Urban Governance and Community Resilience Guides

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Risk Assessment in Cities

2

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The "Urban Governance and Community Resilience Guides" is a series of references for local governments who choose to be on the path to community resilience. It is designed to raise awareness of the challenges of reducing disaster risks in urban and urbanizing areas, and to present the essential tools and possible solutions.

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risk assessment in cities

book 2

ADPC dedicates the Urban Governance and Community Resilience Guides to

David Hollister
(1952 -2010)

who pioneered Urban Disaster Risk Management in ADPC and in the region by initiating the Asian Urban Disaster Mitigation Program funded by USAID/OFDA, contributed to make ADPC a regional resource center dedicated to DRR, and witnessed and took part in the growth of the DRR discipline from the sidelines to the center of the development discourse for over two decades. Dave, a tireless "American Asian", inspirational mentor to a generation of young professionals, champion of South-South and South-North partnerships, and partner of emerging champion institutions in Asia, who dedicated a major part of his professional career to making cities safer before disaster strikes, whose life was tragically cut short in an accident this March. In remembering Dave we renew our firm commitment to building resilience in urban communities and cities of Asia.

Foreword

As a former Governor of Bangkok, I know firsthand that mayors and other local officials can take action for fighting floods, fires and other hazards. Sometimes, it just takes leadership, inspiration and good examples to follow to get going in the right direction.

If you are an urban or municipal planner, this guidebook series is for you with its examples on risk reduction planning. If you are a health officer, community health worker, social worker, NGO staff, or community leader, this guidebook series is for you because of our firm belief in the ability of all stakeholders and communities to reduce disaster risk. Whether you are in charge of cleaning drains, issuing business permits or inspecting buildings for safety, this guidebook series will remind you how important all of that is for reducing risk. If you are an elected official, then this book series will show you what directives and policies are possible in your town or city because other towns and cities mentioned in these books have paved the way for you. We are inviting your comments as readers and users of the guidebooks, as these can help shape future editions.

I have witnessed the strong advocacy of many disaster management professionals for local governments to take on the cause of disaster risk reduction. The ideas and processes in this book have been tested and shaped by the team of people working for the Program on Hydro-Meteorological Disaster Mitigation in Secondary Cities in Asia (PROMISE) that was implemented from 2006 to 2010. This team includes ADPC staff who directly worked for PROMISE and on the content of the guidebooks, and our consultant Christine Apikul for helping craft the messages in the books.

There are other national-level champions who also contributed in numerous ways, and whose contribution we acknowledge with much gratitude.

I would like to thank our PROMISE implementing partners who indirectly contributed to the guidebooks through the disaster mitigation practice that they shaped during the program:

Chittagong City Corporation and Jamalpur Pouroshava and the people of the wards in PROMISE Bangladesh, the Bangladesh National Institute for Local Governance, CARE Bangladesh, and Bangladesh Disaster Preparedness Centre;

Jakarta Provincial Government and South Jakarta City Government and the people of the kelurahan in PROMISE Indonesia, SMAN 8 high school, and Bandung Institute of Technology;

Hyderabad District Council and Hyderabad District Coordination Office and the people of the union councils in PROMISE Pakistan, and Aga Khan Planning and Building Service in Pakistan;

Dagupan City Government and Pasig City Government and the people of the barangays in PROMISE Philippines, the Philippine Department of the Interior and Local Government, and the Center for Disaster Preparedness;

Kalutara Urban Council and Matara Municipal Council and the people of the GN Divisions in PROMISE Sri Lanka, University of Peradeniya, the Sri Lanka Disaster Management Centre, the Sri Lanka Institute of Local Governance, Lanka Jathika Sarvodaya Shramadana Sangamaya, the National Building Research Organization, and The Asia Foundation;

People's Committee of Da Nang City and Cam Le District and the people of the wards in PROMISE Viet Nam, Da Nang Committee on Storm and Flood Control, the Viet Nam Disaster Management Centre, and Center for International Studies and Cooperation Vietnam.

We want to give thanks to the Center for International Studies and Cooperation (CECI) and the Uniterra project who provided research interns under its voluntary service program during the early days of the project.

ADPC would like to acknowledge the support from the Office of Foreign Disaster Assistance of the U.S. Agency for International Development (USAID/OFDA). They have provided funding assistance for urban disaster mitigation, through not only PROMISE, but also beginning with the landmark Asian Urban Disaster Mitigation Program (AUDMP) that was implemented from 1995 to 2005. That program helped 30 Asian cities develop mitigation plans and activities for urban natural hazards such as earthquakes, landslides, and floods. It also provided the seed for many of our regional courses, such as the Earthquake Vulnerability Reduction Course, Urban Disaster Mitigation, and Urban Flood Mitigation. ADPC strongly encourages other donor and financing institutions to look toward the subject of urban disaster risk management just as USAID/OFDA did for fifteen years.

This guidebook series is a tribute to the good work done by advocates of urban disaster risk management. There have been many experts who helped shape the PROMISE program design out of their desire to help. Among such champions is the late Lionel Hewawasam, former Deputy Director of the Sri Lanka Centre for Housing Planning & Building, whose contribution to urban disaster risk reduction and to building the capacity of local government we acknowledge with gratitude.

Most of all, we wish to thank Dave Hollister, former ADPC Deputy Executive Director, program manager of AUDMP, who set the direction of many of our early programs and projects in urban disaster mitigation. He was one of the initiators for a PROMISE city demonstration project in Jakarta. ADPC dedicates the *Urban Governance and Community Resilience Guides* to the memory of Dave and other urban risk management champions who worked with ADPC towards urban resilience and have faded away.

Dr. Bhichit Rattakul
Executive Director, ADPC

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Preface

Asia ...

... is the most urbanized region in the world

- Asia's urban population is rising at a rapid rate.
- Forty per cent of Asia's four billion people currently live in urban areas.
- Projections indicate that one out of every two Asians will live in cities before the year 2025.

... has high levels of poverty

- In Asia, about 60% of the poor live on less than $2 a day, most of them still living in rural areas.
- In Asian cities, almost 25% are living below the poverty line.
- The rate is increasing with the continuous influx of poor people into cities.

... has some of the fastest-growing economies in the world

- At the same time, rapid urbanization has been the key driver of Asia's dynamic growth.
- East Asia's urban population produces 92% of its wealth, with South East Asia not very far behind at 77%, and South Asia at 75%.

... is very prone to disasters

- It accounted for 40% of the world's disasters between 1999 and 2008.
- Disasters affect over 200 million people annually.
- Compared to 1989–1998, the past decade has seen disaster deaths in Asia rise by 52 % and the numbers affected by disasters rise by 26%.

... is affected by climate change

- Many cities in Asia are located along the coastline or in river deltas, exposing populations to hazards that are excacerbated by climate change such as floods and storm surges.
- Asia contains more than half of the world's cities which are most vulnerable to rising sea levels as ice sheets in the North and South Poles melt. Concerns are rising that communities in Asia will need to be relocated, or that there will need to be costly investments in sea defenses.

What does all this mean for people living in Asian cities?

Urban dwellers and local governments will be forced to cope with rising incidents of disasters.

As people and assets concentrate in cities, there is more to lose when hazards strike.

These disasters are likely to be more severe than before. They have the potential to destroy fast-growing economies, health and education facilities, public infrastructure, and cultural heritage sites. Already evident in some cities, disasters have the potential to stall or even reverse development.

Many of Asia's urban poor bear the brunt of disasters because they live in high-density conditions in degraded slums, and lack access to basic services such as a water supply, sanitation, health and education.

This is because many local governments have focused their efforts on responding to disasters rather than preventing or minimizing their impacts.

The disruption of urban systems can have implications beyond the city, affecting nations, and the wider world, due to the globalized connections between economies.

Many local governments feel that despite their best efforts to deal with disasters, conditions are actually becoming worse in their area.

Can we make our cities safer?

The short answer is **Yes!**

Some people believed that disasters are acts of their god, and therefore unavoidable. Because of this belief, some countries focus on providing relief and response as quickly as possible after a disaster, to prevent further loss of life and damage. Naturally this is seen as the responsibility of emergency specialists.

More people are recognizing disasters are as failures of development or as the result of unsustainable development. This implies that we ourselves are creating the social, economic and political conditions that lead to disasters.

Individuals, communities and governments can increase their disaster risk by:

- Living in ways that degrade the environment
- Overpopulating urban centers, pushing the urban poor into hazard-prone areas
- Creating and supporting structures and practices that promote unequal access to, and control, over resources
- Allowing the construction of unsafe/substandard houses and buildings, and building in high-risk areas

This understanding of risks has led to approaches for disaster risk management that consist of:

- Identifying potential hazards
- Determining their probability of occurrence
- Estimating their impact on the communities at risk
- Promoting practices for reducing vulnerability
- Planning measures and taking action to reduce risk
- Creating awareness of how to implement disaster risk reduction (DRR) measures
- Providing opportunities for the sharing of experiences on DRR by local government offficials

Disaster risk reduction needs to take place at the local level. Why?

Because even in the event of catastrophic disasters like the 2004 Indian Ocean tsunami, the 2005 Pakistan earthquake, or Typhoon Ketsana in 2009, the impacts from each disaster in each municipality differ widely.

The degree of economic losses and amount of damage to buildings and infrastructure are determined by the different levels of exposure and vulnerability of the population, infrastructure, facilities, etc. of each locality.

The more local governments and local communities know about their risks by doing their own risk assessment and evaluation, the more they can learn about what they can do to protect themselves. We then have a better chance of reducing risks, loss and damage, and using the recovery period as an opportunity to create a stronger, more resilient community.

At the same time, many of the causes of disasters are not local. Flooding in one area can be affected by deforestation several kilometers away. One single local authority cannot resolve all risk factors. Therefore, it is also necessary to work with networks and associations of municipalities on a larger scale.

"I call for the need of world leaders to address climate change and reduce the increasing risk of disasters – and world leaders must include Mayors, townships and community leaders."

Ban Ki-Moon, United Nations Secretary-General

"A lesson from the Hat Yai flood crisis is that a disaster is never caused by any one factor. The success of overcoming this crisis depends on the effective cooperation of all departments concerned."

Kreng Suwanwongse, Mayor of Hat Yai (1999-2002) in the aftermath of the major flood of November 2000 in Hat Yai, Thailand

"Urban risk reduction delivers many benefits. When successfully applied as part of sustainable urbanization, resilient cities help reduce poverty, provide for growth and employment, and deliver greater social equity, fresh business opportunities, more balanced ecosystems, better health and improved education."

Margareta Wahlström, Special Representative of the Secretary-General for Disaster Risk Reduction, United Nations International Strategy for Disaster Reduction

Introduction

Risk assessment answers the fundamental question: "What would happen if a hazard event occurred in my area?"

Risk assessment is a methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat, or harm, to people, property, livelihoods and the environment. (Book 1 has a detailed discussion on the definitions of hazard, vulnerability, capacity and risk.)

Results from the risk assessment should enable action and form the foundation for planning and implementing disaster risk reduction measures, which are discussed in Book 3.

The process of conducting a risk assessment is based on a review of both the technical features of hazards (such as their location, intensity, frequency and probability), and the analysis of the dimensions of vulnerability and exposure (physical, social, economic and environmental), while taking particular account of the coping capabilities pertinent to the risk scenarios.

Risk assessments should not be undertaken as one-off analyses but as an integral and regular element of the planning process.

Why is a risk assessment needed?

Because you want to know:

"What risks potentially interfere with a community's ability to meet the goals and objectives defining its vision for the future."

Risk assessments are conducted at different levels (from global to local levels) and for different purposes. But essentially, it provides a systematic process to answer questions about the risks faced by the community, town or city. It focuses attention on areas most in need by evaluating which groups of people and facilities are most vulnerable to hazards and to what extent injuries and damages may occur.

Results from the risk assessment allow local government to decide where and what disaster risk reduction interventions can be most effective.

Risk assessments are essential for disaster mitigation and preparedness, as well as emergency response planning.

Risk assessment results allow emergency management personnel to establish early response priorities by identifying in advance, potential hazards, vulnerable people and assets, and the capacities and resources that could be tapped during emergencies.

Findings from risk assessments have often been presented in training and educational programs, as well as awareness campaigns in the 'pre-disaster' phases. Risk assessments are also critical for guiding the future growth and land use patterns of cities.

Risk assessments integrated into the development planning process can identify actions that meet both development needs and reduce risk, and contribute to improved development decisions.

For example, the city council that considers climate risk assessments in its planning and uses a risk management framework can take the appropriate steps against future changes in weather patterns, availability of water, and other environmental changes related to climate changes.

Planning Risk Assessments

Prior to the actual conduct of the risk assessment, a substantial amount of time and effort should be given to planning the risk assessment process. Identifying a suitable lead individual, team or agency that is qualified to oversee the process is critical to its success.

In addition to having proven experience in conducting risk assessments and knowledge in a range of assessment methodologies, familiarity with the locality, knowledge of the local language, and good communication, consensus-building, facilitation and team work skills are added advantages.

Who can help a city lead a risk assessment?

- National disaster management organization
- Government institutions mandated to carry out risk assessments (e.g. Philippine Institute of Volcanology and Seismology, National Building Research Organisation, Badan Meteorologi Klimatologi dan Geofisika)
- Universities (e.g. department/faculty of planning, geography, engineering or geology)
- Professional institutions (e.g. National Society for Earthquake Technology-Nepal, TARU in India)
- International organizations (e.g. Asian Disaster Preparedness Center)
- Non-governmental organizations (NGOs) with expertise in risk assessment (e.g. Earthquake and Megacities Initiative)

QUESTIONS TO ASK

- Which institutions can help your local government conduct a risk assessment of the locality?
- What arrangements and procedures are required to partner with the named institutions in conducting a risk assessment of the locality?
- Can your local government enter into a long-term partnership so that the selected institution(s) can help to conduct regular assessments and monitor risk levels?
- Are there any universities within or outside your locality that can help conduct risk assessments?

With a lead consultant or agency, a multi-disciplinary team is normally formed that includes representatives from various organizations. As risk assessments are multi-disciplinary undertakings, multi-disciplinary teams are often more effective.

Team members that can add value to the risk assessment process include:

- Representatives from local government
- Representatives from sectoral departments to provide insights into their vulnerabilities and capacities to various hazards
- Representatives from NGOs who have worked in the locality for an extensive period of time and have in-depth knowledge of communities' way of life, including the National Red Cross and Red Crescent Societies

For example, a Fire Risk Assessment of Vientiane, Lao PDR was carried out by the Urban Research Institute with technical assistance from ADPC and Chiang Mai University, Thailand. Also part of the team was the National Disaster Management Office and the Vientiane Disaster Management Committee comprised of representatives from relevant sector departments (for more details see Section 5 – Case Studies).

In some cases, risk assessment is regarded as the first phase of the planning process and the same team carries out both the processes of risk assessment and planning, and contributes to monitoring and evaluation during the implementation phase. This approach has the advantage of continuity where the same team is able to gradually build its knowledge and relationship with stakeholders.

With this approach, it is more important to select team members that have the competencies to lead all the components.

Photo by: Aekkapol Aekakkararungroj

What will this team do?

The team should work with the local government in setting the objectives of the assessment, as this will determine the type of data to be collected, the tools and techniques that will be used, and how the results will be presented.

Based on the objectives, and the five essential steps described in the next section, the team should devise a plan that provides details on:

- Where will will the assessment be conducted?
- What data need to be collected to assess the hazard, vulnerability and capacity of the chosen area(s)?
- How reliable or credible is the available data?
- How will the data be collected? Is data collection a major part of the risk assessment process?
- Who will collect data, and do the data gatherers need training on data collection methods?
- In what format will data be collected?
- Will the assessment be participatory, and if so who will be involved and what participatory tools will be used to engage individuals in the assessment process? See Table 3 on page 27 for a summary of the pros and cons of adopting a participatory approach
- How will the data be analyzed?
- How will results be presented? Can a GIS database be developed for a mapped presentation of the analysis?
- Who will receive the results, and how will the information be disseminated?
- What are the milestones in the assessment and what is the schedule for completing each milestone?
- What is the budget?

The risk assessment team may consider conducting a 'rapid' risk assessment to initially screen risk issues and identify priority risk problems that require a more detailed risk assessment in order to determine appropriate risk reduction measures.

Risk Assessment Methodologies: An Introduction

There are five essential steps in the risk assessment process:

1 **Hazard Identification** – includes identifying the hazards from which an area is at risk.

2 **Hazard Assessment** – includes estimating the likelihood of experiencing the hazards at a location or in a region, and studying the characteristics, frequency and potential severity of the hazards.

3 **Vulnerability and Capacity Assessment** – includes determining who or what are exposed to which hazards, where and why; and the resources, assets, skills, knowledge and social relations available to reduce the impact of those hazards, and cope with them.

4 **Risk Estimation** – includes combining all of the above steps to analyze the identified risks and the extent of their impact.

5 **Risk Evaluation** – includes examining how important the risks are to different groups of people, and prioritizing them for action.

Each step requires different types of data and there are a range of approaches and techniques that can be used to obtain and process the data. They range from quantitative analysis built around scenario modeling and mapping, to qualitative, non-technical approaches. The choice depends upon the kinds of output that need to be generated.

The case studies at the end of this book serve to show different methodologies used in risk assessment. The selection of methodology is dependent on the purpose of the assessment, its coverage (city-wide or selected communities), the availability of reliable data, and the availability of resources, particularly human resources.

There are complex risk assessment processes by technical experts who conduct statistical analyses of a wide range of past hazard events and geological, climatic and meteorological data to determine probable losses on an annual basis. Sometimes, additional scientific investigation is needed to substantiate anecdotal or incomplete data.

Risk assessments can be conducted by community members themselves, using methodologies such as direct observation and informal interviews. There are also assessments that use a combination of scientific and lay person knowledge.

The scientific studies are normally carried out for larger areas, and can be very expensive and time-consuming. If a risk assessment has to be done in a community (that has been identified as a high risk area), one of the cost-effective ways to do it is using a community-based disaster risk management (CBDRM) approach. This guidebook has case studies to provide examples.

Regardless of the methodologies used, risk assessment is an opportunity to get stakeholders involved right from the start. In the process, you will begin to foster relationships with experts and with the local community. This network will continue to be useful in the planning phase described in Book 3.

The process of risk assessment can build up the local capacity and contribute to shared understanding of common threats and opportunities.

The result of a risk assessment can change the perception of risk of community members, program managers, high-level officials etc.

Ideally, it will lead to an increased concern about the need to implement risk reduction measures in order to achieve a sustainable society. It can be a forum for engaging in partnerships that could make available the needed financial and/or human resources towards risk reduction efforts.

Step 1 - Hazard Identification

QUESTIONS TO ASK

- What kinds of hazards can affect your locality?
- What may have happened in the past that you should know about?

Quite naturally, many people are only aware of the most obvious risks, usually as a result of a disaster that affected their community in the recent past.

In many cases, most people are not aware of the hazards around them because they have not affected the community during the lifetimes of current residents. Therefore, a systematic process of hazard identification is required.

The hazards identified can be listed in a table format (a sample table is given in Table 1).

Hazards are not limited to natural ones such as earthquakes, floods and landslides. Human-made hazards and human-induced hazards should also be identified (see their definitions in Box 1).

Box 1

Types of Hazards

Hazards, potentially damaging events, can be divided into three categories – natural, human-made and human-induced.

Natural hazards are natural processes or phenomena within the earth system (lithosphere, hydrosphere, biosphere, or atmosphere) that may constitute a damaging event.

Examples: cyclones, earthquakes, floods, landslides, storms.

Human-made hazards include dangers originating from technological or industrial accidents, dangerous procedures, infrastructure failures or certain societal activities such as conflicts that may cause the loss of life or injury, property damage, social and economic disruptions or environmental degradation.

Examples: industrial pollution, nuclear activities and radioactivity, toxic waste, dam failure, and transport, industrial or technological accidents (explosions, fires, spills).

Table 1 Sample table for hazard identification exercise

Hazard type	**Past occurrence** (date/duration)	**Areas affected**	**Level of threat** High (H), Medium (M), Low (L) or None (0)

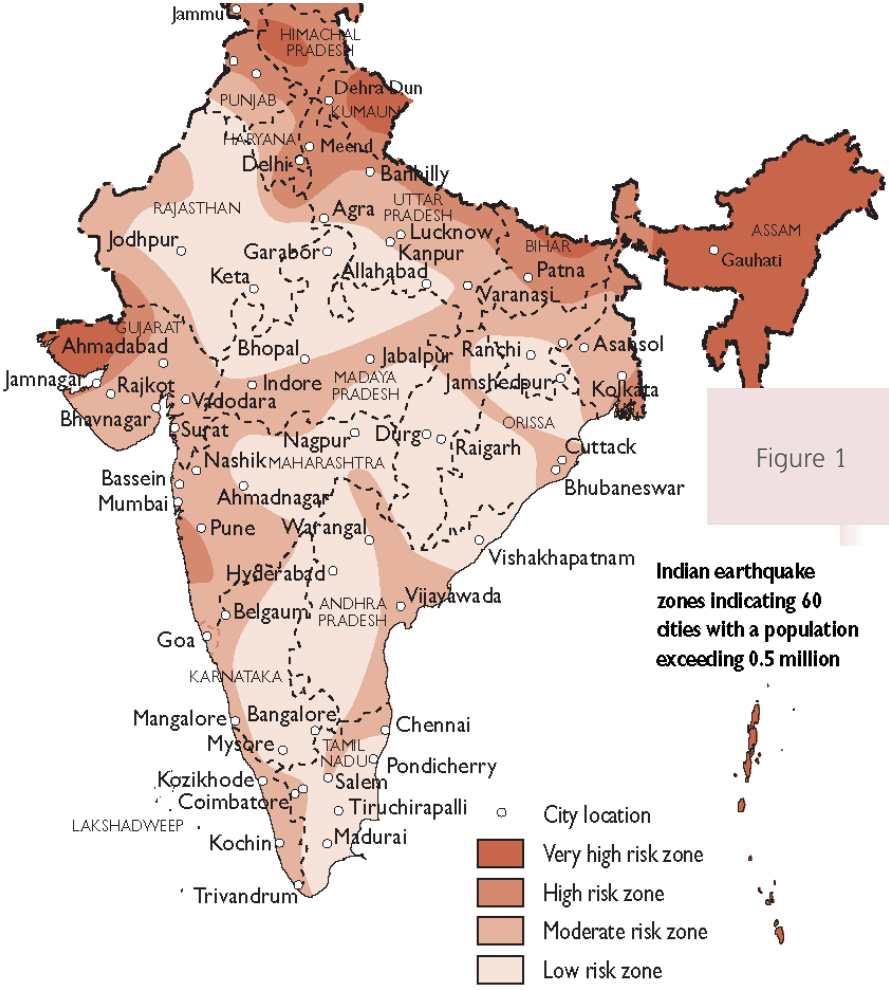


Figure 1

The earthquake hazard map of India divides the country into different zones of risk

Source: Global Report on Human Settlements, 2007

Methods for identifying hazards that may have an impact on city life

Information on past hazards and their impacts on communities may be obtained from a variety of sources. To begin with, one may do the following:

- Peruse and collate newspaper reports and other historical records.
- Review existing plans and reports.
- Talk to the local experts working in government, civil society, academia and the private sector, as well as national and provincial disaster management officers, Red Cross staff and emergency management personnel.
- Talk to community members, particularly the elderly, for myths or legends related to the impact of natural forces.
- Gather information from the Internet

Next, specify the threat level of the impact as high, medium, low or none so that risk assessment can focus on the most prevalent hazards in your locality.

The level of threat is a combined assessment of the frequency and damage potential of a hazard. You can again find this information in technical reports found in university libraries and websites of government agencies that conduct hazard mapping.

Check with the national disaster management organization to see if hazard or risk maps have already been developed that cover your locality. See Figure 1 for an earthquake hazard map of India.

University departments of planning, geography and engineering may already have hazard maps or can help obtain them.

The output of Step 1 is a list of hazards that could affect your town or city.

The plans, reports, websites, articles, maps and a list of contacts obtained during this process will be useful for the subsequent steps of the risk assessment.

Table 2 Results from Step 1 – Hazard Identification conducted in Chittagong, Bangladesh

The following table is taken from a vulnerability assessment of Chittagong City conducted in 2009 by ADPC, the Chittagong City Corporation, and CARE Bangladesh. The data for it were obtained using various methods such as household surveys, direct observation, focus group discussion, and consultation with government agencies, ward commissioners, and ward committees, ward level volunteers and community. The other sources were newspapers, journals, books etc. and categorized based on the potential damage to life and property.

S.N.	Hazard	Data sources	Significance of the hazard
1	Cyclone	Newspaper articles, journals, survey and field visits, consultation with ward commissioners, Chittagong City Corporation (CCC), government agencies and other stakeholders (NGOs and community)	There was huge devastation due to cyclone and it is a regular event for the city and the region
2	Landslide	Newspaper articles, survey and field visits, consultation with ward commissioners, CCC, government agencies and other stakeholders (NGOs and community)	Has become a new threat to the people living in and around hillsides. A number of casualties in recent years
3	Earthquake	Newspaper articles and other records	Chittagong is located in an earthquake zone and has records of earthquake in the past
4	Flood and Water logging	Newspaper articles, survey and field visit, consultation with ward commissioners, CCC, government agencies and other stakeholders (NGOs and community)	The city has been seriously affected a number of times in the recent past
5	Fire	Newspaper articles, survey and field visit, consultation with ward commissioners, CCC, government agencies and other stakeholders (NGOs and community)	Slum area residents are seriously affected in their daily life; fire has become a serious threat to the rest of the urban population as well

Step 2 - Hazard Assessment

QUESTIONS TO ASK

- How badly can a hazard affect an area?
- Where within a town or city will the hazard hit the hardest?
- How often does it pose a threat?
- How predictable is the threat?

Each hazard type has unique characteristics that can impact a town or city. For example, an earthquake causes ground shaking that can cause buildings to crumble, heavy rain can produce the floods that drown people, and drought diminishes the water supply.

The analysis of the hazard goes even further. A hazard type can produce different effects depending on its magnitude, duration and intensity.

In addition, the same hazard events will affect different communities in different ways, based on geography, level of development, population distribution, age of buildings, the extent of community preparedness, etc.

For these reasons, the information gathered on the main hazards identified in Step 1 will reflect these different characteristics. Box 2 provides a list of characteristics to consider.

Box 2

Factors to consider in understanding the nature and behavior of various hazards

Origin
The cause of a hazard, which can be natural or human-made, e.g. the origin of a volcanic eruption is caused by magma pushed upwards through internal pressure developed by dissolved gases

Warning Signs and Signals
Scientific and indigenous indicators that a hazard is likely to occur, e.g. rainfall duration, intensity and quantity; speed of wind; temperature; movement of animals, insects and birds

Forewarning
Time gap between warning signs and the impact of hazard

Force
Factors that determine the power of hazards, e.g. intensity and magnitude of an earthquake, or flow discharge in river determining the force of a flood

Rate of Onset
The rapidity or slowness of hazard arrival and impact, e.g. an earthquake is a rapid onset hazard and drought is a slow onset hazard

Frequency
Time-related patterns of occurrence of hazards

Seasonality
Occurrence of a hazard in a particular time of the year

Zone of Impact
Area coverage or the zone of influence of the hazard that will create an impact

The process of collecting these information is called hazard assessment.

Hazard assessment involves an analysis of the likelihood of occurrence of natural or human-made hazards in a specific future time period, including their intensity and area of impact.

There are a number of different approaches to collecting hazard information. Depending on the availability of data, various approaches are used with variations in the degree of accuracy.

The essence of four key approaches used and their limitations are provided next.

Quantitative Approach

- A hazard is quantified using variables, and the impact of a hazard event is assessed and expressed as numerical data.
- Mathematical functions that describe the relationships between variables could be used to forecast future events.
- City level interventions (land use planning, zonation, etc) can be based on the results. This approach may not be possible for all hazard types due to lack of data available or the difficulty in assigning a numerical value to the variable.

Qualitative Approach

- This method uses ranking such as high, moderate and low to assess a hazard event.
- Where there is a lack of sufficient data for quantitative evaluation, or where certain variables cannot be expressed numerically, this qualitative ranking may be used.
- It is good for comparative assessment between communities and for awareness creation, but it is not sufficient for any city-level interventions.

Deterministic Approach

- A past event is selected and associated characteristics and the consequences are described. Past impact data are then combined with current conditions and possible exposure levels and impact.
- This would be adequate to visualize the recurrence of an event for community awareness but leaves room for inaccuracies.
- It is good for site specific investigations to determine the risk (slope stability calculations, liquefaction studies, etc.).

Probabilistic Approach

- After identifying the hazards that affect the planning area and assessment of the impacts from those hazards, a probability analysis is undertaken. It provides an estimate of the probability of each hazard affecting an area or region.
- Probability for each hazard may be categorized as high, moderate or low.
- Probability of occurrence can be calculated through research on past events.

Hazard Mapping

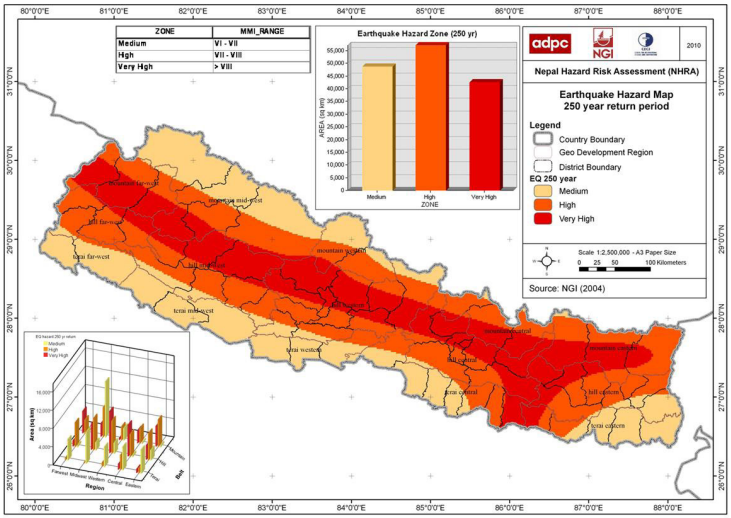
Results generated through hazard assessments need to be presented to decision makers and communities at risk to raise awareness and enable the design of appropriate interventions and policies.

The use of maps is one way to depict the spatial location, size and frequency of hazards. Figure 2 is one example.

Hazard maps provide clear, attractive pictures of the geographic distribution of potential hazard sources and impacts. These maps frequently provide motivation for risk management actions that would be difficult to obtain without a compelling visual.

Most countries are prone to at least some combination of hazards and all face the possibility of technological disasters as industrial development progresses.

Figures 2 Example of a hazard map



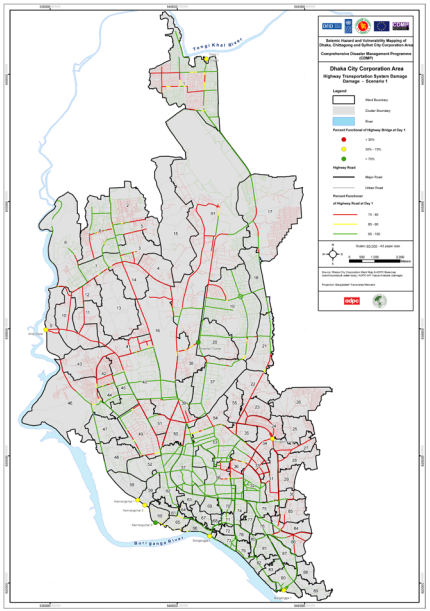
Earthquake hazard map of Nepal. Image source: Norwegian Geotechnical Institute.

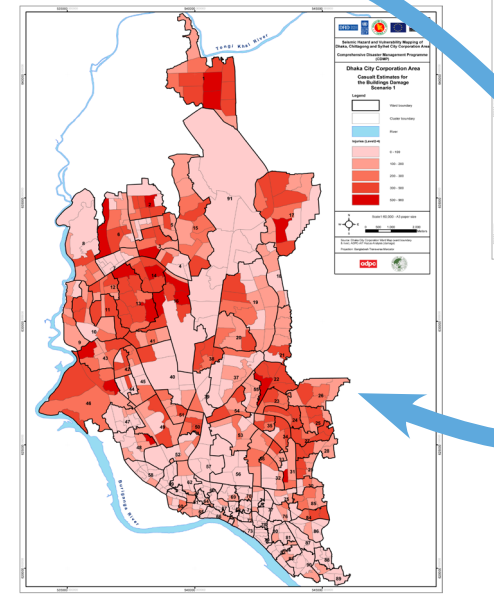
Modern technology has advanced hazard mapping and prediction of future events considerably, especially through Geographic Information Systems (GIS).

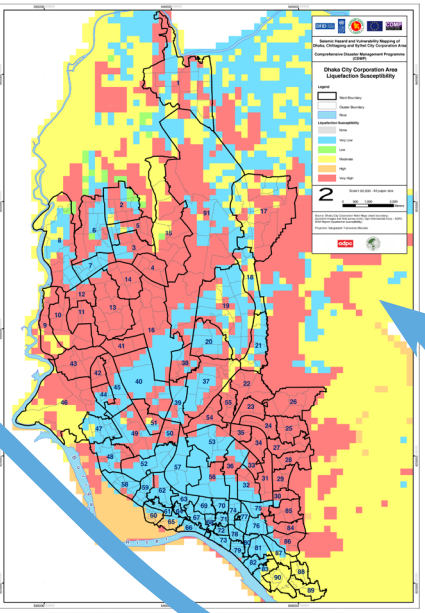
GIS is essentially the merging of cartography and database technology , transforming images to an information system that can be used to produce interactive maps, conduct spatial analyses, present results in a variety of ways, and manage the data. GIS.

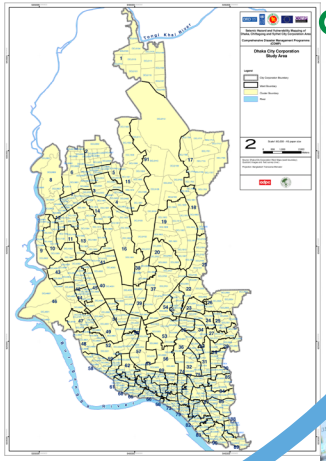
For example, plans for mitigation, preparedness, response and recovery can be formulated better when hazards are mapped against the location of houses, schools, critical infrastructure (hospitals, airports), power lines, storage facilities, etc. Figure 3 shows how GIS software can be designed to generate hazard, vulnerability, capacity or risk analysis for a given area.

The use of GIS and remote sensing have allowed a more comprehensive mapping of not only hazards but also









RISK ASSESSMENT DATA

Figure 3

GIS applications projected and mapped the liquefaction potential, number of casualties, and extent of damage to infrastructure in each ward of Dhaka.

vulnerabilities, capacities and risks to better support decision-making and improve coordination among agencies. GIS maps can be used in planning to avoid the inappropriate use of hazard-prone areas, but also for other purposes such as to show the progress of tax collection. See Section 5 – Case Studies for examples of risk maps developed for Dhaka, Jakarta and Vientiane.

The map can show the impact of a single hazard or multiple hazards. The benefits of multi-hazard maps include the following:

- Characteristics of the hazard and their possible impacts can be synthesized from different sources and placed on a single map.
- It can call attention to hazards that may trigger others (as earthquakes trigger fires or volcanic eruptions trigger landslides) or exacerbate their effects.
- Sub-areas requiring more information or additional assessments can be identified.
- A more precise overview of the effects of hazards on a particular area can be obtained, and common risk reduction measures can be recommended for the area or sub-areas.
- Land-use decisions can be based on all hazard considerations simultaneously.

Risk maps supplement the detailed report of the risk assessment that documents the tangible as well as the intangible aspects of vulnerabilities and capacities, and attempts to identify root causes underlying the development challenges.

Step 3 - Vulnerability and Capacity Assessment

QUESTIONS TO ASK

- Who and what will be affected by hazards?
- Do you have specific groups of people in your city that could have more deaths than other groups due to hazards?
- Which areas are safe from hazards? What makes them safe?
- Is your locality well-prepared for emergencies?
- Why do disasters happen?

In a hazard prone area, people, property and systems, or other elements are **expose**d to potential losses, but they are not all vulnerable to the hazard in the same way.

Vulnerability is a condition determined by physical, social, economic, and other factors, which increases or decreases the susceptibility of communities, individuals, and even physical structures or the environment, to the impact of the hazard.

Vulnerability can be quantified as the degree of loss to a given element at risk (or set of elements) resulting from a given hazard at a given severity level. The distinction between this definition and that of risk is important to note.

Vulnerability Assessment is the process of estimating the susceptibility of the 'elements at risk' to various hazards and analyzing the causes behind their vulnerability.

The assessment takes into account the physical, geographical, economic, social, political and psychological factors, which make some people or assets more vulnerable to the dangers of a given hazard while others are relatively protected.

The reverse of vulnerability is capacity. **Capacity** is a combination of all the strengths and resources available within communities, organizations and individuals that can reduce the level of risk, or the effects of a hazard.

Capacity Assessment is the process of determining the resources, assets, skills, knowledge and social relations that communities, organizations and individuals have themselves or have access to (e.g. support from national-level agencies and NGOs) to prevent, mitigate, prepare, respond to and recover from disasters.

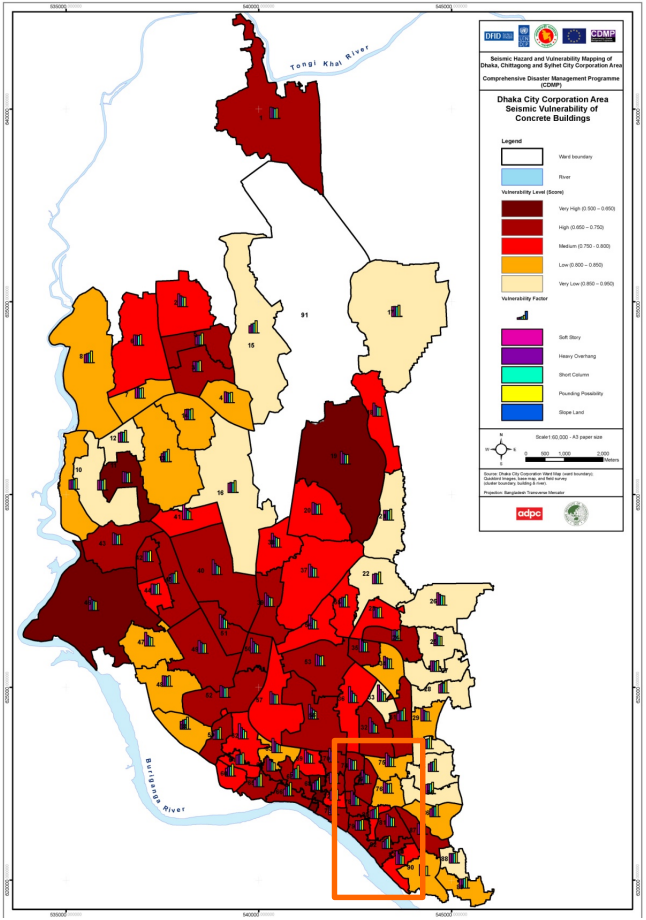
Risk combines the expected losses from all levels of hazard severity, also taking into account their occurrence probability and the ability of a community to cope with the hazard.

Since the process of reducing disaster risk is largely focused on reducing vulnerabilities and enhancing capacities, decision makers and planners need an understanding of which elements are most at risk from the principal hazards that have been identified, and why.

Elements at risk can be classified as tangible or intangible**, depending on whether they can be quantified.** Tangible elements are physical elements such as people, buildings, equipment and infrastructure, as well as economic elements such as income and savings. Intangible elements are social elements such as social ties, cultural heritage and psychological well-being.

If we **quantify the tangible aspects** of vulnerability and capacity, we can use the data to estimate the deaths, damage and losses that may occur, or to assess those that resulted from an event.

The **tangible aspects** of vulnerability can be presented in the form of tables or maps. For example, the location of vulnerable people (children, disabled, elderly, widowed, etc.) and vulnerable assets (buildings, critical facilities, infrastructure) can be mapped. Figure 4 is an example from the Bangladesh Comprehensive Disaster Management Programme. The vulnerability of buildings to earthquake in Dhaka and other cities were assessed and mapped per ward.



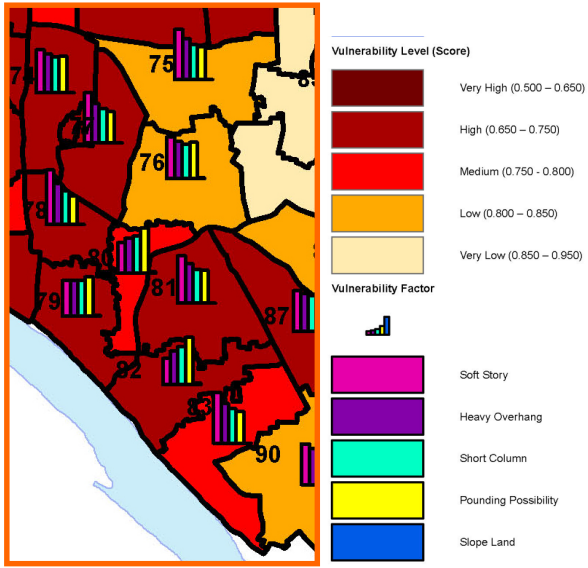


Figure 4 Map Showing Seismic Vulnerability of Concrete Buildings in Dhaka City Corporation Area, Bangladesh

Figure 5

Vulnerability and capacity map of UC-16 Ali Abad, City Sub-District Hyderabad, Pakistan

Source: Hyderabad: Hazard Mapping and Participatory Vulnerability Assessment Report, 2007

Similarly, the tangible aspects of capacity can be listed or mapped. They include facilities and resources such as fire stations, hospitals and clinics, schools, water sources, evacuation areas and shelters, search and rescue teams, etc.

Figure 5 shows a vulnerability and capacity map of a sub-district in Hyderabad, Pakistan that pinpoints vulnerable houses and facilities, as well as provides the locations of health centers and areas safe from flood to where people may evacuate.

In a risk assessment of the communities of Bukit Duri and Kebon Baru in Jakarta, Indonesia, led by the Institute of Technology Bandung, a capacity assessment of the area was conducted in addition to hazard and vulnerability assessments.

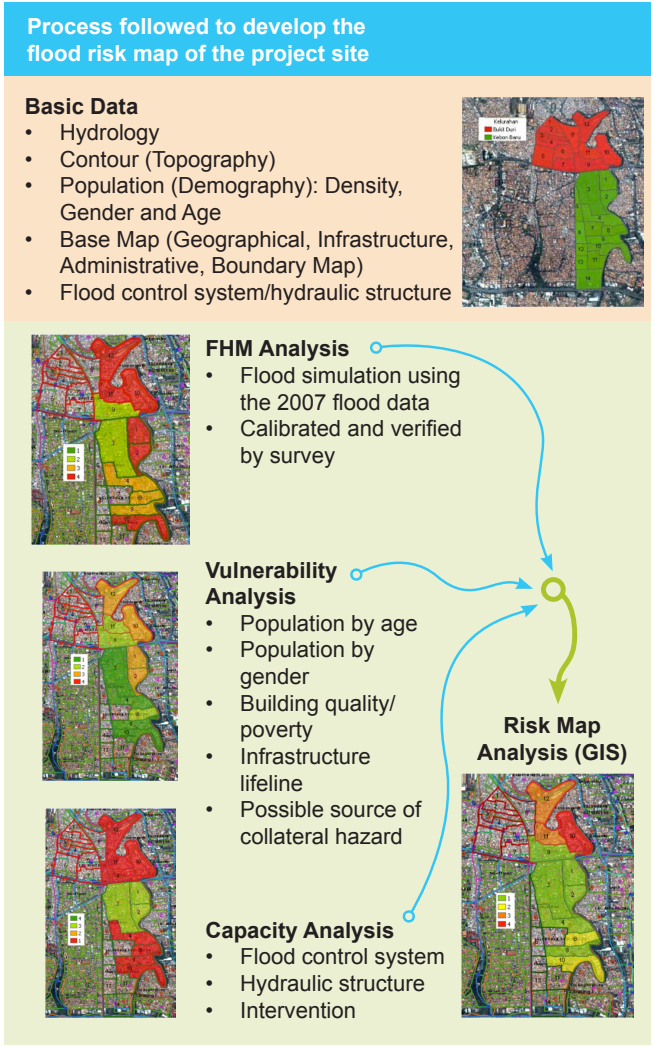
Following field observation of the flood control system, drainage and hydraulic structures, and interviews with residents of both communities, it was decided that two variables will be used to assess the capacity of the neighborhood units – 1) the conditions of levees and 2) the conditions of pumps. Their results were combined and presented on a capacity analysis map.

Other observations and findings from the assessment were documented in a report and referred to at the planning stage (see Figure 6 and the case study on Indonesia for more details).

Figure 6

Capacity Maps of Bukit Duri and Kebon Baru, Jakarta

Source: Flood Preparedness Initiatives of High-risk Communities of Jakarta, 2010.



The **intangible aspects** of vulnerability and capacity, which are as important as the quantifiable aspects, must not be neglected.

Vulnerability and capacity assessment require the assessment team to go into local communities to study the social, economic, cultural, political and environmental conditions, and they will need to engage with the local community in one way or another.

Vulnerability and capacity assessments can take on a number of different forms, from a quick information gathering process to a more complicated and detailed 'participatory' course of action. A short process will provide information but it also means a missed opportunity to involve community members.

Table 3

Pros and cons of adopting a participatory approach to vulnerability and capacity assessment

Pros	Cons
Provides more reliable and qualitative understanding of vulnerabilities and capacities.	Requires greater sensitivity, time and resources to conduct.
Creates strong community ownership in the assessment process.	May lead to unrealistic expectation of assistance offered in future development programs.
Builds a stronger foundation for creating sustainable programs with local communities.	Process may become too complicated if the objective of the assessment is to develop a 'baseline' to assess future programs.
Assists in forming better linkages between communities and the organizations concerned with reducing disaster risks.	The poorest or most vulnerable may not be represented, e.g. women and children, because participatory techniques are often carried out with the community as a whole.
Contributes to community empowerment so that the community themselves can reduce disaster risks.	Linked to the point above, it may lead to interventions that do not benefit or further marginalize the poorest or most vulnerable groups.

The involvement of community members in the vulnerability and capacity assessment process has been widely documented as good practice. It provides valuable information and the chance to cross-check data acquired from secondary sources. It also raises the community's awareness of the risk they face and builds up their commitment to implementing disaster risk reduction interventions.

Participatory processes can be empowering experiences for communities. As they better understand the risks faced, they come to realize their own capacities to cope with those risks.

Additionally, it can help initiate dialogue and partnership between the vulnerable communities and other actors in disaster risk management, including government authorities, NGOs, international agencies, academia and the private sector.

A participatory process requires additional time and resources, including skills to facilitate the participatory process. See Table 3 for a summary of the pros and cons of adopting a participatory approach to vulnerability and capacity assessment.

The risk assessment team should engage NGOs who have worked in the locality for an extensive period of time to be part of or even lead the participatory assessment.

For example, the Red Cross and Red Crescent Societies have a well-established process and methodology for participatory vulnerability and capacity assessments at the community level. The National Red Cross could be a valuable partner.

Some of the principal methods for capturing information for vulnerability and capacity assessments include:

- Questionnaire surveys
- Interviews
- Focus group discussions
- Mapping
- Historical timeline
- Direct observation
- Analysis of secondary sources e.g. reports, newspaper articles, websites

Usually a combination of these methods is used.

Step 4 - Risk Estimation

QUESTIONS TO ASK

- Where are the high risk areas?
- What are the risk issues in these areas?
- What can be done about the risk issues?
- What are the resources available to address these risk issues?

This step brings together the results from the hazard, vulnerability and capacity assessments to provide an overview of the risk faced by a town or city that will help in decision-making and planning risk reduction measures.

Following the analysis of results, risk statements or scenarios can be prepared for key development sectors (education, environment, health, housing, water resources management, etc.), regions and/or vulnerable groups. Visual risk maps can also be produced.

For example, hazard and vulnerability can be scaled according to the severity.

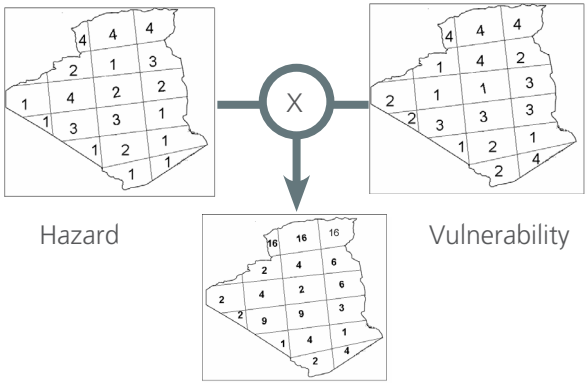
Hazard	Value
Very high	4
High	3
Average	2
Low	1

Vulnerability	Value
Very high	4
High	3
Average	2
Low	1

Risk can be classified into different classes according to the combined results of hazard and vulnerability based on the equation: Risk = Hazard x Vulnerability

Risk Class	Values
Very high	13 to 16
High	9 to 12
Average	5 to 8
Low	1 to 4

... and mapped as follows:



To consider the dimension of 'capacity', the following equation can be used:

Risk = (Hazard x Vulnerability) / Capacity

The table below shows sample results of the risk estimation by location within a municipality.

Location	Exposure to Hazard	Vulnerability	Capacity	Risk
A	1	3	3	1
B	2	1	4	0.5
C	2	3	2	3
D	3	2	1	6

According to the information on the sample table, location D shows the highest risk location.

Step 5 - Risk Evaluation

QUESTIONS TO ASK

- What are the priority risk issues?
- What are the costs and benefits of addressing the different risk issues?
- Do these risk solutions contribute to achieving local development goals?

The purpose of risk evaluation is to help identify and prioritize risk reduction measures. At this stage, communities and local authorities can jointly agree on criteria to rank the risks. They can decide what levels of risk are acceptable for which no actions need to be taken.

Risk reduction actions should be in line with and contribute to local and national development goals.

The other risks could be ranked as high, medium or low priority.

An acceptable level of risk varies among individuals, depending on their experience, exposure, understanding, beliefs and other factors. An acceptable level of risk can change over time. A risk assessment and other pertinent information can change people's perception of risk.

Risk evaluation involves balancing perceived risks against potential benefits, and scientific judgments against beliefs systems.

Local participatory risk assessment processes could provide vulnerable groups with insights into the risk they perceived that should be taken into consideration when defining acceptable levels of risk.

Risks are ranked according to:

- Their significance
- The existence and feasibility of risk reduction solutions
- The cost-effectiveness of potential risk reduction solutions
- The availability of funds

The broad strategies for dealing with different risks are also identified. At this stage, the cost-benefit analysis of various risk reduction options can be undertaken.

Challenges of Urban Risk Assessment

While the understanding of disaster risks has increased steadily, data limitations combined with the unpredictable and unique nature of hazards means that uncertainty remains.

Rapid increases in vulnerability and in the exposure of population and economic assets, as well as the possibility of shifting climatic conditions affecting hazard location, frequency or magnitude, further magnify the uncertainty.

Despite improvements in disaster reporting, the economic loss information for individual disaster events is often incomplete, and suffers from inconsistent measurement of damages and losses.

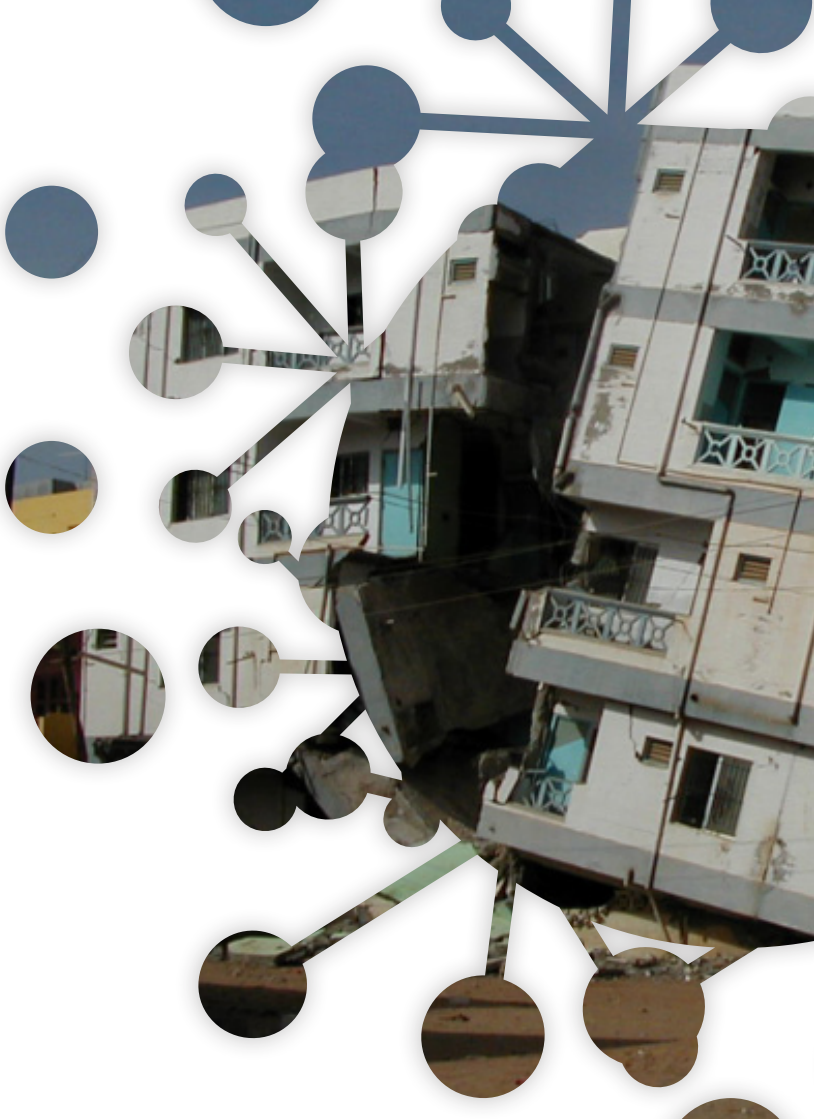
Some of the common challenges faced by local governments that should be kept in mind include:

- High demand for assessments to be used in risk-based city planning
- Inadequate capacity of stakeholders to conduct risk assessments
- Lack of flexible approaches to risk assessment
- Lack of accurate and reliable data
- Lack of funds for risk assessment
- Difficulties in the identification of coping mechanisms to reduce risk
- Difficulties in assessing complexities in vulnerabilities and underlying causes
- Need for cost effective methodologies
- Need for risk assessment standards that will result in comparable maps and interoperable systems
- Need for simplicity in data presentation

Case Studies

Three case studies will be showcased that show how cities in three countries have conducted their risk assessments. Each case study will examine the following:

- The objective of the risk assessment
- Who led the risk assessment process and who were the other stakeholders involved?
- What approach and methodologies were used to conduct the risk assessment?
- What were the outputs from the assessment, and were these used in the local development planning process?



Each city highlighted below adopted different approaches to risk assessment, showing the range of methodologies that can be used to conduct these assessments.

1. The Bangladesh Comprehensive Disaster Management Programme, a long-term multi-partner program led by the Ministry of Food and Disaster Management conducted a seismic risk assessment in Dhaka, Chittagong and Sylhet. As the objective of the assessment was to study the crtical infrastructure and building stocks of these cities, the methodology used was very technical including the study of active faults, development of a database and maps, and estimation of economic loss.
2. The Institute of Technology Bandung with the Jakarta Provincial Government and ADPC conducted a flood risk assessment in Jakarta as part of a wider regional program of ADPC entitled, "Program for Hydro-Meteorological Disaster Mitigation in Secondary Cities in Asia." A risk assessment was conducted to identify preparedness and mitigation interventions in high risk areas prone to flooding. In this case, the hydrology data of the major flood in 2007 was used as the model input (deterministic approach). Various variables reflecting the vulnerability and capacity of the area were used and integrated to create risk maps showing the different levels of risks in the area should the 2007 flood hit again. The simulation result was calibrated and verified with field data through direct observation and interviews with residents.
3. In Lao PDR, in response to the growing number of urban fires, the National Disaster Management Office (NDMO), the Urban Research Institute (URI), and other organizations mapped out the fire risk in Vientiane. The fire risk map was prepared by assessing seven variables (e.g. building material type, wiring system, road accessibility, etc.), and when combined gave four categories in which the map was divided into (very high, high, moderate and low risk areas). One of the communities in the 'very high risk area' – Ban Hatsady also produced a fire risk map using the same variables as the Vientiane Fire Risk Map, with some modifications to suit the community situation. Rarely done but critical for ensuring that the risk map is 'live' and continually updated, some of the components identified in the community risk map (such as evacuation routes) were incorporated into the city-level fire risk map. This was possible because a participatory approach was used to develop the community risk maps, with the active engagement of the NDMO and URI.

Bangladesh – Earthquake

Purpose

The risk assessment aimed to produce hazard and vulnerability maps for the critical infrastructures and building stocks of Dhaka, Chittagong and Sylhet City Corporations including the areas under future extensions.

Stakeholders

The seismic risk assessment was a component in Bangladesh's Comprehensive Disaster Management Programme, a high profile multi-hazard, multi-sector and multi-stakeholder program supported mainly by the United Nations Development Programme, the UK Government's Department for International Development and the European Union, with the Secretary of the Ministry of Food and Disaster Management as the National Program Director.

ADPC was commissioned to provide technical support in the conduct of the risk assessment, as well as enhance national capacity in earthquake risk management, including the development of a contingency plan based on results of the risk assessment. The ADPC team included experts from the Asian Institute of Technology, Thailand; Oyo International Corporation, Japan; and National Society of Earthquake Technology, Nepal.

The stakeholders involved in the risk assessment process included professionals from government agencies and academic institutions:

- Chittagong City Corporation
- Dhaka City Corporation
- Sylhet City Corporation
- Geological Survey of Bangladesh
- Power Development Board
- Public Works Department
- City Development Authority (RAJUK), responsible for revising land use plans and building codes
- Roads and Highways Department
- Bangladesh University of Engineering and Technology
- Civil Engineering Department of Chittagong University of Engineering and Technology
- Civil Engineering Department of Shajala University of Science and Technology
- Geology Department of Dhaka University

Methodology

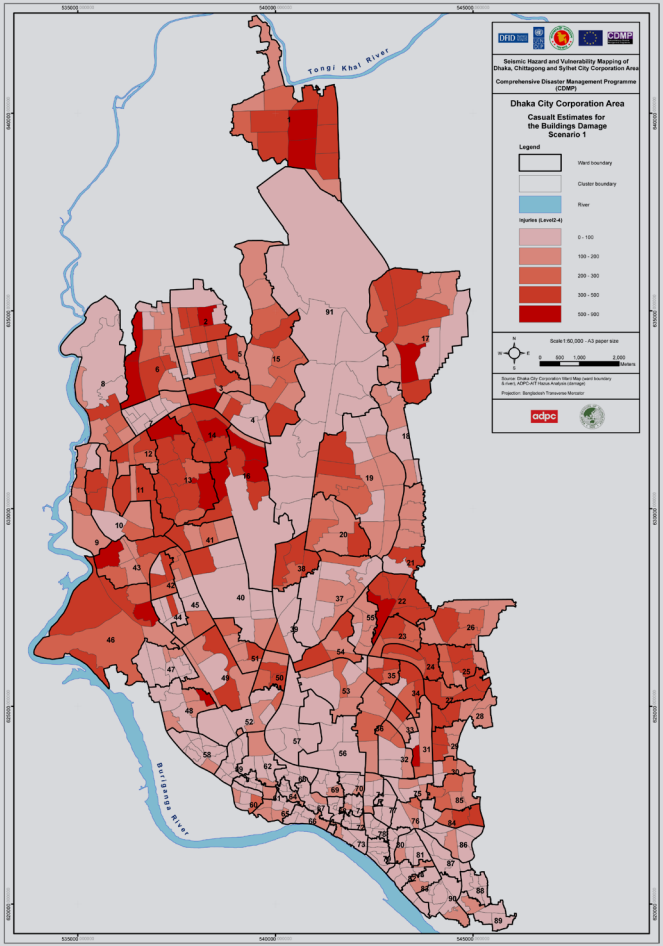
The assessment began by identifying the location of active faults and mapping geological conditions. Based on these findings, seismic hazard maps were developed for the three cities using probabilistic and deterministic approaches.

Base maps of the three cities were also prepared marking the location of buildings, roads, water bodies and open spaces. Lifeline information like water, gas and electricity supply network and other facilities were incorporated into the base maps. Attribute information like height, use and construction type were also included against each of the surveyed buildings of the three city corporation areas. Over 500,000 buildings were surveyed in total.

The vulnerability of buildings to earthquake in the cities was assessed by testing the structural elements of the buildings using equipment such as the micro-tremor machine, Schmidt Hammer, Ferro Scanner and vibration shaker.

HAZUS, a GIS-based natural hazard loss estimation software package that was developed and freely distributed by the U.S. Federal Emergency Management Agency, was used to bring all the information collected together to estimate the impact of different earthquake scenarios on buildings and infrastructure.

Based on the number of buildings damaged, casualties (at night and during the day) were estimated for the three cities.



Outputs and Impact

A series of hazard and vulnerability maps were produced, and various reports developed that document the assessment process and results.

Results showed the number of buildings that would be completely or partially damaged, and the probable level of fatalities in the worst case scenario in Dhaka with a 7.5-magnitude earthquake originating from the Madhupur fault.

These outputs were used as the basis to develop earthquake contingency plans for the city. Contingency plans are plans drawn up in advance to better respond to disasters.

The maps were also used in awareness campaigns and training courses for decision makers, planners, religious leaders, masons, security officers, teachers and even school children.

Indonesia – Flood

Purpose

Flooding is a regular event in Jakarta, but a major flood in 2007 that paralyzed the city for several days prompted the need for a flood risk assessment.

As part of the regional Program for Hydro-Meteorological Disaster Mitigation in Secondary Cities in Asia (PROMISE), the Institute of Technology Bandung with the Jakarta Provincial Government and ADPC conducted a flood risk assessment in the kelurahans of Bukit Duri and Kebon Baru that were heavily affected by the 2007 flood. A kelurahan or village is the lowest local government level in Indonesia.

The purpose of the risk assessment was to identify preparedness and mitigation interventions in the high risk areas prone to flooding. This was a pilot initiative to establish a risk assessment and management methodology that could be replicated in other keluharans in Jakarta and other cities.

Stakeholders

Local government and community members of Bukit Duri and Kebon Baru were consulted in the risk assessment process.

The Indonesian Red Cross – Jakarta Chapter contributed to the process. Other stakeholders at the provincial and district level included:

- Jakarta Fire Brigade and Disaster Management Department
- Jakarta Health Department
- Jakarta Public Works Department
- Jakarta Regional Planning and Development Agency
- Jakarta Social Department
- Disaster Coordination Unit at Province Level
- Disaster Coordination Unit at City Level
- Crisis Center of DKI Jakarta
- City Government of South Jakarta
- Sub-District Government of Tebet

Experts from national government agencies including the National Disaster Management Agency (BNPB) and the National Meteorological, Climatology and Geophysical Agency (BMKG) were also involved in the risk assessment process with the intention of replicating the methodology in other parts of Jakarta and in other municipalities.

Methodology

A technical working group comprised of experts from the Institute of Technology Bandung and the Jakarta Provincial Government and other relevant stakeholders, was established to lead the risk assessment process.

In developing the flood hazard map the hydrology data of the major flood in 2007 was used as the model input along with the topography map and drainage system and capacity of the area. GIS was used to input and analyze the data and create the maps.

For the vulnerability assessment, five variables were used, each one given a weight of importance that defined the significance of the variables towards overall vulnerability:

1. Infrastructure condition (25%)
2. Building type/poverty (30%)
3. Population by gender (15%)
4. Population by age (15%)
5. Possible source of collateral hazard (15%)

Each variable was indexed; the higher the index value, the more vulnerable.

	Infrastructure condition	Building type/ poverty	Population by gender	Population by age	Possible source of collateral hazard
4	more than 90% infrastructure flooded in more than 2 meters of water	Majority of houses are non-permanent, without proper access road (capacity only for pedestrian)	Less than 45% of the population are male	More than 55% of the population are at the age <14 or age >55	Potential cause to death, disease, and environmental damage
3	50%-90% of infrastructure flooded in more than 2 meters of water	Majority of houses are non-permanent, without proper access road (capacity can accommodate motorcycle)	45%-50% of the population are male	50%-55% of the population are at the age <14 or age >55	Potential cause to disease, and environmental damage
2	20%-50% of infrastructure flooded in more than 2 meters of water	Majority of houses are permanent, with less proper access road (capacity can accommodate single car)	50%-55% of the population are male	45%-50% of the population are at the age <14 or age >55	Potential cause to environmental damage
1	Less than 20% of infrastructure flooded in more than 2 meters of water	Majority of houses are permanent with proper access road	More than 55% of the population are male	Less than 45% of the population are at the age <14 or age >55	No possible source of collateral hazard

To assess the capacity of the communities, it was decided that two variables would be used: 1) the existing conditions of levees (50%) and 2) the existing conditions of pumps (50%). Again, each variable was indexed.

A risk map was subsequently developed that combined the hazard, vulnerability and capacity assessments (shown on p. 26).

As the program was expected to implement disaster risk reduction measures, two scenarios were created to assess the risk.

The moderate-optimistic scenario was based on the following assumptions:

- Climate will not change significantly
- Program is successfully implemented and developed
- No significant environmental damage in the upstream river basin

And the moderate-pessimistic scenario was based on the following assumptions:

- Climate will change significantly
- Program implementation and development faces problems
- Significant environmental damage in the upstream river basin

The moderate optimistic scenario showed a significant reduction of risk in several areas. However, the moderate pessimistic scenario did not show significant improvement compared to the existing condition.

The simulation result was calibrated and verified with field data through the following methodologies:

- Direct observation
- Focus group discussion
- Interview with the local communities
- Secondary data collecting

Outputs and Impact

Based on the risk assessment, risk reduction measures were identified that included awareness raising and training activities, as well as development of a community-based flood early warning system.

One of the activities included enhancing the capacity of local government officers, community leaders, school communities and local NGOs in conducting their own risk assessment and developing their own action plans in a participatory manner.

In the implementation of the risk reduction efforts, national and local governments contributed staff time, office space, equipment and facilities.

Lao PDR – Fire

Purpose

The Government of Lao PDR's new policy promoting private sector investments resulted in a construction boom, focused on roads and large modern buildings. At the same time, urban fires caused more damage than any other hazard events over the past few years, particularly in Vientiane. The city government wanted to know what could be done to reduce fire risks in Vientiane.

Stakeholders

A Fire Risk Assessment of Vientiane was carried out by the Urban Research Institute with technical assistance from ADPC and Chiang Mai University, Thailand. Also part of the team was the National Disaster Management Office and the Vientiane Disaster Management Committee comprised of representatives from relevant sector departments.

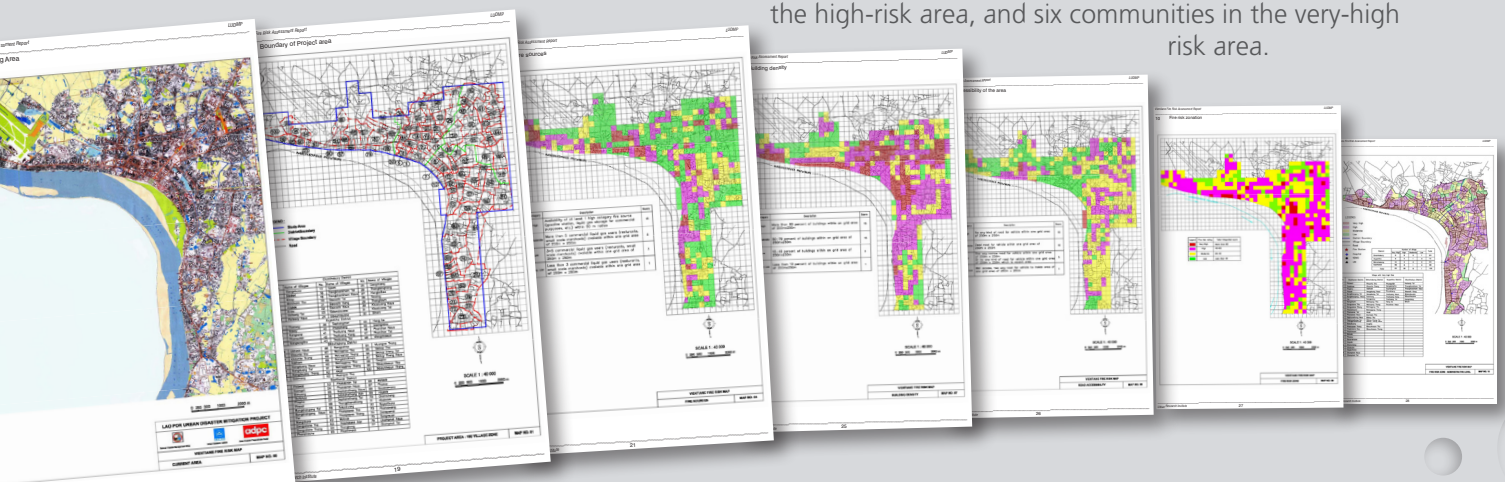
Methodology

Through stakeholder consultation it was decided that data would be collected on seven variables: 1) building material type, 2) availability of fire sources (quantity of fuel), 3) effectiveness of fire fighting services determined by availability of water and space to mobilize

fire fighting team, 4) quality of electrical wiring, 5) fire history, 6) building density, and 7) road accessibility. All information, except for fire history was collected through field surveys. Information on fire history was obtained from the Fire Prevention and Protection Police Department.

A fire risk map overlaying a land-use and infrastructure map of Vientiane obtained from the National Geographic Department was produced to display the data collected. Scores were given to the seven variables and when combined gave four categories in which the map was divided into: very high, high, moderate and low risk areas. In addition, qualitative data was collected on the vulnerability of people, buildings, infrastructure and facilities. Qualitative records showed the causes of vulnerabilities. For example, rehabilitation of the old water pipes under the roads had not been included in the road improvement projects, and the fire hydrants were not being replaced as the road surfacing was completed.

Integration was done manually using the AutoCAD software. The resulting Vientiane Fire Risk Map covered the four urban districts of Vientiane: Sikhottabong, Chanthabouli, Sisattanak, and Xaysettha, comprised of about a hundred communities in total. The scoring results classified more than half of the 100 communities in the high-risk area, and six communities in the very-high risk area.



Outputs and Impact

Upon the completion of the risk assessment process, a series of stakeholder workshops were organized to develop a city-level action plan.

Recognizing that it takes time before external assistance could reach a fire when it occurs, the communities realised that it is important to undertake fire risk reduction.

From a list of priority communities identified as 'very high risk' on the risk map, Ban Hatsady community was selected to undertake a community-based fire risk mapping process.

The Ban Hatsady residents worked together to produce their own fire risk map using the same variables as the Vientiane Fire Risk Map, with some modifications to suit the community situation.

In developing the map, the community leaders and representatives from the elderly, women, youth, and the village security groups, participated in group discussions, conducted interviews and questionnaire surveys, and reviewed secondary data to trace fire history, cause of fire and community's level of preparedness.

Collectively, vulnerabilities and capacities were mapped to show places where there was storage of flammable materials (wood, chemicals, gas, etc.), narrow roads that were inaccessible to fire trucks, and areas with poor electrical wiring systems. The map also marked the location of fire hydrants and other water sources, and public telephones. Areas where fire extinguisher, water containers, ladders and ropes should be placed for ready access in case of fire emergencies were also marked.

Based on this map, a number of risk reduction measures were identified and implemented by the community members in collaboration with relevant organizations. Activities ranged from awareness raising campaigns, the establishment of a network of volunteers, to training these volunteers in fire preparedness and response.

A small fire caused by faulty electrical wiring in one of the houses in Ban Hatsady just months after the risk mapping and planning process tested the community's level of preparedness. No one was hurt, and damages were minimal. Community members now feel safe and confident that they can together prevent fire accidents from occurring.

The fire risk assessment methodology adopted in Vientiane was replicated in two other cities of Lao PDR in Luang Prabang and Pakse.

Conclusion

The risk assessment has been completed. What next?

Risk assessment is the foundation upon which a local disaster risk reduction plan is developed. With the results from the risk assessment, you should be able to identify what areas of your locality are susceptible to each hazard, where the highest losses would occur, how the lives and quality of life in your town or city might be affected in the aftermath of a disaster.

These identified risk areas and estimated impacts will be the information necessary to support future disaster risk reduction decisions. It is therefore important to compile the results of your work into a written report.

This report should be presented to citizens and elected officials, and made available for them to refer to on various occasions. Feedback allows information to be reviewed and validated. It also informs stakeholders and facilitates their wider involvement in the risk reduction process.

The provincial and/or national disaster management organization should be made aware of the completion of your risk assessment as they may want to use it as part of their provincial or nationwide risk assessment.

The results of your risk assessment will likely draw interest from a wide range of sectors in the town or city. Business owners and residents will want to know what the results of the risk assessment mean for them and what to do next.

This is an opportunity to use the results of the risk assessment as a tool to galvanize the community and key officials, and secure interest and support in the planning process. The risk assessment can be an effective tool for public education, disaster response and recovery, and economic development.

Disseminate results using a range of different media. Maps and reports could be developed and presented at stakeholder workshops. Other ways of dissemination include the newspaper, pamphlets, radio, television and the Internet.

In the planning phase, you will find solutions to address the potential impacts of hazards in your town or city. The disaster risk reduction plan will be based on the results of the risk assessment. But as risk is constantly changing, it is important to develop a mechanism for ongoing monitoring, evaluation and feedback.

Risks assessments are useful for policy formulation, program design, and evaluation of interventions, and are carried out at all phases of the disaster risk management cycle, albeit at different levels of detail and emphasis. While the response phase involves the conduct of rapid damage and needs assessment to allow for quick decisions to be made, programs and projects that are focused on mitigating risks should include in their planning process, an extensive risk assessment process.

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glossary

Note: All definitions provided in this series of "Urban Governance and Community Resilience Guides," are the terminology promoted by the UNISDR in 2009, unless otherwise stated.

Adaptation - The adjustment in natural or human systems in response to actual or expected climatic stimuli or
their effects, which moderates harm or exploits beneficial opportunities.

Capacity - A combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster. Capacity may include physical, institutional, social or economic means as well as skilled personal or collective attributes such as leadership and management. Capacity may also be described as capability.

Climate Change - The Inter-governmental Panel on Climate Change defines climate change as: "a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use."

Disaster - A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.

Disaster Risk Management - The systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of hazards.

Disaster Risk Reduction - The conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development.

Exposure - People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.

Hazard - A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Mitigation - Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.

Preparedness - Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations.

Prevention - Activities to provide outright avoidance of the adverse impact of hazards and means to minimize related environmental, technological and biological disasters. Depending on social and technical feasibility and cost/benefit considerations, investing in preventive measures is justified in areas frequently affected by disasters. In the context of public awareness and education, related to disaster risk reduction changing attitudes and behavior contribute to promoting a 'culture of prevention'.

Recovery - Decisions and actions taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk. Recovery (rehabilitation and reconstruction) affords an opportunity to develop and apply disaster risk reduction measures.

Response - The provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. It can be of an immediate, short-term, or protracted duration.

Risk - The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.

Vulnerability - The conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.

About the guidebooks

Recognizing the important role local governments can play in reducing disaster risks, the Asian Disaster Preparedness Center has developed a series of "Urban Governance and Community Resilience Guides" to guide local governments in understanding disaster risks in the locality and in identifying measures to enhance their citizens' safety.

The intention is not to develop a technical guide, but rather to raise awareness of the challenges local governments face in reducing disaster risks. These guidebooks offer essential tools and possible solutions to make that will help local governments to make effective decisions.

The series, comprised of four guidebooks, is designed in such a way that they can be used as self-study material by individual readers, as a resource for participants in a training course or program, or as a reference for government officials. Each guidebook is a standalone book as well as linked to the others. Effort has been made in each guidebook to link with discussions in the other guidebooks in the series.

Each guidebook contains case studies and questions that are designed to enable readers or trainees to think reflectively on the concepts and issues presented, and draw on their own experience to benchmark the content. The aim is to make the content as closely relevant to their work experience as possible, and to enable readers to link the knowledge gained to their own experience in order to solve problems.

The first guidebook provides the basics of disaster risk management. Subsequent guidebooks in this series serve to provide the 'how-to' of disaster risk management. The topics include essential tools, good practices and step-by-step guides that are vital to the successful implementation of risk reduction projects in urban communities.

Book 1 demonstrates the potentially destructive impacts of various hazards and climate change on urban communities. It examines the causes of increasing urban risks, and stresses the urgency to act now in a collaborative and integrated manner involving all sectors of society. It shows the importance of understanding the unique conditions at the local level, and of harmonizing efforts over larger geographic areas.

Book 2 provides guidelines in selecting appropriate assessment methodologies to evaluate risks and support decision-making processes.

Book 3 outlines the planning process in managing urban disaster risks. This book focuses on the process of transforming the knowledge gained through various assessments into appropriate, effective and sustainable actions, towards safer urban communities.

Book 4 introduces the concept of 'mainstreaming' as the core framework for local government to reduce disaster risks. This guidebook demonstrates how to integrate the principles of disaster risk management into development goals, governance arrangements and action strategies.

Do you have comments or suggestions about the guidebook? If yes, kindly send us an email at *adpc@adpc.net*

ADPC resources on mainstreaming DRR into local governance

RCC Working Paper, "Mainstreaming Disaster Risk Reduction: A Road Towards Sustainable Urban Development and Creating Safer Urban Communities,": http://rccdm.net/sites/default/files/MainstreamingDRR%20Urban%20Local%20Governance-Working%20Paper.pdf

Webpage on PROMISE country demonstration projects on mainstreaming DRR into local governance: http://www.adpc.net/v2007/Programs/UDRM/PROMISE/PROGRAM%20COMPONENTS/Component3/Component3.asp

Regional Course on Mainstreaming Disaster Risk Reduction into Local Governance: http://www.adpc.net/v2007/Programs/UDRM/PROGRAMS%20&%20PROJECTS/CAPACITY%20BUILDING/TRAINING/05GDRR.asp

PROMISE

The development of the guidebook series was supported by the Program for Hydro-Meteorological Disaster Mitigation in Secondary Cities in Asia (PROMISE). PROMISE ran from 2005 to 2010, with city demonstration projects in Bangladesh (Chittagong and Jamalpur), Indonesia (Jakarta), Pakistan (Hyderabad), the Philippines (Dagupan and Pasig), Sri Lanka (Kalutara and Matara), and Viet Nam (Da Nang). Support came from the local governments of each city, and from the Office of Foreign Disaster Assistance of the U.S. Agency for International Development (USAID/OFDA). This paper was developed under the component "Regional Information and Networking." Learn more about PROMISE at: http://www.adpc.net/v2007/Programs/UDRM/PROMISE.

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Mainstreaming Disaster Risk Reduction

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