

A vision for managing natural disaster risk



Proposals for public/private
stakeholder solutions



Disclaimer

This report reflects the views of the authors and not necessarily those of their institutions.

Cover photograph: Feirooz Mohammed, Atelier WM / AP

Table of Contents

Foreword and Contributors	4
1. Executive Summary	7
2. Overview	13
2.1 The global impact of natural disasters	13
2.2 Purpose of this initiative	18
2.3 Approach	19
3. A vision for dealing with natural disasters	21
3.1 Data	21
3.2 Awareness	22
3.3 Planning and prevention	23
3.4 Risk transfer	24
3.5 During an event	25
3.6 Response	26
3.7 Recovery	27
4. Understanding risk	29
4.1 Capturing risk data	29
4.2 Raising awareness	32
5. Physical Resilience	37
5.1 Resilience planning	38
5.2 Better building	41
5.3 Economic rationale for investment in resilience	47
5.4 Case study – Mexico City	52
6. Financial preparedness	57
6.1 Risk transfer	58
6.2 Alternative insurance schemes	63
7. Defining roles for action	69
7.1 Public-sector roles	69
7.2 The role of the international community for lesser-developed countries	72
7.3 The Private Sector	74
8. Conclusions and next steps	77
9. Davos	82
10. Next steps	95
Annex I: Principles of insurance and commercial insurability	100
Annex II: The Hyogo Framework for Action (HFA)	103
Annex III: Initiatives within the Hyogo Framework for Action (HFA)	104
Annex IV: Disaster timeline mapping of initiatives	106
Annex V: Best practices of state pools	107
Annex VI: Physical preparedness measures	108
Annex VII: Related World Economic Forum Initiatives	111
References	117
Acknowledgements	123
About the Contributors	124

Foreword and Contributors

The World Economic Forum has launched a multiyear initiative – Financial Impact of Global Shocks – that in its first phase focuses on the economic and humanitarian risks posed by natural disasters, such as earthquakes, hurricanes and floods.

We are pleased to present this report on strategies to mitigate and respond to catastrophic risk. This initiative stems from the Financial Services Governors session at the World Economic Forum's Annual Meeting in 2010, where the Governors agreed to carry the dialogue and work beyond Davos in the interest of the public and the financial services industry. Subsequently, a working group consisting of industry representatives, academics, experts and Forum staff developed concrete recommendations to reduce the impacts of natural disasters.

This work complements a number of Forum initiatives, led by the Global Risk Team, the Disaster Resource Partnership (DRP), and various Global Agenda Councils, integrated under the Risk Response Network. The objectives of this project are to enhance resiliency (lessening the immediate impact of a disaster) and to increase preparedness (improving response and recovery). The pre-disaster work of this initiative, leveraging risk knowledge from the insurance industry, complements the other Forum initiatives, such as the DRP, which addresses post-disaster response and recovery. The insurance industry partners led this effort with input from other private-sector stakeholders in banking, engineering, construction and media.

Developing countries face particularly severe exposure and vulnerability to natural disaster. The damage and losses incurred by local populations can take many years to be repaired and restored. The humanitarian implications of low resiliency of homes and structures leads to dramatically increased human suffering, as witnessed in the natural catastrophes of 2010. Consequently this report does not just focus on the developed world, but also on measures that can be taken in lesser-developed countries to strengthen their resilience and preparedness.

This report provides a reference for possible actions and best practices across the natural disaster timeline, which are supplemented by specific recommendations around which public and private sector stakeholders may come together.

An effort such as this requires many dedicated people contributing their time and knowledge towards a common goal. We thank our committees, sponsors, workshop participants, experts and team members for their invaluable input.



Gian Carlo Bruno
Director, Head of Financial Services
World Economic Forum USA



Tom Watson
Project Manager
World Economic Forum USA



Abel Lee
Associate Director,
Head of Insurance and Asset Management
World Economic Forum USA

Foreword and Contributors

Operating Committee

David Bresch

Director Sustainability and Emerging Risk Management
Swiss Re

David Fried

Group General Manager and Group Head of Insurance
HSBC

Ed Hardy

Partner
Insurance Practice
Deloitte

Daniel Hofmann

Group Chief Economist
Zurich Financial Services

Wilfred Lau

Director
Arup

Trevor Maynard

Manager of Emerging Risks
Lloyd's

Stefan Reichenbach

Global Head of Strategy & Marketing
Commodities
Thomson Reuters

Deborah Traskell

Executive Vice President
State Farm

Steering Committee

Tom Bolt

Director of Performance
Management
Lloyd's

Philip Dilley

Group Chairman
Arup

Michel Liès

Chairman Global Partnerships
Swiss Re

Jack Ribeiro

Managing Partner
Deloitte

Geoff Riddell

Chairman of Global Corporate and CEO Asia-Pacific and Middle East
Zurich Financial Services

Raj Singh

Chief Risk Officer
Swiss Re

Michael L. Tipsord

Vice Chairman and Chief Financial Officer
State Farm

Academic Advisors

Prof. Howard Kunreuther

James G. Dinan Professor of Decision Sciences and Public Policy
Wharton School, University of Pennsylvania

Dr. Erwann O. Michel-Kerjan

Managing Director
Wharton School, University of Pennsylvania

Contributors

Eric Brosius

Senior Vice President and Manager
Liberty Mutual

Olivier Mahul

Program Coordinator, Disaster Risk Financing
World Bank

Freda Chu

Senior Engineer, Geotechnics
Arup

Peer Reviewer

Dr. Nicola Ranger

Research Fellow
London School of Economics and Political Science

World Economic Forum

Gian Carlo Bruno

Director
World Economic Forum USA

Ann Gallo

Project Associate
Seconded by Deloitte

Colleen De Groot

Project Associate
Seconded by Deloitte

Sebastian Ippisch

Project Associate
Seconded by Allianz

Markus Kalepky

Project Associate
Seconded by Allianz

Abel Lee

Associate Director
World Economic Forum USA

Tom Watson

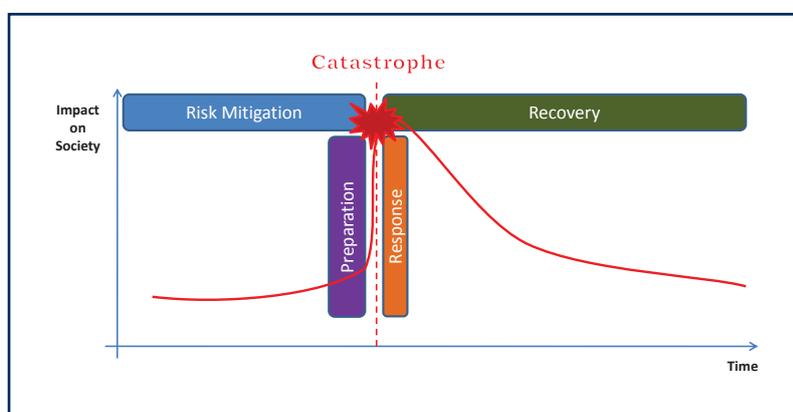
Project Manager
World Economic Forum USA

Executive Summary

1. Executive Summary

In 2010, earthquakes, hurricanes and floods hit numerous countries across the globe, causing loss of life, suffering and large economic loss. The number of people affected by increasingly frequent hydrological events has doubled over the last 30 years.

The contrasts between countries that have suffered a similar severity of hazard, but whose losses have been in orders of magnitude greater for lesser-developed countries, have shown that there is much work to be done in disaster risk reduction. Conceptualising the effects of a natural disaster by viewing these along the timeline beginning with preparedness and ending with recovery is necessary for developing a meaningful strategy for reducing future losses and facilitating the process where individuals and communities get back on their feet. Envisioning this timeline as a repeating line, where events reoccur, may encourage increased focus on pre-disaster initiatives and longer-term thinking for response and recovery.

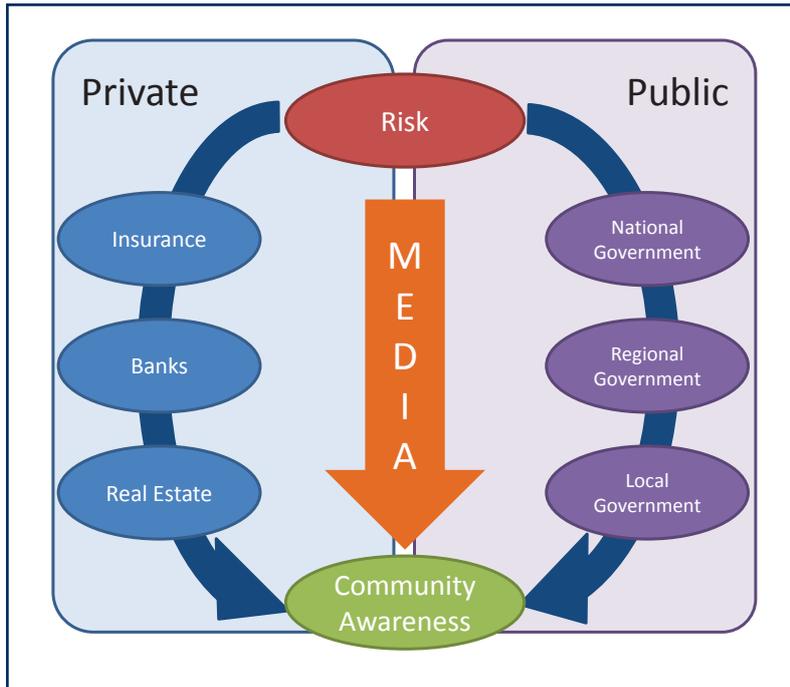


In this context, *A vision for managing natural disaster risk* provides a focused vision for dealing with natural disasters, including a perspective on how to deal with the more severe effects for lesser-developed countries. The recommendations in this report focus on three areas: raising awareness, enhancing resiliency, and encouraging preparedness. The roles of different stakeholders are explored, particularly the importance of the public and private sector's abilities to add knowledge, expertise and capacity.

1. Executive Summary

Raising Awareness

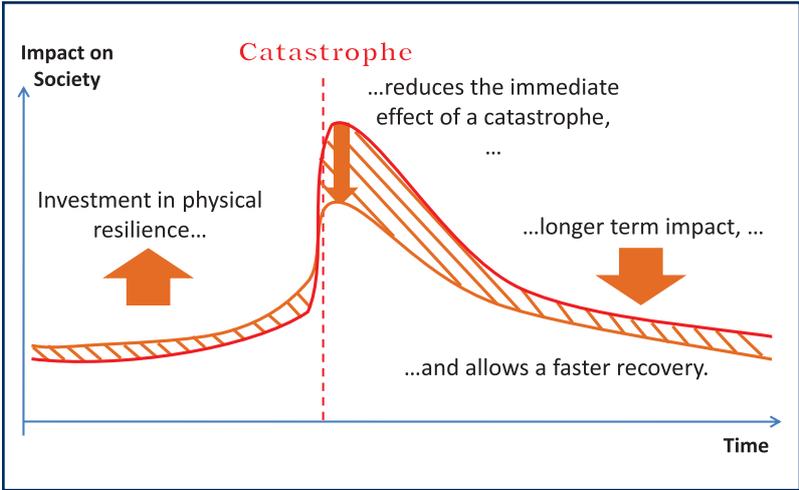
Building awareness brings recognition of risk and initiates behavioural change. To begin the process one needs to collect appropriate data on risks, which needs to be made publicly available. Communicating the message in a way that informs the affected public of the risks they face is needed to motivate an increase in resilience and preparedness.



1. Executive Summary

Enhancing Resiliency

Reducing risk through enhancing resilience requires an integrated planning process to make sure that structures are resilient to current and future hazards. This involves a) land use management, b) better building codes through an efficient code improvement plan, applied to rebuilding as well as new structures, c) enhanced supervision of construction and building end-use, and d) retrofitting existing structures for increased resilience.

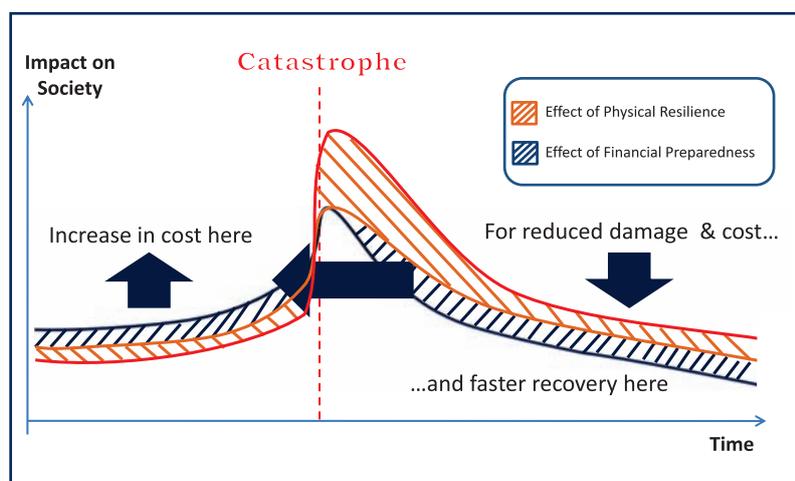


At some point, additional resilience measures are not cost-effective. For example, it may not be economically justifiable to use limited resources to build a sea wall another metre higher to only combat the 1-in-100 year event. At this point financial preparedness should be used to mitigate the remaining risk. Economic incentives that tie financial preparedness to resilience measures, such as their linkage to a property, may increase investment in resilience. Economic incentives must be based on the correct pricing of risk.

1. Executive Summary

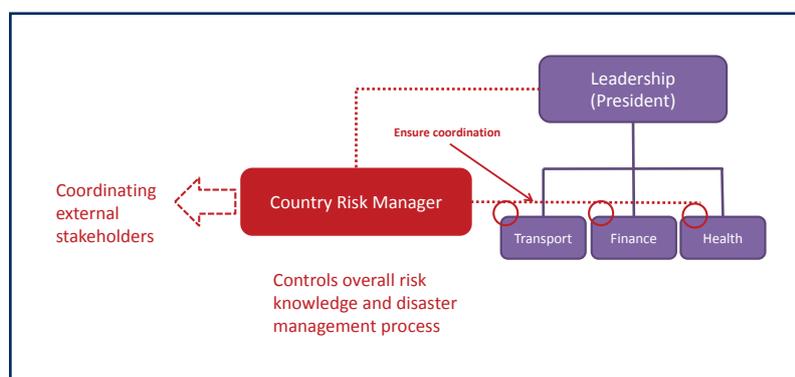
Financial Preparedness

Financial preparedness includes the concept of risk transfer to protect people's livelihoods. Traditional insurance using risk-based pricing free from political intervention is an important part of the toolkit to enable faster recovery and reconstruction. Alternative preparedness measures include microinsurance; catastrophe bonds (cat bonds), which in parametric form can provide fast liquidity in times of crisis; and country level funds to help reduce public sector liability. Making these measures affordable may require additional support from other stakeholders or post-disaster funding mechanisms.



Public Sector

The public sector role depends on a country's capacity to mitigate and respond to natural disasters. Despite different starting points for various countries, the recommendation for an overarching risk management body, called the country risk officer, would provide a systematic approach to risk reduction through national and regional plans that coordinate multiple stakeholders to bring about the necessary solutions. A lesser-developed country will need to develop institutional, legislative and operational mechanisms. For developed countries, the public sector's assumption of the role of payer of last resort will support deeper risk transfer and an increased willingness to incentivize resilience.



1. Executive Summary

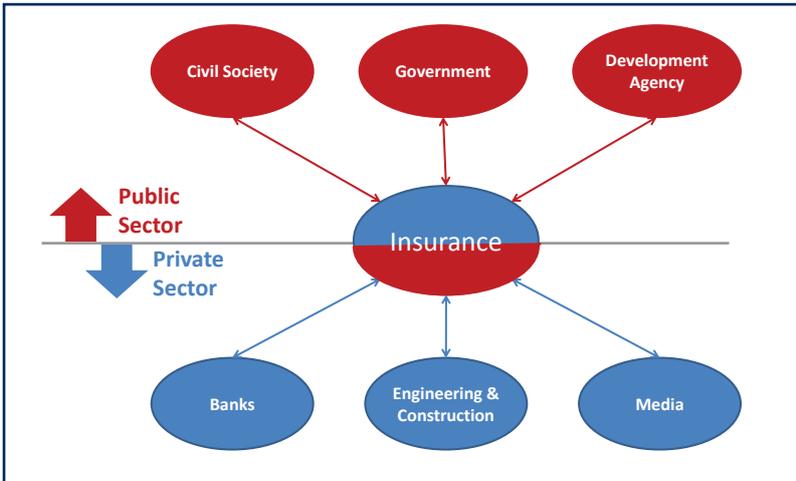
International Community

The international community should promote capacity building for lesser-developed countries through knowledge, technical skills and funding. Its focus should shift away from disaster response towards pre-disaster resilience measures. Establishing an international response unit with standardized guidelines for disaster risk reduction could reduce adverse impacts on society.



Private Sector

The private sector's knowledge and capacity is underutilized. There are many obvious, but also less obvious, private sector organizations with useful expertise. The need to understand risk puts the insurance industry at the centre of private stakeholders and as a bridge to the public sector. However, the role the insurance industry plays needs to be complemented by other key stakeholders including banks, engineering, construction, real estate and the media.

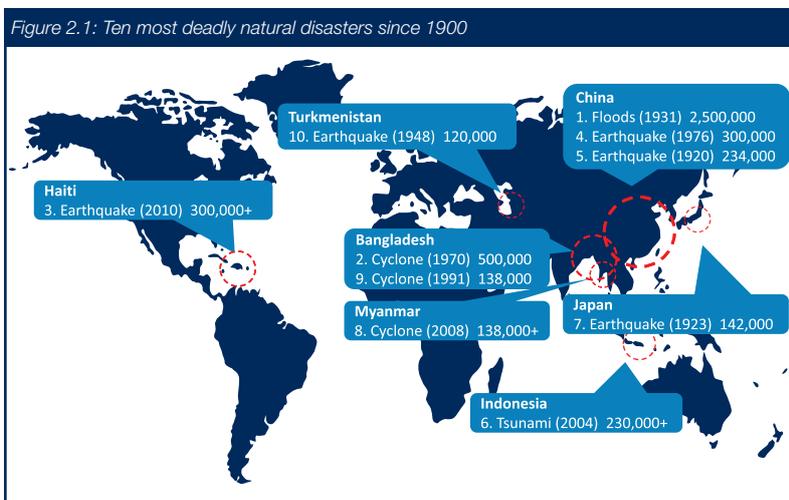


Overview

2. Overview

2.1 The global impact of natural disasters

In 2010 there were a number of severe natural disasters. The Haiti earthquake in January, the third most deadly natural disaster since 1900, continues to claim lives with the cholera epidemic in the autumn of 2010. Other events have been no less significant. However, there have been large variations in their societal impact, particularly on developing countries. Much work needs to be done at local, regional, national and international level to improve preparation and response through enhanced resiliency and risk mitigation.¹

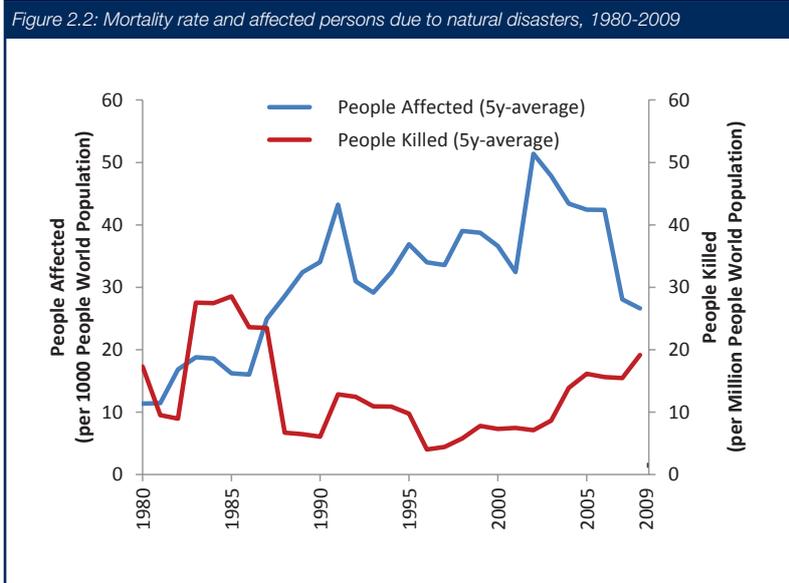


Source: CBC News

¹Swiss Re (2010)

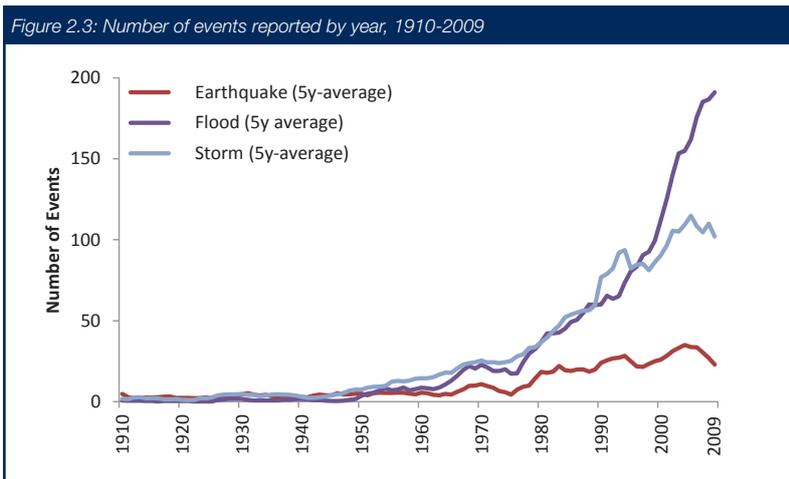
2. Overview

During the last 30 years, fewer people, as a percentage of the total affected, are losing their lives. However, the number of people affected has doubled (Figure 2.2).



Source: OFDA/CRED International Disasters Database (EM-DAT), UN

The frequency of natural disasters appears to have risen over this period. Figure 2.3 indicates the number of events reported during the last century. The sharp rise in events might be partly explained by increased observation and reporting (earthquake activity is assumed constant). However, there appears to be an increase in the number of hydrological events.



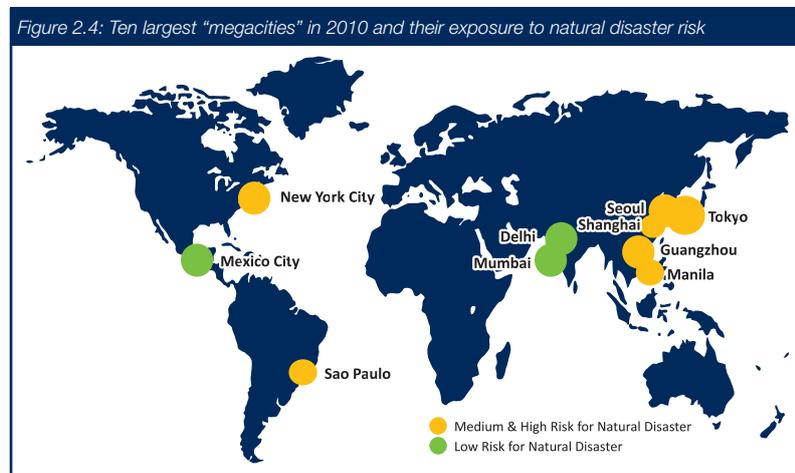
Source: The OFDA/CRED International Disasters Database (EM-DAT)

2. Overview

Drivers

There are several reasons for the increased vulnerability of societies to natural disasters, including:

- **Population growth:** Between 1950 and 2010, world population grew from 2.5 to 6.9 billion,² putting more people in harms way.
- **Location:** Population growth has occurred in areas more prone to natural disasters, such as coastal areas and riverbanks.³
- **Urbanization:** Poor urban planning, zoning and construction exacerbate the effects of natural disasters.⁴



Most megacities are in vulnerable areas.

Source: World Bank (2010), Brinkhoff (2010)

- **Value:** Economic development brings higher asset values, thereby increasing the possible financial loss.
- **Climate change:** While there is not yet consensus in the scientific community whether and to what extent climate change increases the number and severity of climatic events,⁵ there are several prominent studies suggesting that there exists a causal relationship, increasing risk uncertainty.⁶

²Source: Population Division of the Department of Economic and Social Affairs of the UN Secretariat (2009)

³Source: Pelling (2007)

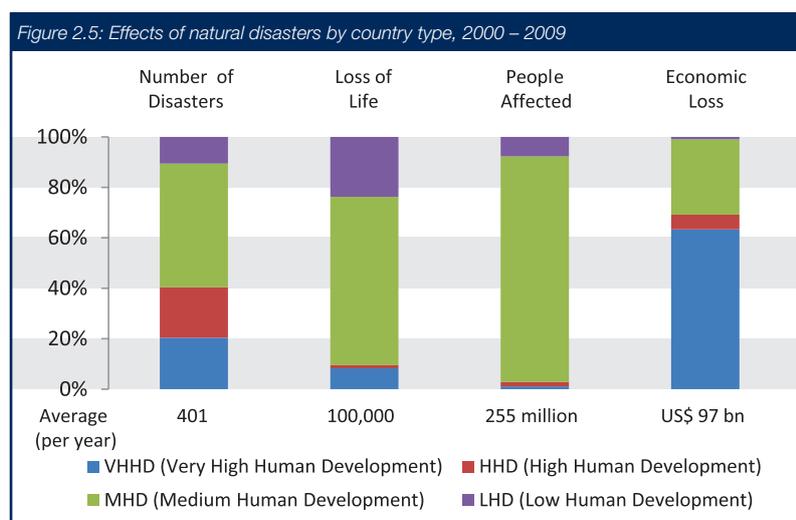
⁴Source: Pelling (2007)

⁵See Kunreuther and Michel-Kerjan (2009)

2. Overview

Consequences

Natural disasters affect all countries. However, in lesser-developed countries natural disasters cause disproportionate impact, killing thousands and threatening the livelihoods of those who survive. The 2010 earthquake in Haiti highlighted the vulnerability of lesser-developed countries. Figure 2.5 shows the proportional effects of natural disasters during the last 10 years among countries with a Low (LHD), Medium (MHD), High (HHD) and Very High (VHHD) Human Development Index.⁷



Source: IFRC (2010), UNDP (2010), IMF (2010)

Figure 2.6 shows the increased likelihood of adverse impacts from natural disasters for low and medium development countries compared to high and very high development countries.

Figure 2.6: Effects of natural disasters compared with a high human development region, 2000 –

Region	Likelihood of losing life	Likelihood of being affected	GDP % damaged
Medium Development	3x	14x	2x
Low Development	14x	15x	4x

Source: IFRC (2010), UNDP (2010), IMF (2010)

⁷The Human Development Index assigns countries a certain level of development based on education, life expectancy and per-capita GDP. According to these index levels, countries are categorized LHD, MHD, HHD and VHHD (see United Nations Development Programme (2010)).

2. Overview

Underlying issues

As we examine the consequences of natural disasters several issues must be considered. For example:

- Many countries lack the knowledge, capacity and resources to deal with natural disasters. After a disaster the public sector is often paralyzed by damaged infrastructure and unable to cover the costs of emergency and relief efforts, let alone reconstruction work.
- Lack of overall risk planning and investment in physical resilience measures, with too much focus on post-disaster response, leads to increased loss of life, suffering and damage.
- People in poor countries are generally more exposed to natural disasters, particularly through a higher dependency on agriculture and increased vulnerability to the natural environment. However, these countries are not capable of protecting themselves, due to lower levels of physical and financial preparedness partly due to low income and insurance penetration.
- Insurance penetration is high in developed countries. In lesser-developed countries, the availability of insurance is limited and premiums are often not affordable. With less coverage, impacts from natural disasters can derail economic growth.

2. Overview

2.2 Purpose of this initiative

This report provides recommendations that can reduce the impact of natural disasters, through a multistakeholder approach. At the heart of these recommendations is a desire to reduce the overall impact on society. The variations in these effects between countries, as shown below in Figure 2.7, indicate that there is a need to transfer knowledge, mobilize financial resources and strengthen institutional capacity for natural disaster management in proactive and sustainable ways.

Figure 2.7: A comparison of earthquake losses

	Increased Level of Country Development 			
	Haiti	Sichuan, China	Chile	New Zealand
Occurrence Date	12 January 2010	12 May 2008	27 February 2010	4 September 2010
EQ Strength (comparison to Haiti)	Magnitude 7.0	Magnitude 8.0 (x 31 stronger)	Magnitude 8.8 (x 500 stronger)	Magnitude 7.1 (x 1.4 stronger)
Social Cost	Killed 217,000 Injured 300,000	Killed 69,227 Injured 374,638	Killed 486 Injured 500	Killed 0 Injured 2
Economic Loss (% of GDP)	About US\$ 10 bn. (84% of GDP)	US\$ 127 bn. (1.2% of GDP)	About US\$ 20-30 bn. (8-12% of GDP)	About US\$ 2.7 bn. (1-3% of GDP)
Insured Damage (% of economic loss)	US\$ 30 million 0.3%	US\$ 400 million 0.3%	US\$ 7 bn. 25%	US\$ 1.5 – 3 bn. >50%

Source: Swiss Re, New Zealand Treasury, New Zealand Herald

Implementation of these measures can have a significant impact on the extent of suffering after a natural disaster:

1. Increase knowledge and awareness of the population at large, the private sector and policy-makers to achieve behaviour change.
2. Take preventative steps to reduce risk through physical measures, such as enhanced resilience. This is the only way to directly reduce the loss of life and number of people affected.
3. Mitigate residual risks through a variety of methods using both public and private means.
4. Apply post-catastrophe rebuilding processes to increase recovery speed and lessen follow-on effects.

Some ideas in this report have been presented before, for example, by the Alliance of Small Island States (AOSIS), the Munich Climate-Insurance Initiative (MCII), and the United Nations Framework Convention on Climate Change (UNFCCC).⁸ However, we hope that our commentary and focus on removing barriers will prove useful. Similarly, there are frameworks, such as United Nations International Strategy for Disaster Reduction (UNISDR) Hyogo Framework for Action (HFA),⁹ designed to promote risk reduction. Our project aims to supplement resource mobilization, and strengthen dialogue and action by both public and private sectors.

All countries can benefit from these proposals. However, lesser-developed countries can gain significantly through these steps with the proviso that understanding national and regional specifics is necessary for application of the appropriate recommendations.

⁸Schwank et al. (2010).

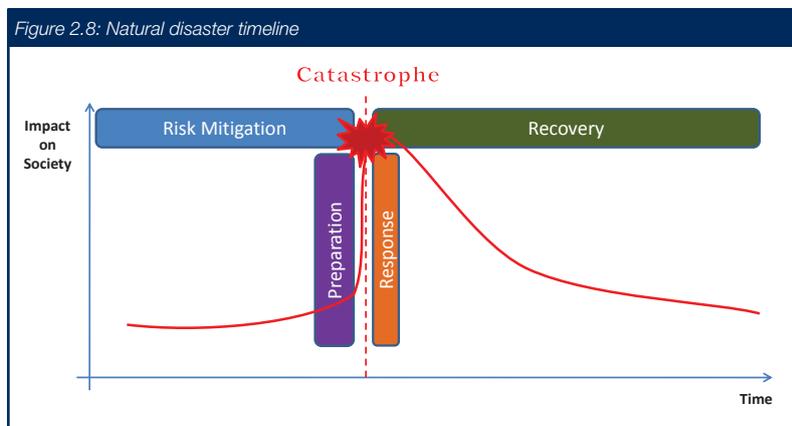
⁹See Annexes III – IV.

2. Overview

2.3 Approach

Figure 2.8 illustrates a natural disaster timeline, with its changing impacts, over four stages:

1. Mitigation
2. Preparation
3. Response
4. Recovery



The area under the red line represents the impact on society, and includes: casualties, negative impact on livelihoods, and regression in development. The goal is to minimize this area by reducing the peak impact and speeding up recovery, through the presented recommendations.

In Chapter 3, this report presents a vision that outlines some key aspects for dealing with natural disasters. The following chapters then provide recommendations to implement this vision, including stakeholder roles.

Recommendations throughout the report are shown in highlighted boxes, with lesser- developed country focused recommendations shaded in blue. Proposed stakeholders for each recommendation are grouped as follows:

- Insurers (“I”)
- Banks (“B”)
- Engineering and Construction (“E&C”)
- Media (“M”)

I	B	E&C	M
●	○	●	○

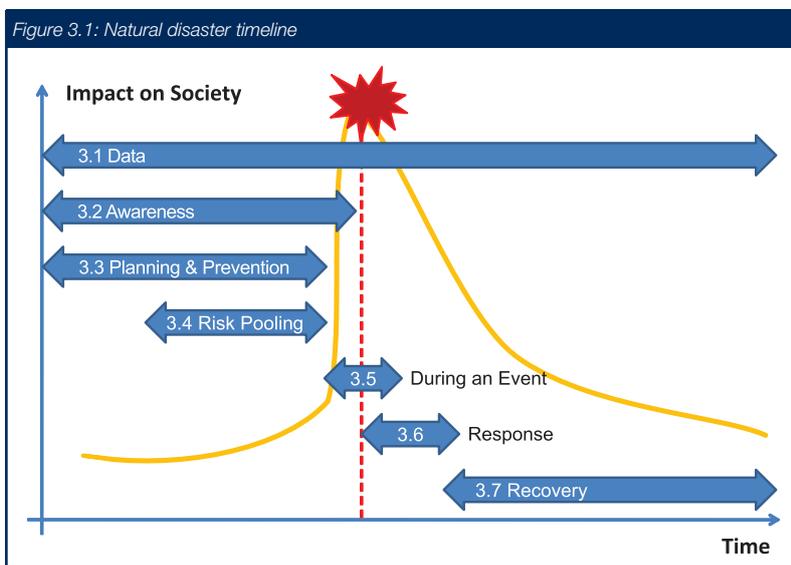
Each of these stakeholders is represented on the project committee. Public sector commitment is necessary across all recommendations and is therefore not mentioned. There are a number of development and civil society organizations working on these issues, as summarized in Annex IV, where the relationship to each recommendation is highlighted.

A vision for dealing
with natural disasters

3. A vision for dealing with natural disasters

This chapter presents a vision of how various means of risk management could work together through "backward imaging". We take realistic natural disaster scenarios and apply best practice recommendations to develop a vision for the future. Our focus is on risk transfer solutions and enhanced risk resiliency. Promising solutions require an eclectic mix of orthodox and alternative insurance and non-insurance schemes, and other policy tools such as pre-disaster warnings, economic incentives and well-enforced building codes.

The natural disaster timeline in Figure 3.1 shows where in the vision the measures described in the follow subsections should occur.



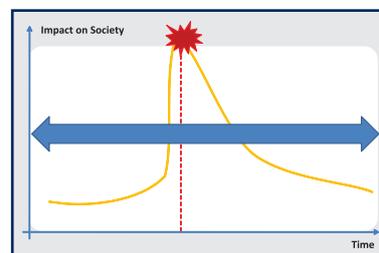
3. A vision for dealing with natural disasters

3.1 Data

This section describes issues surrounding data, risk identification, awareness, quantification, contingency planning and adaptation. Comprehensive data is crucial throughout the natural disaster timeline for increasing awareness, finding effective resilience measures, early warning systems, efficient disaster response and resilient rebuilding.

Capturing and mapping: The international community with local cooperation will implement a long-term programme of global observation data. This data will include satellite observations and ground-based observations to allow for «truthing» of the satellite data.

Risk identification and assessment: Using open-access catastrophe modelling architecture and risk models created by the insurance industry and academia with funding from UNFCCC adaptation funds, insurers and other risk pooling mechanisms will be able to assess risk and characterize the uncertainties surrounding their estimates. Data sources and their quality are well maintained and updated frequently. All data – including anonymous and aggregated summaries of insurers' loss data – is freely available.



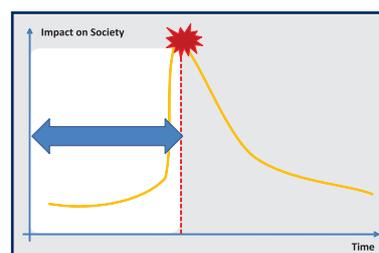
3.2 Awareness

With good data, the public understands the need for preparation and risk reducing measures. Governments, the private sector and the media build awareness of risks and risk-mitigation principles at national, regional, and community levels.

School awareness programmes: Schools play an important role. Children from a young age must understand the perils to which their communities are exposed and the appropriate response behaviours.

Community awareness: Education in the community is required to ensure that awareness building continues in adult life.

Communication: The media will run long-term campaigns on regional natural catastrophe risks, highlighting the benefit of resilience and risk pooling measures. Multiple channels should be used, using resonating messaging to counter psychological tendencies of avoidance and denial, and foster behavioural change.



The public sector's role in building awareness cannot be underestimated.

3. A vision for dealing with natural disasters

3.3 Planning and prevention

Planning and prevention require long lead times, especially for physical resilience projects. These large-scale projects and local community response plans are both important to community awareness. Coordinating these measures to ensure effectiveness and efficient use of funds requires a central government figure, called in this report a “country risk officer”.

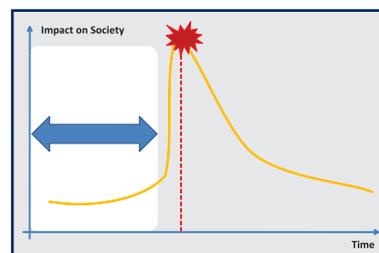
Country risk officers: Tasked with keeping up-to-date risk and asset data, they coordinate pre-disaster mitigation measures, such as building resilience, with financial preparedness. These central figures should lead cross-sector coordination among government ministries and private stakeholders in creating disaster response plans. Country risk officers are the primary contact points and key decision-makers in times of crisis.

Large-scale defence: Using risk maps, large-scale peril defence programmes are conducted in areas of high value or national importance, potentially contributed to by UNFCCC adaptation funds. Risk maps are revised after the defences are complete. The defences should be easily augmented in the future if risk levels or understanding of risk changes.

Community-level defence: With awareness of risk, communities can work together on local measures, particularly where large-scale defences are not possible. This may include avoiding construction in peril-prone areas, or making buildings temporary or peril-resilient in such areas. Resiliency measures should be regularly inspected and certified as fit for purpose. If approved, they are added to a community-level risk scorecard, so they can be rewarded through cheaper insurance premiums. Other defensive actions include raising riverbanks or sea walls, and relocating households or facilities.

Individual-level defence: Some individuals and businesses may choose to adapt their properties, as they will see lower insurance premiums as a consequence if insurance premiums reflect risk. Country risk officer website communicates the adaptation measures that are recommended and financially rewarded.

Assign liability in advance: Risk pooling organizations are able to reduce their prices because they have contract certainty due to clear liability laws enacted in advance. Legal certainty is one of the reasons these programmes are successful and is a critical factor to their design.



As a part of community planning, business contingency plans are an important part of speeding up recovery.

3. A vision for dealing with natural disasters

3.4 Risk transfer

There are various options for risk management – avoidance, reduction, transfer or retention. Risk transfer is the underlying tenet for insurance markets, passing a liability onto another party (spreading the risk). Risk pooling is vital to the recovery of individuals, firms and economies following a natural disaster.

Indemnity cover: Traditional indemnity cover from insurers has reached a high penetration in certain countries as the benefits are well understood. However, in many lesser-developed countries coverage is still in “micro” form.

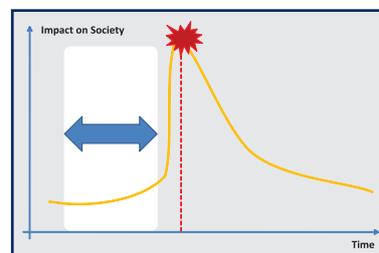
Parametric insurance – government catastrophe funds: Local governments will buy fast payout peril index coverage.¹¹ Government officials understand and are able to deal with basis risk¹² and appreciate that well-maintained local peril data recording stations are critical to reduce their pooling costs as reduced uncertainty for insurers allows for lower premiums. Risk-pooling organizations reduce basis risk through a process of continued model improvement. Liquidity schemes pay out within 15 days of an event based on an easily calculated, independent and verifiable peril index.

Mutual schemes:¹³ Where traditional indemnity cover is not available or not yet broadly accepted (e.g., in lesser-developed countries), mutual schemes will be set up to encourage trust.

Alternative-risk transfers (ARTs): These are techniques, other than traditional insurance, that spread risks among parties. ARTs are innovative solutions allowing for finite cover of large risks that cannot be absorbed by traditional indemnity covers. ARTs are used where capacity in traditional insurance markets cannot efficiently absorb specific risks. ARTs allow various parties to participate in the profit of transferring risks, including those not part of the traditional insurance market.

Risk-based incentives for adaptation: Pooling schemes cost less to regions, communities and individuals that have taken loss reduction measures where the expected discounted benefits exceed the costs over the life of the property.

Commodity and equipment pooling: Neighbouring countries engage in pooling of commodities (e.g., building materials) and disaster equipment (e.g., pumps and mobile hospitals) to avoid price spikes and the need to maintain materials locally. The international pools are based on peril models so that the likelihood of two regions needing the equipment simultaneously is low.



Risk pooling is vital to the recovery of individuals, firms and economies following a natural disaster.

¹¹See the CCRIF example on page 78

¹²Basis risk is the risk of divergence between the underlying risk (e.g., the ‘actual’ occurrence of a catastrophe) and the insured risk (e.g., the reflection of a catastrophe in the peril index).

¹³A mutual scheme is a grouping of individuals who each make payments into a pool from which they can each benefit if and when the need arises, such as in the case of a natural disaster.

3. A vision for dealing with natural disasters

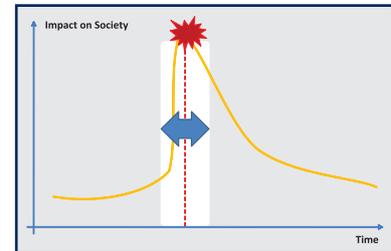
3.5 During an event

Actions taken immediately before and during an event are crucial for limiting impact on lives and livelihoods. These actions include last minute resilience measures, early warning systems, evacuation plans and efficient response measures.

Early warning prior to an event: For some events (e.g., flooding, tropical cyclones and tsunamis) early warning is possible; others are more of a surprise (e.g., earthquakes). Where early warning is possible, meteorological offices and other peril monitoring services send warning messages to a list of stakeholders for broader dissemination, and also post information on their websites. Once early warning messages are communicated, emergency-response staff go on “high alert” and pooling schemes prepare to make payouts, and deliver goods and equipment.

Mobile warning cascade: Peril-prone regions have free mobile technology early warning systems (e.g., EuroTempest in the United Kingdom) that cascade a series of warnings.

Fast-evacuation warnings: Local police and coastguard remove people from high-risk areas (e.g., off beaches in a tsunami). Prior emergency drills have informed all stakeholders what they are expected to do. The evacuation is orderly.



Actions taken immediately before and during an event are crucial for limiting the impact on lives and livelihoods.

3. A vision for dealing with natural disasters

3.6 Response

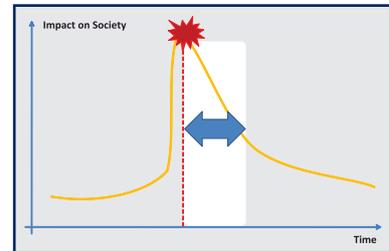
The response phase begins after the post-disaster situation has stabilized and there is no longer imminent threat of loss of human life. The response phase focuses on restoring law and order, ensuring a secure environment and distributing resources and supplies. During this phase there is risk of secondary disasters such as mud- or rockslides following heavy rain and flooding. The risk of secondary disasters may require relocating people.

Order and control: Restoring law and order is crucial to an environment in which appropriate response measures can be taken. If civil society and security deteriorate it will be more difficult or impossible to distribute resources to those in need, unnecessarily prolonging suffering.

Quick damage assessment: Satellite images provide an initial quick overview of the damage.

Liquidity pooling schemes pay out: If the event has triggered the pooling policies, funds, commodities and equipment are transferred within 15 days (or more quickly for critical equipment).

Use of funds: The country risk officer implements the catastrophe response plan. Funds from pooling schemes are deployed to purchase necessary supplies.



Use of vulnerability data from the insurance industry could improve distribution of resources for improved preparedness and therefore response.

3. A vision for dealing with natural disasters

3.7 Recovery

The recovery phase begins once the post-disaster situation has stabilized enough for activities focused on returning people and the economy to pre-disaster or better levels. Recovery involves getting people and communities back on their feet, and ideally in a better position than before the disaster.

Deploying loss adjusters: Using satellite and aerial photography loss adjusters decide whether they can pay claims remotely. There are a sufficient number of loss adjusters, provided by both public and private sectors. The risk-pooling industry shares loss-adjusting resources to aid in the assessment of losses. Correctly understanding the losses enables government and donors to generate the required funding and resources.

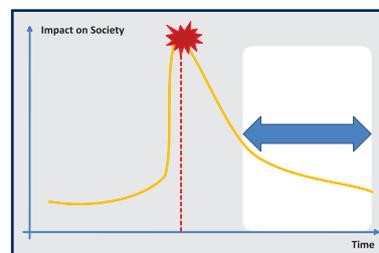
Resilient and sustainable rebuilding: The country risk officer issues guidelines on peril-resilient rebuilding. All new construction conforms to the code. Non-compliance results in non-payment of future risk pooling claims or building condemnation.

Managed retreat: Some regions will not be re-populated to make green spaces or other mitigation schemes. The difficult question of whether to turn over damaged homes to these spaces is an important policy issue.

Community adaptation measures: The opportunity to adapt regions will be taken at the time of large-scale rebuilding (e.g., sustainable urban drainage). This is a unique opportunity to re-design for the future.

Lessons learned: All stakeholders devote time and resources to learn lessons from the disaster about such things as evacuation processes, risk models, data, building performance under stress, etc. Results are freely disseminated for the benefit of the international community.

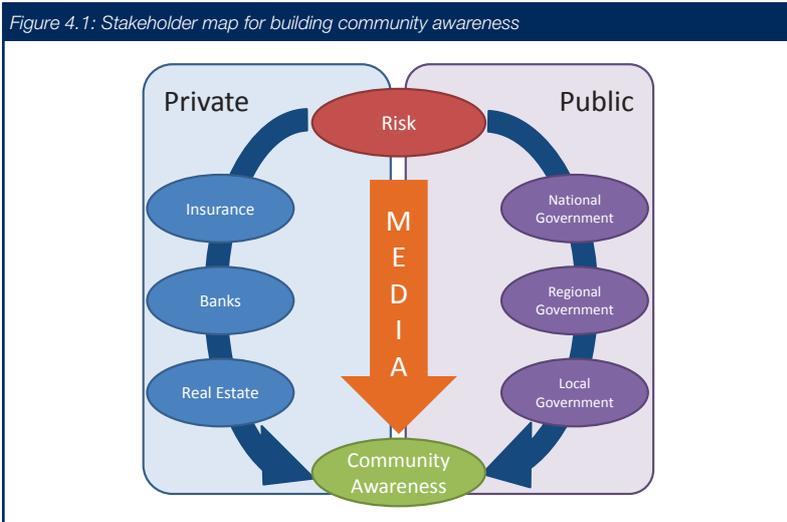
Microfinance, structured loans and microleasing: These financial products provide liquidity for affected individuals, initiating faster recovery and promoting self-sufficiency.



Understanding risk

4. Understanding risk

Understanding the hazards and risks a community is exposed to is one of the prerequisite recommendations in this report. Continued advancement in this understanding will allow for more focused and improved solutions across the disaster timeline. Ensuring that this knowledge is cascaded down to the local level creates awareness and initiates responsibility. Where possible, effective disaster preparedness and risk mitigation must start at an individual and community level. This chapter presents solutions that map against the data and awareness phases of the vision for improved disaster management outlined in the previous chapter.



There are many stakeholders involved in building community awareness, some of which are shown in Figure 4.1. Understanding how to use these channels effectively, often in combination with the media, will increase risk understanding and awareness.

4. Understanding risk

4.1 Capturing risk data

Establishing reliable data is the first step and involves multiple stakeholders. There are numerous gaps in the data that has been captured on multiple platforms and in various data sets around the world. The biggest holes exist where there are no funds available and/or no mechanisms in place to collect data. This is typical in lesser- developed countries that do not have risk maps to initiate risk awareness and the risk mitigation process. Haiti is an unfortunate example, as the fault that caused the recent earthquake was previously unknown. Post-disaster pro bono work has been provided by many organizations, which includes Swiss Re's seismic hazard map. However, for other lesser-developed countries there needs to be sustainable funding for data measurement.

GEO: The Group on Earth Observation is a partnership of 81 governments and 58 international organizations building a coordinated earth observation system to facilitate sound decision-making. One key pillar of the system is to implement common data sharing principles and procedures for all participating parties.

Source: http://www.earthobservations.org/documents/dsp/Draft%20White%20Paper%20for%20GEOSS%20Data%20Sharing%20Policies_27Sept08.pdf

Data Capture (1)*

Set up robust and effective data monitoring sites in lesser developed countries for data capture of earthquake and hydrological events through the following steps:

- Establish funding, potentially with NGO or international donors
- Define location and appropriate network of measurement stations
- Collect and store data
- Combine with other appropriate data sources, such as satellite data

* For a key on the abbreviations and the layout of the recommendation boxes, see section 2.3

I	B	E&C	M
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

Data interpretation and modelling

Data aggregators are required to collect and clean the raw data, making sense out of fluctuations and providing it to institutions for analysis, such as modelling firms, universities, government and insurers. This data may then be used to provide a comprehensive data bank.

GEM: The Global Earthquake Model is a public-private initiative to build a global database of historical information on earthquakes, which will be free to all. The initiative is primarily using academics to develop risk maps, which are then checked and confirmed by the private sector.

4. Understanding risk

Interview with a catastrophe modeller



“Models can help to quantify the benefits in terms of reducing loss of life, disruption and financial impacts.”

Karen Clark is President and CEO of Karen Clark & Company, a company helping insurers and other entities better understand and manage catastrophe risk. Ms. Clark founded the first catastrophe modelling company, Applied Insurance Research (AIR, which became AIR Worldwide after acquisition by Insurance Services Office).

We use catastrophe models to project the financial consequences of potential disasters. Can they play a useful role in estimating the impacts in terms of lost or disrupted lives?

Catastrophe models use damage estimates for buildings and other structures as a starting point for projecting financial impacts. We can also use these damage estimates to quantify the human impact — lives lost when buildings collapse and communities disrupted when buildings and infrastructure are severely damaged. Damage levels for specific catastrophic scenarios can be estimated by the models and then used to project how many people will be impacted and how severe the impacts will be.

How can quantitative estimates help guide the efforts of those who seek to mitigate the effects of natural disasters?

There are many options for mitigating the disruptive impacts of natural disasters —enforcing stronger building codes, retrofitting existing structures to decrease their vulnerability, establishing early warning systems, discouraging building in the most vulnerable areas, and moving people out of harm’s way. All of these options involve significant costs. Models can help to quantify the benefits in terms of reducing loss of life, disruption and financial impacts. A quantitative analysis of the costs versus benefits of different options can help guide mitigation decisions and build support for the implementation of the approaches that are most effective.

We often think about disaster management in terms of post-event recovery, but prevention may be more efficient than remediation in some cases. Given the limited resources available, how should stakeholders (public, private, and non-profit) divide their efforts?

“An ounce of prevention is worth a pound of cure” applies to natural disasters as well as to healthcare. Mitigation, especially the enforcement of stronger building codes, saves lives and drastically reduces the cost of post-disaster recovery, as a comparison of the recent earthquakes in Chile and Haiti clearly demonstrates. Homes built to the most stringent Florida building codes experienced less than half the damage from the hurricanes of 2004 and 2005 than other homes.

An important role of the public sector is to fund research on the most effective building techniques in specific regions and to promulgate and enforce building codes that reduce the vulnerability of the region to natural disasters. Although this may increase the cost of construction, the additional costs are a small percentage of the total cost of new construction, and for many segments of the private sector there is no affordability issue. Public and non-profit funds, combined with appropriately structured incentives, can be used to address segments of the population that face affordability constraints. An example is helping families living in hazardous areas re-locate to safer ground.

Can effective mitigation activities lead to more risk transfer options in parts of the world where insurance penetration is low?

In many of the most vulnerable regions of the world, insurance penetration is very low. This is true not only because financial resources are limited, but also because buildings are vulnerable to frequent and severe damage. Effective mitigation will not only reduce the direct costs of natural disasters, it will also make risk transfer options more affordable, increasing insurance penetration and helping to smooth recovery from natural disasters.

Data Analysis (2)

I	B	E&C	M
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

Data from monitoring sites should be combined With data from other sources such as older non-commercial. Public availability should aid increased data analysis and awareness. The data will facilitate risk knowledge transfer to public departments (including education, health, emergency response and defence), and the private and civil society sectors.

This will require:

- Publicly funded data platforms
- Control body to ensure accuracy of data feeds and correct use by subscribers
- Strong link to country risk managers and other stakeholders

4. Understanding risk

4.2 Raising awareness

Raising awareness is needed at the local community level. Different channels of communications that can reach individuals locally include the use of media, education, and community involvement. Small behavioural adaptations can result in large reductions in the impact to society. For lesser-developed countries with high casualty rates, the importance of awareness and understanding various need factors is critical.

Organizations such as the Red Cross have significant expertise and capacity to help in countries where institutional capacity is not available.

Red Cross offers free courses to volunteers to help others in the community prepare for disasters and emergencies, and/or provide basic relief services to disaster victims.

Examples of courses offered include:

- Disaster courses – damage assessment to determine the size and scope of a disaster
- Mental Health – emotional needs of affected individuals, families, and communities
- Public Affairs – distributing information to the public on available disaster relief services
- Logistics – procuring and distributing supplies and materials for disaster relief

Source: <http://www.tallyredcross.org>

4. Understanding risk

Interview with a mayor



“Graphical output from risk modelling was essential for getting the message across to local communities.”

Marc Morial served as the Mayor of New Orleans, Louisiana, from 1994-2002. He currently serves as the President and CEO of the National Urban League, one of the oldest civil rights organizations in the United States. He spoke with us about his time in civic leadership and responsibilities for natural disaster preparation, response and recovery.

What are the primary responsibilities of civic leaders in natural disaster mitigation and preparation?

First, local leaders need to evaluate risk at the local level and distinguish between general risks (e.g., terrorist attack) and specific risks to the localized area. In New Orleans, I was primarily concerned with hurricanes and floods, which are two separate events as floods were caused by heavy rainfall not associated with hurricanes. Second, local leaders need to conduct scenario analysis and plan for the worst-case scenario.

What are the most important factors for physical preparedness?

The risk calculation needs to be right, and it has to be focused on people first, property second. For example, in New Orleans we had a risk model developed by the US Army Engineers that was based solely on property values, which skewed the overall risk picture in terms of potential loss of life. I objected to this and utilized our own analysis based on people first and property second. Building codes are also a crucial area that local leaders can influence.

What were the biggest challenges you faced as a civil leader in preparing for natural disasters?

Applying knowledge on the ground is one of the hardest issues. This communication with your community is continuous and requires multiple channels and frequent refreshing to ensure that information is kept current. It is also an important balancing act, as you want to instill trust, rather than stoke fear and risk people saying that you are crying wolf.

During my time as Mayor new technologies were being developed, such as computer modelling, which shows in three dimensions the flooding effects of hurricanes in New Orleans. These tools quickly became an essential part of the communication with local leaders to ensure that the community was informed and supportive.

How can partnerships create more resilient cities going forward?

In my experience, the most successful partnerships are between the public, private and non-profit sectors. Each has an important role – the public sector coordinates the overall effort (provides command and control), the private sector contributes money and resources, and the non-profit sector helps distribute resources to those in need.

Risk Awareness (3)

I	B	E&C	M
●	●	●	●

Engage local communities through long-term programmes aimed at all community levels and through multiple channels, including:

- School education – regular classes, plays and taught as a part of the curriculum
- Community education – community plays and art, Internet games, cinema, town hall, places of worship
- Community involvement – disaster simulations, engagement in data collection, planning and response

4. Understanding risk

Behavioural psychology – natural disaster syndrome

Even with compelling data there are numerous human psychological and situational barriers to overcome. Below we discuss some of the barriers to getting the message across.

There are various ways people interpret data and understand risk. There is a gap between what preparation is needed and what individuals actually do leading to the natural disaster syndrome. More specifically, many homeowners, private businesses and the public sector do not voluntarily adopt cost-effective loss-reduction measures. Hence, the area is highly vulnerable and unprepared should a severe natural disaster occur. The magnitude of the destruction following a catastrophe often leads public sector agencies to provide disaster relief to victims even if prior to the event the public sector claimed that it had no intention of doing so.¹⁴

Studies have identified psychological and situational barriers that can influence how we make decisions. Some examples include:

1. **Lack of risk awareness.** The simplest explanation is that people are not always aware they reside in high-risk areas.
2. **Underestimation of the risk.** Even when aware of the risks, people often underestimate the risk and often believe that a future disaster “cannot happen to me”.
3. **Myopic behaviour and procrastination.** People often do not consider the long-term benefits of investing in mitigation measures that can reduce losses and prefer to delay these costs.
4. **Budget constraints.** One frequently hears the comment: “I live from pay-day to pay-day. I cannot afford the high costs of protective measures or the insurance premiums.”
5. **Samaritan’s dilemma.** People who expect the government to provide disaster relief tend to refuse to purchase insurance voluntarily or invest in risk-reduction measures.
6. **Politician’s dilemma.** The “not during my term of office” (NIMTOF) attitude leads to inaction as it is difficult for elected officials to make the hard decision to increase spending and hence raising taxes for long-term measures that may show no benefit during their terms.

Risk Psychology (4)

I	B	E&C	M
●	●	○	●

Raising risk awareness requires an understanding of psychological tendencies:

- A local message to raise awareness to tackle local risks, using local channels
- Clear messaging about the role of the public sector, reducing Samaritan’s dilemma

¹⁴Kunreuther, H. (1996)

4. Understanding risk

Correct risk pricing

Pricing signals are essential to building awareness, enabling one to undertake relevant cost-benefit analyses that balance the advantages of living in a given location against the associated costs and dangers.

End-users should be exposed to the true cost of hazards they face, thereby encouraging cost-effective mitigation measures that reduce catastrophe vulnerability. Uneconomic risk transfer through direct or indirect subsidies should be avoided. Where insurance is involved, premiums should be based on risk to provide the correct signals to those currently residing in natural disaster-prone areas and those considering moving to those areas. Risk-based premiums enable insurers to provide discounts to homeowners and businesses that invest in cost-effective and loss-reduction mitigation measures.

When insurance is priced below the expected costs of losses, those residing in hazard-prone areas will perceive themselves to be safer than they actually are and unsafe development will take place in these areas.

Risk Pricing (5)	I	B	E&C	M
Ensuring that risk pricing correctly reflects the risk exposure. This signal then allows :	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none">• Raised awareness which will influence behaviour• Stimulate correct risk resilience decisions, including investment to reduce the risk• Raised awareness and influencing behaviour. It can increase risk resilience and financial preparedness.				

Data and knowledge are critical for proper response. Control structures and mechanisms must be created for data dissemination through the different levels of government and to communities.

Vietnam: In Vietnam the Central Committee for Storm and Flood Control (SOCCFSC) has the responsibility for monitoring the effects of storms and floods, gathering damage data, providing official warnings, and coordinating and implementing disaster response and mitigation measures. To expedite the transmission of information an emergency email network is used for gathering damage data and coordinating disaster relief activities between the SOCCFSC and disaster affected provinces.

Source: <http://www.undp.org.vn/what-we-do/focus-areas/disaster-risk-management/?&languageId=1>

Jamaica: Hurricane Gilbert, which hit Jamaica in September 1988, was one of the worst storms in the island's history. The storm was tracked, its path predicted and timely warnings were issued. The result, according to the World Meteorological Organization, was a much lower death toll than when a similar hurricane struck in 1951, despite the fact that the population of Jamaica had doubled in the meantime.

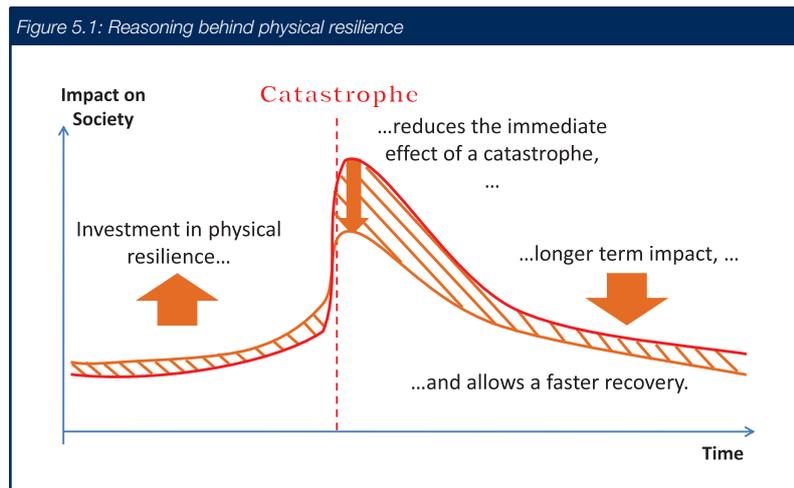
Source: <http://www.annenberg.northwestern.edu/pubs/disas/disas32.htm>

Physical Resilience

5. Physical Resilience

Increasing physical resilience is an ongoing process for ensuring that structures, from large-scale infrastructure to individual buildings, are better prepared for natural disasters. This is an iterative process as cities and regions regenerate themselves, and as knowledge, technology and materials improve. Increasing resilience should be a priority for policy-makers to reduce loss of life and lessen economic loss. Figure 5.1 illustrates these effects.

Increasing physical resilience will enhance a community's robustness to withstand natural disasters.



Physical resilience requires long-term planning at the national, regional, and local levels; between local governments; with rural and urban areas; and across departments and agencies. Natural disasters know no boundaries and they cross government jurisdictions. There is a need to work horizontally across departments, across higher and lower levels of government, to coordinate, with other local entities, as well as with the private sector and the media.

Physical resilience occurs on two levels:

1. **Resilience planning:** This relies on current and accurate risk knowledge to make decisions that integrate and balance the diverse and sometimes conflicting issues that shape societal development. These issues are dynamic and require an overall framework that includes various stakeholders and functions (energy, transport, water and waste).
2. **Robust building:** This requires writing and enforcing building codes for new construction and improving the robustness of existing vulnerable buildings.

Both are required and need to be supported by emergency response planning.

Japan: Since the large Kobe earthquake in 1995 the government has undertaken a nationwide programme to investigate possible active earthquake fault zones. This has resulted in the identification of more than 100 new faults, requiring remedial works and code updates.

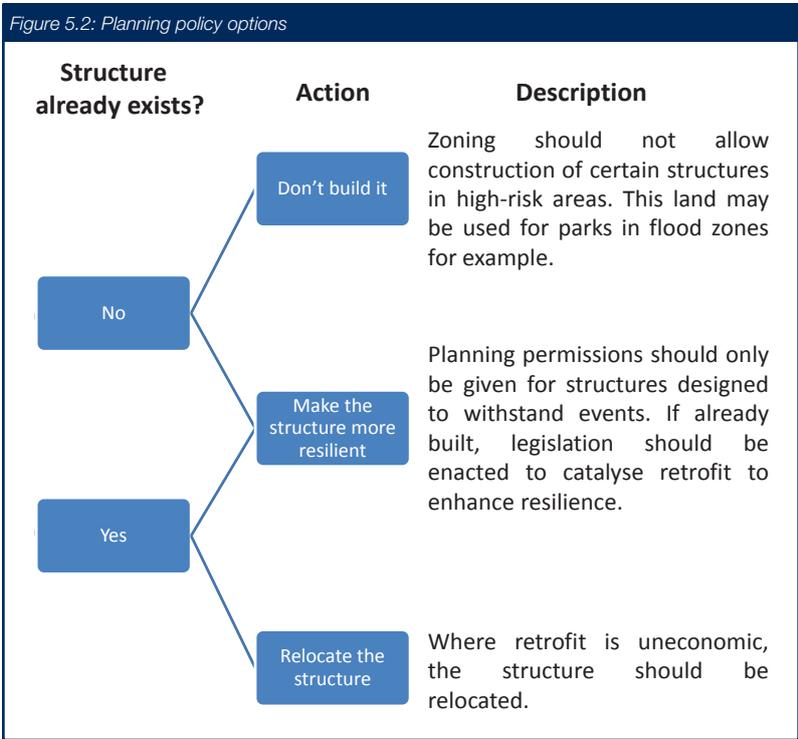
5. Physical Resilience

5.1 Resilience planning

An integrated process

The increased frequency of natural disasters presents a challenge in development planning, with a need to integrate resilience and mitigation in all planning decisions. Natural disasters should be regarded as a key issue, in addition to poverty, public health, and infrastructure, which all should be addressed within overall development planning. An integrated planning process is required to build true risk resilience.

The following decision tree describes options for planners.



Case study for public-private collaboration

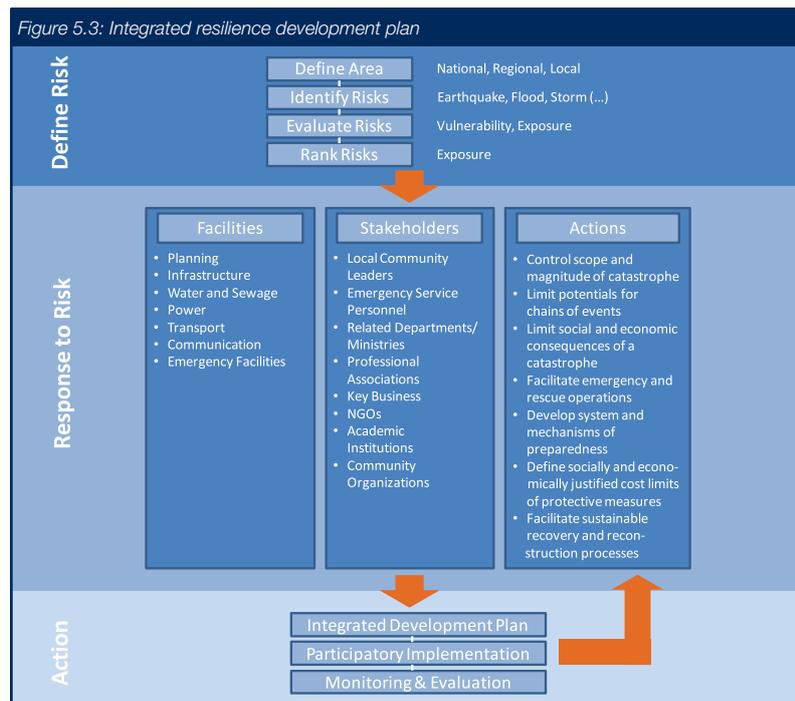
The North East Scotland Flood Liaison and Advice Group (NESFLAG) works closely with the insurance industry to bring additional knowledge to the planning process. This liaison gives advice on the insurability of development proposals, the latest developments in flood research and best practice from other local authorities. The insurance industry provides aggregated data as to the level of flood risk and what is acceptable to insurers at normal terms. The insurance perspective is important as insurers are starting to increase premiums where the flood risk exceeds the 1-in-200-year event.

5. Physical Resilience

Creating a framework for integrated planning

Integrated planning for hazard mitigation involves coordinating risk assessment, stakeholder engagement, and formulating and applying solutions.

The framework in Figure 5.3 presents an integrated resilience development plan.



Define the risk: A risk-based approach, consisting of risk identification, evaluation and prioritization, should be used so that urban planners, engineers, architects and other stakeholders can integrate natural disaster projections into development planning and decision-making.

Response to the risk: Infrastructure planning should be incorporated as officials and planners must understand that life cycles are long, require large financial investment and are difficult to adjust once in place.

One key component of integrated planning is stakeholder involvement.¹⁵ When formulating plans, planners and decision-makers must involve various stakeholders, such as government departments, the private sector, politicians, civil society and the local community.

Action: The response to risk should be integrated into an overall development plan, with ongoing monitoring and evaluation.

Lee County, Florida, takes a holistic approach to integrate mitigation into other local planning activities and across the stages of the disaster policy cycle. The mitigation approach is community-wide and covers multiple hazards. Specific hazard mitigation strategies are integrated into plans for local land use, disaster recovery, and evacuation and shelter.

Source: http://hazardscenter.unc.edu/diem/documents/01_Berke_Smith.pdf

¹⁵See Intergovernmental Panel on Climate Change (2007).

5. Physical Resilience

Physical resilience measures and mitigation techniques

Investment in physical resilience measures can reduce risks to life and property in natural disaster-prone areas. Integrated adaptation projects, such as the Three Gorges Dam in China, which provides hydroelectric power and flood control along the Yangtze River, are an important part of the solution. Government planning and funding is essential in achieving these large-scale projects, which also require private know-how and technology.

Vietnam: In its 2020 Disaster Prevention Plan the Vietnamese government proposes to spend US\$ 18 billion; around US\$ 13 billion for structural measures (i.e., building reservoirs, dams and dykes) and US\$ 5 billion for non-structural measures.

Figure 5.4: The Three Gorges Dam in China



Country Risk Manager (6)	I	B	E&C	M
An integrated planning process is needed to ensure that risks are correctly taken into account and integrated into urban planning design. This requires a central coordinating public body termed here as a Country Risk Manager:	●	●	●	○
<ul style="list-style-type: none">• Act as the central decision-maker for policy decisions with overall remit and responsibility for risk.• Empowered to ensure collaboration and efficient decision-making.				

5. Physical Resilience

5.2 Better building

Learning from experience

Updating building codes by using failure analysis is an effective way to understand building performances in unpredictable situations. It is important to perform post-disaster studies of damaged buildings and to use this failure mode data for different disaster types and structural characteristics. This data should be accumulated for further analysis and use. Those structures that are at high risk should be identified and repaired or retrofitted. An open-source platform for this data, segmented by disaster type and building structural characteristics, can improve analysis and create better understanding of which buildings are at risk and in need of retrofit.

Learning from research and development

As better building materials become available and construction techniques are improved, they should be included in building regulations to maximize their benefits.

Massachusetts Institute of Technology, USA: New construction materials based on naturally occurring substances such as silk could offer new opportunities for material performance in traditionally difficult stress situations. Currently, most engineered high strength materials are brittle, but silk has outstanding extensibility and strength. This will potentially lead to the creation of highly functional materials out of abundant, inexpensive materials.

Source: <http://web.mit.edu/press/2010/spider-silk.html>

Buildings covered by codes and standards

One central authority should monitor all building codes, including those from professional bodies. The codes should be written with unified approaches to avoid conflicting clauses with clear definitions for buildings with different categories of importance. The centralized authority should be responsible for the regular review and updates of the codes.

A local level community initiative to increase risk awareness and education for better construction could be a first step.

5. Physical Resilience

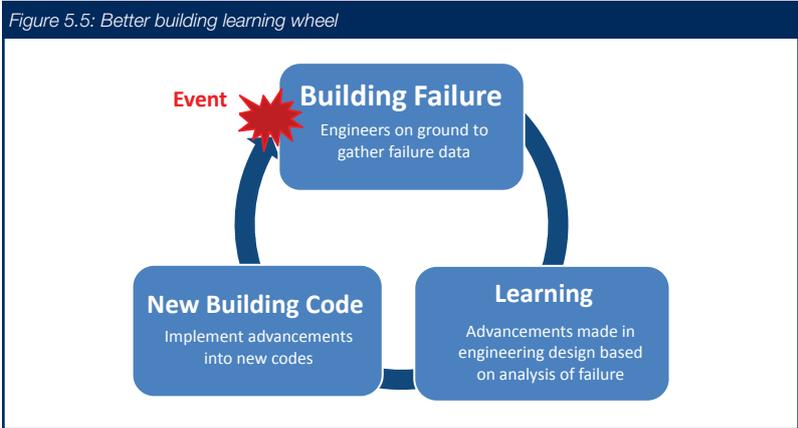
Incentives for better building

Better building should be incentivized by public and private institutions, with government or private companies providing subsidies to communities for designs and construction practices that increase resilience.

An award system for buildings and construction materials that enhance resilience could be created. Property values are likely to increase if owners are made aware of improved designs against disasters. Such a system could be similar to accreditation systems used in sustainable building designs, including Leadership in Energy & Environmental Design (LEED), an internationally recognized green building certification system,¹⁶ and Building Research Establishment Environmental Assessment Method (BREEAM), the most widely-used environment assessment method for buildings.¹⁷ These accreditations could provide the basis for tax rebates, low-interest loans, reduced insurance premiums or other incentives.

Fiji: Current building codes are weak. The insurance industry, with its stipulation for an Engineers Cyclone Certificate renewed at regular intervals, encourages resilience. The mechanics of this certificate include:

- Checking building dimensions, code wind category, roof overhangs, purlin sizes, and the presence of cyclone shutters for windows and large glass doors.
- Authorizing engineers to issue the certificates from the Fiji Insurance Association.



Better Building (7)

I	B	E&C	M
●	●	●	○

Better building, essential to reducing the risks caused by natural disasters, should be encouraged through :

- Updating building codes regularly, using academia and the private sector to learn from failure modes, new design initiatives and new materials
- Ensuring supervision to prevent substandard construction
- Implementing a contractor credit system to highlight poor performance
- Providing financial benefit for high resilience structures

¹⁶See: <http://www.usgbc.org/>.
¹⁷See: <http://www.breeam.org/page.jsp?id=66>.

5. Physical Resilience

Legislation and supervision

In lesser-developed countries where self-built structures are common, specialists from engineering consultancies or design institutes could supervise construction.

China: There are strict requirements for the supervision of construction by a third-party supervising engineer, called a Jianli. These supervising engineers hold specific qualifications and ensure that construction is done according to specifications.

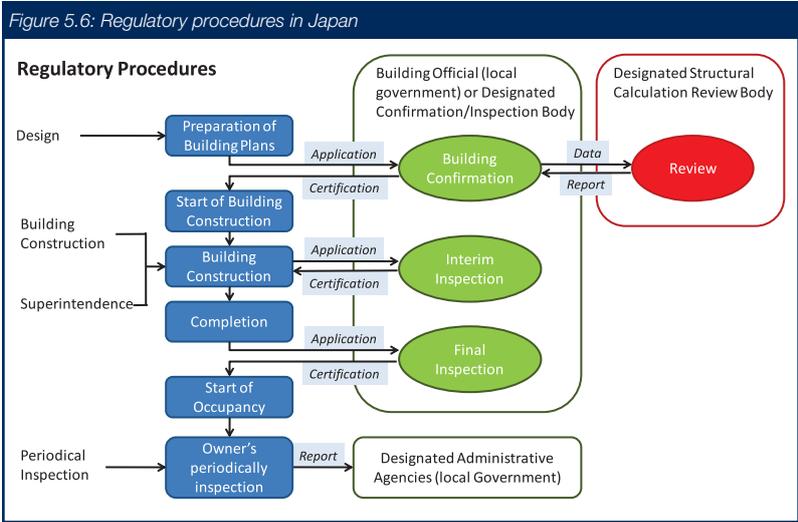
Enforcement: Enforcement of codes and standards through robust laws and severe penalties is essential. There should be clear statutory requirements for building designs and performance under normal conditions and during disasters. Clear lines of accountability should be required so that all stakeholders are encouraged to act responsibly.

Hong Kong, China: The Building Ordinance clearly defines the roles and responsibility of personnel for different streams of works: Authorised Person (AP), Registered Structural Engineer (RSE) and Registered Geotechnical Engineer (RGE). They are held responsible for safeguarding the quality of the designs and the construction to the best of their professional knowledge. Failure can result in heavy fines and imprisonment.

Contractor accreditation programme: A system to rate past performance of contractors should be created that would allow low performing contractors to be excluded from important projects.

The Japanese have a number of independent inspection stages to ensure that buildings are resilient. The design phase includes an analysis of the structural calculations. There is continual inspection during construction, with an interim certificate. Following completion there is another inspection. There are periodic inspections throughout the building's life.

5. Physical Resilience



Source: National Graduate Institute for Policy Studies, Kenji Okazaki.

China: “Lots of things have been done well in comparison to other disaster recovery experiences,” said Dan Abramson, an associate professor of Urban Planning at the University of Washington, who is working on reconstruction in Sichuan. “But official haste means new buildings are flung up in ways that could damage the town’s longer-term revival by not considering how the land or the buildings will be used. As a result of the earthquake, the government issued new design codes for urban planning in seismic zones, rural seismic design standards and zoning laws for active seismic zones in China.”

Ensuring that buildings are built to code is a common problem, but more relevant to poorer communities, particularly those in lesser-developed countries. The impact on communities through loss of life and damage caused by the failure of buildings can be devastating. How can building resilience be increased? A local level initiative to increase risk awareness and education for better construction is a first step. Standardized designs, units and materials should be required, perhaps with economic incentives to encourage compliance. There should also be verification of compliance by qualified personnel.

5. Physical Resilience

Interview with a secretary for development



“We strongly believe that community involvement and partnership are essential.”

Mrs. Carrie Lam was appointed Secretary for Development of the Hong Kong Special Administrative Region Government (HKSARG) in July 2007. Her responsibilities include city planning, land supply, public works, water supply, flood prevention, slope safety, greening and landscape, heritage conservation, harbourfront enhancement, building safety, urban renewal and HKSARG’s post-quake reconstruction works in Sichuan.

What are the kinds of resources required to properly address natural disasters?

Government’s foremost responsibility is to minimize the exposure of citizens to natural hazards. In Hong Kong, landslides and flooding are the two most common natural disasters, and hence resources for combating disasters of this kind are strategically directed at all levels and times to ensure that a robust system is in place to keep Hong Kong safe. This includes strategic asset management, preventive and mitigation measures and emergency response. At each level, resources of all relevant disciplines are pooled to achieve the goal.

How can government improve natural disaster mitigation, preparation and rehabilitation?

Measures can be structural or non-structural including engineering solutions, land-use planning and legislation.

For flood control in Hong Kong, at the strategic and project level, drainage master plans in all regions of the territory are tailor-made to identify flooding zones with an aim to build up the capacity of a reliable and resilient infrastructure network for flood prevention. On slope safety, we have adopted a registration risk-based priority ranking system in Hong Kong to devise landslide preventive and mitigation programmes to make slopes safe.

At the emergency response level, we instituted a three-phase (“3 Rs”) system, i.e., Rescue, Recovery and Restoration, to ensure provision of adequate and immediate response to natural disasters. The system involves setting up a central security command centre at the top and then integrating emergency arrangements at all government levels.

How can the government work together with the private sector on natural disasters?

We strongly believe that community involvement and partnership are essential. We raise public awareness on preventive approaches and promote concepts for maintenance by building owners through public engagement and education. Various warning systems on landslip, flooding and heavy rainfalls are put in place with information disseminated via mass media and electronic means. In areas prone to flooding, we have an outreach programme to work closely with stakeholders in anticipation of heavy rainfalls. Assistance from NGOs and volunteers is solicited as necessary through the three phases of a natural disaster.

What are some natural disaster challenges in Asia, and can others learn from Hong Kong in overcoming them?

Apart from tsunamis, earthquakes and volcanic eruptions, which are rare in Hong Kong, we are not dissimilar to other parts of Asia that are facing increasing challenges in the midst of climate change. We have witnessed signs of changes in rainfall patterns, with them becoming more intense and occurring more frequently. There is a need to expand R&D efforts to focus on climate change and develop more sophisticated early warning systems. This will require enhanced collaboration of all parties, in which Hong Kong would be delighted to share its experiences.

5. Physical Resilience

Retrofitting

Retrofitting is a laborious process, requiring an understanding of the different structural construction techniques used in different periods for different types of structures. Examination and remediation should be carried out on a regular basis with tests on various aspects, such as material, fire protection, structural and electrical. Where building codes have changed, a public programme for retrofitting, based on a cost-benefit analysis, should be introduced.

China: The National Disaster Reduction Center of China carried out a field study to determine to what extent bamboo can be used for retrofitting houses. Historically, bamboo-constructed dwellings have proved to be resilient against earthquakes. The cost of a bamboo dwelling is approximately US\$ 450 per room, only one-third to one-half the cost of concrete and brick construction.

Source: <http://www.proventionconsortium.org/themes/default/pdfs/AG/2048CHNLai.pdf>

	I	B	E&C	M
Retrofitting (8)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Encourage retrofitting through home resilience programmes:				
<ul style="list-style-type: none">• Public sponsorship for high-risk areas• Insurance and local community schemes to provide easy to understand sliding scales of resilience vs. cost tables for typical houses by region				

5. Physical Resilience

5.3 Economic rationale for investment in resilience

Rohini River Basin flooding case study

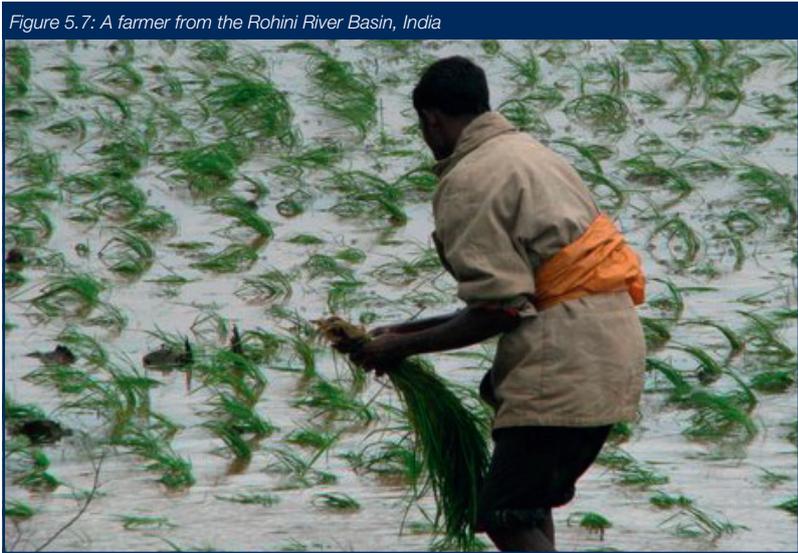


Figure 5.7: A farmer from the Rohini River Basin, India

Source: World News Network

One dollar invested before a disaster saves seven dollars of cost after a disaster.

A recent study¹⁸ on the Rohini River Basin in Uttar Pradesh in India presented the economic rationale for investment in resilience. In this region flooding is common due to the flat terrain and small deviations from the natural water flow can cause large scale and long-term flooding. The local population derives its livelihood from subsistence farming with an average annual income of US\$ 712. There are two types of houses in this area, mud and brick, with brick more resilient to flooding. The following table illustrates the costs and lifetime of each structure

Figure 5.8: Costs and lifetime of different structures

House type	Replacement Value	Lifetime
Kacha (mud)	US\$ 150	5-10 years
Pukka (brick)	US\$ 1,500	≥ 25 years

Source: IFRC (2010), UNDP (2010), IMF (2010)

¹⁸Hochrainer-Stigler et al. (2010).

5. Physical Resilience

The simple resilience measure proposed for both structures is to build each on a plinth to reduce the likelihood of flooding at a cost of US\$ 25 at the time of construction. The study found that the payback for such a measure was 2.4 times the cost-to-benefit ratio applied to either a mud or brick house at the end of its lifetime. For these calculations a discount rate of 12% was used. However, if a lower rate of 5% were used, then the replacement of a mud home would be economically beneficial even before the end of its expected life. These results show that where funding mechanisms can be put in place there is an investment rationale in resilience measures. In lesser-developed countries, funding could come from the NGO community or multilateral development banks.

Figure 5.9: Benefit/cost ratios of disaster risk resilience (DRR) measures

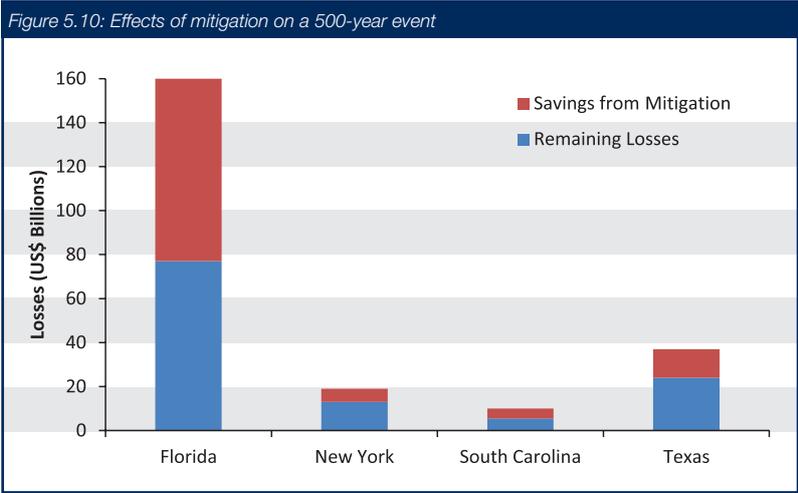
DRR Measure	B/C ratio (compared to w/o plinth)
Build new mud house on a plinth	2.4
Replace with brick building raised on a plinth	2.4

Assumptions: Time Horizon: 10 years, Discount Rate: 12%

These numbers do not include the effects of casualties that would further add to the benefits of increased resilience.

Florida hurricane case study – loans and premium reductions

Chapter 4 presented the principle of correct risk pricing. Multi-year loans coupled with premium reductions provide economic incentives for investing in mitigation if insurance premiums reflect risk. To highlight this point, consider the following example in Florida, which stands to produce large savings should resilience mitigation measures be employed.



Source: Kunreuther and Michel-Kerjan (2009)

5. Physical Resilience

Assume a family could invest US\$ 1,500 to strengthen the roof of its house so as to reduce the damage by \$27,500 from a future hurricane with an annual probability of 1/100. An insurer charging a risk-based premium would be willing to reduce the annual charge by \$275 (1/100 x \$27,500) to reflect the lower expected losses if a hurricane occurred. If the house were expected to last for 10 or more years, the net present value of the expected benefit of investing in this measure would exceed the upfront cost at an annual discount rate as high as 10%.

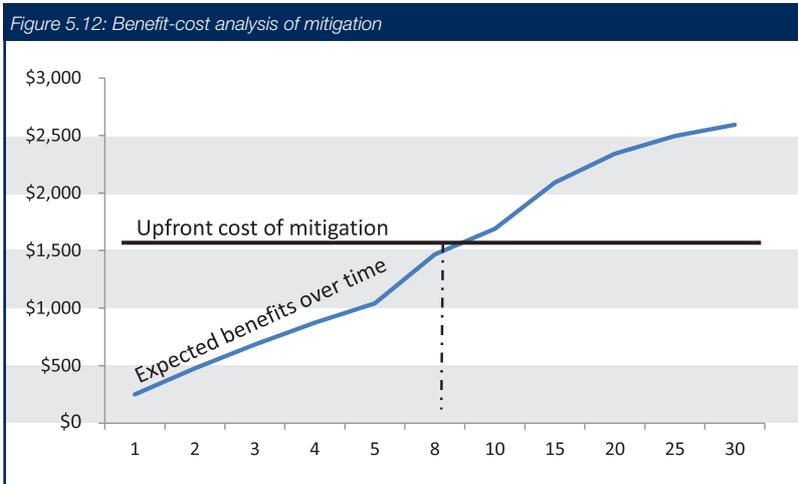
Figure 5.11: Economics of mitigation measures (example)

Year	0	1	2	3	4	5	6	7	8	9	10
Savings on insurance	0	300	300	300	300	300	300	300	300	300	300
Costs of mitigation	1500	-	-	-	-	-	-	-	-	-	-
Net cash flow	-1500	275	275	275	275	275	275	275	275	275	275
Present value of net CF (discount rate: 10%)	-1500	250	227	207	188	171	155	141	128	117	106
Overall present value	190	190	190	190	190	190	190	190	190	190	190

Nevertheless, many property owners may be reluctant to incur the \$1,500 cost for the following reasons:

First, property owners may be uncertain as to how long they will reside in their houses and/or whether insurers would reward them again when their policies are renewed. Finding ways to link mitigation measures to properties, rather than owners, may reduce this barrier. Insurance policies renewable for several years should be tied to the improved properties rather than to the current owners. With such policies, the savings on insurance could be locked-in when mitigation measures are taken. Even if there were a change of owners, the above calculation would still apply.

Second, property owners might have a short-term perspective. If they incur an upfront cost for financing the roof strengthening rather than taking a loan, it will take around eight years for the invested money to be paid back in the form of reduced premiums (see Figure 5.13).



Source: Howard Kunreuther, Wharton Risk Management and Decision Processes Center, University of Pennsylvania

5. Physical Resilience

Third, budget constraints could discourage property owners from investing in the mitigation measures. However, as long as they are able to get loans with interest rates below 10%, it is still beneficial to strengthen the roof if the house is expected to last more than eight years. The owners could obtain home improvement loans tied to mortgages that would usually have an interest rate below 10%.

By linking the mitigation expenditures to the structure rather than to the current property owner, the annual insurance payments would be lower, which would be a selling point to mortgagees. The bank would be more fully protected against a catastrophic loss to the property, and the insurer's potential loss from a major disaster would be reduced. These mitigation loans would constitute a new financial product. Moreover, the general public would be less likely to have large amounts of their tax dollars going for disaster relief. A win-win-win situation for all.

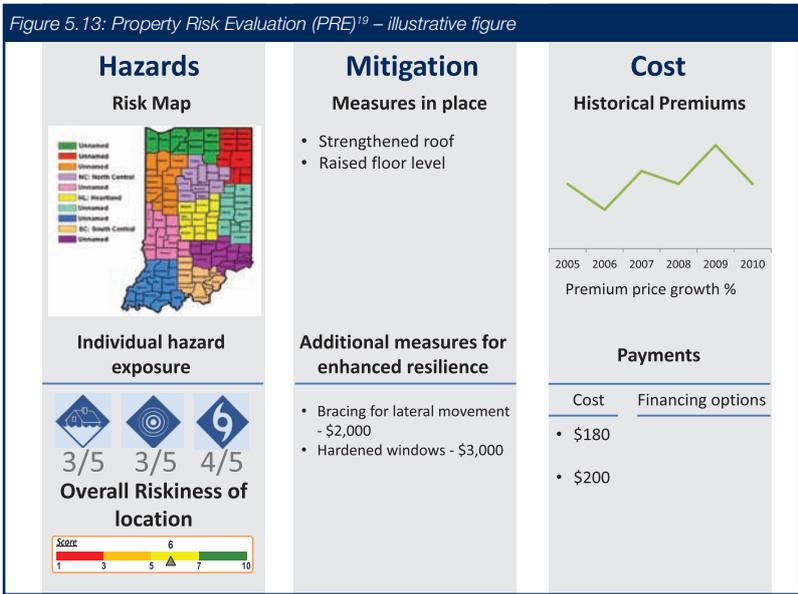
Physical resilience measures will save lives, and help people deal with increasing uncertainty of risk.

Incentives for Resilience (9)	I	B	E&C	M
Further supporting Recommendation 5 on correct risk pricing, facilities should be put in place to encourage investment in resilience:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<ul style="list-style-type: none">Publicly funded or financial institution supported low-interest loans for retrofittingInsurance policies which reflect reduced risk for mitigation by charging lower premiumsLinkage of mitigation investment to the structure				

5. Physical Resilience

Coupling insurance and loans with other measures

Generally, apart from legal requirements, individuals need economic incentives to invest in resilience measures. This may either be done through a direct increase in value of the property (similar to the increase in value from adding a bathroom) or through the economic burden of the resilience measures being transferred from the owner to the property or to a third-party. A way to formalize the link between increased value and resilience is through the requirement for a Property Risk Evaluation (PRE) at the time of sale, as outlined in Figure 5.14. PREs should include: a risk map detailing the gravity of hazard risk; a ranking of the likelihood of individual hazards; mitigation measures invested in and potential options with a link to potential insurance savings.



Some have argued that multi-year policies linked to the properties would offer some premium certainty over a set period of years. However, many insurers are concerned that the introduction of longer-term guarantees at a time when risk levels are changing rapidly and unpredictably would reduce financial stability for the insurer and increase costs to the policyholder. Many see the flexibility of the annual pricing model for general insurers as a key strength of the industry. However regardless of the absolute level of premium rates, a property that is adapted to natural catastrophic risk should, other things equal, require a lower premium compared to one that is not.

Property Evaluation (10)

I	B	E&C	M
●	●	●	○

When a property is bought or sold a Property Risk Evaluation (PRE) should be required. The PRE should include:

- Easy to read and understand, detailing hazards to which the property is exposed, their relative likelihood and insurance cost
- Inclusion of further resilience measures, their costs and potential premium savings, which could drive further investment in resilience.
- Potentially be combined with other financial considerations, such as taxes and mortgage payments.

¹⁹See Appendix V.

5. Physical Resilience

5.4 Case study – Mexico City

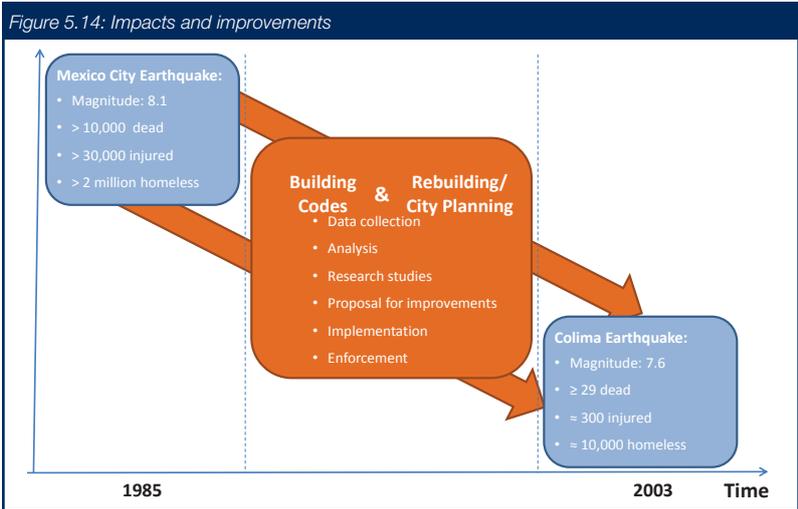
A series of powerful earthquakes and aftershocks hit Mexico City in 1985, causing large-scale damage:

- Magnitude 8.1 on the Richter scale
- More than 10,000 people killed²⁰
- More than 30,000 people injured²¹
- Over two million residents left homeless
- US\$ 4 billion economic loss
- Temporary shutdown of services, such as transport, electricity, and water
- Large-scale infrastructure and building damage, including loss of historic buildings and artefacts

This disaster struck Mexico at a time of extreme economic vulnerability with the debt crisis and rising oil prices. Politics undermined decision-making and relief efforts, causing further damage to society. However, NGOs and civil society groups provided volunteers, food, medicine and other resources. In the aftermath of the earthquake, Mexico City sought to improve:

- Governing codes and enforcement
- City planning and rebuilding
- Community awareness

The 1985 earthquake initiated building and planning improvements that drove efforts to elevate the overall robustness of the city. Sufficient time has now passed to evaluate these policy changes, with some results mentioned below.



²⁰http://earthquake.usgs.gov/earthquakes/world/events/1985_09_19.php.

²¹http://earthquake.usgs.gov/earthquakes/world/events/1985_09_19.php.

5. Physical Resilience

Codes and enforcement

Mexico is one of the world's most seismically active countries, sitting atop the intersection of five tectonic plates. Following strong earthquakes, the Mexican government issued code revisions in 1957, 1966 and 1976, to comply with international building safety standards. However, compliance and enforcement remained weak. Following the 1985 earthquake, analyses revealed much more serious damage from the continued tremors; even the most modern buildings were not immune. The combination of the city's geological vulnerability, low code adherence and enforcement, and weak preparations worsened the damage.

Post-disaster studies focused on engineered structures. Damaged non-engineered structures were either built illegally or had deteriorated to sub-standard levels. Some structures, considered legal, did not conform to the 1957 code, or had not had adequate maintenance. Multi-storey buildings collapsed due to the resonance with the amplified vibrations. After an improved understanding of earthquake mechanisms, the Mexico City Building Code (MCBC) was revised in 1993 and 2004.

Code revisions were based on experts' field observations and analytical and experimental programmes. For example, the 2004 MCBC presented a procedure that allowed design strengths and displacements to be determined with updated knowledge on the dynamic response of soft soils and contemporary tendencies in building codes.

The updated codes focused on transparency, simplicity and enforcement. Designers and construction professionals were trained to understand and properly apply the codes. Qualified design and construction personnel became mandatory. This was supported with the development of a registry of specialists, rated by their peers. A "liability statement on structural safety" from qualified specialists, involved in the entire design to construction process, became mandatory for critical facilities and large buildings. Such liability statements are required prior to occupancy, renewed every three years, and re-examined after major earthquakes.

Building codes should be easy to use and enforce.

5. Physical Resilience

City planning and rebuilding

For planning and rebuilding of earthquake-prone areas, planners and officials must use the latest hazard-zoning maps when considering the following items on master plans or reconstruction plans:

Spatial distribution, concentration and density

Concentration and density are prime factors that affect the damage caused by a natural catastrophe. Key considerations are: (1) keeping building density down wherever possible in terms of street width and distance between buildings; and (2) providing open spaces within dense areas to act as fire barriers, emergency evacuation routes and staging areas for response.

In the Mexico City earthquake, debris fell from structures, causing casualties and car collisions. Bursting gas pipes caused fires. Insufficient evacuation routes clogged the central city area and added to the panic of survivors, who had no escape routes. To decrease vulnerability, appropriate design measures must focus on the overall urban environment and not just building safety and provide overhead protection for pedestrians.

Shape of buildings

More complicated shaped buildings – especially horizontally ones – were more vulnerable than those of a single rectangular design. The most vulnerable appear to be the corner-sections of L-shaped buildings or the points between wings in those that are T-shaped. Buildings should be of simple rectangular shape; distance between buildings should be enough to avoid collision between them when they start moving during an earthquake.

Legislation and financial measures

Town planning and building legislation should include provisions for acquiring land, limiting property rights, provision of facilities for emergency services, identification of high-risk structures and structures to be rectified during reconstruction, with codes for reconstruction and repair work. To stimulate the appropriate application of physical planning and reconstruction measures, the development of corresponding insurance policies should be implemented. For example, the level of insurance premiums should reflect the vulnerability levels by taking spatial density factors into account. The level of premium should be used to stimulate design at lower densities similar to the manner used to stimulate higher levels of fire resistance in building structures.

5. Physical Resilience

Capacity building, community participation and awareness

The 1985 earthquake served as a wake-up call for natural disaster planning nationwide. Mexico has taken significant steps towards addressing earthquake risks. In addition to technological advancements, improved control and dissemination of building, planning and construction codes, several other policies were enacted:

- Educational programmes were created to improve community awareness. School children are taught earthquake awareness and response. Earthquake response drills are conducted to ensure orderly and well coordinate efforts in case disaster strikes.
- There are new mechanisms to incorporate citizens' ideas into public debate and decision-making to improve communication and cooperation.
- Improved action plans for rescue efforts and post-quake assistance have been implemented. The National Civil Protection System (Sinaproc) was created in 1987 to coordinate preparedness and disaster response. The Seismic Alert System (SAS) was established in 1991 as a monitoring and warning system for earthquakes, volcanoes and tropical storms.
- In 1996, the Mexican government created a country level fund for natural disasters, Fondo para Desastres Naturales (FONDEN), to financially support natural disaster response. This fund allows the Mexican state to transfer risk internationally with the 2009 World Bank backed US\$ 290 million parametric, multi-hazard capital markets catastrophe bond arranged by Swiss Re.

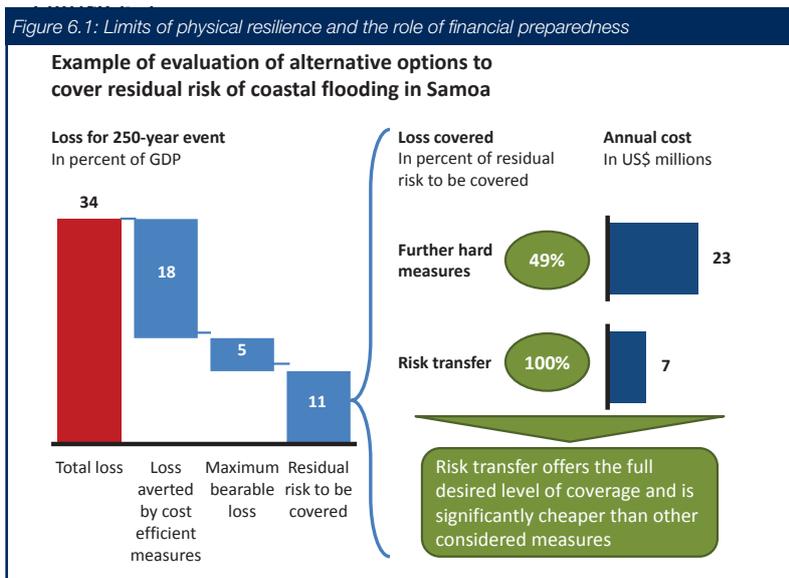
Mexico has experienced several large earthquakes since 1985. These serve as indicators for improvements to disaster preparedness. An earthquake registering 7.6 on the Richter scale hit the state of Colima in January 2003. A reconnaissance team from the Earthquake Engineering Research Institute (EERI) visited affected municipalities immediately after the event. The team described the Mexican government's response as "rapid and well-managed". With a death toll of 29 people and much less damage than expected, the Colima earthquake, 18 years after the Mexico City earthquake, suggests that Mexico's disaster preparedness is much improved.

Resilience Learning (11)	I	B	E&C	M
An improvement loop driven by developments in risk knowledge and engineering should introduce:	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
<ul style="list-style-type: none">• Evaluations by engineers of building failure modes• Frequent update of risk maps for the region• Updates to code in conjunction with town planning and building construction regulators				

Financial preparedness

6. Financial preparedness

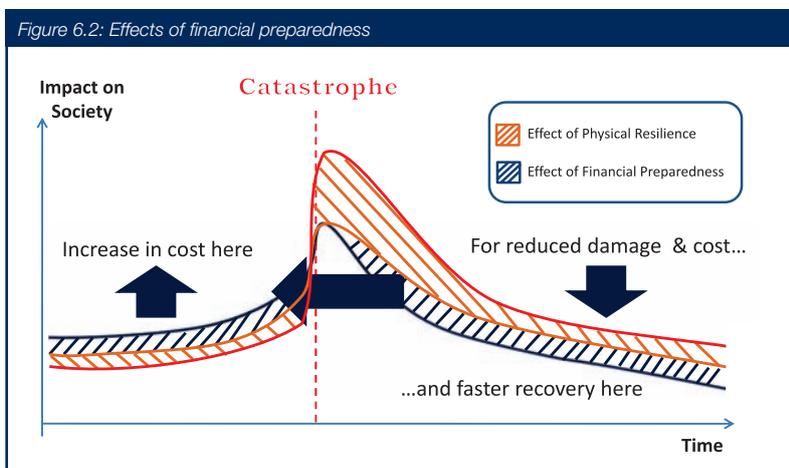
The previous chapter discussed how countries could reduce risk through physical resilience. This chapter discusses financial preparedness, and predominantly on using risk transfer to protect against hazards that may not be prevented through enhanced resilience. Insurance protects individual livelihoods from catastrophic impacts and reduces the burden on public budgets. In so doing, it strengthens the financial preparedness of communities exposed to natural disasters. However, in some communities in lesser-developed countries risk transfer may be poorly understood and not the best option, especially where affordability is an issue.



From a cost-benefit analysis, risk transfer is preferable to further resilience above a certain level of cost.

Source: *Economics of Climate Adaptation (2009)*

Figure 6.1 illustrates the limits of physical preparedness and the relative costs and benefits of financial preparedness. It is important to understand the interrelationship of various physical and financial preparedness measures, as well as the role that stakeholders play in influencing optimal outcomes and preventing market failures.



6. Financial preparedness

Financial preparedness is a key element in a country's overall resilience to natural disasters. It can reduce the long-term impact on economic development at the macro level as evidenced by the 2010 earthquake in New Zealand, which is expected to have a positive effect on GDP due to recovery spending. At the micro level it provides financial protection to individuals and businesses to reduce the impact on livelihoods.

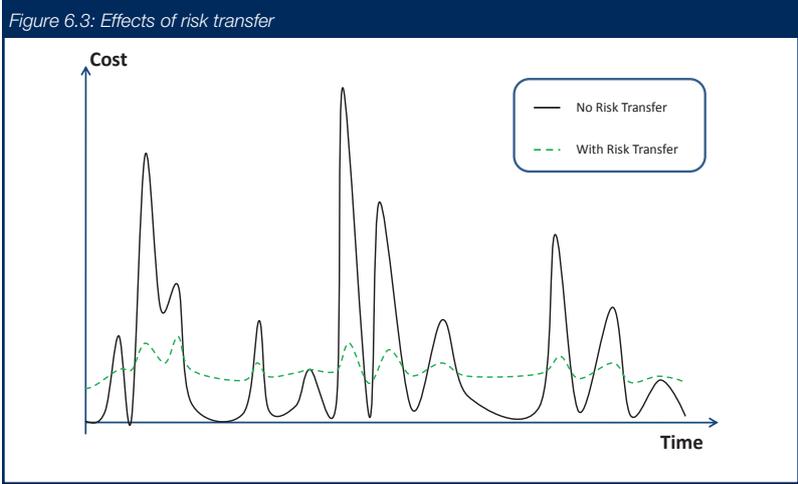
Insurability (12)

Increase awareness in lesser-developed countries on the benefits of financial preparedness and risk transfer to stimulate transfer of liability.

I	B	E&C	M
●	●	○	●

6.1 Risk transfer

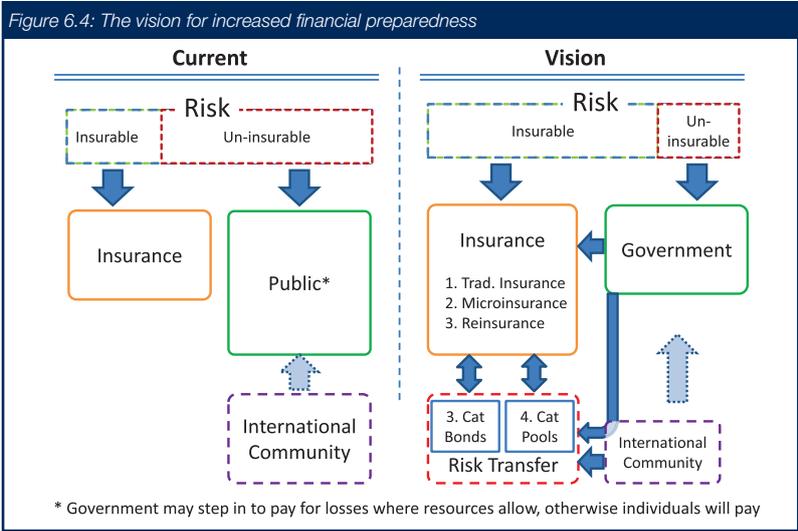
Risk transfer helps societies and individuals prepare for catastrophes and mitigate their effects on households and the broader economy. Figure 6.3 is a schematic diagram showing the smoothing effect of risk transfer, reducing the severity of the peaks while creating a base-line cost. Furthermore, these instruments put a price tag on risks and thus create transparency for the costs of physical preparedness measures.



Insurance minimizes the shock to those affected by catastrophe, facilitating faster and more robust recovery.

In the developed world, risk transfer instruments such as insurance play an important role in mitigating economic loss from natural disasters, covering about 30% of economic losses. In lesser-developed countries, these instruments cover only 1% of losses.²² The right side of Figure 6.4 shows the desired situation consistent with the vision in Chapter 3.

6. Financial preparedness



The goal is to ensure that risks are spread among capital bases sufficient to absorb the losses with society and governments not serving as the sole risk bearers. Catastrophe bonds and catastrophe pools are risk transfer instruments, which are particularly important for raising funds after a disaster. This report details four methods of risk transfer:

1. Traditional insurance and reinsurance
2. Micro insurance
3. Catastrophe bonds
4. Country catastrophe pools

Where there is a gap in risk coverage the affected populations and their governments will incur the costs and suffer the losses, unless the international community intervenes.

Certain economic activities would not take place without the mechanism to pool and transfer risk that insurance companies provide. By creating an environment of greater security, insurance fosters investment and economic growth. By allocating resources more efficiently to activities that promise to yield net benefits – particularly where the activities face low-frequency, but high-severity risks – insurance frees up funds for other investments needed to achieve economic growth and development.

I	B	E&C	M
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Risk Transfer (13)

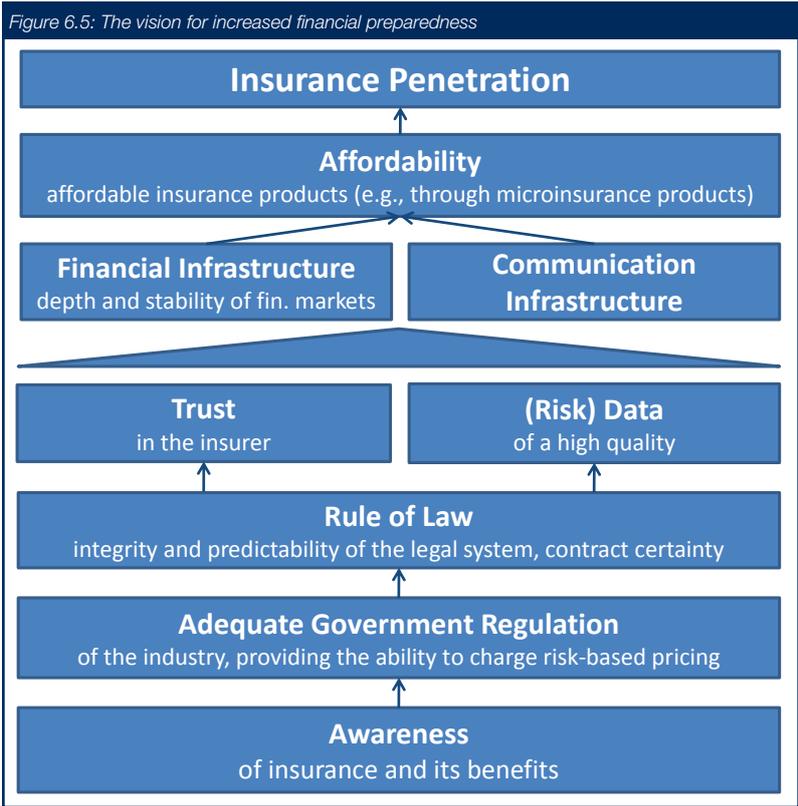
Risk transfer is an important method of reducing sudden financial shocks caused by natural disasters. These shocks may be more damaging to lesser-developed countries. Thus, basic insurance mechanisms in these regions should be created:

- Microinsurance options could initiate market demand and requirements
- Government must ensure regulatory frameworks are established, including dependable and predictable rule of law for policy enforcement
- Requirement for risk data, financial and communication infrastructure

6. Financial preparedness

Foundations for insurance

In addition to a functioning public policy and regulatory framework, insurance development depends on factors that define a country's broader development strategy. These include social and environmental policies, health and education, urban and geographic planning, as well as legal protection and competition policy.



Good Practice (14)

An insurance industry code of good practice should be implemented to build understanding and trust.

I	B	E&C	M
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. Financial preparedness

Microinsurance

Microinsurance, which protects low-income people from specific risks, is typically characterized by low premiums reflecting the pricing of focused coverage. Low-income people are often exposed to risks due to the nature of their livelihoods, for example, subsistence farming, or because they live in disaster-prone areas. In addition, low-income people do not have the assets to recover their livelihoods or property following a catastrophe. Given these considerations, microinsurance can help these people reduce their risk exposure. However, there are a number of challenges in developing robust microinsurance markets and potential solutions.

Distribution

High volume is a key to the insurance business model. Therefore, microinsurers need to partner with organizations with ties to the communities that they seek to serve to gain access to and build trust with potential customers. The most obvious partners are microfinance institutions because they can assist with raising insurance awareness and premium collection. Other key partners include NGOs, trade unions and industry groups, regulators, and other community organizations.

Financial literacy

Explaining how insurance works can be difficult. It is also difficult to build trust with potential customers because the benefits of insurance are realized in the future, if at all. Partnerships are critical to overcoming these barriers because many partner organizations are trusted in their community and can assist in education efforts. Another way to overcome this barrier is by making insurance products as standard as possible so they are easy to understand by potential customers and easy to sell by agents.

Measuring success

Measuring the success of microfinance products both in terms of financial bottom line and social impact can be challenging. Some of the metrics in these two categories are often in tension with one another. Yet, microinsurers must find a way to balance these two imperatives to justify their programmes. The Microinsurance Academy and other organizations have done some work on identifying key performance indicators that microinsurers can adopt, but more work needs to be done.

To overcome these challenges, the private sector should take a long-term view, focusing on strategic market entry and creation of new markets, rather than immediate profitability. Governments, through regulatory provisions and public-private partnerships with development agencies and NGOs, should work to develop microinsurance markets and provide subsidies to counteract affordability barriers.

6. Financial preparedness

Interview with a microinsurance expert



“Microinsurance requires a multistakeholder approach amongst insurers, social aggregators and governments.”

Michael Anthony is a Senior Microinsurance Manager at Allianz SE and member of the Group’s Sustainability Strategy team. He co-authored Allianz SE’s climate change strategy and is facilitating the Group’s initiatives on microinsurance with partner organizations. He spoke with us about the role of microinsurance in natural disaster risk mitigation and current challenges.

Why is microinsurance so critical in lesser-developed countries?

Lesser-developed countries are the most vulnerable to natural disasters because they do not possess adequate coping mechanisms. In addition, the physical and financial impacts of natural disasters can push their citizens into a continuous poverty cycle that is difficult to break.

What are the greatest challenges for commercial insurers that offer microinsurance products?

There are two large challenges that insurers face in this market. The first is how to reach consumers, which I refer to as the demand side. The second is how to develop relevant insurance products that are financially viable and offer risk protection that is useful to clients. I refer to this as the supply side.

What are the most successful partnerships on the demand side of the equation?

It is important to work with organizations firmly rooted in their communities such as cooperatives, microfinance institutions, non-governmental organizations, and other commercial and social groups. These organizations are critical social aggregators and serve two purposes. First, they help insurers with operations and organizational issues to keep transaction costs low. Second, they build trust in communities we serve by providing education about insurance and our products.

Where have insurers made progress and where are they facing challenges in providing microinsurance?

Insurers have gained a better understanding of the buying patterns of consumers in lesser-developed countries, and have refined their distribution mechanisms. Insurers are still grappling with the technical challenge of devising products that provide protection against natural disaster risk. In particular, we face the toughest challenges in the delivery and claims adjustment processes. We are always working on how to offer products that keep transaction costs low and offer optimum protection to the consumer. For example, index-based insurance could be a solution, but we need to be more precise about how to assess loss at the consumer level. Perhaps satellite and other technologies can be used to increase the accuracy of loss assessment.

Microinsurance (15)	I	B	E&C	M
	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Initiation of microinsurance in lesser-developed countries will help protect livelihoods and could heighten risk awareness and enhance individual and community resilience.

6. Financial preparedness

6.2 Alternative insurance schemes

Enlisting the capital markets

In the wake of mega-catastrophes like Hurricane Katrina and a renewed appreciation for the high cost of natural disasters, reinsurance capacity diminished, causing reinsurance prices to rise. Primary insurers, looking to strengthen balance sheets that reflected poor investment returns, turned to the capital markets for innovative financing as an alternative to reinsurance. At the same time, with declining interest rates, investors began looking for higher yields, which prompted interest in securitization of insurance risk.

Since then, insurers have sold natural disaster risks to institutional investors in the form of catastrophe (cat) bonds and other products. Investors are interested, not just for the relatively high returns, but because catastrophe risk is not correlated with economic conditions, thus diversifying investors' portfolio and reducing the volatility of returns. The availability of reinsurance and other risk-spreading mechanisms will be a major criterion used by the insurance industry as it decides whether to underwrite catastrophe risks in new markets.

Alternative risk-pooling schemes

Innovative solutions provide the public sector with new models for transferring risk to the insurance industry or to capital markets. Public-private collaboration in emerging markets has produced alternative risk transfer solutions involving public sector entities and the private insurance industry. Among them are weather-index solutions in Africa and India, catastrophe bonds in Mexico, and parametric earthquake and hurricane catastrophe pools for Caribbean nations.

These and similar solutions can be adapted to risk exposures elsewhere in the world. Because one approach will not fit all circumstances, protecting communities against location-specific risks requires constant innovation and tailor-made responses. Global insurers and reinsurers have much to contribute towards these efforts. A combination of public and private resources will deliver the most robust, sustainable risk-reduction solutions.

Strategic planning by businesses should consider the benefit of protecting their operations in lesser-developed countries, which may be dependent on local economic conditions, resources and labour. One option would be to participate in or subsidize insurance schemes and alternative risk transfer solutions to ensure funding for faster recovery and protection against business interruption.

6. Financial preparedness

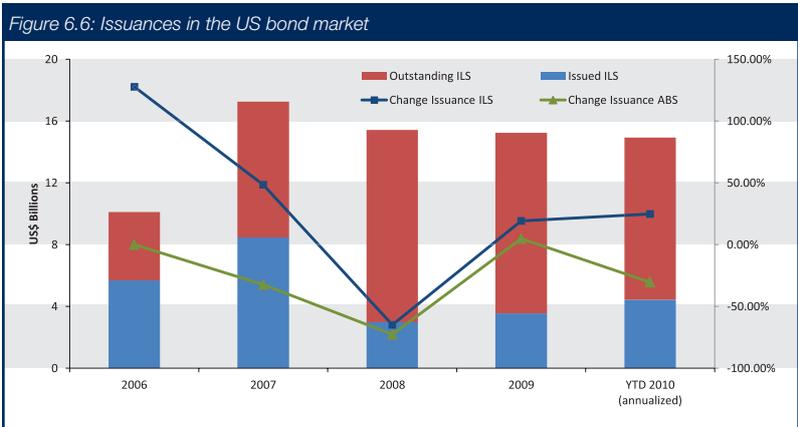
Insurance-linked securities

Financial innovation now permits insurance risks to be transferred to capital markets. One way insurance exposures are transferred to capital markets is through insurance-linked securities (ILS). ILS are similar to securitized mortgage loans or other financial assets. Predictable and unpredictable cash flows can be separated and bundled with the desired cash flows that can be traded between parties.

ILS benefit both the issuer and the investor. For the issuer, they create flexible means to obtain risk transfer other than traditional insurance or reinsurance markets. They can be used as an alternative market when there is a lack of demand or capacity for certain risks in traditional insurance and reinsurance markets. For investors, ILS provide a diversification opportunity to obtain uncorrelated returns as compared to other products in traditional bond markets.

ILS may not be a complete solution for the lack of robust insurance markets. However, they can help the public and private sectors address natural disaster risk issues faced by lesser-developed countries. ILS, by employing funding from global capital markets, can be a more efficient way of establishing risk-transferring options, with a broader capital base and more capacity than traditional insurance markets. Traditional insurance markets may have limited capacity and reluctance to participate in certain areas. ILS can be used to cover risks in a more targeted fashion, with a broader capital base, limited only by the size of the potential investor universe interested in receiving returns uncorrelated to traditional bond markets.

The market turmoil experienced between 2007 and 2010 casts doubt on the future of the ILS market. The traditional securitization market for real estate and other asset-backed obligations experienced significant declines due to decreased demand and market illiquidity. According to published data by organizations such as the Securities Industry and Financial Markets Association (SIFMA), issuance of asset-backed securitizations (ABS) dropped by 71% between 2007 and 2009, while ILS volume decreased approximately 57% for the same period. In the first half of 2010, traditional securitizations of asset-backed obligations declined approximately 30%, while new issues of ILS during the first half of 2010 was US\$ 2.5 billion, 40% higher than the same period in 2009.



Source: *Economics of Climate Adaptation (2009)*

6. Financial preparedness

The ILS market is new and small, but it weathered the recent market turmoil fairly well and remained relatively strong. Based on strong demand relative to similar asset classes over the past few years, it is interesting to consider the factors that could lead to further growth in the ILS market. These factors were analyzed in the October 2008 World Economic Forum report, *Convergence of Insurance and Capital Markets*, which identified unique opportunities presented by the convergence of insurance risks and capital markets. The report also identified barriers and challenges that cause ILS to lack liquidity and transparency.

Since the Forum's 2008 report, there have been some significant developments. Data transparency has improved with the creation of several ILS indexes. The Bermuda Monetary Authority has introduced legislation to make it easier to create and list ILS. These activities could lead to a stronger secondary market and greater price transparency.

Financial reforms in the United States and Europe may improve the price transparency of ILS. Catastrophe swaps and other insurance-linked swaps can provide transparency similar to the way credit default swaps provide transparency to the traditional bond market.

Alternative Insurance (16)

I	B	E&C	M
●	●	○	○

Alternative insurance schemes represent an easier way to initiate risk transfer for lesser-developed regions. To facilitate their use a central coordinating body should be established to bring together both the demand and supply side. This role could be played by the World Bank or a multilateral development agency.

- This body needs to be user (government) friendly
- These schemes could provide foreign organisations working in these regions with a source of insurance

Figure 6.7: Forms of catastrophe pools²³

Country - Scheme	Form of cover	Public-Private Partnership	Incorporates resilience
California - California Earthquake Authority (CEA)	Direct insurance, reinsured by CEA	Participation of insurers and reinsurers in CEA is voluntary	Yes
Japan Japan Earthquake Reinsurance (JER)	Direct insurance, reinsurance by JER (excess of loss)	Yes Direct cover through the private market, reinsured by the Government through the JER	Yes
New Zealand - Earthquake Commission (EQC)	Direct insurance. Reinsurance: international market	Yes Market: premium collection EQC: claims handling	No
Mexico - Fondo Nacional para Desastres Naturales	Federal and state agencies	No	No
Taiwan - Taiwan Residential Earthquake Insurance Fund (TREIF)	Direct insurance (coinsurance pool). Reinsured by TREIF	Yes	No
Turkey - Turkish Compulsory Insurance Pool (TCIP)	Direct Insurance. Reinsurance by alternative risk transfer	Yes (private management by Garanti Insurance)	Yes

Source: World Forum of Catastrophe Programmes (<http://www.wfcatprogrammes.com>), 2010

²³A more detailed version of this table is in Annex V.

6. Financial preparedness

Some key elements of these schemes are:

- The California Earthquake Authority is self-funded by policyholders, participating insurers, investment income, and reinsurance. Private insurers are included, encouraging greater contribution of intellectual capital. Five percent of investment income is used to increase awareness for home safety and earthquake preparation.
- New Zealand’s Earthquake Commission uses private insurers to collect a surcharge on fire insurance, thus increasing penetration and reducing overhead costs.
- Japan Earthquake Reinsurance is a liability-sharing scheme between the government and private insurers. It allows coverage of high-loss, low-probability events with large capital requirements in a way that protects market function should a very large event occur.

The Caribbean Catastrophe Risk Insurance Facility (CCRIF)

Established in 2007 to combine 16 Caribbean countries’ emergency reserve funds into a common pool, CCRIF is a regional insurance facility with a parametric trigger, designed to provide quick liquidity for affected countries. CCRIF is the first multi-country risk pool in the world and represents a real shift in the way governments treat risks and the associated economic costs. Impetus for the facility was Hurricane Ivan, which caused losses in Grenada and the Cayman Islands close to 200% of GDP. In addition to hurricane and earthquake policies, during the 2010-2011 policy year, CCRIF will offer excess rainfall coverage. Agriculture sector and utility company policies are under consideration. CCRIF paid out US\$ 8 million after the Haiti earthquake in January 2010.

The World Bank was a key sponsor of CRRIF. There is a potential role for other organizations, such as the multilateral development banks and development organizations in providing impetus for similar schemes.

These pools provide a backstop of risk coverage to support insurance and financial preparedness in vulnerable markets, while providing extra protection to the public sector. Where available, these schemes may provide a limited economic safety net to vulnerable communities.

Catastrophe Funds (17)

	I	B	E&C	M
Country level catastrophe funds should be used as a mechanism to prepay for natural catastrophes, based on three principles:	●	○	○	○

- Use of correct risk pricing, thereby not disturbing the market but allowing insurers and individuals to obtain increased risk coverage
- Providing government guarantee for extreme events, where private markets are not able to provide cover
- Financial independence from government

6. Financial preparedness

China: case study on country level funds²⁴

In China, more than 200 million people are affected by natural disasters each year.²⁵ Recent events such as the 2008 Wenchuan earthquake caused large economic losses, borne predominantly by the government and individuals, with very little financial preparedness to reduce the shock. China is coming to understand the need for and benefits of increased financial preparedness and needs to move further from a top-down government response bias to an overall risk management structure. The following lessons from other countries may help China in establishing a new system, which should include three elements: high penetration, economic viability and mitigation incentives.

Lesson 1: Financial architecture

The fund must be financially viable, appropriately pricing risk at competitive market rates. It should be based on actuarial fair risk pricing to set the base price. This will ensure that the fund is financially viable, while ensuring a price that does not distort the market and preclude private sector involvement.

Lesson 2: Structurally independent and efficient

By allowing a specialized agency to control its own funds, as do the New Zealand Earthquake Commission and the California Earthquake Authority, the agency can determine and grow its capital without the threat of having its funds diverted during times of surplus. The government and private entities must both have a stake in the insurance system to establish checks and balances.

Lesson 3: Multiple roles for the public sector

The public sector should provide financial guarantees in the form of a liquidity backstop to help insurers quantify and limit their exposure from low-frequency, high-intensity events that can significantly impact pricing. Mandatory insurance in risk-prone areas will help spread risk and alleviate adverse selection issues. This will prevent problems seen in areas where insurance is not mandatory, such as California. Insurance stamps could be used for affordability issues.

Lesson 4: Reducing the risk to society

Public awareness and risk mitigation programmes diminish risks, thereby lowering the cost of actuarially fair premiums. These programmes not only save lives, but also teach people about insurance products. Households must have incentives to mitigate risk. Subsidies often decrease motivation to mitigate if premiums are artificially cheap. The insurance system can contribute to risk reduction efforts by contributing to public awareness and risk mitigation programmes. For example, the insurance system should establish separate entities specializing in mitigation that homeowners could contact to prove that they are entitled to a refund for taking risk-mitigating measures, and ask for lower premiums.

National Development Reform Commission (NDRC), China: The Chinese government has enacted laws and regulations to enhance its capacity to withstand natural disasters. These measures aim to help reduce vulnerability and mitigate the adverse effects of natural disasters. These mitigation efforts cannot be accomplished by the government alone and require the resources of both the private sector and communities.

Source: Interview with Ms. Huang Wenhong, Chief of NDRC Climate Change Department

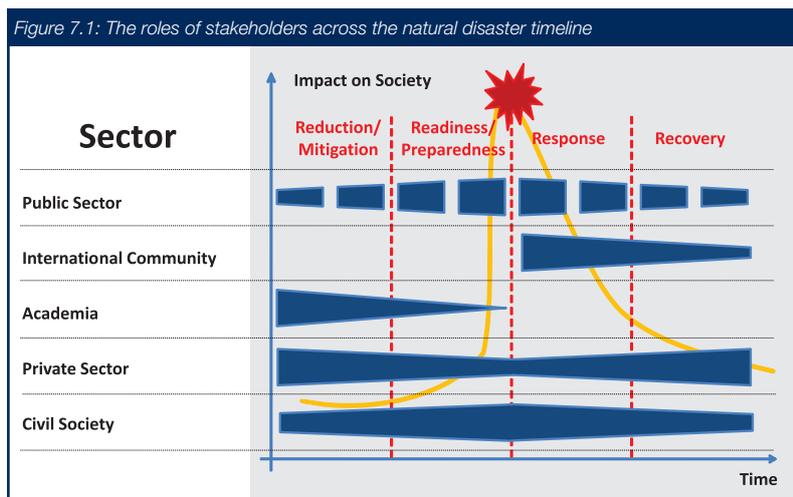
²⁴Based on a study by Jenny Fan, Lawrence Gu and Xiaochun Ni of the Wharton Risk Management and Decision Processes Centre, University of Pennsylvania.

²⁵Ting (2004).

Defining roles for action

7. Defining roles for action

The previous three chapters looked across the natural disaster timeline and provided recommendations for three groups of issues, identifying potential stakeholders. In a broader sense, this chapter examines the roles of the three main stakeholder groups: the public sector, international community and the private sector. Figure 7.1 illustrates the current bias towards post-disaster response and recovery. There is need for increased pre-disaster focus and deeper, more coordinated private-sector involvement.



7.1 Public-sector roles

The roles the public sector in various countries can play are constrained by institutional capacity and financial resources. For lesser-developed countries, lack of institutional capacity is a significant barrier to implementing many of the solutions detailed in this report. Developing the institutional, legislative and operational mechanisms for natural disaster management requires strong long-term political commitment. Building functional organizational structures, with people who possess the technical skills, requires mentoring from other public and private sector institutions possessing the needed expertise. While creating this infrastructure the use of an integrated risk management department could reduce bureaucracy and build more effective public response to risk. Academia, civil society and the private sector should play a significant role in building this knowledge and expertise.

Information and risk-data capacity are a natural first step in building the institutional capacity needed to manage risks and solutions along the natural disaster timeline.

Bogotá, Columbia: Bogotá created the Fund for Prevention and Emergency Response (FOPAE) in 1987 to improve risk prevention, mitigation and emergency preparedness. As a result, Bogotá has strengthened capacity in organizational, technical and legal aspects. Important results have been an increase in risk awareness through education and participation, and enhanced resilience including mitigation works, relocation of homes in high-risk zones and structural reinforcement. These resilience measures are planned at city-wide level for maximum benefit.

Source: 3D city profile series on Bogota Columbia, Pacific Disaster Centre

7. Defining roles for action

Capacity Building (18)

I	B	E&C	M
●	●	●	●

Initiating institutional capacity building is a key step for lesser-developed countries to create their own risk management tools. This requires the development of institutional, legislative and operational mechanisms:

- Building functional structures which share knowledge and skills from the private sector and NGO community
- Building risk awareness with the private sector and academia
- Political commitment to long-term process

In developed countries, governments often assume the role of payer of last resort. The assumption behind this role is that governments can better withstand catastrophic losses. If a private insurer has insufficient capital at the time of a catastrophe, it may be unable to pay covered losses and continue doing business. Supported by tax revenues, many governments are able to cover losses that would cripple a commercial insurer, as they are able to absorb the timing risk associated with catastrophic losses. This role benefits the insurance industry by providing support for low-frequency, high-severity events.

There are dozens of examples of private-sector insurers working with governments to participate in loss exposures they would normally avoid. In some cases, governments require insurers to participate as a condition of doing business. In other cases, insurers participate voluntarily. There is a spectrum of private-sector involvement, as detailed in Figure 6.7.

Public Sector Liability (19)

I	B	E&C	M
●	○	○	○

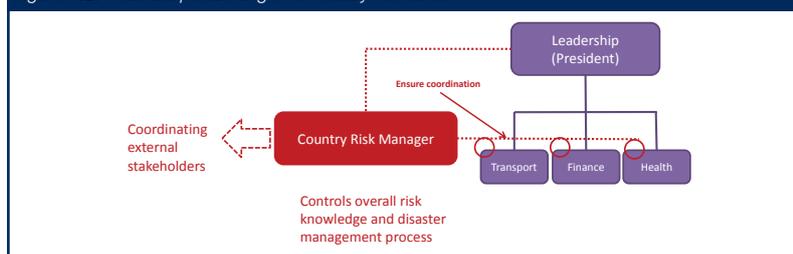
The public sector for developed countries should acknowledge its role as payer of last resort and provide facilities to financially support low-probability, high-severity events.

Risk management – country risk officer

For decision-makers, a major challenge is to adopt a comprehensive risk management approach striking the right balance between disaster prevention and risk transfer. Risk management must also be firmly embedded in a broader strategy of economic growth and development.

Managing natural-disaster risk requires a coordinated approach between national-level risk mitigation and response plans from various government departments, while taking into account specific local needs and conditions. A country risk officer could represent this public oversight body and be a natural focal point for the engagement of other stakeholders. Functional responsibilities would include the inception, design, implementation and operation of the risk-management programme.

Figure 7.2: Potential positioning of a country risk officer



7. Defining roles for action

Interview with a catastrophe response official



“Public-private partnerships can help stabilize markets following a catastrophe, prevent insurance availability problems, and reduce insurance costs.”

Admiral James M. Loy is currently a senior counselor for The Cohen Group. Previously, he served as Deputy Secretary of the US Department of Homeland Security, administrator of the Transportation Security Administration and Commandant of the Coast Guard.

What is the value of public-private partnerships in preparing for and recovering from catastrophes?

The value of public-private partnerships in preparing for and recovering from catastrophes is threefold.

First, this type of partnership draws from the expertise of both sectors. Insurance companies specialize in claims and logistics, risk assessment, and mitigation. Governments, on the other hand, have the resources and expertise to help prepare for and recover from catastrophic situations. Governments also have the ability to enact stronger building codes and prudent land-use policies to reduce the impact of catastrophes. For example, one study estimated the damage from Hurricane Andrew would have been US\$ 8.1 billion less if the building codes now in effect in Miami-Dade had been in effect in 1992.

Second, costly government bailouts can be avoided in the aftermath of a mega-catastrophe if there is a national catastrophe fund in place to act as a financial backup. This can reduce insurance costs for consumers, protect the private market from collapse and help ensure that resources are available to rebuild after a major catastrophe.

Third, the lessons learned from Katrina clearly identify many opportunities for public-private partnerships. Planning and scenario-based exercises should routinely be conducted such that both public and private sector entities have realistic and planned expectations regarding crisis management.

What can insurance companies provide that governments cannot and how can governments best incentivize insurance companies?

Functioning in a competitive private space, insurance companies have developed niche capacities in risk assessment, mitigation, claims and logistics. With catastrophe funds, insurers can provide the necessary cover against natural disasters such as hurricanes and earthquakes. Public-private partnerships have the potential to help stabilize markets following a catastrophe, prevent insurance availability problems, and reduce insurance costs for consumers.

Governments can refrain from issuing mandates that are counterproductive. Public and private stakeholders must be engaged and legislation should be enacted to more effectively mobilize and deploy resources needed for disaster recovery. Haphazardly throwing money at natural disaster victims after a catastrophic event is inefficient and inequitable and harms consumers and taxpayers as well as the victims who need money to rebuild their lives.

7. Defining roles for action

7.2 The role of the international community for lesser-developed countries

The role of the international community stems from a desire to reduce loss of life and human suffering, largely in reaction to catastrophic events. This duty of care that the international community assumes is increased when tragedy affects countries that are less able to cope. Today's unstructured support leads to an expectation for levels of aid based on past experience. This may lead recipient countries to take less responsibility for catastrophes, focusing less on preparedness measures that could reduce the impact and suffering. For donors, these expectations can create an implicit burden to provide a certain level of funding, even when economic circumstances may have changed. Another reason for change could be caused by concurrent severe events, such as the 2010 earthquakes in Haiti and China, followed by the floods in Pakistan, which led to donor fatigue.

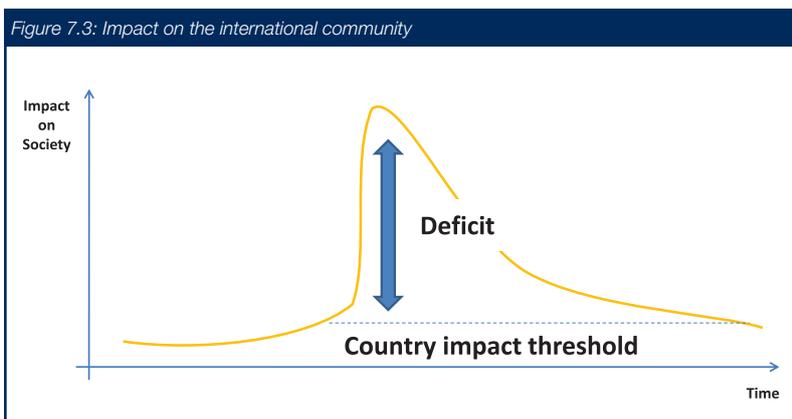


Figure 7.3 shows the natural disaster impact on society and the inability, shown as a deficit, of the country to deal with this impact. In this case the people affected have no support, apart from international community disaster aid. Current international funding is heavily biased towards response, with 95% spent post disaster. However the World Bank estimates that for every US\$ 1 spent in risk mitigation and disaster preparedness, US\$ 7 are saved in reduced costs of response and recovery.²⁶ If the international community were to look at the overall natural disaster curve holistically a more economically efficient programme could be put in place that would save lives and money.

At the recent **UNFCCC COP16 talks in Cancun**, Mexico, December 2010, the parties agreed on a new framework to help countries design and implement effective adaptation strategies, which explicitly include risk management and the insurance industry as enablers.

²⁶World Bank (2008)

7. Defining roles for action

Interview with an academic



“There is a need for improved preparedness and response.”

Bill McGuire is Professor of Geophysical and Climate Hazards at University College London and Co-Director of the UCL Environment Institute and the UCL Institute for Risk & Disaster Reduction. Until recently, he held the position of Director of the Aon Benfield UCL Hazard Research Centre.

How can the international community better prepare for natural disasters?

There is a need for improved preparedness and response. The critical starting point, however, has to be hugely improved risk identification and risk awareness, so that NGOs, governments, businesses and the public know what to expect and what they need to prepare for.

Early warning systems are critical to successful mitigation of a hazard. A great deal needs to be done, however, to make early warning systems effective. Many currently are not. It is not good enough just to have an early warning system in place. It must be appropriate to the culture and situation and familiar to the stakeholders and population so that an appropriate and predictable response is ensured.

If preparedness and understanding of risk are so important, what risk identification models can we look to?

I am not at all convinced that mechanisms are in place for effectively identifying risks. Catastrophe models are all well and good, but they tend to focus on areas of high wealth concentration that are of most interest to the insurance sector. I doubt any catastrophe model was available for the area of Haiti affected by the 2010 quake, nor the Indus flooding of Pakistan. As such, insurance industry cat models have less application in low-income countries where natural disasters have the greatest impact. Models are also not available for all hazards, or for events that are of regional scope. The impact of the recent Eyjafjallajökull eruption in Iceland evidences both these problems. Improved risk identification needs to involve engagement of scientists with relevant expertise who are experts in a particular country, area or region.

How can the international community raise awareness of the issues surrounding natural catastrophes?

This is a critical area, but I am not convinced that many low-income national governments regard awareness raising in relation to natural threats to be of sufficiently high priority, when there are other social and economic issues that seem more pressing. I would suggest that the NGO sector can and should be playing a far bigger role in awareness raising. In particular, it is in their interests as time and money spent in awareness raising and other aspects of preparedness will save more in respect of response and recovery.

How should we plan to limit the effects of a natural disaster?

A multistakeholder approach to reducing the impact of disasters is always desirable. I agree that this has to start with improved knowledge of the risks by the public and policy-makers. Critically, this in turn must require the involvement of the scientific community. Physical measures and the establishment of a risk-transfer framework are both also key to limiting losses and building resilience. In many cases, particularly in earthquake-prone (and to a lesser extent wind- and flood-prone) areas, these are likely to be focused on retrofitting programmes and risk zonation. However, the big problems are cost, enforceability and public support.

How can the international community assist in this area?

An international fund targeting disaster preparedness in low-income countries would probably be the most effective international initiative. Funded projects would have to be closely monitored to ensure they are fit for purpose and in many cases support might have to be open-ended. Whatever the size of this fund it is likely to be hugely oversubscribed.

What role can the insurance industry play in developing a prepared response to natural disasters?

I appreciate that the insurance sector could play a greater role in reducing risk in low-income countries, but the degree to which this is possible remains to be proven. The developing world is completely different to Europe or North America. How do you persuade families in Egypt or Bangladesh to move away from rivers upon which their livelihoods depend, based upon flood zonation maps? For most people in low-income countries, insurance does not currently top their list of priorities. The challenge is to work with such communities to increase the relevance of insurance to their daily lives.

7. Defining roles for action

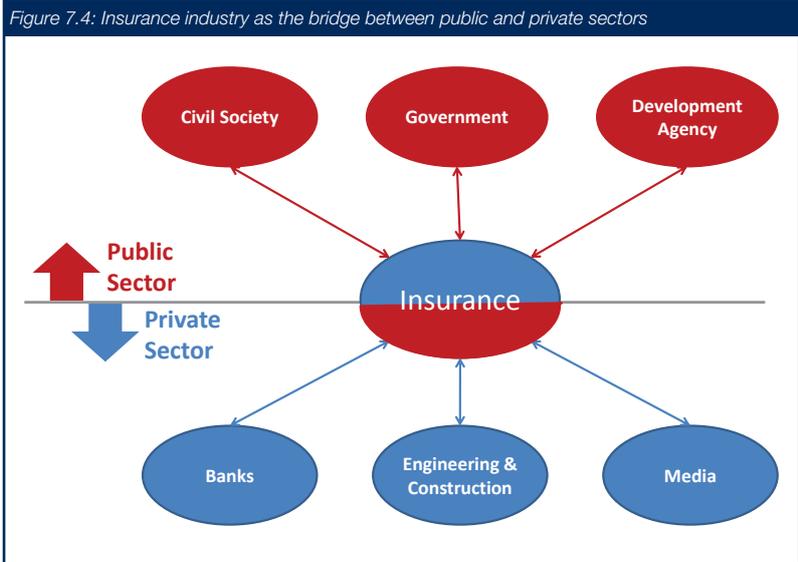
International Community (20)	I	B	E&C	M
	●	●	●	●

The international community should set up an international response plan with the following aspects:

- Re-aligned focus from disaster response to physical preparedness measures to reduce loss of life and to provide overall impact to a country
- Efficient financing through disaster pools, catastrophe bonds or other prepay solutions
- Prescribed disaster response guidelines based on the reduction of human suffering and an understanding of the true cost of aid
- An international response network with fixed resources (e.g., funded airplanes with communications equipment, generators)

7.3 The Private Sector

Role of the insurance industry



The insurance industry, at the centre of Figure 7.4, is the node between the public and private sectors. As a highly regulated industry fulfilling a public service, the insurance industry can act as a bridge between public and private sectors through its understanding of risks. As seen throughout this report, the insurance industry is central to most recommendations and crucially is in a position to connect resilience to financial preparedness.

United Kingdom: To promote contract certainty and to help avoid disputes, the Association of British Insurers has issued a code of good practice. The code, which is not compulsory, provides simple rules so that both insurers and insureds have clarity on terms of insurance contracts.

Source: Association of British Insurers

7. Defining roles for action

Interview with the ClimateWise chairman



“The insurance industry can play a positive role in helping developing countries adapt to natural disasters and climate change”

Mr. Andrew Torrance is CEO of Allianz Insurance and Chairman of ClimateWise, an initiative of leading insurers, aiming to respond to and reduce the myriad risks faced by economies and societies.

What can insurers do to help developing countries?

The insurance industry can play a positive role in helping developing countries adapt through expertise in risk management and the cost effectiveness of proposed resilience measures. Insurance pricing free from political intervention can send strong signals to incentivize adaptation by informing economic actors about the risks they face and recognizing when those risks have been reduced. Insurance products can be developed or tailored to cover the risks affected by climate and weather events. ClimateWise highlighted the importance of resilience to the UNFCCC negotiators at Cancun.

What barriers does the insurance industry face when creating developing world solutions?

Insurance models depend on good quality data. Therefore, a long-term plan from policy-makers to capture good quality and insurance relevant earth observation data is critical.

It is crucial for individuals, businesses and governments to be aware of the risks they face. Accurate and regularly updated risk maps, which illustrate the level of hazard to which a stakeholder is exposed, help raise awareness and assist future planning decisions.

The insurance industry has been working to build trust in developing regions where the concept of risk transfer is often quite alien. A partnership among many local stakeholders, including the media, businesses and aid agencies, is critical. Policy-makers must help by delivering the relevant global regulatory frameworks; a level playing field with high goals is crucial where competitive pressure is high.

ClimateWise recently worked with other insurance industry initiatives to create a statement on adapting to climate change in developing countries. This statement highlights the important role of the country risk officer to work with other stakeholders to reduce barriers and coordinate action.

Private Sector (21)

I	B	E&C	M
●	●	●	●

The private sector has a number of roles and resources which constitute parts to each of the recommendations in this report.

These include:

- Technical know-how
- Human resources
- Risk Modelling
- Distribution channels
- Source of funding
- Risk management tools

Conclusions and next steps

8. Conclusions and next steps

The conclusions of this report are grouped around three core issues of risk awareness, physical resilience and financial preparedness, emphasizing the respective roles of the major stakeholders.

Risk awareness

Creating risk awareness initiates changes in behaviour towards natural disaster risk. Capturing risk data, the first step to creating awareness, is often lacking in lesser-developed countries. To overcome this barrier, funding from the international community and know-how from the private sector should be provided. Using this data to create a behavioural change requires understanding human psychological tendencies and how these may be overcome. Academic research and multiple channel delivery, supported by government legislation may increase effectiveness. Finally, correctly-priced insurance can provide another tool, using the insurance industry as both an information provider and educator.

The involvement of the community through initiatives such as the safer schools partnership (discussed below) may encourage increased awareness and behavioural change.

Physical resilience

With increasing uncertainty of natural disaster risk and demographic shifts putting more people in harms way, enhanced physical resilience is critical. Planning processes must deter construction in high-risk areas. Where this is unavoidable, structures must be engineered to withstand the hazards to which they will be exposed. Better building should be achieved through frequent code improvements using engineering and academic experts to identify building failure modes and best construction techniques. Improved supervision of construction should ensure building codes are enforced and buildings are used for their designated purposes. Existing structures should be retrofitted to comply to new codes, with economic incentives through insurance or public sector products that tie investment to property.

Physical resilience measures should be coordinated by a central coordinating body, which this report calls a country risk officer. This entity should be empowered to work across government departments and construct partnerships with external stakeholders. The private sector's underused knowledge and capacity should be tapped to provide technical and disaster-risk management expertise.

For lesser-developed countries investment in resilience may be cheaper than expected. Programmes with organizations such as Engineers Without Borders or private sector firms may provide cost effective solutions. Ensuring that the poor are not forced to live in high-risk locations requires up-to-date risk maps and government planning. The international community should provide some of this funding with the aim to rebalance funding from disaster response towards pre-disaster resilience measures.

8. Conclusions and next steps

Financial preparedness

Financial preparedness requires risk awareness. Awareness of the benefits of financial preparedness can stimulate demand for insurance and other risk-transfer mechanisms. However, a number of fundamentals for insurance are lacking in lesser-developed countries. Where traditional insurance is unavailable there are alternative risk transfer mechanisms to transfer liability from communities and the public sector.

Microinsurance can transfer risk and in time may initiate traditional insurance where it is not available. Catastrophe bonds and country or multinational funds should be used to limit liability at a regional or national level.

These tools can provide additional coverage for events the traditional risk-transfer sector cannot handle in developed countries. The public sector should acknowledge its role as payer of last resort to provide the insurance industry with certainty and manageable liability limits.

8. Conclusions and next steps

Next Steps

Dialogue and discussion of issues

The Forum hosted its Annual Meeting of New Champions in September 2010, where Chinese and Asian perspectives on natural disaster risk mitigation were discussed. Further discussions will occur at the Forum's 2011 Annual Meeting in Davos with an opportunity to engage the different stakeholder groups.

Disaster preparedness city scorecard

The city scorecard will be an opportunity to further the dialogue on disaster preparedness with selected municipalities. It will provide a policy tool for discussions on how other stakeholders may be integrated into city planning.

The scorecard will include this report's recommendations, providing a toolkit for assessing their relative benefits and the underlying building blocks. The scorecard uses 10 dimensions comprising financial and physical preparedness measures, and country factors such as rule of law and the political environment. The combination of these 10 dimensions will provide an overall indication of a city's resilience to a natural disaster, with resilience defined as a city's ability to physically and financially mitigate the risk and recover from a natural disaster.

The scorecard will factor in a city's risk probability for natural disasters based on historic patterns to provide a level of comparability between locations. The target audiences for the scorecard include government policy-makers, the insurance industry, engineering and construction firms, and the public.



8. Conclusions and next steps

Cities will be scored on a sliding scale with four quartiles (shown above) for each of the 10 dimensions. The quartiles will be determined according to the peer set of the country in which the city is located (e.g., OECD country, lesser-developed country). The 10 dimensions, or score card sub-pillars, and their organizing pillars are listed below:

Figure 8.1: City scorecard

Pillars	Pre-Disaster Financial Stability		Post-Disaster Financial Robustness		Physical Readiness			Will	
	Sub-Pillars	Access to Capital Markets	Insurance Coverage	Ability to Raise Debt	Ability to Raise Taxes	Physical Standards	Infra-structure	Operational Readiness	Political / Social

Each sub-pillars is comprised of variables that, when calculated together, provide a sub-pillar score that is indicated on the sliding scale above. Below is the listing of the variables that comprise each sub-pillar:

Pillars	Pre-Disaster Financial Stability		Post-Disaster Financial Robustness		Physical Readiness			Will	
	Sub-Pillars	Access to Capital Markets	Insurance Coverage	Ability to Raise Debt	Ability to Raise Taxes	Physical Standards	Infra-structure	Operational Readiness	Political / Social
Variables	<ul style="list-style-type: none"> • Frequency of banking crises • Financial strengths indicator • Manageability of private debt • Local currency sovereign rating • Foreign currency sovereign rating • Aggregate macro-prudential indicator • Manageability of public debt • Credit default swap spreads • Central Bank assets to GDP • Bank deposits to GDP 	<ul style="list-style-type: none"> • Insurance premiums, direct • Insurance density • Real growth of direct insurance premiums • Insurance penetration • Relative value-added of insurance to GDP 	<ul style="list-style-type: none"> • Change in real effective exchange rate • External vulnerability indicator • Dollarization vulnerability indicator • External debt to GDP • Net international investment position to GDP • Member of financial community 	<ul style="list-style-type: none"> • Trade liberalization • Tax avoidance and evasion • Revenue authority capacity • Tax compliance 	<ul style="list-style-type: none"> • Land-use planning • Building codes 	<ul style="list-style-type: none"> • Mitigation of environmental degradation • Engineering intervention • Physical infra-structure robustness 	<ul style="list-style-type: none"> • Emergency response systems • Contingency plans • Training • Education • Number of first responders 	<ul style="list-style-type: none"> • Sufficient set of political actors with common understanding of the problem • Authority to enact needed reforms • Organizational capacity to enact reforms successfully 	<ul style="list-style-type: none"> • Rule of law • Legal infrastructure and capacity to enforce reforms

8. Conclusions and next steps

The variable scores are derived from a number of data sources, all of which are open-source and transparent. To calculate the sub-pillar score that comprises the sliding scale rating, a methodology will be developed in partnership with academic experts to ensure transparency and accuracy.

The goal of the city scorecard is to identify dimensions where the city is performing well (1st or 2nd quartile) and dimensions where the city should improve (3rd or 4th quartile).

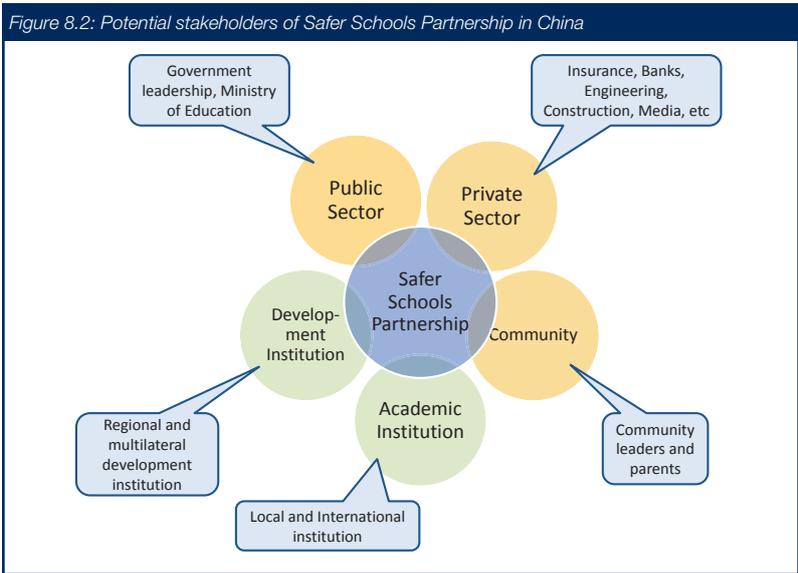
The scorecard has other benefits, including encouraging policy-makers to emphasize pre-disaster planning, both physical and financial, by highlighting and weighting certain variables or drivers. Lastly, the scorecard can promote dialogue between participating cities.

Safer schools Partnership

The Safer Schools Partnership is an initiative that could put into place many of the recommendations of this report. This initiative focuses on data, awareness and risk reduction at a community level. School, as focal points for communities, could be used for the following:

- Building risk awareness through all grade levels and with parents;
- Strengthened buildings – with strong adherence to building codes and safe site location;
- Emergency services, including temporary medical facilities;
- Central response stations for communications hubs, power generators and water storage;
- Muster stations for community gathering; and
- Data collection – hardened measuring stations to capture weather and risk data

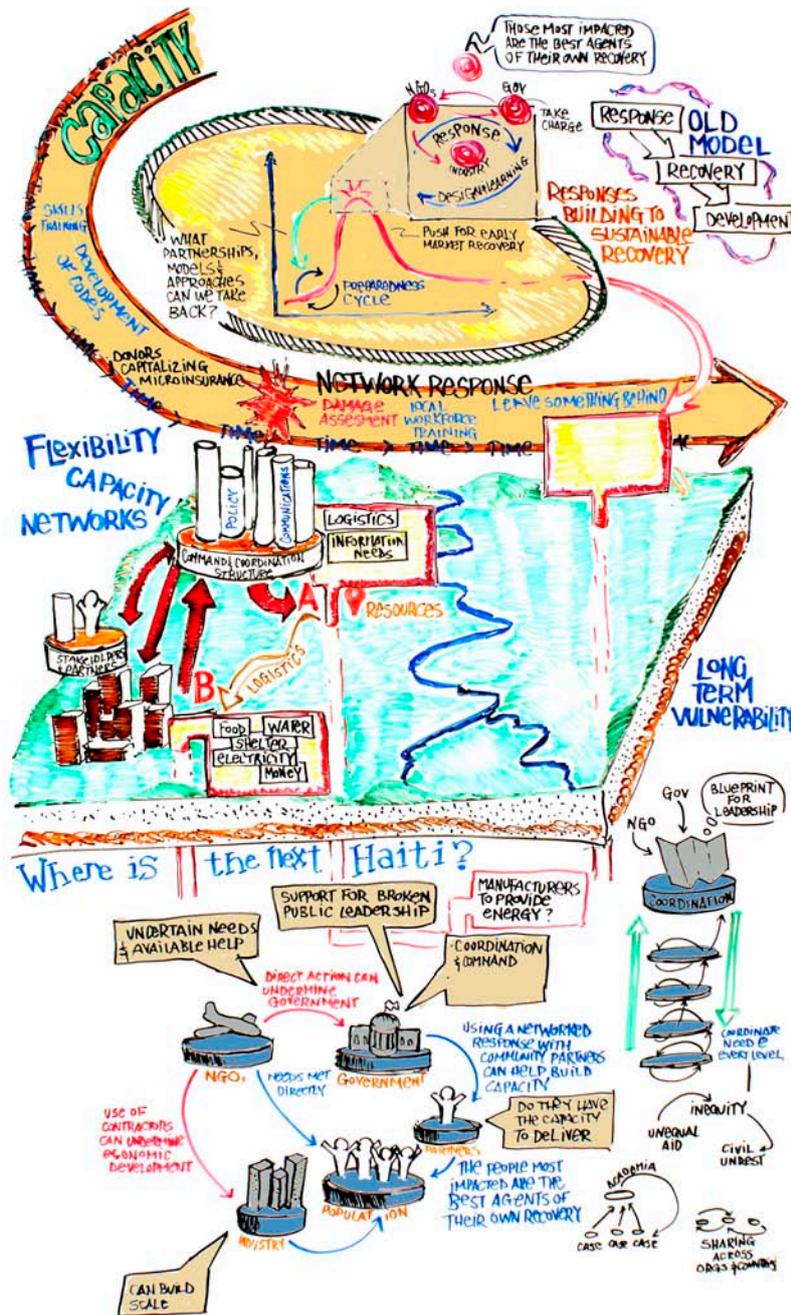
The following figure describes some potential stakeholders and actors for the Safer Schools Partnership.



Davos

9. Davos

The initiative hosted two events at the Forum's World Economic Forum Annual Meeting 2011 in Davos to discuss principles and recommendations presented in this report and broaden the audience of potential stakeholders. The first was a workspace style session²⁷, titled "Earthquake: Public and Private Roles for Risk Mitigation and Response" that took participants through the phases of the natural disaster timeline. The second session, titled "Mitigating Risks and Building Resilience for Natural Catastrophes", investigated several questions arising from the recommendations.



²⁷A WorkSpace session involves facilitated brainstorming where breakout groups use artists to represent outcomes, as shown above.

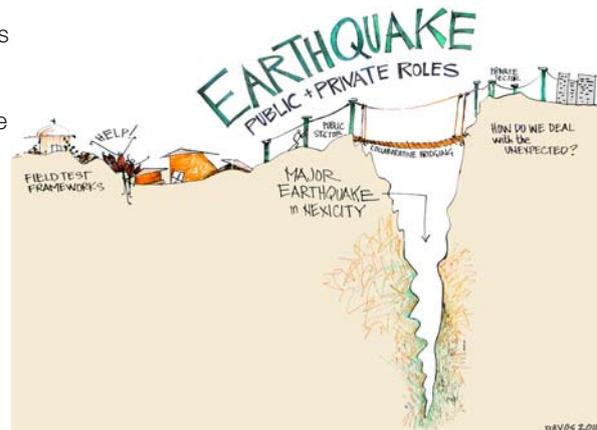
Earthquake: Public and Private Roles for Risk Mitigation and Response

Wednesday 26 January 09.00 - 12.00

Session introduction

An earthquake strikes an urban centre. Several stakeholders assemble to respond to the disaster, including government, business, the United Nations and Red Cross, and civil society. The clock is ticking. The stakeholders need to make best use of all available resources.

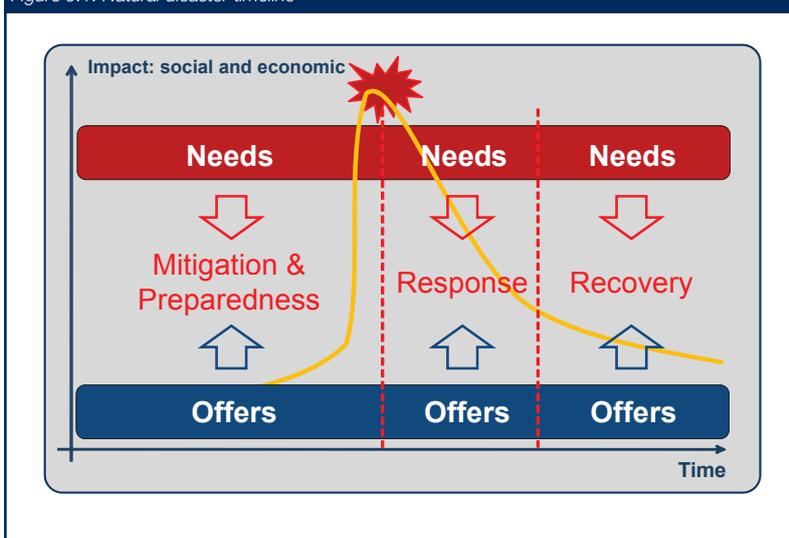
1. What are the immediate and long-term needs in the different phases of a disaster?
2. How can the private sector take a more active, integrated role in all phases of disaster management?
3. What would this combined stakeholder framework look like for risk mitigation, preparedness, response and recovery?



Session initiation

The session began with a simulation of an earthquake using a soundscape with vibrations, followed by a newscast to set the scene. Further details of the extent of the disaster were provided by the moderator, John Kao, who introduced the natural disaster timeline with its three phases (shown below), which were to act as a guide to the participants.

Figure 9.1: Natural disaster timeline



9. Davos

Participants then chose a group that either represented a phase of the natural disaster (termed need) or an industry (termed offer). The following discussion leaders led the groups:

Group	Discussion Leader	Organization		
Needs	Mitigation & Preparedness Phase	Howard Kunreuther James G. Dinan Professor; Professor of Decision Sciences and Public Policy	The Wharton School, University of Pennsylvania	
	Response Phase	Unni Karunakara President	Médecins Sans Frontières International	
	Recovery Phase	Bekele Geleta Secretary-General	International Federation of Red Cross and Red Crescent Societies (IFRC)	
Offers	Financial Services Industry	Michel M. Liès Chairman, Global Partnerships	Swiss Re	
	Logistics, Engineering & Construction Industry	Jack J. Ribeiro Chairman, Global Financial Services Industry	Deloitte	
	Utilities Industry	Jonathan Reckford Chief Executive Officer	Habitat for Humanity	
		Cameron Sinclair Co-Founder and Executive Director	Architecture for Humanity	
		Roberta B. Bowman Senior Vice-President and Chief Sustainability Officer	Duke Energy Corporation	
Moderator	John Kao Chairman and Founder	Institute for Large Scale Innovation		

Session structure

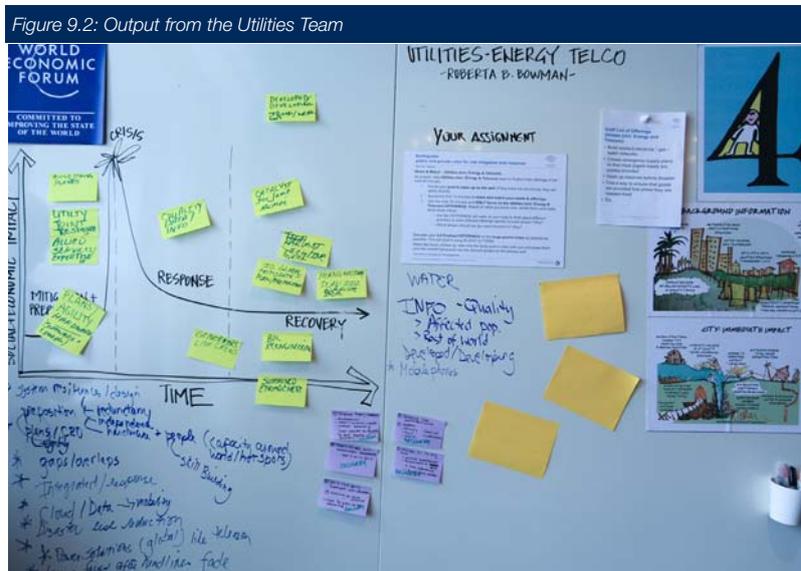
Time	Module	Content	Output
Intro 09:00 (20 min)	Introduction	<ul style="list-style-type: none"> • Earthquake simulation • Introduction of natural disaster timeline • Transition to breakout groups 	
Step 1 09:20 (50 min)	Create and Prioritize Lists of Offers and Needs	<ul style="list-style-type: none"> • What can your industry do to reduce the impact of natural disasters? • What is required in your phase of the natural disaster? 	Explored list of offers or needs, placed on disaster time line
Step 2 10:10 (50 min)	Match Offers to Needs	<ul style="list-style-type: none"> • Where can you match needs and offerings? • What cross-industry solutions needed? 	Offers matched to needs to stimulate further iteration
Step 3 11:00 (60 min)	Report Out, Discussion and Conclusion	<ul style="list-style-type: none"> • Where are good matches, where are gaps? • What are the next steps? 	Present table discussions and matches on plenary disaster time line. Discussion and iterate of key groupings

Step 1: Needs, offers and prioritization

Participants were given a preliminary list of offers (industry teams) or needs (phase teams) and asked to expand on the list and prioritize their top five. Key themes to emerge were:

Needs: improved communication and coordination, better needs and risk assessment, clearer policy frameworks, improved standards and regulation, and participatory approach to empower communities

Offerings: channels for funding, mobile banking, education awareness, capacity building, risk management and sharing infrastructure.



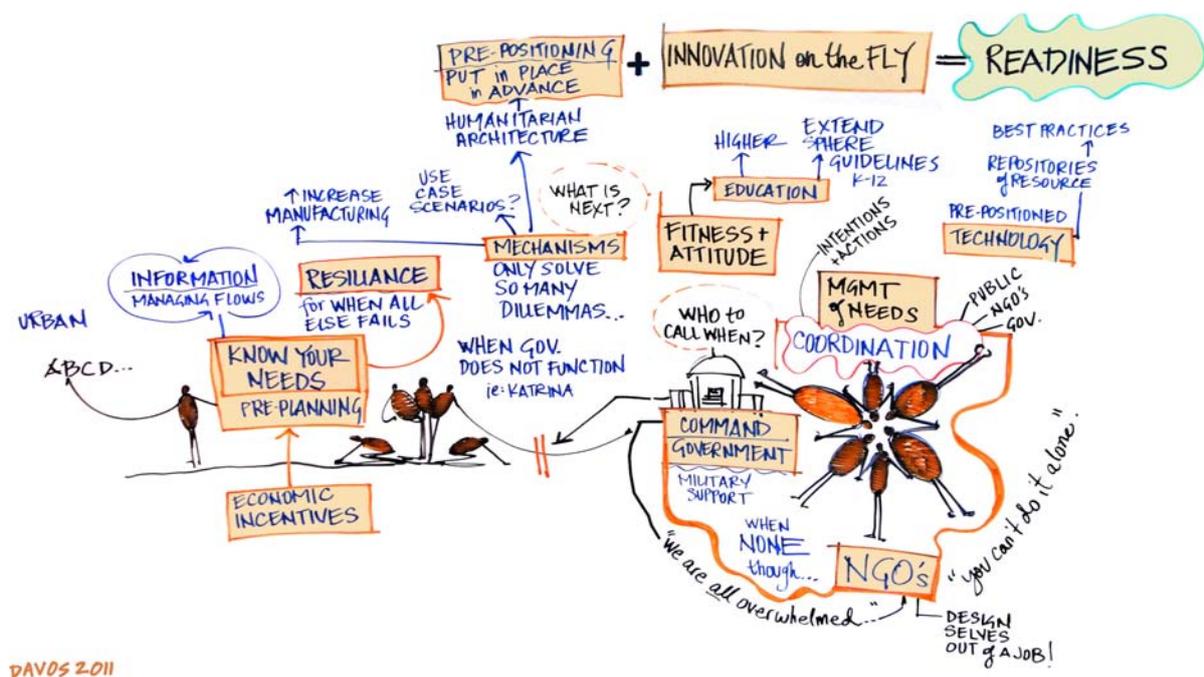
9. Davos

- Link all three phases: mitigation, response, recovery
- Improve coordination among industries, public sector and humanitarian architecture
- Improve information and communication before, during and after a disaster
- Funding: cash availability, loan forgiveness, investment in better building and infrastructure, parametric insurance, support for rebuilding the private sector and microfinance
- Build back better: sustainable building, build in resilience, invest in infrastructure
- Improve regulation, including building codes, standards and policies
- Involve communities: change social norms and education
- Job creation, skills and training, education, cash-for-work, dispatch human capital
- Improve risk and needs assessment, data collection, vulnerability analysis, causes of disaster and scenario planning, leverage technology

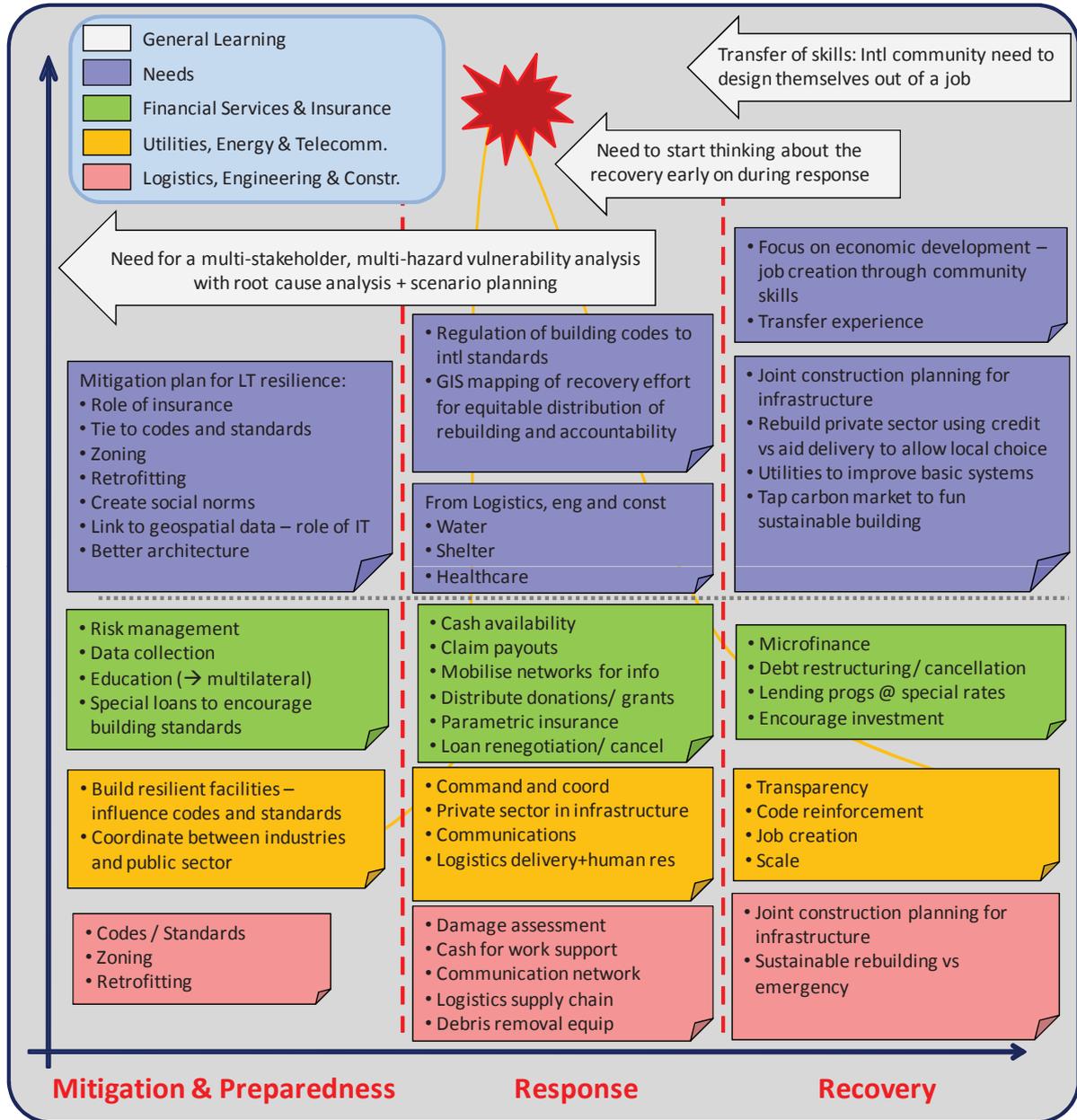
Participants agreed that this is the beginning of a dialogue not the end. The outcomes of this session will be fed into an ongoing discussion with likely follow-on activities either through the Forum or via other interested bodies such as Innovation 20 and UNISDR.



Artist's summary output



Plenary outputs



Mitigating Risks and Building Resilience for Natural Catastrophes

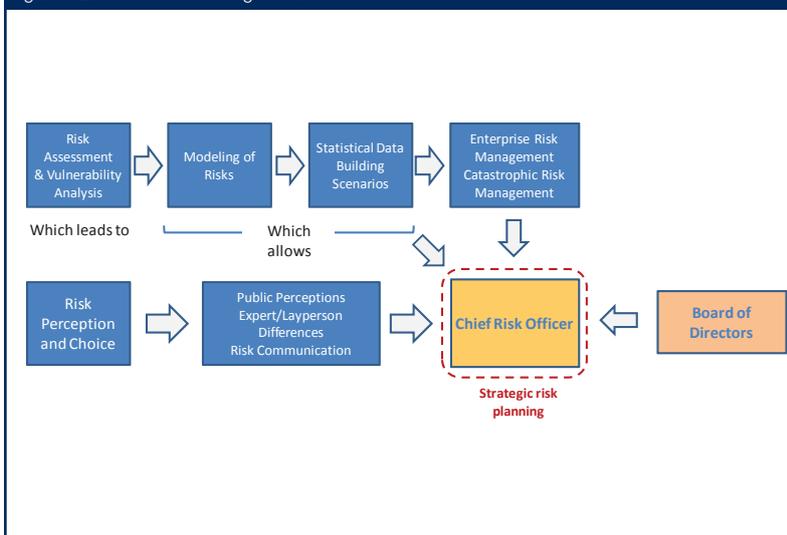
Thursday 27 January 09.00 - 12.00

Overview

The session opened with an introduction to the two Forum reports on risk, *A Vision for Managing Natural Disaster Risk* and *The Global Risk Report 2011*. Howard Kunreuther from the Wharton Risk Center of the University of Pennsylvania then presented an overview of the outcomes from the previous day's earthquake simulation, along with the conceptual framework for mitigating risk in the boardroom called the Global Risk Management Framework (shown below). Among the key points were:

- Risk should be assessed by determining the likelihood of alternative scenarios and the uncertainties surrounding these estimates.
- It is important to understand how different stakeholders perceive risks based on their values and agendas when making choices.
- Strategies for enterprise risk and catastrophe management should be based on the risk assessment and risk perception components of the Global Risk Management Framework.
- A Chief Risk Officer could have the responsibility for coordinating the risk management strategies, including multi-hazard mitigation plans.

Figure 9.2: Global Risk Management Framework



Discussion leaders and public figures

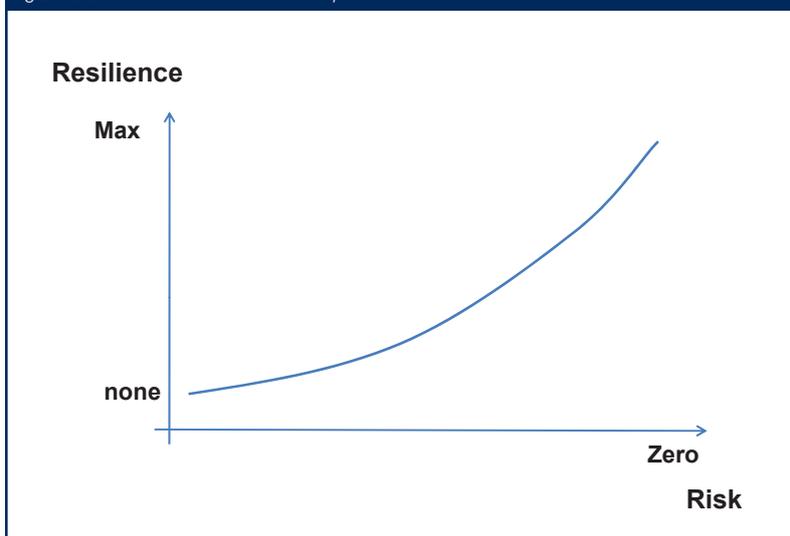
Participants then divided up into these five discussion groups with the discussion leaders and public figures.

Discussion Group	Discussion Leader	Public Figure
1. Building True Systemic Resiliency	Angela Wilkinson Director, Futures Programmes Smith School of Enterprise and the Environment (SSEE)	 Bekele Geleta Secretary-General International Federation of Red Cross and Red Crescent Societies
2. The Role of Insurance as a Bridge to Enhance Resilience	Erwann Michel-Kerjan Managing Director, Wharton Risk Center The Wharton School, University of Pennsylvania	 Antonio Guterres UN High Commissioner for Refugees United Nations High Commissioner for Refugees
3. Establishing an International Community Role in Disaster Preparedness	N. K. Singh Member of Parliament, India	 Marcelo Luis Ebrard Casaubón Mayor of Mexico City
4. Policy Implications – City Catastrophe Preparedness Scorecard	Andrew Power Partner Deloitte	 Baroness Amos Undersecretary-General for Humanitarian Affairs and Emergency Relief Coordinator UN Office for the Coordination of Humanitarian Affairs (OCHA)
5. Improving Public-Private Collaboration for Risk Mitigation / Safer Schools Partnership	Michel M. Liès Chairman, Global Partnerships Swiss Re	 Lars H. Thunell Executive Vice-President and Chief Executive Officer International Finance Corporation (IFC)
	Geoff Riddell Member of the Group Executive Committee and Regional Chair- man, Asia-Pacific and Middle East Zurich Financial Services	
Moderators	Howard Kunreuther James G. Dinan Professor; Professor of Decision Sciences and Public Policy The Wharton School, University of Pennsylvania	
	Michael Useem Professor of Management and Director, Center for Leadership and Change Management The Wharton School, University of Pennsylvania	

Group 1: Building true systemic resiliency

The group agreed that building true systemic resiliency is unrealistic. What is needed is an understanding of the risk landscape and how it could be influenced through resiliency. The relationship between risk and resiliency was expressed in terms of time, where risk exposure is determined from the historical record from present to past. These known risks and future unknown risks lead to investment in resiliency. Understanding risk preferences through appetite, awareness and perception is an important first step.

Figure 9.3: The risk-resilience relationship



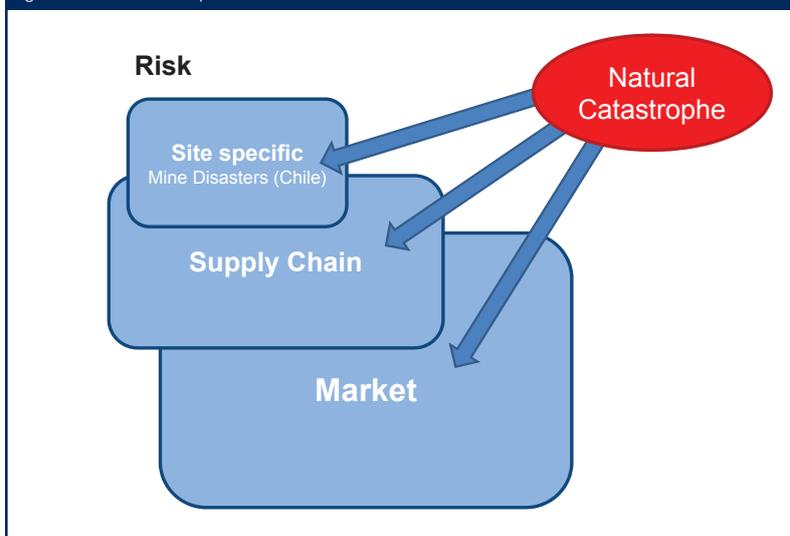
A natural disaster can affect numerous points on the value chain. An example of the consequences to particular industries, such as mining and energy, include:

- Specific damage to a company facility
- Damage to a node or connection in the supply chain
- Knock-on effect to the market

Where should investments be made in risk mitigation and what are the trade-offs?

- Efficiency versus redundancy – how much to invest in capacity to deal with risks
- Investment in innovation, e.g. robotics
- Investment to increase skills to deal with risk

Figure 9.4: Business impact from natural disaster risk



Group 2: The role of insurance as a bridge to enhance resiliency

The insurance industry should work on the following initiatives to reduce the impact of natural disasters:

- Community education on “your” risk exposure
- Transfer risk expertise and knowledge
- Create a national campaign on the value of investment in resiliency
- Develop national insurance schemes, such as the Caribbean Fund which includes Haiti and the Mexico catastrophe bond
- Speed up reconstruction through fast payment and contingency planning

Group 3: Establishing an international community role in disaster preparedness

Participants agreed that the international community must play a significant role in both disaster preparedness and response. Coordination in response is critical as there can be many international organizations and charities putting resources and people on the ground with little understanding of the bigger picture and their overall role in solutions. An international master coordination body should provide assistance to these organizations and ensure that they work in conjunction with local city, regional and national plans.



Group 4: Policy implications – city catastrophe preparedness scorecard

The group agreed that a city scorecard would be valuable in reducing the effects of natural disasters and brainstormed how to create it. In terms of disasters, natural catastrophes are easier to define and quantify than anthropogenic disasters, although they share many of the same solutions.

Figure 9.5: Business impact from natural disaster risk

Pre-Disaster Financial Stability		Post-Disaster Financial Robustness		Physical Readiness			Will	
Access to Capital Markets	Insurance Coverage	Ability to Raise Debt	Ability to Raise Taxes	Physical Standards	Infra-structure	Operational Readiness	Political / Social	Legal
<ul style="list-style-type: none"> • Frequency of banking crises • Financial strengths indicator • Manageability of private debt • Local currency sovereign rating • Foreign currency sovereign rating • Aggregate macro-prudential indicator • Manageability of public debt • Credit default swap spreads • Central Bank assets to GDP • Bank deposits to GDP 	<ul style="list-style-type: none"> • Insurance premiums, direct • Insurance density • Real growth of direct insurance premiums • Insurance penetration • Relative value-added of insurance to GDP 	<ul style="list-style-type: none"> • Change in real effective exchange rate • External vulnerability indicator • Dollarization vulnerability indicator • External debt to GDP • Net international investment position to GDP • Member of financial community 	<ul style="list-style-type: none"> • Trade liberalization • Tax avoidance and evasion • Revenue authority capacity • Tax compliance 	<ul style="list-style-type: none"> • Land-use planning • Building codes 	<ul style="list-style-type: none"> • Mitigation of environmental degradation • Engineering intervention • Physical infrastructure robustness 	<ul style="list-style-type: none"> • Emergency response systems • Contingency plans • Training • Education • Number of first responders 	<ul style="list-style-type: none"> • Sufficient set of political actors with common understanding of the problem • Authority to enact needed reforms • Organizational capacity to enact reforms successfully 	<ul style="list-style-type: none"> • Rule of law • Legal infrastructure and capacity to enforce reforms

- Prioritize cities that are vulnerable
- Structure of the scorecard: financial/physical/political
- Importance of what to include
- City type: high rise, slums, townships
- Risk vulnerability analysis
- Independent measurement and assessment

The Forum will take forward the city scorecard idea (see section 10 “Next steps”).

Group 5: Improving public-private collaboration for risk mitigation

Steps to improve public-private-NGO collaboration for risk mitigation include:

- Developing better coordination and more robust communication
- Establishing a Country (Regional/State) Risk Officer to provide holistic consideration of risk, using an all-hazards approach
- The use of public-private partnerships to create preparedness infrastructure

Examples:

- FONDEN, Mexico: placed risk to capital market
- Aga Khan Foundation building project in collaboration with all stakeholders in Pakistan



Group 6: Building safer schools

Participants viewed the safer schools concept as a good opportunity to impact communities in high-risk areas. Many ideas focused on Haiti, although they are applicable to other countries as well. Principal barriers to building safer schools are fraudulent construction and poor building standards. Participants asked whether a global standard for school construction could be adopted with a third party monitoring construction quality. Understanding local community needs and cultural context is important. An annual appraisal to assess and understand risks is important and a way to promote good practices. The focal point of schools in communities makes them natural places for first response and for building risk awareness through the youth. Zurich Financial Services and The Wharton School committed to continue this dialogue and support a safer schools project. The Forum will take forward this idea (see section 10 “Next steps”).

Next steps

10. Next steps

City scorecard and simulation for disaster mitigation

Overview

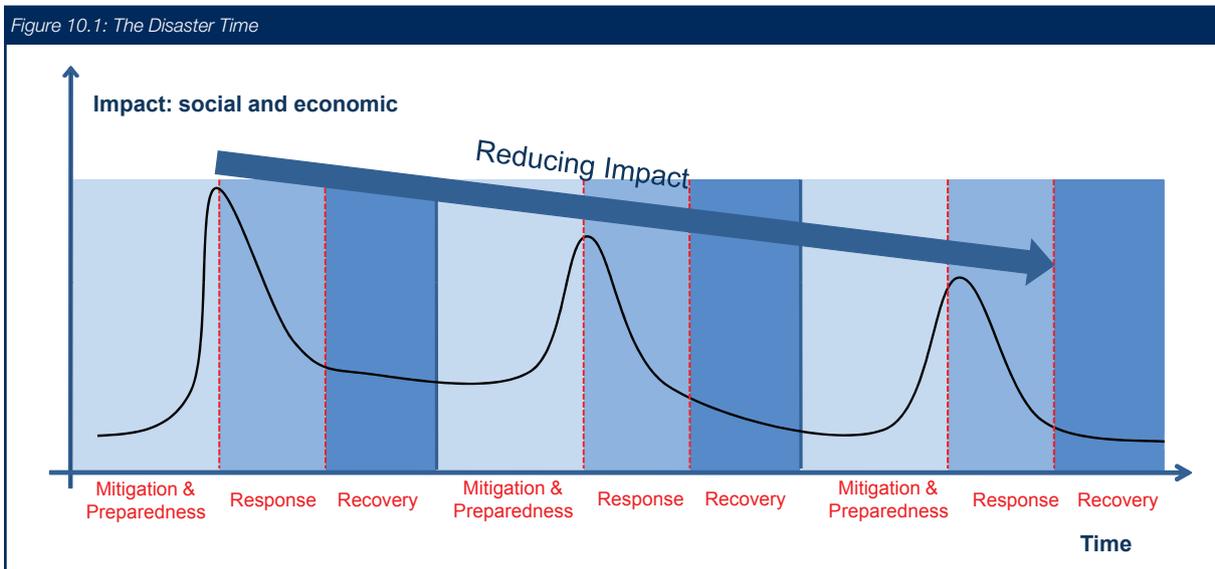
Disasters, both natural and man-made, are severe threats to city dwellers and challenges to mayors and policy-makers. Tough decisions that impact people's lives must be made within economic constraints. The complexity of these decisions combined with the need for long-term planning and coordination make the decision-making process opaque.

To facilitate and enhance this process a city preparedness scorecard produced in conjunction with a facilitated disaster simulation is proposed.

Aims of the scorecard and workshop series

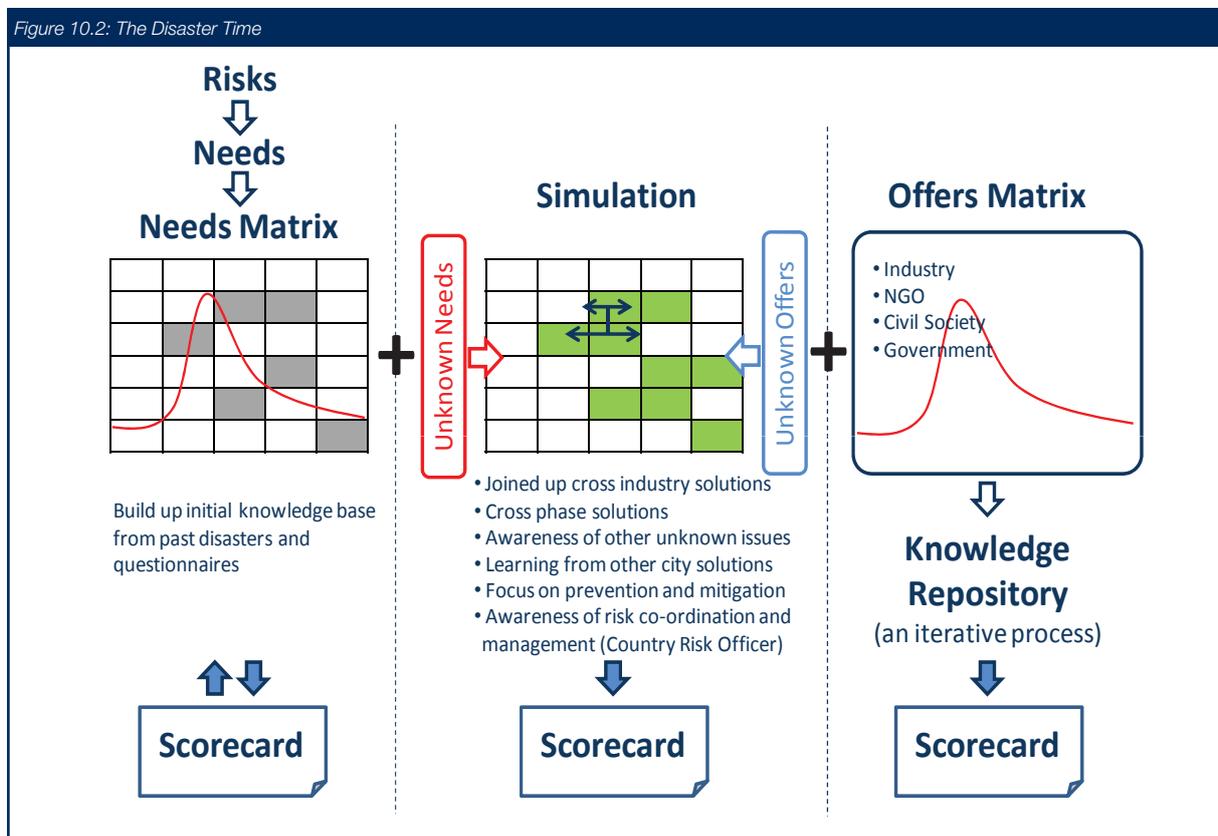
1. Provide an opportunity for city policies to realign against the changing risk landscape while harnessing capacity and knowledge from all areas including the private sector and civil society
2. Partner with the Institute for Large-Scale Innovation to identify needs, problem solve and coordinate solutions across the disaster timeline
3. Provide a coordinated long-term solution incorporating all available resources and build public institutional capacity where required
4. Construct a framework for the inclusion, coordination and management of non- government stakeholders
5. Identify imbalances in risk strategy across different risk categories and propose solutions based on knowledge banks from other cities

Learning from disasters



10. Next steps

Simulation proposal for Jakarta



Output from initiative

Disaster Preparedness City Scorecard – a tool to highlight vulnerabilities of a city and the options available to reduce the risks
 Frameworks for action – an agreement to include private sector and NGOs in the different disaster phases (Mitigation and Preparedness, Response and Recovery)

Building Safer Schools

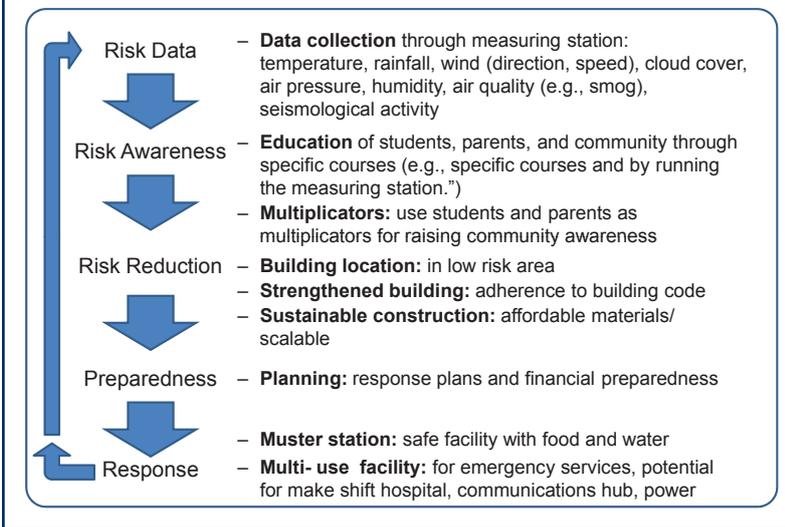
Proposition overview

Building safer schools will help local communities by providing a number of solutions to problems across all three phases of the natural disaster timeline.

Establishing a causal risk chain, shown below, illustrates the importance of risk data and risk awareness to initiate behavioural change. This may lead to change at all phases of the natural disaster timeline, which is a central element of the building safer schools proposition. Initiating data collection, which is often lacking in lesser developed countries, and building awareness are long-term measures requiring a strong and committed group of stakeholders.

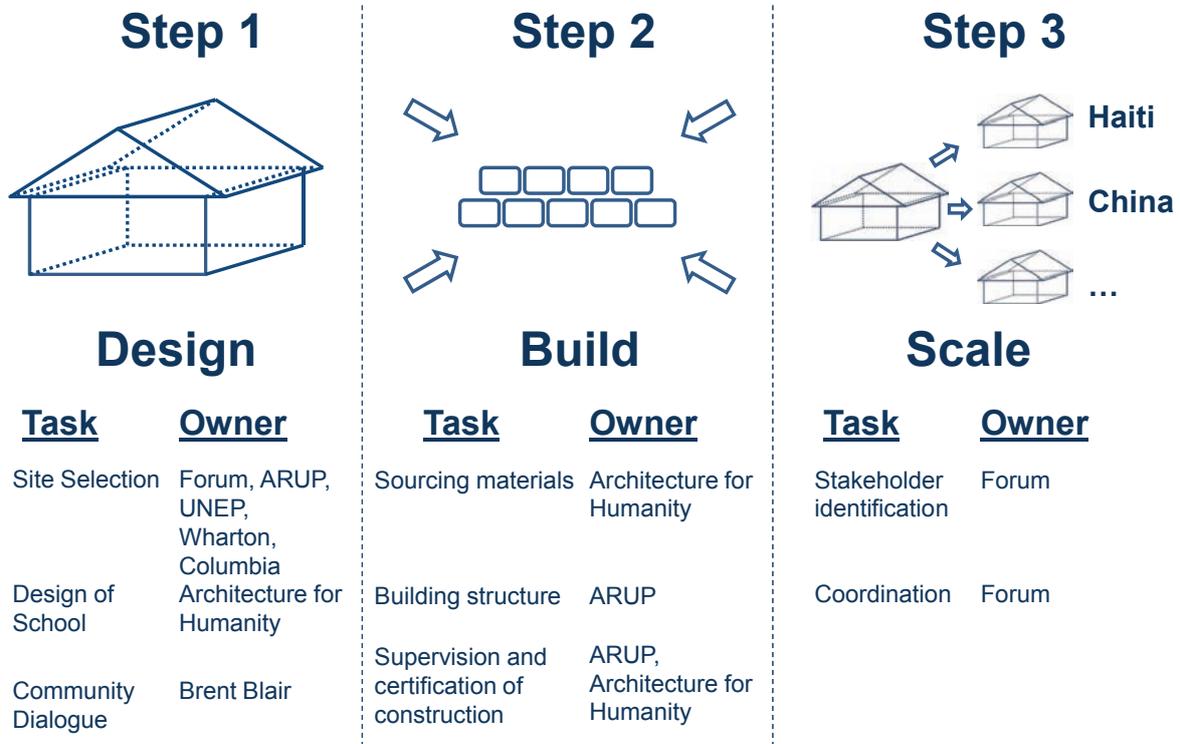
10. Next steps

Figure 10.3: Causal Risk Chain



Schools, as a central part of the community, are key enablers for building awareness through students and parents. Behavioural change should lead to risk reduction measures, such as better locations and more resilient schools. Safer schools will protect children in the event of a natural disaster and can serve as multi-use facilities to provide emergency services for the community.

Project development



The project development outlined above shows three phases for the safer schools initiative, with an initial trial phase for design and build, followed by a scaling phase in Step 3

10. Next steps

Haiti proposal

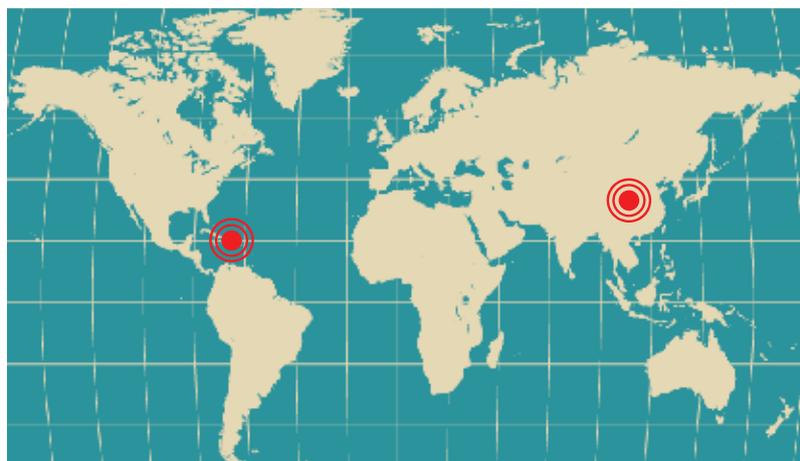
Haiti's vulnerability to frequent natural hazards weakens the government's ability to pursue and maintain momentum toward long-term development goals. Haiti's natural environment has been severely degraded, with little remaining forest cover, soil erosion and destabilized river catchments.

These conditions subject the population to heightened risks from natural hazards. Building safer schools will enhance the resilience of communities. Community involvement in the consultation process, addressing needs and end uses will be central to this project.

Haiti's education system is in crisis. Nearly half of all children are unable to attend school regularly. The loss of civil servants in the earthquake has weakened the government and added to the challenges already faced by national policy-makers. More than 80% of school children attend private schools, many run by churches and NGOs. The schools across the country, in both rural and urban areas, are in desperate need of basic infrastructure improvements. Year one of the project will focus on improving existing structures. In later years, new classrooms and schools will be constructed based on the results of a baseline analysis. Constructing new schools provides an opportunity to make schools more resilient to natural disaster risks. These schools will provide multiple uses in rural Haiti, for example as critical infrastructure for hurricane shelters, evacuation points, and centres for training.

Beyond Haiti to China and other countries

The Safer Schools initiative, while initially focusing on Haiti, will be a tool for improving communities in many developing countries. The model developed here will be scalable and adaptable to other regions.



Annex I: Principles of insurance and commercial insurability

Insurance does not make anything cost less; it simply spreads costs over groups, time and geography. Insurance pricing that accurately reflects the risk of loss can provide a strong incentive for mitigation and preparedness, which ultimately reduce the cost of recovery. If the fundamental economics are maintained, insurance can play an important role in managing risk.

Insurance is a risk management technique that transfers the financial consequences of losses from the insured to an insurer. Insurance is a device under which many insureds contribute to a fund from which the insurer promises to make payments to those insureds suffering losses. It provides benefits not just to the individuals and businesses insured, but also to society as a whole.

- Payments for loss: When an individual or business is paid following a loss, insurance fosters economic, social and political stability. Payment may allow a family-owned business to survive and continue operations. It may stabilize earnings for a larger company, allowing it to continue growing and meeting its responsibilities.
- Reducing uncertainty: Insurance reduces the cost of losses that an individual or business might incur. In doing so, it reduces anxiety for individuals and uncertainty for society as a whole. Reduced uncertainty, in turn, leads to additional benefits:
 - More efficient use of resources: When businesses feel more secure about the future, they make better use of existing capital and labour, resulting in increased productivity.
 - Social stability: By reducing uncertainty, insurance lessens tensions, physical stress, and concern about the future.
 - Better price structures: When businesses buy insurance, they substitute the certainty of an insurance premium for the uncertainty of an estimate of expected losses. As a result, prices can be more accurate and fairer.
 - Increased competition: Because insurance provides certainty, it improves the ability of smaller businesses to compete with larger ones and levels the competitive playing field.
- Improved loss-control activity: Insurers provide risk management services that help insureds prevent or minimize losses.
- Reduced risky behaviour: When insurers can freely select risks, they avoid exposures prone to excessive losses. When they have pricing freedom, insurers charge high rates for high-risk exposures. Both practices, over time, incentivize society to avoid risky behaviours and practices, such as overbuilding in catastrophe prone areas.
- Source of funds: Insurers are a source of funds for investments. They purchase government, corporate bonds and equities.²⁸

²⁸Rejda (2007).

Commercial insurability

Because of the potential for abuse that comes with a business selling complex promises to consumers, insurance has long been regarded as a business affected with the public interest. In most jurisdictions, insurance is heavily regulated. Like all other players in the private sector, insurers want to avoid serious financial reversals and make reasonable returns on their operations. One way they meet these objectives is by providing insurance only on loss exposures that are commercially insurable.²⁹ While no exposure is perfect, some meet the conditions of commercial insurability better than others.

For an exposure to be commercially insurable, many potential insureds must be exposed to the loss. Moreover, the potential loss must be serious enough relative to the premium charged that many will buy insurance. Finally, an insurer's exposure portfolio must be well diversified, so that not all loss events occur at the same time.

All these conditions are needed for the law of large numbers to apply. A fundamental insurance principle states that as the number of independent exposure units increases, the actual loss experience tends to approach the expected experience. If premiums are to be statistically based, there must be a sufficient number of past exposures to analyse. The stronger the statistical base, the more attractive the exposure is to an insurer.

For commercial insurability, exposure units should face about the same probability of loss and potential severity. The greater the variation in likelihood of an insured occurrence and severity of potential losses, the more exposure units the insurer must have to predict loss experience accurately.

The loss amount should be definite or subject to reasonably precise estimation. Besides allowing for accurate loss prediction, this characteristic minimizes loss adjustment problems, thus helping avoid consumer controversy and dissatisfaction. There also should be a predictable legal and regulatory environment that does not revise rules after losses occur.

Expected loss for each insured during the policy period must be calculable. Insurers are in the business of classifying risks and setting rates to match them. For each risk class to be charged an appropriate premium, insurers must estimate expected losses for the policy period. For these predictions to be accurate, future conditions, including legal and regulatory environments, must be similar to those in the past. Otherwise, the insurer must be able to predict changes in underlying conditions and how those changes will affect losses. Thus, commercial insurability favours exposures where changes occur slowly and predictably, if at all.

Losses must be accidental from the viewpoint of the insured. To be commercially insurable, the covered loss cannot be an intended result of the insured's activities. For the law of large numbers to apply, the loss must be a random occurrence.³⁰

²⁹Commercially insurable" means that private insurers (as opposed to public or governmental insurers) are willing to insure the risk.

³⁰Rejda (2007).

Preconditions of insurance

A minimum level of physical defences. Risk transfer and risk prevention are mutually reinforcing. Insurance, when properly priced, provides a strong incentive to invest in physical defences that make economic sense. But keeping insurance prices in check by minimizing risks through prevention measures is equally important. As a result, investing in a minimum level of prevention measures reduces the exposure to risk and ensures that insurance options continue to be affordable for future events,

Education. Insureds must understand their contractual rights and obligations.

Good governance and rule of law. These two factors ensure there is minimal corruption and fair and efficient dispute resolution mechanisms.

Consumer protection. A regulatory framework should ensure transparency and protection against fraud.

Good faith and contract certainty. The insured and the insurer are bound by obligations of good faith, honesty and fairness. Contracts terms should be clear.

Product transparency. There should be the utmost level of openness between the insurance company and the insured. The terms and conditions of insurance products should be clear and understandable.

Banking and stock market development. The availability of private credit and stock capitalization are important metrics for determining the maturity of the financial sector.

Low or moderate levels of inflation. This factor keeps wages constant so that consumers are more inclined to purchase insurance protection for assets.

Competition. Competition in the insurance sector leads to higher levels of efficiency and lower premiums.

Annex II: The Hyogo Framework for Action (HFA)³¹

The Hyogo Framework for Action, adopted by UN member countries in 2005, is an important instrument for disaster risk reduction. HFA has five priority areas:

1. Disaster risk reduction
2. Ensure that disaster risk reduction is a national and local priority with a strong institutional basis for implementation.
3. Know the risks and take action
4. Identify, assess, and monitor disaster risks, and enhance early warning.
5. Build understanding and awareness
6. Use knowledge, innovation, and education to build a culture of safety and resilience at all levels.
7. Reduce risk
8. Reduce risk factors, through sustainable development and effective financial safety mechanisms.
9. Be prepared to act
10. Strengthen disaster preparedness for effective response at all levels.

Crucial for implementing HFA is collaboration and cooperation between states, regional organizations and institutions, and international organizations, which all have a role to play.

The United Nations International Strategy for Disaster Reduction (UNISDR)³² is the focal point for implementing the HFA. The UNISDR is the Secretariat of the International Strategy for Disaster Reduction (ISDR) system. The ISDR system is a strategic framework comprised of nations, intergovernmental organizations, NGOs, financial institutions, technical bodies and civil society, which work together and share information to reduce disaster risk. Some of the ISDR system partners are introduced in Annex III.

The Global Platform for Disaster Risk Reduction is the main forum for concerted emphasis on disaster reduction, providing strategic guidance and coherence for implementing HFA, and for sharing experiences and expertise among all stakeholders.

In its 2009 global assessment report,³³ UNISDR states that progress towards reducing disaster risk is still mixed. In general terms, countries are making significant progress in strengthening capacities, institutional systems and legislation to address deficiencies in disaster preparedness and response. Good progress is also being made in other areas, such as enhancement of early warning. In contrast, countries report little progress in mainstreaming disaster risk reduction considerations into social, economic, urban, environmental and infrastructural planning and development. Predictably, high-income countries outperform low- and middle-income countries across all five HFA priorities.

³¹See *International Strategy for Disaster Reduction (2005)*.

³²http://www.unisdr.org/eng/about_isdr/isdr-mission-objectives-eng.htm.

³³See *United Nations (2009)*

Annex III: Initiatives within the Hyogo Framework for Action (HFA)³⁴

The following organizations and initiatives are important partners in HFA.

World Bank

World Bank is the largest provider of development assistance for disaster recovery and risk mitigation. It supports partner countries to mainstream hazard risk management in development strategies. Mainstreaming hazard risk management in Poverty Reduction Strategy Papers and Country Assistance Strategies requires advocacy and awareness among the national planners and policy-makers followed by appropriate public expenditures to achieve desired results. World Bank has established a Global Expert Team for disaster risk reduction to provide high quality rapid advisory support to governments in disaster risk assessments, risk reduction, risk transfer and insurance products, post-disaster needs assessment and recovery and reconstruction operations.

United Nations Development Programme (UNDP):

Through its Bureau for Crisis Prevention and Recovery, UNDP supports disaster-prone countries in the development of legislative frameworks, operational systems and coordination mechanisms to ensure the integration of risk reduction into economic development. It designs training courses for government officials. UNDP has established a Global Risk Identification Program and responds quickly and effectively in the recovery phase following a disaster.

United Nations Office for the Coordination of Humanitarian Affairs (OCHA):

OCHA seeks to incorporate disaster risk reduction into humanitarian work and strengthen preparedness for effective humanitarian response. OCHA focuses on operational preparedness, as well as on supporting institutional preparedness through engagement with national governments, strengthened legal frameworks and resource mobilization initiatives. It is involved in strengthening national capacities for tsunami early warning and response systems in the Indian Ocean. OCHA works closely with other disaster preparedness initiatives.

United Nations Educational, Scientific and Cultural Organization (UNESCO):³⁵

UNESCO promotes a shift in thinking from post-disaster reaction to pre-disaster action. UNESCO helps countries reduce vulnerability to natural hazards and build capacity to cope with disasters. It provides governments with advice on disaster reduction and a forum to find solutions. In post-disaster settings, UNESCO's Intergovernmental Oceanographic Commission plays a leading role in the implementing early warning systems.

Vulnerability and Capacity Assessment (VCA) of International Federation of the Red Cross and Red Crescent Societies (IFRC):

VCA is an assessment process used by Red Cross and Red Crescent National Societies in their work with communities. It uses hazard/risk mapping, resource maps, Venn diagrams, community focus groups, seasonal charts, historical charts, and household and neighbourhood assessments.

³⁴<http://www.preventionweb.net/english/professional/contacts/>.

³⁵http://portal.unesco.org/science/en/ev.php-URL_ID=6774&URL_DO=DO_TOPIC&URL_SECTION=201.html.

Red Cross Red Crescent Centre on Climate Change

This centre seeks to make national Red Cross and Red Crescent societies aware of the risks of climate change for vulnerable people and to assist them in developing disaster risk reduction programmes. It fosters dialogues with policy-makers on inclusion of climate change related risks in disaster risk reduction strategies. It promotes research on linkages between climate change, extreme weather events, vector borne diseases and other climate change related risks to develop adequate response strategies and programmes.

World Health Organization (WHO):

WHO promotes disaster risk management research for effective health-risk reduction. In its Safe Health Infrastructure programme, WHO encourages to development of health facilities capable of remaining functioning after a disaster.

WHO identifies priority causes of ill health and death to support member states in coordinating action for health, to ensure that critical gaps in health response are rapidly filled and to revitalize and build capacity of health systems for preparedness and response.

World Meteorological Organization (WMO):³⁶

Disaster-risk reduction is a mission of WMO, and of the countries that are member of its National Hydrological and Hydrometeorological Services. WMO's activities include observing, detecting, monitoring, predicting and early warning of a wide range of weather-, climate- and water-related hazards. Working with its partners, WMO addresses information needs and requirements of the disaster risk management community.

United Nations Operational Satellite Applications Program (UNOSAT):

UNOSAT seeks to make satellite imagery and geographic information easily accessible to the humanitarian community and experts working to reduce disasters and plan sustainable development.

UN University – Institute for Environment and Human Security (UNU-EHS):

UNU-EHS addresses risks and vulnerabilities caused by environmental hazards. It aims to improve understanding of cause and effect relationships to find ways to reduce risks and vulnerabilities. The institute supports policy-makers with authoritative research and information.

International Recovery Platform (IRP)

IRP is an initiative of United Nations organizations and other partners. It seeks to transform the post-disaster recovery process into opportunities for sustainable development. It functions as an international repository of knowledge and as a networking mechanism for recovery.

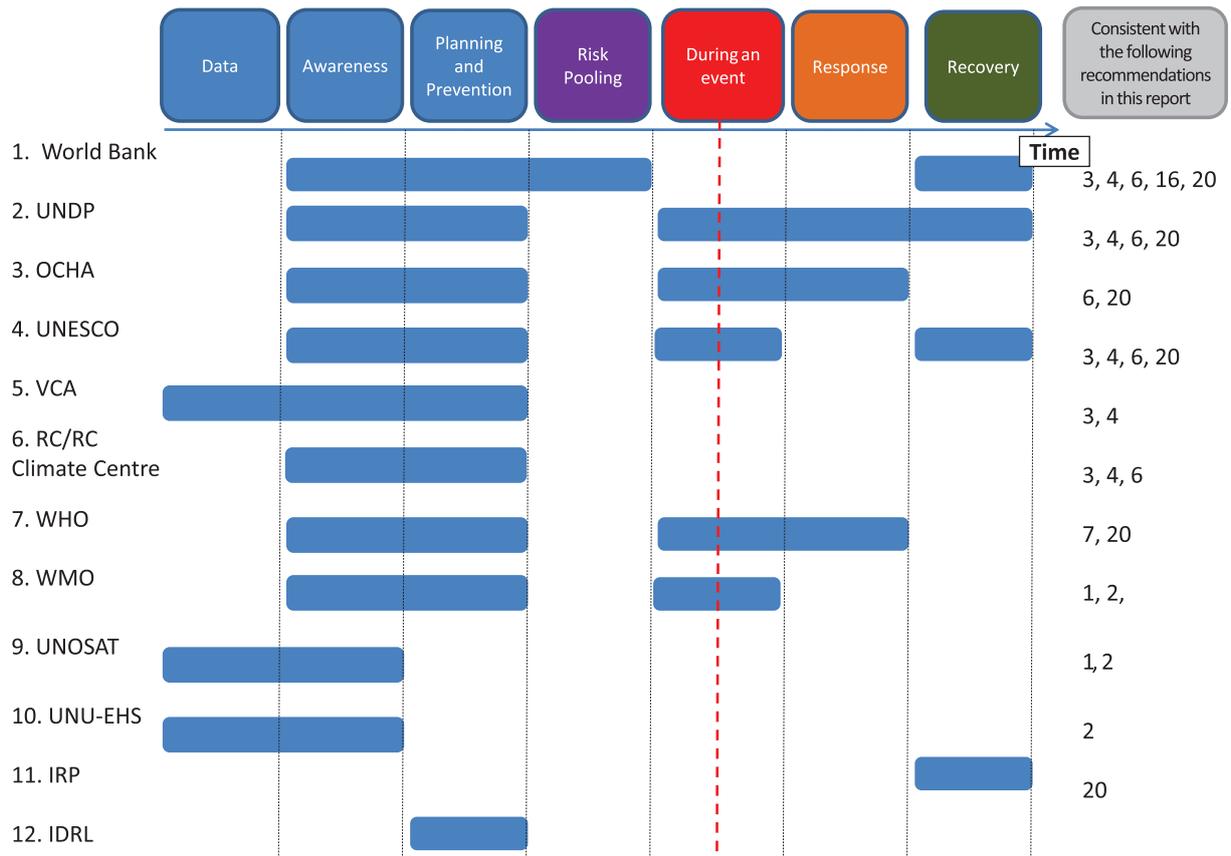
International Disaster Response Laws, Rules and Principles (IDRL)

An initiative of IFRC, the IDRL programme emphasizes the need for “legal preparedness” to facilitate and regulate international response when disasters occur, as a component of general disaster preparedness.

³⁶<http://www.wmo.int/pages/prog/drr/>

Annex IV: Disaster timeline mapping of initiatives

This figure illustrates where the listed organizations and initiatives apply on the disaster timeline and their consistency with this report's recommendations.



Annex V: Best practices of state pools

Country - Scheme	Risks covered	Form of cover	Cover purchase	Cover price	Indemnity limits	Deductibles	Who issues the policy	Public Private Partnership	State guarantee
California - California Earth-quake Authority (CEA)	Earthquake (shake, not subsequent events: fire, etc.)	Direct insurance, reinsured by CEA	Earthquake cover compulsorily offer by direct insurers	A premium according to dwelling value, type and date of construction, location and preventive measures	Limits per policy Limit of the system capacity: 8,5 bn US\$	Yes	CEA	Participation of insurers and reinsurers in CEA is voluntary	No
Japan- Japan Earthquake Reinsurance (JER)	Earthquakes, volcanic eruptions and tsunamis	Direct insurance Reinsurance by JER (Excess of loss)	Facultative for policyholders Compulsory for insurers (linked to a fire policy)	A tariff according to location (risk level) and type of construction	Aggregated limit per event: JPY 5.5 trill	No	Private companies	Yes Direct cover: private market Reins. (compulsory): JER, retroceded to Non-life insurers and Government	Limited, according to the reinsurance scheme
New Zealand- Earthquake Commission (EQC)	Earthquakes, tsunami, volcanic eruption, landslides, hydrothermal activity. Storm & flood cover to land. Cover includes fire following any of these perils	Direct insurance Reinsurance: International market	Compulsorily linked to a fire policy	A single premium: 0.5 per thousand on the insured amount. General application	Dwellings NZ\$ 100,000 Contents NZ\$ 20,000 Land to market value	Yes	No policy issued. Cover is in the Statute	Yes Market: premium collection, EQC: claims handling	Yes. Unlimited
Mexico -Fondo Nacional para Desastres Naturales	Any unforeseeable natural event of a catastrophic magnitude exceeding state's own capacity to respond with their own budgets	Federal and State Agencies	States and Federal Agencies automatically enrolled into program	Created within the framework of the Federal Budget		Yes	Federal FONDEN Trust and State FONDEN Trust	No	Yes
Taiwan - Taiwan Residential Earthquake Insurance Fund (TREIF)	Earthquakes (and consequential events: flood, tsunami, landslide, etc.)	Direct insurance (coinsurance pool) Reinsured by TREIF	Compulsorily attached to the fire policies for dwellings	Uniform annual premium (surcharge: 15 %) (risk premium: 85%)	Aggregated limit per event		Private companies	Yes	Yes (Up to the aggregated limit of the system)
Turkey - Turkish Compulsory Insurance Pool (TCIP)	Earthquake (fire, landslide...)	Direct Insurance Reinsurance by Alternative Risk Transfer	Compulsory for every dwelling inside the boundaries of municipalities	Premium depending on risk zone, type of construction and square area of the dwelling	Maximum insured capital depending on type of construction	Yes	TCIP policies arranged through accredited insurance companies	Yes (private management of the Pool by Garanti Insurance)	

Annex VI: Physical preparedness measures

Issues	Measures & Techniques	Natural Disaster			
		Earthquake	Hurricane	Volcanic Eruption	Floods
Planning	Development of the settlement network in accord with hazard macrozoning; priority of lower hazard zones for settlement development	√	√		√
	De-concentration of population and of economic activities within high-hazard areas	√	√		√
	Land-use zoning in harmony with hazard microzoning indications	√	√		√
	Restrictions against residential business and industrial sites in areas of high hazard	√	√		√
	Low plot ratio and lower than standard densities of population and of development	√			
	Restrictions on developments situated downstream of large dams	√	√		√
	Spatial separation of potentially dangerous industrial installations (oil refineries, gas storage, nuclear power stations, chemical plants, etc)	√			
	Green, isolating belts between industrial and other such as residential commercial districts	√			√
	Green belts and green corridors within urban areas to prevent spread of firestorms	√			√
	Specify sea level/natural hazard thresholds or indicators (informed by climate projections) as a basis for setting coastline building rules for set-back/elevation/removal of buildings and infrastructure	√	√		√
Infrastructure	Revise land-use designations and permitted building/infrastructure forms in the light of natural hazard assessment, informed by climate change projections	√	√		√
	Identify vulnerable buildings and infrastructure, and prioritize a replacement programme or rectification programme during reconstruction	√	√		√
	Development of the settlement network in accord with hazard macrozoning; priority of lower hazard zones for settlement development	√	√		√

Annex VI: Physical preparedness measures

Issues	Measures & Techniques	Natural Disaster			
		Earthquake	Hurricane	Volcanic Eruption	Floods
Water and Sewage	Duplication of major supply sources and lines	√	√		√
	Emergency back-up drinking water supply	√	√		√
	Water reservoirs for fire fighting	√			
	Perform scenario-based dam failure analysis to assess impact of flood and build flood control dams on streams		√		√
	Build floodwalls and/or levees along streams		√		√
	Construct underground river passes for pipelines and adequate settling basins;		√		√
	Plant and maintain vegetation cover of the watershed, use landfill to raise ground level.		√	√	√
	Repair or replace elements, pipe connections, equipment, and accessories that are defective or at poor quality	√	√	√	√
	Minimize fill in wetlands and flood plain		√	√	√
	Maintain flood plain vegetation buffers		√	√	√
	Preserve natural drainage system		√		√
	Deepen, widen and/or line streams		√	√	√
	Clear debris and/or obstructions in streams		√		√
	Stabilize river banks and construct wetland		√	√	√
	Provide structural retrofitting of the components	√	√	√	√
Relocate components if possible or provide permanent covers to protect storage and treatment tanks and setting basins	√	√	√	√	
Power	Restriction of overhead power lines within populated and urbanized zones (crucial in earthquake and cyclone-prone regions)	√	√	√	
	Back-up power by off-grid power supplies, emergency fuel supplies (e.g. diesel generator), or/and uninterrupted power supplies (UPS)	√	√	√	√
	Continuous power system for critical services (data centre, communication system), buildings (e.g. medical facilities, police, fire stations, army) and infrastructure (emergency street lights)	√	√	√	√
	Additional structural strengthening for power plants	√	√		√
	Protect critical plants against landslides, rockslides, and floods	√	√		√

Annex VI: Physical preparedness measures

Issues	Measures & Techniques	Natural Disaster			
		Earthquake	Hurricane	Volcanic Eruption	Floods
Transport	Duplicate access (roads to every distinct part of zones, districts, etc)	√	√	√	√
	Duplicated road crossings of natural barriers (rivers, canyons, etc)	√	√	√	√
	Safeguarding operational capacities of major components of transportation lines (streets, intersections, squares etc) against being blocked by falling debris (appropriate rights of way, distances from buildings)	√	√	√	√
	Added fill to raise elevation of roads				√
Communication	Install the required detection, communication, warning and evacuation systems (e.g. communications, signal processing and real-time detection system for tsunami)	√	√	√	√
	Choose and update the appropriate technologies	√	√	√	√
	Alternative means of communication in emergency situation	√	√	√	√
	Back-up power for critical infrastructure (e.g. data centre)	√	√	√	√
Emergency facilities	Green and open spaces as evacuation routes and evacuation zones – in vicinity of every significant concentration of population and within residential districts	√	√	√	√
	Maintain system and space of emergency access routes, and co-ordinate with contingency evacuation plans	√	√	√	√
	Contingency stores of building materials and of prefabricated components for emergency shelters	√	√	√	√
	Definition of location of emergency operations centre with minimal vulnerability to the most common hazards in the area	√	√	√	√
	Reserve locations for intermediate post emergency recovery	√	√	√	√
	Design emergency response plan	√	√	√	√
	Emergency exit routes from inner blocks	√			

Annex VII: Related World Economic Forum Initiatives

Global Risk Report

In a complex and interconnected landscape of global risks, there is the prospect of rapid contagion and disastrous impact on organizations, governments and societies. At the same time, understanding the global risk landscape can offer new opportunities for growth and innovation. The Forum's *Global Risks* report serves as a guide to understanding the most important global risks over the next 10 years, harnessing the insights of the world's leading network of risk experts through the Forum's Risk Response Network.

What Is the Risk Response Network?

Launched in January 2011, the Forum's Risk Response Network (RRN) brings together the world's leading network of risk experts to explore new and innovative approaches to understanding, mitigating and encouraging a collective response to a broad range of global risks. Through innovative risk assessment and analysis, such as the *Global Risks* report, the Forum and its network of risk experts generate knowledge and insights in risk resilience and response, foster the unique interaction of experts across domains and encourage new responses that create real impact on managing and mitigating global risks. The RRN builds on the four core pillars of the World Economic Forum: communities, interaction, insight and impact.

About the Project

The *Global Risks* report is useful for policy-makers, CEOs, senior executives and thought leaders around the world to enhance their understanding of how a comprehensive set of global risks is evolving, how their interaction impacts a variety of stakeholders and what levers and trade-offs are involved in managing them.

The distinctiveness of the Forum's *Global Risks* report lies in its perspective on global risks and its underlying methodology.

- *A unique perspective:* The Forum focuses on a broad set of global risks, examining their interconnections and dynamics to both address the causes, rather than the symptoms, of global risk and to identify effective points of intervention in underlying structures and systems. Difficult trade-offs and the threats of unintended consequences are explored and a longer term approach is taken to global risk assessment and response.
- *A unique methodology:* The initiative is based on the Forum's *Global Risks Survey*, the perceptions of over 500 experts, business leaders and policy-makers on a selection of global risks tracked by the Forum. The insights are developed further on interviews and in workshops with a broad set of multidisciplinary experts as well as business, public sector, academic and civil society leaders experienced in global risks.

Engagement

The *Global Risks* report engages members of the Global Agenda Councils and Community of Risk Officers, as well as a broad set of risk expertise from across the Forum's industry, government and thought leadership communities.

Leading Practices Exchange

Global risks are increasingly interrelated and have wide-ranging impacts across organizations and systems. However, addressing risks in isolation can lead to overall organizational and systemic weakness, as experienced through the global financial crisis. The Leading Practices Exchange provides a platform for decision-makers to share best practices on how their organizations proactively manage a broad range of risks. The initiative will leverage risk experts' knowledge in risk preparedness and risk mitigation techniques to increase organizational resiliency and contribute to new thinking in global risk management.

About the Project

While shaping the community and fostering engagement within it, the main purpose of the Leading Practices Exchange is to launch a peer-to-peer exchange of insights on managing external risks affecting organizations. Through the exchange, the community will benefit from a much broader range of approaches and options for managing and mitigating risk and closing the "knowledge-action gap" between what we know about risk and what is actually implemented to manage it. This insight will enable the community to make a positive impact on the world by applying the best techniques to make organizations and systems more resilient and responsive to managing a broad range of risk areas. Collaboration across industries and sectors will contribute to a much deeper understanding of how best practices in one area can be applied to others. The Leading Practices Exchange will be shaped in two ways:

- *Meetings*: Discussions will be initiated at a series of workshops and meetings of industry and other risk experts, the first of which will be held in April 2011.
- *Online*: A virtual Repository of Leading Practices is being put in place to continue the discussion from live events, bring in a wider group of risk experts and create and curate a lasting library of knowledge exclusive to the Forum's Risk Response Network. It will build and expand on the social networking features of WELCOM³⁷, allowing collaboration, sharing and the evaluation of best practices among the community.

Global Agenda Council on Humanitarian Assistance

Description of the issue

Since last year, the world has witnessed millions of fellow humans affected by crises: in Pakistan, Sri Lanka, Gaza and other long-standing conflict areas; in Vietnam, Indonesia, the Philippines and the Pacific, as a result of weather extremes and earthquakes; and in many other countries affected by the global food crisis and the fall-out from the global recession. The earthquake that devastated Haiti was more than a wake-up call to the international community. It has catapulted humanitarian assistance to the front lines.

The humanitarian caseload will become more complex. In addition to the short-term impact of the financial crisis, growing and unprecedented problems caused by climate change, the pressure on natural resources and sudden shocks can be foreseen. These problems will intensify political instability and risk and bear most heavily on weak and fragile states. Vicious

³⁷WELCOM is the World Economic Forum's Internet-based knowledge sharing and communication portal.

feedback loops and the risk of downward spirals are expected as each risk factor exacerbates the others. These trends are likely to continue. The humanitarian sector will need not only to improve its own capabilities but also to further support the rest of the international system in addressing the root causes of humanitarian crises.

Dimensions

Because of the combination of the likely increased frequency of extreme events and the importance of the more gradual changes in risk, the council has developed a new approach to humanitarian response, more focused on pattern and structures – the Vulnerability and Protection “Business Model”. This model engages actors around six key points:

- A comprehensive risk framework
- A reworked balance of spending between response, prevention and recovery
- A big investment in national and local capacity for response, prevention and recovery
- Fuller engagement of the private sector
- Linking the humanitarian to broader social and economic development issues
- Regional and international readiness to address cross-border humanitarian issues

The council will focus on the following dimensions:

- **Interconnected global trends and risks aggravating people’s vulnerability**

There is a strong need to identify key trends such as population growth and rethink the way risks are assessed, monitored and managed to plan for a more efficient response. In the future, these risks will increase, not diminish, and could undermine the livelihoods of millions, lead to migration on an unprecedented scale and undermine good governance in the world’s most fragile countries.

- **Strengthening the humanitarian response cooperation system by developing tri-sector partnerships**

The council will promote the concept of tri-sector partnerships, bringing together the three key groups of actors – business, government including intergovernmental organizations, and the not-for profit sector of NGOs and community organizations. These tri-sector partnerships hold the key to successful investment in building local resilience to both natural and man-made disasters, and will be locally driven, nationally coordinated and globally supported. The council will also provide intellectual guidance to the Disaster Resource Partnership and the Logistics Emergency Teams, two public-private partnerships initiated by the World Economic Forum.

- **Bridging the gap between relief, recovery and prevention/preparedness activities**

Humanitarian assistance goes beyond responding quickly to an emergency, as the way help is delivered can possibly hamper the recovery phase, and considerably delay the reconstruction effort. The recovery phase, eventually leading to what is usually considered as development activities, must encompass prevention and preparedness measures to build back better and improve people’s resilience. Consideration of these humanitarian activities will be conducted for both conflict cases and natural disasters.

Disaster Resource Partnership – engineering & construction industry partnership for disaster response

More than 250 million people each year are affected by natural disasters. The annual number of natural disasters has more than doubled since 1980 as a result of climate change, population increase and rapid urbanization. Disasters such as the 2010 earthquake in Haiti demonstrate how pressing the issue of humanitarian assistance is. A new understanding of the crucial role that the private sector can play is now changing the thinking of the traditional humanitarian actors.

A unique opportunity exists to develop innovative public-private partnership solutions. The Disaster Resource Partnership enables the core strengths and existing capacities of the Engineering & Construction (E&C) community to be mobilized during and after crises to reduce suffering and save lives.

A partnership built on successes and lessons learned

The Engineering & Construction Disaster Resource Partnership (DRP) is a new model for coordinated private sector partnership in response to natural disasters. The DRP builds on the original concept and intent of the Engineering & Construction Disaster Resource Network (DRN) launched by the E&C Governors in response to the Gujarat earthquake in 2001. It has been developed through case studies of past private sector interventions, through numerous workshops and interviews with key humanitarian actors in disasters, and with continuous input and direction provided by the working group executives of the E&C Members and Partners.

Disaster Resource Partnership “Build Back Better” at all levels

The DRP is structured to allow the activities of individual organizations to be facilitated through engagement at the national level, through the development of DRP National Networks and at the global level, through the development of the DRP International Services component:

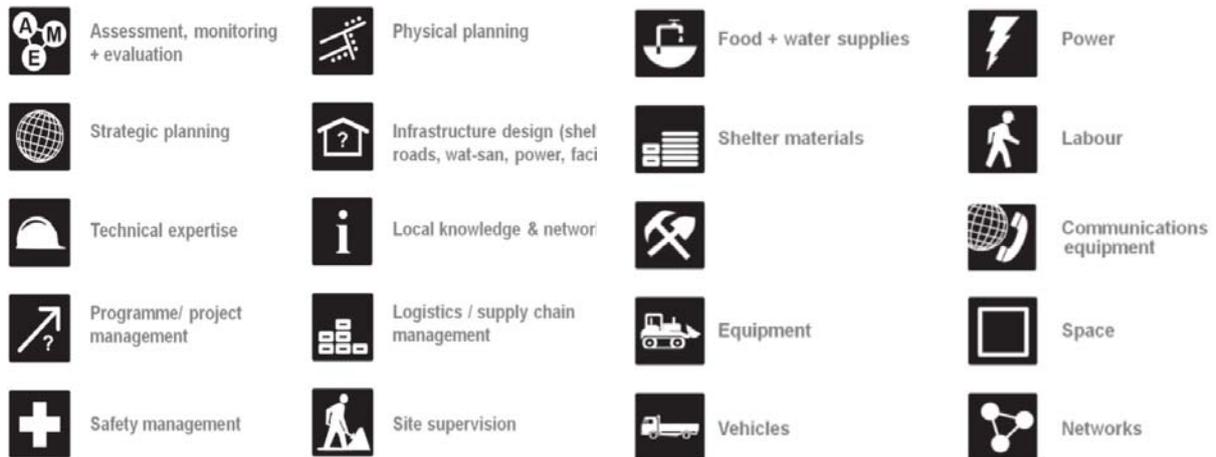
- **DRP National Networks** will engage local companies and staff from E&C companies in active preformed partnerships with government and key humanitarian actors to improve coordination in all aspects of natural disaster preparedness, response and recovery.
- **DRP International Services** will operate within the framework of the global humanitarian cluster system and in partnership with key humanitarian organizations relevant to the E&C sector.

Leveraging the assets, services and engagement of the E&C industry

The emphasis has shifted from seeing the private sector as a donor to being a doer. The DRP builds on the core strengths and existing capacities of the companies involved and leverages the contribution that companies often already make in times of natural disasters. Mobilization will depend on each company's proximity to the disaster-affected area, its assets and skills, and the needs of affected communities.

The added value of the E&C industry in disaster response and mitigation

- In the immediate aftermath of a disaster, a construction company already operating in the affected area is well placed to contribute labour, materials and equipment, as well as mobilizing networks and supply chains that can save lives and reduce suffering.
- In the months following a disaster, the E&C industry has specific knowledge and technical expertise essential to promoting early recovery, particularly the reinstatement of infrastructure essential to establishing supply chains and making health and education facilities operational. The industry can also provide services such as damage and hazard assessment, hydrological surveys, seismic expertise, design, planning and programme management.
- Early engagement in the relief and recovery phases means that E&C companies are well placed to contribute strategically to longer term planning of reconstruction, playing a critical role in mitigating the risk of future disasters.



A compelling business value proposition

The humanitarian imperative is the most significant driver for companies to join the DRP. Experience based on a detailed assessment of 14 case studies involving E&C companies demonstrates that significant internal value is created within the companies involved. In addition, long-term business opportunities in the recovery and reconstruction phases arise as a result of companies' involvement in the initial stages.

The business case

Preparedness	Relief	Recovery	Reconstruction
<ul style="list-style-type: none">• Strengthen local relationships• Reinforce brand, reputation, values• Staff development	<ul style="list-style-type: none">• Strengthen local relationships• Reinforce brand, reputation, values• Staff development	<ul style="list-style-type: none">• Strengthen local relationships• Reinforce brand, reputation, values• Staff development• Direct business opportunities	<ul style="list-style-type: none">• Strengthen local relationships• Reinforce brand, reputation, values• Staff development• Direct business opportunities• Business development

The DRP objectives for 2011 and beyond

- Support existing national networks in India and Mexico and catalyse new national networks
- Establish partnerships and framework agreements with humanitarian organizations, donors and governments that:
 - Facilitate the engagement of national networks locally
 - Facilitate the delivery of global E&C expertise at the global and local level (in countries where national networks exist and in countries where no national network exists)
- Capture and share best practices and institutional knowledge between national networks and with humanitarian organizations and academic institutions
- Provide a focal point and voice for the E&C sector in global humanitarian coordination

References

- Allen, M., et al. «Liability for Climate Change? Experts view on a potential emerging risk.» Munich Re, 2010
- Allianz SE. "Learning to insure the poor", 2010.
- Asian Development Bank. "Positioning ADB's Disaster and Emergency Assistance Policy in a Changing Regional Environment", 2008.
- Barratt, B., et al. "Earthquake Insurance: Nevada Consumer's Guide", State of Nevada, Department of Business and Industry, Division of Insurance. http://www.doi.state.nv.us/scs/doc/EarthquakeInsurance_A.pdf, 2010.
- Basnet, S., et al. "Kathmandu Valley's Earthquake Scenario." In National Society for Earthquake Technology–Nepal (NSET-Nepal), 1998.
- Beers, D., et al. "Standard & Poor's Speculative-Grade Sovereign Debt Recovery Ratings." RatingsDirect, 2007.
- Below, R., et al. "Disaster Category Classification and Peril Terminology for Operational Purposes." Working Paper, 2009.
- Berke, P, Smith, G. "Hazard mitigation, planning, and disaster resiliency: challenges and strategic choices for the 21st century", in Planning the Risk: Spatial Planning as a Strategy for Mitigation and Adaptation to Natural Hazards. Amsterdam: NL: ISO Press, http://hazardscenter.unc.edu/diem/documents/01_Berke_Smith.pdf, 2009.
- Blumel, W. "Naturkatastrophen und Versicherungswirtschaft – Handlungsoptionen, Szenarien der aktuellen und zukünftigen Entwicklung. In Hauptseminar Physische Geographie Naturrisiken, 2002 / 2003.
- Borensztein, E., et al. "Aid Volatility and Macro Risks in Low-Income Countries." Working Paper No. 273, OECD Development Center, 2008.
- Bowen, A., Stern, N. "Environmental policy and the economic downturn", Centre for Climate Change Economics and Policy, Working Paper No. 18, Grantham Research Institute on Climate Change and the Environment, Working Paper No. 16, 2010.
- Boyer, M., Porrini, D. "The Efficient Liability Sharing Factor for Environmental Disasters: Lessons for Optimal Insurance Regulation", In The Geneva Papers, 2008, 33.
- Brainard, L. "What is the role of insurance in economic development?" Zurich Government and Industry Affairs thought leadership series, 2008.
- Brinkhoff, T., "The Principal Agglomerations of the World". <http://www.citypopulation.de/world/Agglomerations.html>, 2010.
- CEA Insurers of Europe. "Reducing the Social and Economic Impact of Climate Change and Natural Catastrophes: Insurance Solutions and Public-Private Partnerships", Brussels, 2007.
- CBC News. "The world's worst natural disasters", <http://www.cbc.ca/world/story/2008/05/08/f-natural-disasters-history.html>, 2010
- Charpentier, A. "Insurability of Climate Risks", In The Geneva Papers, 2008, 33.
- Chemarin, S., Picard, P. "Insurance and Adaptation to Climate Change", In The Geneva Papers, 2008, 33.
- Ciborowski, A. "Physical development planning and urban design in earthquake-prone areas". In Engineering Structures, 1982, July, 4, 153–158.
- Clemo, K. "Preparing for Climate Change: Insurance and Small Business", In The Geneva Papers, 2008, 33.

References

- Cooke, J. "Public-Private Partnerships to Cover Terrorism Risks in OECD Countries." OECD Conference on Catastrophic Risks and Insurance. 22-23 November 2004.
- "Creating a Technical Foundation for Earthquake Insurance in China." Risk Management Solutions Inc., 2005.
- Crichton, D. "Role of Insurance in Reducing Flood Risk", In *The Geneva Papers*, 2008, 33.
- Cummins, J.D. "Should the Government Provide Insurance for Catastrophes?" *Federal Reserve Bank of St. Louis Review*, July/August 2006, 88(4), pp.337-79.
- Davies, M., et al. "Climate Change Adaptation, Disaster Risk Reduction and Social Protection. In *Promoting Pro-Poor Growth: Social Protection*, 2009.
- Dechezleprêtre, A., et al. "What drives the international transfer of climate change mitigation technologies? Empirical evidence from patent data", Centre for Climate Change Economics and Policy, Working Paper No. 16, Grantham Research Institute on Climate Change and the Environment, Working Paper No. 14, 2009.
- Dietz, S., Fankhauser, S. "Environmental prices, uncertainty and learning", Centre for Climate Change Economics and Policy, Working Paper No. 12, Grantham Research Institute on Climate Change and the Environment, Working Paper No. 10, 2009.
- Dietz, S., Hepburn, C. "On non-marginal cost-benefit analysis", Centre for Climate Change Economics and Policy, Working Paper No. 20, Grantham Research Institute on Climate Change and the Environment, Working Paper No. 18, 2010.
- Dlugeolecki, A. "Climate Change and the Insurance Sector", In *The Geneva Papers*, 2008, 33.
- Economics of Climate Adaptation. "Shaping Climate-Resilient Development: a framework for decision-making". Climate Works Foundation, Global Environment Facility, European Commission, McKinsey & Company, The Rockefeller Foundation, Standard Chartered Bank and Swiss Re, 2009.
- Faure, G., Fiore, K. "The Coverage of the Nuclear Risk in Europe: Which Alternative?", In *The Geneva Papers*, 2008, 33.
- Fankhauser, S. "The costs of adaptation", Centre for Climate Change Economics and Policy, Working Paper No. 8, Grantham Research Institute on Climate Change and the Environment, Working Paper No. 7, 2009.
- Fraser, E. "Economic crises, land use vulnerabilities, climate variability, food security and population declines: will history repeat itself or will our society adapt to climate change?", Centre for Climate Change Economics and Policy, Working Paper No. 1, 2009.
- Freeman, P., et al. "Being Prepared: Natural disasters are becoming more frequent, more destructive, and deadlier and poor countries are being hit the hardest." In *Finance & Development*, 2003.
- Freeman, P., et al. "Government Natural Catastrophe Insurance Programs." OECD Conference on Catastrophic Risks and Insurance. 22-23 November 2004.
- Fujikura, M., et al. "Overview of Japanese Earthquake Insurance and Its Characters – Proceedings ASTIN." The Institute of Actuaries of Japan Catastrophic Risk Research Group, 1999.
- Gatzert, N., et al. "The Influence of Corporate Taxes on Pricing and Capital

References

Structure in Property-Liability Insurance.” Working Papers on Risk Management and Insurance No. 24, 2006.

Gurenko, E. Catastrophe Risk and Reinsurance: A Country Risk Management Perspective. London: Risk Books, 3-16, 2004.

Guzmán, J., et al. “Population Dynamics and Climate Change.” UNFPA and International Institute for Environment and Development, 2009.

Hamin, E., Gurrán, N. “Urban form and climate change: balancing adaptation and mitigation in the U.S. and Australia”. In *Habitat International*, 2009, 33, 238-245.

Harmeling, S., et al. “Global Climate Risk Index 2010: Who is Most Vulnerable? Weather-Related Loss Events Since 1990 and How Copenhagen Needs to Respond.” In *Germanwatch*, 2009.

Hoch, S., Kunreuther, H. *Wharton on Making Decisions*. New York: John Wiley & Sons, Inc., 2001.

Hochrainer-Stigler, S. et al. “The Costs and Benefits of Reducing Risk from Natural Hazards to Residential Structures in Developing Countries”, Working Paper # 2010-12-01, The Wharton School.

Hoeppe, P. “Geohazards: Minimizing Risk, Maximizing Awareness, The Role of the Insurance Industry.” 2008.

Hoeppe, P. “High Demand for Climate Data in the Insurance Industry for Risk Modelling and Development of New Insurance Products.” 2009.

Hoeppe, P. “Trends of Natural Disasters – the Role of Global Warming.” *Geo Risks Research*, Munich Reinsurance Company, 2007.

Hofman, D., et al. “Insuring Public Finances Against Natural Disasters - A Survey of Options and Recent Initiatives. International Monetary Fund Working Paper, 2006.

International Institute of Applied Systems Analysis (IIASA)/ Risk Management Solutions (RMS)/ The Wharton School, University of Pennsylvania. “The Challenges and Importance of Investing in Cost-Effective Measures for Reducing Losses from Natural Disasters in Emerging Economies”, 2009.

Insurance Information Institute. “Residual Markets”, White Paper, <http://old.iii.org/media/hottopics/insurance/residual/>. 2009.

Intergovernmental Panel on Climate Change. “Climate Change 2007 – Mitigation of Climate Change», Fourth Assessment Report (AR4), 2007.

International Monetary Fund. “World Economic Outlook Databases”, <http://www.imf.org/external/ns/cs.aspx?id=28>, 2010.

International Federation of Red Cross and Red Crescent Societies. “World Disasters Report 2010 – Focus on Urban Risk», <http://hdr.undp.org/en/reports/global/hdr2010/>, 2010.

International Strategy for Disaster Reduction. “Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters”, <http://www.unisdr.org/eng/hfa/docs/Hyogo-framework-for-action-english.pdf>, 2005.

Japan Earthquake Brochure. Risk Management Solutions, 2005.

Japan Earthquake Reinsurance Co., Ltd. “Reinsurance of Earthquake Insurance: Mechanism of Reinsurance”, Annual Report, 2009.

Jeworrek, T. “Business Models in Reinsurance: Munich Re’s Positioning.” *Rendez-Vous de Septembre Press Conference*, 2009.

References

- Jongejan, R., Barrieu, P. "Insuring Large-Scale Floods in the Netherlands", In *The Geneva Papers*, 2008, 33.
- Kithiia, J., Dowling, R. "An integrated city-level planning process to address the impacts of climate change in Kenya: the case of Mombasa". In *Cities*, 2010, 27, 466-375.
- Klugman, J., et al. "Overcoming barriers: Human mobility and development. Human Development Report. [www.http://hdr.undp.org](http://hdr.undp.org), 2009.
- Kunreuther, H. "Mitigating disaster losses through insurance". In *Journal of Risk and Uncertainty*, 1996, 12: 171-187.
- Kunreuther, H. "Reducing Losses from Catastrophic Risks through Long-term Insurance and Mitigation". In *Social Research*, Fall 2008, 75, No. 3, 905-930.
- Kunreuther, H., et al. "The Psychology of Natural Hazards: Why do few people in catastrophe-prone areas invest in risk reduction measures?" Issue Brief, Winter 2010.
- Kunreuther, H., Michel-Kerjan, E. "At War with the Weather: Managing Large-Scale Risks in a New Era of Catastrophes". Cambridge: MIT Press, 2009.
- Kunreuther, H., Michel-Kerjan, E. "Encouraging Adaptation to Climate Change: Long-Term Flood Insurance." Wharton School Publishing, 2009.
- Kunreuther, H., Michel-Kerjan, E. "Managing Catastrophes through Insurance: Challenges and Opportunities for Reducing Future Risks." Wharton School Publishing, 2009.
- Kunreuther, H., Michel-Kerjan, E. "Evaluating the Effectiveness of Terrorism Risk Financing Solutions." National Bureau of Economic Research Working Paper # 13359, 2007.
- Kunreuther, H., Pauly, M. "Insuring Against Catastrophes." Wharton School Publishing, 2009.
- Kunreuther, H., Useem, M. "Learning from Catastrophes: Strategies for Reaction and Response", Wharton School Publishing, 2010.
- Larson, D., et al. "Commodity risk management and development, Volume 1." http://econ.worldbank.org/external/default/main?pagePK=64165259&theSitePK=477872&piPK=64165421&menuPK=64166093&entityID=000009265_3981005112553, 1998.
- Leblanc, E. "Challenges of the Renewable Energy Industry Generate New Demands for Risk Advisory: How to Value an Insurance Package from a Financing Perspective". In *The Geneva Papers*, 2008, 33.
- Lenntorp, E. "Hell or High Water? An Economic Analysis of the Swedish Institutions for Flood Risk Management". In *The Geneva Papers*, 2008, 33.
- Linnerooth-Bayer, J., Mechler, R. "Insurance against Losses from Natural Disasters in Developing Countries", DESA Working Paper No. 85, 2009.
- Mahul, O., et al. "Catastrophe Risk Financing in Developing Countries: Principles for Public Intervention." The International Bank for Reconstruction and Development/The World Bank, 2009.
- Martin, R., et al. "The impacts of the Climate Change Levy on business: evidence from microdata", Centre for Climate Change Economics and Policy, Working Paper No. 7, Grantham Research Institute on Climate Change and the Environment, Working Paper No. 6, 2009.
- Maskrey, A., et al. "Reducing Disaster Risk: A Challenge for Development, A Global Report." www.undp.org/bcpr, 2004.

References

- Maynard, T. "Climate Change: Impacts on Insurers and How They Can Help With Adaptation and Mitigation". In *The Geneva Papers*, 2008, 33.
- McDaniels, T., et al. "Fostering Resilience to Extreme Events within Infrastructure Systems: Characterizing Decision Contexts for Mitigation and Adaption". In *Global Environmental Change*, 2008, 18, 310-318.
- Michel-Kerjan, E. "Extreme Events, Global Warming, and Insurance-Linked Securities: How to Trigger the 'Tipping Point'", In *The Geneva Papers*, 2008, 33.
- Mills, E. "A Global Review of Insurance Industry Responses to Climate Change", In *The Geneva Papers*, 2009, 34.
- Munich Re Foundation. "From Knowledge to Action", 2008 Report.
- Munich Re Group. "Munich Re Newables: Our contribution to a low carbon energy supply", 2009.
- Munich Re Topics Geo. "Natural Catastrophes 2009. Analysis, Assessments, Positions", 2009.
- Munich Re Topics Geo. "Natural Catastrophes 2008. Analysis, Assessments, Positions", 2008.
- Office of Foreign Disaster Assistance (OFDA)/Centre for Research on the Epidemiology of Disasters (CRED) International Disasters Database (EM-DAT), Université Catholique de Louvain, Brussels, Belgium, www.emdat.be, 2010.
- Organisation for Economic Co-operation and Development (OECD). "Large-scale disasters: Lessons Learned", 2004.
- Padamadan, R., et al. "Too Close For Comfort: The HSBC Climate Vulnerability Assessment – Mapping Risks for the G-20 in 2020. In *HSBC Global Climate Change*, 2009.
- Pelling, M. "Urbanization and Disaster Risk", Panel contribution to the Population-Environment Research Network, http://www.populationenvironmentresearch.org/papers/Pelling_urbanization_disaster_risk.pdf, 2007.
- Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. "World Population Prospects: The 2008 Revision Population Database", <http://esa.un.org/unpp>, 2009.
- Porrini, D. "Law and Economics of Environmental Insurance (Editorial)". In *The Geneva Papers*, 2008, 33.
- Qureshi, Z., et al. "Making Insurance Work for the Poor." Report: 4th International Microinsurance Conference, 2008.
- Ranger, N., et al. "Development and Climate Change: Assessing Extreme Climate Hazards and Options for Risk Mitigation and Adaptation in the Developing World." *Risk Management Solutions*, 2009.
- Rejda, G. *Principles of Risk Management and Insurance*, 10th edition, Pearson International Edition, 2007.
- Rockett, P. "Catastrophe Bond Risk Modelling." *Risk Management Solutions*, 2007.
- Rodgers, J., et al. "Reducing Earthquake Risk in Hospitals: From Equipment, Contents, Architectural Element and Building Utility Systems." In *GeoHazards International and GeoHazards Society*, 2009.
- Roy, M. "Planning for Sustainable Urbanization in Fast Growing Cities: Mitigation and Adaptation Issues addressed in Dhaka, Bangladesh". In *Habitat*

References

- International, 2009, 33, 276-286.
- Schwank, O., et al. "Insurance as an Adaptation Option Under UNFCCC: Background Paper. INFRAS/IRI/Swiss Re, 2010.
- Skogh, G. "A European Nuclear Accident Pool". In *The Geneva Papers*, 2008, 33.
- Stern, N. "Stern Review on the Economics of Climate Change", London: HM Treasury, 2006.
- Swiss Re. "Sigma – Natural catastrophes and man-made disasters in 2009: catastrophes claim fewer victims, insured losses fall", 2010a.
- Swiss Re. "Weathering climate change: Insurance solutions for more resilient communities", 2010b.
- Ting, Y. "Natural Disasters in China", Chapter 9. In *International Perspectives on Natural Disasters: Occurrence, Mitigation, and Consequences*, New York: Springer, 2004.
- Tompkins, E., Hurlston, L. "Public-private partnerships for storm risk management in the Cayman Islands", Centre for Climate Change Economics and Policy, Working Paper No. 21, Grantham Research Institute on Climate Change and the Environment, Working Paper No. 21, 2010.
- Tucker, B. "Earthquake Disaster Prevention: Exporting Earthquake Safety Practices from California – A look at the work of GeoHazards International." In *Losses and Loss Prevention*, Munich Re, *Schadenspiegel*, 2006, 49th year – Extract.
- Twigg, J. "Characteristics of a Disaster-resilient Community: A Guidance Note", for the DFID Disaster Risk Reduction Interagency Coordination Group, http://www.preventionweb.net/files/2310_Characteristicsdisasterhighres.pdf, 2007.
- United Nations. "2009 Global Assessment Report on Disaster Risk Reduction: Risk and poverty in a changing climate", <http://www.preventionweb.net/english/hyogo/gar/report/index.php?id=9413&pid:34&pif:3>, 2009.
- United Nations. "The World at Six Billion", Table 1 (p. 5), available at: <http://www.un.org/esa/population/publications/sixbillion/sixbilpart1.pdf>, 2010.
- United Nations Development Programme. "Human Development Report 2010", New York, <http://hdr.undp.org/en/reports/global/hdr2010/>, 2010.
- Ward, M. N. "Index Insurance for Climate Risk Management & Poverty Reduction: Topics for Debate". IRI Technical Report 07-03 Working Paper – Poverty Traps and Climate Risk: Limitations and Opportunities of Index-based Risk, 2007.
- Warner, K. "Insurance Instruments for Adapting to Climate Risks: Moving towards Copenhagen." Munich Climate Insurance Initiative, 2008.
- Warner, K. "MCCI Press Briefing: MCCI Proposal on Risk Management and Insurance." United Nations University Institute for Environment and Human Security (UNU-EHS), 2008.
- World Bank. "Natural Disaster Hotspots and Vulnerable Countries", available at: <http://www.worldbank.org/ieg/naturaldisasters/maps/>, 2010.
- World Bank, United Nations. "Natural Hazards, UnNatural Disasters: The Economics of Effective Prevention." World Bank, 2010.
- World Economic Forum. "Convergence of Insurance and Capital Markets", October 2008.

Acknowledgements

We are grateful to the following people for their contributions to this project:

Marta Alejano
Spanish Red Cross

Sandy Boguki
Yale University

Gregory Clancey
National University of Singapore

Prof. David Crichton
Benfield UCL Hazard Research Centre

Prof. Dan Esty
Yale University

Kevin Frederick
State Farm

Ulrich Hess
World Bank

Prof. Robert E. Hoyt
University of Georgia

Mahmoud Khater
EQECAT

Alice LeBlanc
Environmental and Economic Consulting

Ming Lee
AIR

Joanne Linnerooth-Bayer
International Institute for Applied Systems Analysis (IIASA)

Prof. Donald McMillan
Yale University

Minh Nguyen
Eastmeetswest

Prof. Valérie November
ESpRI Group

Tran Phoung Dzung
Association of Vietnamese Insurers

Cathy Pickering
IBM

Badaoui Rouhban
UNESCO

Prof. Charles Scawthorn
Kyoto University

Reto Schnarwiller
Swiss Re

Prof. Robin Spence
University of Cambridge

Ross Stein
US Geological Survey

Bhupinder Tomar
International Federation of Red Cross (IFRC)

Dr. Koko Warner
United Nations University – Institute for Environment and Human Security

Wayne A. Dean
State Farm

Simon Young
CaribRM

About the Contributors

Dr David N Bresch
Director, Head Sustainability & Political Risk Management

Swiss Re
Zürich, Switzerland

David heads the Sustainability & Political Risk Management group. He has been a member of the official Swiss delegation to COP15 in Copenhagen and COP16 in Cancun. He has served as Head of University and Risk Research Relations and Head Atmospheric Perils Group at Swiss Re. He served as chief architect for natural catastrophe risk assessment models and member of the deal teams for many innovative risk transfer transactions. David serves as member of the Global network for climate solutions of the Earth Institute at Columbia University, and as steering committee member of ProClim, Switzerland. David has a PhD in physics from the Swiss Federal Institute of Technology (ETH) where he still lectures on economics of climate adaptation.

David Fried
Group General Manager and Group Head of Insurance

HSBC
Hong Kong, Hong Kong SAR

Mr. David Fried has overall responsibility for the insurance and retirement businesses for the HSBC Group. Mr. Fried holds the office of Chairman and Chief Executive Officer, HSBC Insurance (Asia-Pacific) Holdings Limited. He is the Chairman of HSBC Insurance (Asia) Limited, HSBC Life (International) Limited, Hana HSBC Life Insurance Company Limited and HSBC Life Insurance Company Limited. Mr. Fried is the lead HSBC Insurance representative director in several joint venture partnerships and strategic investments. He serves as a senior member of the management of the Hongkong and Shanghai Banking Corporation Ltd where he is a member of the Bank's Executive Committee and Risk Management Committee. Mr. Fried has a Bachelor of Arts degree in Political Science and Economics from Miami University, Oxford, Ohio.

Ed Hardy
Partner

Deloitte & Touche LLP
New York, United States of America

Ed Hardy is a partner with Deloitte & Touche LLP and has been with the Firm for more than 16 years focusing on serving financial services industry clients in areas such as life, property and casualty, reinsurance companies, insurance intermediaries, and derivative broker-dealers. Ed serves some of our largest financial services clients with respect to analyzing complex structured transactions, hedging strategies, securitizations, and alternative investments structures. In addition, Ed serves as one of the Firm's specialists in evaluating risk transfer criteria for reinsurance arrangements and alternative risk-transferring arrangements.

Daniel M. Hofmann
Group Chief Economist

Zurich Financial Services
Zürich, Switzerland

Daniel M. Hofmann joined Zurich Financial Services as Group Chief Economist in 2001 after a long career as financial editor for the Neue Zürcher Zeitung including nine-year assignment as White House Correspondent. He taught international monetary economics at the Zurich Management School and has published in professional journals and books. He is a member of the Economic Advisory Committee of the International Institute of Finance. Professional membership include the American Economic Association, the National Association of Business Economists, and the European Council of Economists. He received advanced degrees in economics from the University of Zurich and Brown University (USA).

Wilfred Lau
Director of Arup and Executive of Arup's Global Consulting Practice

Arup
Hong Kong, Hong Kong SAR

Wilfred Lau leads the Consulting Practice in East Asia Region and is responsible for Arup's Vietnam operation. He was the Chairman of the Association of Consulting Engineers of Hong Kong 2005 – 2006. He has served on various expert panels in Hong Kong and China and has represented the consulting industry on transport and sustainability matters. Mr. Lau has over thirty years experience in managing large scale multi-disciplinary projects in Hong Kong, Asia and Canada. In recent years, he has been involved in developing solutions for low carbon economy and urbanization in Asia.

Trevor Maynard
Deputy Head of Exposure Management

Lloyd's
London, United Kingdom

Trevor is deputy head of exposure management at Lloyd's of London, responsible for catastrophe modelling and emerging risks management. He has authored or edited the majority of Lloyd's published reports on Climate Change and represents Lloyd's on related initiatives. Trevor is on the management board of the Lighthill Risk Network, a collaboration between Lloyd's and others in the insurance market. He sits on the Industry Advisory Board of the Industrial Maths Knowledge Transfer Network. Until 2010 he sat on the Maths Strategic Advisory Team for the Engineering and Physical Sciences Research Council. He is a Fellow of the Institute and Faculty of Actuaries. Trevor holds a M.Sc in pure mathematics from the University of Warwick.

About the Contributors

Stefan Reichenbach **Global Head of Strategy & Marketing, Commodities**

Thomson Reuters Markets
Toronto, Canada

Mr. Reichenbach leads the strategy and marketing functions for the global Thomson Reuters Commodities business, a \$350M business unit that has doubled its revenues over the last five years. In his role Mr Reichenbach is responsible for the business unit's M&A, strategic planning, customer insight, product inception and marketing activities.

Mr. Reichenbach's strategic insight and commodities market expertise is highly sought after and he works with organisations like the World Economic Forum, the University of Toronto and the Toronto Atmospheric Fund on everything from executive education courses, to policy recommendation and strategic planning. Mr. Reichenbach holds a Master of Arts in Economics from the University of Cambridge and a Master of Science in Environment Change & Management from the University of Oxford.

Deborah Traskell **Executive Vice President**

State Farm Mutual Automobile Insurance Company
Illinois, United States of America

Deborah is a member of State Farm's Chairman Council, the Senior Leadership committee, and provides executive leadership to 10,000 employees and oversees the integration of business and information technology, coordination of business and technology strategies, innovation, and enterprise information security. Deborah serves as an executive sponsor for Enterprise Crisis Management and Business Continuity efforts. Deborah is a member of the board of directors of State Farm General Insurance Company, serves on the National Merit Scholarship Corporation Board of Directors, is a trustee of the Children's Home + Aid Society of Illinois, a member of the National Leadership Council of Liberal Education and America's Promise. Deborah graduated from the College of William and Mary in Virginia. She is a Chartered Property and Casualty Underwriter, a Chartered Life Underwriter and a Chartered Financial Consultant.



COMMITTED TO
IMPROVING THE STATE
OF THE WORLD

The World Economic Forum is an independent international organization committed to improving the state of the world by engaging leaders in partnerships to shape global, regional and industry agendas.

Incorporated as a foundation in 1971, and based in Geneva, Switzerland, the World Economic Forum is impartial and not-for-profit; it is tied to no political, partisan or national interests.

www.weforum.org