs arising from severe hurricanes and earthquakes. At the request of participating governments, efforts to expand insurance coverage to include flood losses are in progress. Policies are issued individually to governments based on their individual requirements and risk profiles and then reinsured in global markets. The insurance coverage is based on a parametric trigger (i.e., claims are paid based on the severity and location of the event, not the ascertained loss) and therefore funds can be rapidly disbursed and flexibly targeted by the government as the situation requires.

Since 2007, CCRIF has paid more than $30 million in claims to participating governments. However, in addition to claims paid, significant benefits have also accrued to the participating governments in the context of a more efficient distribution of insurance costs, including reduced premium and reinsurance costs achieved by aggregating non-correlated risks. The value of risk pooling has also been demonstrated by the more efficient use of capital, as well as accelerating the formation of risk reserves, which over time should reduce the cost of reinsurance.

The success of CCRIF has depended in part on the availability of high-quality risk assessment data necessary to support the creation of risk models and the creation of parametric triggers to activate the flow of funds after the occurrence of a qualifying disaster. Early funding support from multilateral development banks allowed this work to move forward and provided an important catalyst for consensus building and market acceptance. This demonstrates how investment in risk assessment capacity forms an essential building block for the development of disaster risk financing options and, by reducing uncertainty, can pay dividends in the form of lower costs of risk transfer. CCRIF has also demonstrated the critical importance of regional consensus building and continued open communications when contemplating regional disaster risk financing solutions.

Source: World Bank and Global Facility for Disaster Reduction and Recovery (2012b).

associated with sovereign DRM are adaptable for use by cities and local government authorities. These include risk pooling, reserve development, credit and insurance liquidity facilities, insurance captives, and microinsurance programs for lower income groups. As noted, many local governments understand perfectly well that a contingent disaster liability attaches to them, regardless of the extent of national disaster funding. However, their ability to quantify and plan for that liability has been quite difficult in the absence of new technical skills and resources. Local governments will normally rely substantially on national funding and external support from the international community—thereby leaving their populations at the mercy of national programs and the hope that they will perform as intended, or on the generosity of others. In either case, local government will have partially ceded responsibility for managing disaster consequences for which they know they will be held accountable. Local governments, therefore, have a significant self-interest in attracting new investment to build their capacity in this regard.

Capital markets represent a liquid source of DRF that has been much discussed but infrequently used within developing country markets. Developed primarily as an alternative source of risk capital for the insurance industry, capital market products such as catastrophe bonds have been an integral part of Mexico's FONDEN program since 2006, but they remain largely undeveloped for government applications within Asia and the Pacific (Box 24). Obstacles to more widespread use of catastrophe bonds include high transaction costs, long structuring periods, the need for specific risk models, and risk premiums that are nearly the cost of traditional disaster risk reinsurance. Some of these hurdles can be managed through the development of platform mechanisms such as the World Bank's MultiCat program, which provides a shared utility for the development of catastrophe bonds worldwide and thereby reduces costs. Catastrophe bonds can provide substantial amounts of protection for events that typically have a low probability of occurrence (at high layers of loss) but nonetheless require significant capital commitments. In addition, because they are fully collateralized, they are substantially free of counterparty risk, unlike traditional insurance products.

MDBs, in partnership with the private sector, could make more creative use of the

Many disaster risk financing tools typically associated with sovereign disaster risk management are adaptable for use by cities and local government authorities

Box 24 Mexico's Fund for Natural Disasters

Mexico's Fund for Natural Disasters (FONDEN), originally established in the late 1990s as a budgetary mechanism to provide prompt support to federal and state governments affected by natural disasters, has evolved into a multifaceted and systematic national disaster management framework that could potentially serve as a model for governments in Asia and the Pacific. FONDEN's principal support for disaster impacts is directed at reconstruction of public infrastructure at the federal, state, and municipal levels. However, in the past decade, FONDEN has expanded its focus on ex ante disaster risk financing and risk reduction efforts.

In order to leverage its budgetary authority and deal with the potential uncertainty of the call on its resources, FONDEN, beginning in 2006, entered into various market-based transfer instruments such as reinsurance and catastrophe bonds with the support of private sector firms such as Swiss Re. In that year, it succeeded in arranging $450 million in earthquake protection through a combination of parametric reinsurance and a catastrophe bond—the first ever government catastrophe bond—issued in global capital markets. Following the expiry of this bond, a second catastrophe bond was issued in 2009, providing both earthquake and hurricane coverage. In 2011, the program was expanded to include an indemnity insurance cover for government assets and low-income housing with a $400 million excess-of-loss reinsurance treaty.

FONDEN demonstrates the feasibility and potential scope of a government-led, market-based disaster risk management framework. In particular, the program demonstrates how insurance and capital market products can be structured to maximum effect when combined with sound budgetary and reserving practices. The FONDEN experience also demonstrates the value of including local district and municipal governments in the development of disaster risk financing programs and how the creation of a truly systematic risk management framework and market-based instruments can be put to work at the subnational level.

Source: World Bank (2012a).

risk appetite of capital markets. For example, one method of achieving more widespread use of catastrophe bonds could be the deployment of bond collateral into DRR uses during the life of the bond. In the event there is no call on the collateral (i.e., no qualifying disaster event), an MDB standby loan could be applied to the risk reduction investment to free up the funds for disbursement to investors at maturity. Alternatively, in the event of a qualifying disaster, a portion of the bond proceeds could be dedicated to paying off existing loans for risk reduction activities and a portion could go to disaster response or reconstruction. In either case, the benefits of the bond would be brought forward to provide real present value and to create a virtuous cycle: Risk transfer costs would actually be helping to fund risk reduction, which in turn should yield lower risk transfer costs.

The development of domestic credit and export credit insurance capacity (from both national and international insurance companies) can also be encouraged. A well-developed domestic credit and export credit insurance market, providing insurance to companies and exporters under an all-risk policy covering nonpayment, including if the obligor cannot pay due to a disaster, is one factor in providing an important source of liquidity and commercial continuity in the face of disasters. Bankers use insurance as both an indemnity and a credit enhancement; therefore, governments can recognize the value of private credit insurance or export credit insurance when it is provided by a highly rated domestic or international insurer, and can allow appropriate capital relief.

There is a natural affinity between the capacity of the private sector to support DRF acceptance and use in Asia and the Pacific and the core mission of the international community. Risk management has been refined and practiced within the commercial world over a long period, and many of its principles and practices have been imported into government programs within the developed world. However, there is a capacity gap among emerging economies within Asia that can leave these private sector resources just beyond reach. For example, the use of sophisticated risk modeling developed in the private sector is of limited use to governments that have not managed to collect basic historical disaster data. The most sophisticated DRF instruments are of little use to departments of finance that lack the training to know when and how they should be considered.

MDBs themselves can begin to access reinsurance market capacity. To the extent that capital constraints limit the ability of MDBs to support new investment in DRF through new lending and guarantees, the use of risk transfer arrangements written directly to MDBs (e.g., guarantees, insurance, or unfunded risk participation) could be used to leverage capital, relieve equity–loan ratio constraints, and provide extra lending headroom for constrained country loan and guarantee ceilings. Depending on the leverage allowed (largely dictated by the counterparty rating), MDBs could become more active in using their lending and guarantee authority to support DRF. For example, MDBs could more creatively explore the use of risk transfer arrangements to enable greater support for credit-based liquidity facilities. Depending on whether the underlying transaction was written on a sovereign or nonsovereign basis, risk transfer arrangements could backstop political risks, credit risks, or both.

The international community itself could make use of reinsurance and capital market capacity as well, thereby leveraging its scarce resources. For example, rather than engaging in reactive, ad hoc post-disaster funding or loan reallocations, MDBs and bilateral donors could allocate a portion of their annual budgets, in line with their historic levels of post-disaster support, and then leverage those funds by entering into reinsurance arrangements with the private sector. The reinsurance support could be structured on a parametric basis to provide the relevant MDB or bilateral donor with ready liquidity and maximum flexibility to direct funds as needed, including to support new investment in DRR. Such an arrangement could provide significantly higher levels of emergency response and reconstruction aid for particularly severe disaster events without otherwise constricting normal operations or country lending limits.

Nonetheless, for all the apparent opportunity, close cooperation between the public and commercial sectors has been more aspirational than real. For its part, the private sector must continue to recognize the skills and relationships that the international community can

bring to bridge these gaps—to act as catalysts to integrate risk management practices in ways that meet private sector objectives and development goals alike. Similarly, the international community must embrace the true spirit of public–private partnerships and accept that the private market has resources and expertise that are essential to building this capacity—and that it makes little sense for international development partners to replicate these resources themselves. Building this partnership will require new investment on both sides. In the private sector, this will require the capacity to engage in training and product development with the specific needs and risk profiles of countries in mind. It will require the leading firms in risk modeling to develop new cooperative business models that allow for data sharing while protecting revenue streams and proprietary intellectual property. For MDBs and bilateral donors, the new investment will need to start with management's awareness of their own capacity constraints and their need to invest in the skills within their own organizations to operate seamlessly on both sides of the public–private divide.

Concluding Thoughts on Investing in Disaster Risk Financing

Looking forward 20 years hence, if the milestones just discussed are reached and expanded levels of DRF investment in Asia and the Pacific are attained, the question remains: What will be the consequences of a more vibrant DRF environment in the region? What can the region expect to experience if such new investment comes to pass, and what is the best way to measure the effectiveness of these DRF instruments? However, one must also ask what the future holds if Asia and the Pacific reverts to the status quo. What repercussions will arise if DRF initiatives lapse and the financial resilience of Asia and the Pacific actually weakens in the face of increasing exposure, urbanization, and climate change?

Certainly, in one sense the answer must begin and end within the context of economic development. The effects of natural hazards on economic growth vary from country to country, but the compounded annual cost of disasters in terms of poverty rates and economic opportunity costs are substantial. Disasters negate a substantial share of the development benefits delivered within the region, and the success or failure of building financial resilience must ultimately be traced back to measures of poverty, growth, and the environment. Over time, disaster resilience must translate into development resilience—that is, the release of development potential, unfettered by the weight of natural hazards.

Over time, disaster resilience must translate into development resilience—that is, the release of development potential, unfettered by the weight of natural hazards

If Asia and the Pacific does take a step backward, the results could likely be measured in widening gaps. The gap between DRF investment in Asia and the Pacific and that of other developing regions would continue to grow. The gap between insured and incurred losses would likely continue to widen. The DRM capacity gap between the least-developed countries in Asia and the Pacific and the middle- and upper-income countries would likely grow. The gap separating most of Asia and the Pacific from global insurance markets would likely remain wide, and the gap keeping individuals and households from having access to even the simplest forms of disaster protection will remain a challenge.

If DRF takes root in the region, the broadest measure of success will be governments taking ownership of DRM as a core function of government rather than just an obligation to react compassionately to disaster consequences, and moving beyond a willingness to engage in DRF only when the cost is borne by others. This ownership will be reflected in many ways, including earnest engagement with the international community and the private sector to exploit opportunities and leverage resources. It will be reflected in a willingness to make tough choices about trade-offs between current expenditures and future security.

In the future, a government's willingness to take on proactive risk management will likely be aided by the delivery of benefits in real time. If the goal of the international community is to reach a point where emerging economies begin to institutionalize risk management practices and culture, that likely will be achieved in part by figuring out how to bring forward benefits and establish program linkages that provide real incentives to governments to make these shifts. Transitioning to a fundamentally different

approach to DRM is unlikely to happen without such assistance.

Finally, if the role of MDBs, in particular, and the public sector is truly catalytic with regard to building financial resilience, then they will need to respect advances made by the emerging economies and shape their residual role accordingly. Even if success is many years away, developing a more robust disaster financing environment should translate into a lower profile for MDBs, rather than a new dependence on public sector support. The public sector can play an enabling role in this context, and thus should know when and how to reinvent its role over time.

Part IV

Achieving Resilience

AFP

Investing in the future. Tashkent, Uzbekistan

13 Conclusion

Urgent action is required to tackle the trend of rising disaster losses in Asia and the Pacific. Vulnerability is growing in many countries. The volume of physical capital stock in the region, and, with it, exposure to natural hazards, is increasing. The frequency and intensity of meteorological, hydrological, and climatological events are also rising as a consequence of climate change. However, there is nothing inevitable about the consequent rise in losses and, with it, the forfeit of hard-won development gains.

Existing technical know-how is sufficient not just to stem but also to reverse this trend. We know how to assess risk, how to reduce risk, and how to manage the residual risk. Moreover, governments and their international development partners have stated repeatedly their intentions to improve disaster risk management (DRM) and reduce losses in a multitude of national, regional, and international public forums.

Yet, despite this technical know-how and good intentions to the contrary, hazard-related physical losses in the region have continued to rise. Moreover, there has been no overall pattern of declining human mortality, particularly from geophysical hazards. Physical losses will escalate even further over the next few decades if the huge sums required to sustain recent high rates of growth are invested without careful regard to disaster risk. Efforts to secure substantial new investment are a central objective of economic policy across Asia and the Pacific, but this will not have its desired impact if disaster risk is ignored in expanding the region's infrastructure.

This report has invited readers to reflect on this breach between rhetoric and action, focusing on a simple yet central and

There is nothing inevitable about the consequent rise in losses and, with it, the forfeit of hard-won development gains

increasingly urgent question: How do we ensure that the actions that we know are required to strengthen resilience are actually taken? It has set out a wide portfolio of policy, capacity, and investment instruments and mechanisms that can be drawn on to achieve change, ultimately contributing to poverty reduction and inclusive, sustainable socioeconomic development.

The report applied a backcasting approach, setting visions of a resilient future and working back from those visions to identify potential pathways to their achievement. This approach, combined with related analyses of existing gaps and obstacles, has revealed a wide variety of potentially useful tools and mechanisms to strengthen resilience. It has emphasized the role of backward and forward linkages between different endeavors and the importance of coordinated action, with progress in any particular area likely to feed from and contribute to others. Furthermore, it has stressed the fact there are no fixed rules on the sequencing of different actions, nor particular instruments and mechanisms that necessarily are better than others.

Envisioning a Resilient Future

If applied in combination with careful planning, coordinated action, and widespread impetus for change, there are sufficient instruments and mechanisms to achieve a future in which resilience is significantly strengthened

If applied in combination with careful planning, coordinated action, and widespread impetus for change, there are sufficient instruments and mechanisms to achieve a future in which the following are true:

- Resilience is significantly strengthened, as demonstrated by a long-term decline in human and physical losses as a consequence of natural hazard events.
- Policy makers, legislators, national, regional, and local government officials, private businesses, communities, individual households, and the international community each recognize and accept their respective roles and responsibilities in strengthening resilience and the long-term nature of their commitment. Furthermore, they acknowledge that related resource needs, in the form of money, capabilities, and human resources, stretch well beyond the capacity and obligations of the public sector.
- The case and opportunity for investing in resilience is considered with each development action. Every public and private partner in development recognizes that its actions potentially carry disaster risk but can also potentially strengthen resilience and, with the support and encouragement of appropriate regulatory, institutional, and policy frameworks and incentives, embraces its responsibility to strengthen resilience for both individual and common good.
- Disaster Risk Financing is an accepted, institutionalized, and routinely employed part of DRM policy and practice.

Achieving the Vision: Critical Next Steps

To achieve this broad vision and the specific thematic and sectoral visions presented in Part II, a wide range of steps can be taken to stimulate, secure, and sustain the desired investments in resilience. This will lead to a series of different paths leading to the same outcome and many actions along the way. However, there are eight critical steps that can help jump-start the process by overcoming a number of the more common gaps and challenges faced in many countries across Asia and the Pacific. These should be regarded as priority tasks that need immediate action.

Policy Change

- Governments can review and, where appropriate, revise DRM legislative and regulatory frameworks to clarify and explicitly articulate the precise roles and responsibilities of individual households, communities, the private sector, governments, and the international community in strengthening resilience. Government and international community forms and levels of relief, early recovery, and reconstruction assistance may need to be adjusted to ensure that designated roles and responsibilities and incentives are not undermined by actual public behavior in the event of a disaster.

Risk Assessment

- Governments can ensure that some form of disaster risk assessment is undertaken for all new investments in their countries, whether financed directly by a government, the international community, or privately. Appropriate risk management features can then be reflected in the resulting project design and in the location of structures, protecting new investments against natural hazards and ensuring that the investments do not create new forms of risk. The international community can support governments in this process.

Financing

- National and subnational governments can develop and implement comprehensive disaster risk financing (DRF) strategies to reduce risk and to provide adequate and timely post-disaster support to strengthen financial resilience. The insurance industry and the international community can play a vital role in this process, including through the provision of risk modeling expertise. The insurance industry can also offer risk-sharing capabilities while the international community can provide start-up capital reserves, guarantees, contingent credit, and technical advice on risk layering and regulatory framework requirements.
- Governments, working in cooperation with the international community, can encourage the growth and development of the insurance and reinsurance sectors in their countries to provide a range of DRF instruments.
- Governments, working in cooperation with the international community, can establish public programs of financial support for community and local investment in risk assessment, risk reduction, and residual risk management. A significant portion of the required investments in resilience are needed at this level, but existing funding for local and community initiatives is typically particularly limited. Programs of financial support can be designed to leverage additional financing from local government, local business, and community funds—through cost-share arrangements, for instance—and to reward progress in strengthening resilience with additional resources. Technical and financial support from the international community may be required to support this process.

Private Sector Engagement

- Governments, working in cooperation with the international community, can develop programs of work to strengthen private sector understanding and appreciation of the commercial opportunities in strengthening resilience, to facilitate regional sharing of ideas, and to incentivize related undertakings—for instance, by supporting first-entrant product development and market research costs.

Knowledge Management

- Governments and regional associations, working in cooperation with the international community and private sector partners, can establish an open-source, regional online information platform to facilitate the development, exchange, and dissemination of hazard and disaster risk data, including climate change modeling.

ADPC

Community consultation to prioritize actions for disaster risk management. Bangladesh

Training on risk assessment methodologies can also be provided. Related tools can be developed and placed on the same platform, offering support for nonexperts in interpreting and applying the data to public and private development planning and investment decisions.

- Governments and regional associations, working in cooperation with the international community, can establish a regional knowledge development and capacity-building program to strengthen understanding in government and the wider society of the potential returns on investment in risk assessment, risk reduction, and residual risk management. The program can collate existing cost–benefit and cost-effectiveness analyses into a central online repository, including analyses undertaken by the private sector and nongovernment organizations as well as governments and the international community; commission further analysis to address any key gaps in the existing knowledge base, relating to types of hazard, sectors of analysis, and scales of intervention; provide related technical training on the application of relevant analytical tools in this area; and highlight potential mechanisms to enhance rewards for investments today that deliver benefits tomorrow. Dissemination activities can be included to inform individual citizens about the net benefits of potential DRM actions that they could take and to enhance their capacity to assess public DRM policies and actions, thereby strengthening political reward for investment in resilience.

Achieving the Vision: Coordinated Action

Policy makers, legislators, governments, the private sector, communities, households, and the international community all have a role to play

Policy makers, legislators, governments, the private sector, communities, households, and the international community all have a role to play in ensuring that these critical next steps lead to further actions that will ultimately result in the achievement of a resilient future. Each group has an important role. No group or even single entity is too small to play a part in strengthening resilience. The importance of national governments creating an enabling environment that permits and encourages subnational governments, the private sector and local communities to experiment and develop homegrown resilient choices cannot be underestimated.

The sum of parts will be far greater, however, if there is strong collaboration and coordination along an agreed-upon common path toward clear common goals, exploiting interconnectedness and linkages, and if individual resilience actions are carefully integrated into wider development concerns. This collaboration needs to occur at all tiers of governance—international, national, regional, subregional, and community. It will not occur on its own. Instead, governments and the international community need to guide and encourage collaboration both in designing and implementing public measures and actions and in stimulating parallel private sector and household initiatives.

Achieving the Vision: Prioritizing Resources

A key part of the solution hinges on resources—money, know-how, and human resources. Resource needs are enormous, and resource envelopes limited, implying that hard choices must be made. Working together, policy makers, legislators, governments, the private sector, civil society, communities, individual households, and the international community must determine which actions to prioritize. They need to consider the cost-effectiveness of different options, their relative scale of potential effects, and, particularly in the case of public investments, their potential contribution to key development objectives, including poverty reduction, as well as enhanced resilience. Choices must be made in the context of desired outcomes; prevailing circumstances, including key gaps and obstacles; resource availability; and specific opportunities to effect change.

Achieving the Vision: Reflecting Prevailing Political Economy Realities

Analysis of prevailing power relations and political incentives is essential in understanding the political constraints

within which resilience strategies will be implemented and in identifying bundles of actions that have a greater likelihood of enduring success. Altering the power relations and political incentives themselves is an enormously difficult and lengthy task. However, strengthened knowledge and understanding of disaster risk and the net benefits of disaster risk reduction options, including wider equity and macroeconomic benefits, can play an important role in helping to shift the balance of incentives in favor of strengthened resilience. Knowledge and understanding enables citizens and interest groups to monitor and judge the actions of others in both creating disaster risk and strengthening resilience.

Specific time-bound political opportunities for change should also be seized. These may arise, for instance, in the aftermath of a major disaster when there is strong public demand to avoid a repeat event or when a resilience champion comes to the fore. However, it should be recognized these opportunities are often short-lived and their impacts on the balance of political incentives in favor and against strengthened resilience typically only temporary. As such, the actions they trigger should be carefully selected to maximize the possibility of long-term benefit despite likely backward shifts in political motivation for strengthened resilience.

Monitoring Progress and Achievements

Progress toward a resilient future can be carefully tracked to ensure that identified steps are taken and that potential unforeseen obstacles along the way are overcome, thereby helping to ensure that the intended end outcome is achieved. Detailed frameworks can be developed to monitor and evaluate progress, potentially covering a wide array of legislative, regulatory, policy, planning, institutional, financial, and capacity-building instruments and mechanisms. There are three critical outcome indicators:

- There is a long-term decline in the direct human and physical losses and indirect impacts occurring as a consequence of natural hazard events.
- This decline is apparent in regional, national, and subnational data.
- The decline holds for both low-impact/high-frequency and high-impact/low-frequency events.

In the more immediate term, broad progress can be measured according to the following indicators:

- Disaster risk data at appropriate levels of resolution are readily available, reliable, up to date, and regularly used to inform government, private sector, community, household, and international development partner investment decisions and actions.
- The government has a comprehensive DRM strategy in place, which is fully integrated into wider national and local socioeconomic and physical development planning frameworks and processes; sector strategies; legal, regulatory, and institutional arrangements; operational processes; and budgetary systems and appropriations.
- There is a reduction in national dependence on international disaster assistance, in local government dependence on federal support, and in private sector and household dependence on public support in the event of a disaster.

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Glossary

Adverse selection. A condition arising from information asymmetry in which the insured knows more about the risk insured than the insurer—resulting in participation by high-risk individuals and nonparticipation by low-risk individuals.

Alternative risk transfer. Any nontraditional form of insurance risk transfer (Cummins and Mahul 2009).

Annual expected loss. Expected loss per year when averaged over a very long period (for example, 1,000 years). Computationally, annual expected loss is the summation of products of event losses and event occurrence probabilities for all stochastic (random) events in a loss model (Cummins and Mahul 2009).

Backcasting. An approach that seeks to determine how to attain desirable ends or visions of the future. It focuses on these visions, rather than on present conditions and current trends, seeking to work backward from visions of the future to the determination of their feasibility and the policy measures required to achieve them. It is typically applied to complex and important long-term issues (Robinson 1990; Dreborg 1996).

Capacity. The combination of all the strengths, attributes, and resources available to an individual, community, society, or organization, which can be used to achieve established goals (IPCC 2012).

Catastrophe bond. High-yield insurance-linked security providing for payment of interest and/or principal to be suspended or canceled in the event of a specified disaster, such as an earthquake (Cummins and Mahul 2009).

Climate change adaptation. In human systems, the process of adjustment to actual or expected climate and its effects in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate (IPCC 2012).

Contingent emergency liquidity. Prearranged disaster funding, either credit- or insurance-based, that can be accessed promptly in the event of a qualifying disaster event and directed as needed by the borrower or insured.

Disaster. Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery (IPCC 2012).

Disaster risk. The likelihood over a specified time period of severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery (IPCC 2012).

Disaster risk financing. Application of financial instruments as part of a systematic approach to managing disasters in order to anticipate, plan for, reduce, transfer, and respond to natural hazard events. It is intended to capture various financial mechanisms and policy options that enable greater financial resilience to natural hazards.

Disaster risk management. Processes for designing, implementing, and evaluating strategies, policies, and measures to improve the understanding of disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, response, and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life, and sustainable development (IPCC 2012).

Disaster risk reduction. Denotes both a policy goal or objective and the strategic and instrumental measures employed for anticipating future disaster risk; reducing existing exposure, hazard, or vulnerability; and improving resilience (IPCC 2012).

Disaster risk transfer. A contractual process whereby the burden of financial loss (arising as a consequence of a natural hazard) is shifted to another party via the use of insurance or other financing instruments in return for a payment or premium.

Diversification. The variety of assets within a portfolio in terms of its geographic or sectoral spread, or in terms of its credit quality. In general, risk is reduced as portfolio diversification increases (Cummins and Mahul 2009).

Expected return period. The mean period between similar hazard events in a defined geographical area.

Exposure. The presence of people; livelihoods; environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected (IPCC 2012).

The amount (sum insured) exposed to the insured peril(s) at any one time (Cummins and Mahul 2009).

Fiscal risk. The likelihood that there will be a shortfall in projected government revenue or additional unforeseen government expenditure requirements, beyond those included in the annual budget. This risk may stem from a range of factors, including natural hazard events.

Hazard. The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources (IPCC 2012).

Hazardscape. The exposure and vulnerability of a particular place, its people, and its assets to the full range of hazards that it faces, including natural, environmental, health, and technological hazards. It links the dimensions of earthbound atmospheric, hydrologic, and geologic processes and human interventions with the spatial dimension of land use, the built environment, and ecosystems.

Insurance. A financial mechanism that aims to reduce the uncertainty of loss by pooling a large number of uncertainties so that the burden of loss is distributed. Generally, each policyholder pays a contribution to a fund, in the form of a premium, commensurate with the risk he or she introduces. The insurer uses these funds to pay the losses (indemnities) suffered by any of the insured (Cummins and Mahul 2009).

Insurance capacity. The maximum amount of insurance or reinsurance that the insurer or reinsurer or insurance market will accept (Cummins and Mahul 2009).

Land use planning. The process undertaken by public authorities to identify, evaluate, and decide on different options for the use of land, including consideration of long-term economic, social, and environmental objectives and the implications for different communities and interest groups, and the subsequent formulation and promulgation of plans that describe the permitted or acceptable uses (UNISDR 2009).

Livelihood. The capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (DFID 2011; adapted from Chambers and Conway 1992).

Moral hazard. The problems generated when the insured's behavior can influence the extent of damage that qualifies for insurance payouts (Cummins and Mahul 2009).

Parametric insurance. An insurance contract in which payment is based on the occurrence of a specified event, as opposed to the measure of loss suffered by the insured (ADB 2009).

Premium. The monetary sum payable by the insured to the insurers for the period (or term) of insurance granted by the policy (Cummins and Mahul 2009).

Probable maximum loss. The largest loss believed to be possible for a certain type of event in a defined return period, such as once in 100 years (Cummins and Mahul 2009).

Reinsurance. Insurance that insurance companies purchase in order to smooth results over time, limit their exposure to individual risks, increase solvency, and spread risk more broadly among a greater number of market participants.

Residual risk. The risk that remains in unmanaged form, even when effective disaster risk reduction measures are in place, and for which emergency response and recovery capacities must be maintained (UNISDR 2009).

Resilience. The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions (IPCC 2012).

Retrofit. Reinforcement or upgrading of existing structures to become more resistant and resilient to the damaging effects of hazards (UNISDR 2009).

Risk assessment. A methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods, or the environment on which they depend (UNISDR 2009).

Risk layering. The process of separating risk into tiers that allow for more efficient financing and management of risks (Cummins and Mahul 2009).

Risk modeling. The use of computer simulations to calculate the risk of natural disasters and resulting monetary loss based on asset values at risk, vulnerabilities, and a range of likely natural hazard occurrences.

Risk pool. An aggregation of individual, roughly homogenous risks that yields a mean average consistent with actual outcomes, thus allowing an accurate prediction of future losses and the setting of accurate premium rates (Cummins and Mahul 2009).

Risk transfer. The process of shifting the burden of financial loss or responsibility for risk financing to another party, through insurance, reinsurance, legislation, or other means (Cummins and Mahul 2009).

Sustainable development. Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (IPCC 2012).

Transboundary hazard. The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources, and which impacts more than one country.

Vulnerability. The propensity or predisposition to be adversely affected (IPCC 2012).

Investing in Resilience
Ensuring a Disaster-Resistant Future

Investing in Resilience: Ensuring a Disaster-Resistant Future focuses on the steps required to ensure that investment in disaster resilience happens and that it occurs as an integral, systematic part of development. At-risk communities in Asia and the Pacific can apply a wide range of policy, capacity, and investment instruments and mechanisms to ensure that disaster risk is properly assessed, disaster risk is reduced, and residual risk is well managed. Yet, real progress in strengthening resilience has been slow to date and natural hazards continue to cause significant loss of life, damage, and disruption in the region, undermining inclusive, sustainable development.

Investing in Resilience offers an approach and ideas for reflection on how to achieve disaster resilience. It does not prescribe specific courses of action but rather establishes a vision of a resilient future. It stresses the interconnectedness and complementarity of possible actions to achieve disaster resilience across a wide range of development policies, plans, legislation, sectors, and themes. The vision shows how resilience can be accomplished through the coordinated action of governments and their development partners in the private sector, civil society, and the international community. The vision encourages "investors" to identify and prioritize bundles of actions that collectively can realize that vision of resilience, breaking away from the current tendency to pursue disparate and fragmented disaster risk management measures that frequently trip and fall at unforeseen hurdles. *Investing in Resilience* aims to move the disaster risk reduction debate beyond rhetoric and to help channel commitments into investment, incentives, funding, and practical action.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to two-thirds of the world's poor: 1.7 billion people who live on less than $2 a day, with 828 million struggling on less than $1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

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