Academy of ICT Essentials for Government Leaders

Version 2.0

Module

09

ICT for Disaster Risk Management

UNITED NATIONS
APCICT - ESCAP

Academy of ICT Essentials for Government Leaders

Module 9

ICT for Disaster Risk Management

Asian Disaster Preparedness Center

APCICT ASIAN AND PACIFIC TRAINING CENTRE FOR INFORMATION AND COMMUNICATION TECHNOLOGY FOR DEVELOPMENT

The Academy of ICT Essentials for Government Leaders Module Series

Module 9: ICT for Disaster Risk Management

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Design and Layout: Scand-Media Corp., Ltd.

PREFACE

In the effort to bridge the digital divide, the importance of developing the human resource and institutional capacity in the use of ICTs cannot be underestimated. In and of themselves, ICTs are simply tools, but when people know how to effectively utilize them, ICTs become transformative drivers to hasten the pace of socio-economic development and bring about positive changes. With this vision in mind, the *Academy of ICT Essentials for Government Leaders* (*Academy*) was developed.

The *Academy* is the flagship programme of the United Nations Asian and Pacific Training Centre for Information and Communication Technology for Development (APCICT), and is designed to equip government officials with the knowledge and skills to fully leverage ICT for socio-economic development. The *Academy* has reached thousands of individuals and hundreds of institutions throughout the Asia-Pacific and beyond since its official launch in 2008. The *Academy* has been rolled out in over 20 countries in the Asia-Pacific region, adopted in numerous government human resource training frameworks, and incorporated in the curricula of university and college programmes throughout the region.

The impact of the *Academy* is in part a result of the comprehensive content and targeted range of topics covered by its eight initial training modules, but also due to the *Academy's* ability to configure to meet local contexts and address emerging socio-economic development issues. In 2011, as a result of strong demand from countries in the Asia-Pacific, APCICT in partnership with its network of partners developed two new *Academy* training modules designed to enhance capacity in the use of ICT for disaster risk management and climate change abatement.

Adhering to APCICT's "We D.I.D. It In Partnership" approach, the new *Academy* modules 9 and 10, like the initial modules 1 to 8, were Developed, Implemented and Delivered in an inclusive and participatory manner, and systematically drew upon an extensive and exceptional group of development stakeholders. The entire *Academy* has been based on: needs assessment surveys from across the Asia-Pacific region; consultations with government officials, members of the international development community, and academics and educators; research and analysis on the strengths and weaknesses of existing training materials; and a peer review process carried-out through a series of APCICT organized regional and sub-regional workshops. These workshops provided invaluable opportunities for the exchange of experiences and knowledge among users of the *Academy* from different countries. The result is a comprehensive 10-module *Academy* curriculum covering a range of important ICTD topics, and indicative of the many voices and contextual nuances present across the region.

APCICT's inclusive and collaborative approach to development of the *Academy* has also created a network of strong partnerships to facilitate the delivery of ICTD training to government officials, policymakers and development stakeholders throughout the Asia-Pacific region and beyond. The *Academy* continues to be rolled out and adopted into training frameworks at the national and regional levels in different countries and regions as a result of close collaboration between APCICT and training institutions, government agencies, and regional and international organizations. This principle will continue to be a driving force as APCICT works with its partners to continuously update and further localize the *Academy* material, develop new *Academy* modules to address identified needs, and extend the reach of *Academy* content to new target audiences through new and more accessible mediums.

Complementing the face-to-face delivery of the *Academy* programme, APCICT has also developed an online distance learning platform called the APCICT Virtual Academy (http://e-learning.unapcict.org), which is designed to enable participants to study the material at their own pace. The APCICT Virtual Academy ensures that all the *Academy* modules and accompanying materials are easily accessible online for download, dissemination, customization and localization. The *Academy* is also available on DVD to reach those with limited or no Internet connectivity.

To enhance accessibility and relevance in local contexts, APCICT and its partners have collaborated to make the *Academy* available in Arabic, Armenian, Azeri, Chinese, English, Indonesian, Khmer, Mongolian, Myanmar, Pashto, Persian, Russian, Spanish, Tajik, Turkmen, Vietnamese with plans to translate the modules into additional languages with plans to translate the modules into additional languages.

Clearly, the development and delivery of the *Academy* would not have been possible without the commitment, dedication and proactive participation of many individuals and organizations. I would like to take this opportunity to acknowledge the efforts and achievements of our partners from government ministries, training institutions, and regional and national organizations who have participated in *Academy* workshops. They not only provided valuable inputs to the content of the modules, but more importantly, they have become advocates of the Academy in their countries and regions, and have helped the *Academy* become an important component of national and regional frameworks to build necessary ICT capacity to meet the socio-economic development goals of the future.

I would like to add a special acknowledgment to the dedicated efforts of many outstanding individuals who have made Module 9 possible. They include lead authors from the Asian Disaster Preparedness Center (ADPC), and contributors from the Center for Disaster Preparedness, Pacific Disaster Center (PDC), Learning Initiatives on Reforms for Network Economies Asia (LIRNEasia), the Sahana Software Foundation, and the Information and Communications Technology and Disaster Risk Reduction Division (IDD) of ESCAP.

I would also like to thank the Economic Commission of Africa (ECA), the Economic Commission of Latin America and the Caribbean (ECLAC) and the Economic and Social Commission for West Africa (ESCWA), the International Telecommunication Union (ITU), Microsoft, and the National Emergency Management Agency (NEMA) of the Republic of Korea for their support in shaping the content of Module 9. And a note a gratitude is extended to the national and sub-regional partners of the *Academy*, and the participants of the Expert Group Meeting on Disaster Risk Reduction, the Second Academy Partners Meeting, the Fourth Regional Training of Trainers Workshop on Modules 9 and 10, and the Sub-regional Training of Trainers Workshop on Modules 9 and 10, for their support in reviewing Module 9.

I sincerely hope that the Academy will help nations narrow ICT human resource gaps, remove barriers to ICT adoption, and promote the application of ICT in accelerating sustainable socio-economic development.

Hyeun-Suk Rhee

Director
UN-APCICT/ESCAP

ABOUT THE MODULE SERIES

In today's "Information Age", easy access to information is changing the way we live, work and play. The "digital economy", also known as the "knowledge economy", "networked economy" or "new economy", is characterized by a shift from the production of goods to the creation of ideas. This underscores the growing, if not already central, role played by ICTs in the economy and in society as a whole.

As a consequence, governments worldwide have increasingly focused on ICTD. For these governments, ICTD is not only about developing the ICT industry or sector of the economy but also encompasses the use of ICTs to engender economic as well as social and political growth.

However, among the difficulties that governments face in formulating ICT policy is that policymakers are often unfamiliar with the technologies that they are harnessing for national development. Since one cannot regulate what one does not understand, many policymakers have shied away from ICT policymaking. But leaving ICT policy to technologists is also wrong because often technologists are unaware of the policy implications of the technologies they are developing and using.

The *Academy of ICT Essentials for Government Leaders* module series has been developed by the UN-APCICT/ESCAP for:

1. Policymakers at the national and local government level who are responsible for ICT policymaking;

2. Government officials responsible for the development and implementation of ICT-based applications; and

3. Managers in the public sector seeking to employ ICT tools for project management.

The module series aims to develop familiarity with the substantive issues related to ICTD from both a policy and technology perspective. The intention is not to develop a technical ICT manual but rather to provide a good understanding of what the current digital technology is capable of or where technology is headed, and what this implies for policymaking. The topics covered by the modules have been identified through a training needs analysis and a survey of other training materials worldwide.

The modules are designed in such a way that they can be used for self-study by individual readers or as a resource in a training course or programme. The modules are standalone as well as linked together, and effort has been made in each module to link to themes and discussions in the other modules in the series. The long-term objective is to make the modules a coherent course that can be certified.

Each module begins with a statement of module objectives and target learning outcomes against which readers can assess their own progress. The module content is divided into sections that include case studies and exercises to help deepen understanding of key concepts. The exercises may be done by individual readers or by groups of training participants. Figures and tables are provided to illustrate specific aspects of the discussion. References and online resources are listed for readers to look up in order to gain additional perspectives.

The use of ICTD is so diverse that sometimes case studies and examples within and across modules may appear contradictory. This is to be expected. This is the excitement and the challenge of this newly emerging discipline and its promise as all countries begin to explore the potential of ICTs as tools for development.

Supporting the *Academy* module series in print format is an online distance learning platform—the APCICT Virtual Academy —with virtual classrooms featuring the trainers' presentations in video format and presentation slides of the modules (visit http://e-learning.unapcict.org).

In addition, APCICT has developed an e-Collaborative Hub for ICTD, or e-Co Hub (http://www.unapcict.org/ecohub), a dedicated online site for ICTD practitioners and policymakers to enhance their learning and training experience. The e-Co Hub gives access to knowledge resources on different aspects of ICTD and provides an interactive space for sharing knowledge and experiences, and collaborating on advancing ICTD.

MODULE 9

Disaster Risk Management (DRM) is a field that greatly benefits from ICTs. The module provides an overview of DRM, its information and communication needs, and the applications of ICTs in its activities.

Module Objectives

The module aims to:

1. Provide an overview of DRM;
2. Present an approach of identifying information needs in DRM, and then matching the needs with ICTs;
3. Describe and provide examples of existing ICT applications for DRM; and
4. Raise policy considerations (benefits and barriers) for employing ICTs in DRM.

Learning Outcomes

After going through this module, the readers should be able to:

1. Identify and describe the major activities in DRM (mitigation, preparedness, response and recovery);
2. Identify some of the information challenges in DRM;
3. Discuss the relevance and usefulness of ICT applications for DRM;
4. Understand the policy issues for creating a suitable ICT framework for supporting DRM; and
5. Know the major regional and international cooperation mechanisms for the use of ICTs in DRM.

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Acronyms

ADPC	Asian Disaster Preparedness Center
ADRC	Asian Disaster Reduction Center
APCICT	Asian and Pacific Training Centre for Information and Communication Technology for Development
ASEAN	Association of Southeast Asian Nations
CATSIM	Catastrophe Simulation
CB	Cell Broadcast
DRCC	Disaster Response Coordination Centre
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DSF	Decision Support Framework (MRC IKMP)
EM-DAT	Emergency Events Database
ESCAP	Economic and Social Commission for Asia and the Pacific (UN)
FAO	Food and Agriculture Organization (UN)
GEOSS	Global Earth Observation System of Systems
GIS	Geographic Information System
GPS	Global Positioning System
GSM	Global System for Mobile Communication
HFA	Hyogo Framework for Action
ICG	Intergovernmental Coordination Group
ICT	Information and Communication Technology
ICTD	Information and Communication Technology for Development
IDNDR	International Decade for Natural Disaster Reduction
IDRN	India Disaster Resource Network
IFRC	International Federation of Red Cross and Red Crescent Societies
IKMP	Information and Knowledge Management Programme (MRC)
INGO	International Non-Governmental Organization
INSAT	Indian National Satellite System
InSTEDD	Innovative Support to Emergencies, Diseases and Disasters
IOC	Intergovernmental Oceanographic Commission
IOTWS	Indian Ocean Tsunami Warning and Mitigation System
ITU	International Telecommunication Union
MDG	Millennium Development Goal
MRC	Mekong River Commission
Mw	Moment Magnitude
NETP	National Emergency Telecommunications Plan
NGO	Non-Governmental Organization
OSADI	Online Southeast Asia Disaster Inventory
PSTN	Public Switched Telephone Network
PTWS	Pacific Tsunami Warning and Mitigation System
RBS	Radio Base Stations
RSMC	Regional Specialized Meteorological Centre (India)
SIM	Subscriber Identity Module
SMART	Stormwater Management and Road Tunnel (Malaysia)
SMS	Short Message Service
SUMA	Humanitarian Supplies Management System
TSF	Télécoms Sans Frontières (Telecom Without Borders)
UN	United Nations

UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNISDR	United Nations Office for Disaster Risk Reduction
UNITAR	United Nations Institute for Training and Research
VSAT	Very Small Aperture Terminals
WFP	World Food Programme (UN)
WMO	World Meteorological Organization
WSIS	World Summit on the Information Society

List of Icons

Case Study


Questions To Think About


Something To Do

1. INTRODUCTION TO DISASTER RISK MANAGEMENT

Every health centre or school that collapses in an earthquake and every road or bridge that is washed away in a flood began as development activities.

United Nations Development Programme[1]

This section aims to provide an overview of disaster risk management (DRM) by:

- **Describing how disasters are a product of hazards' effects upon societal vulnerabilities, and made worse by a society's limited capacity to manage disaster risk;**
- **Emphasizing that DRM is not focused on hazards alone, but on ensuring that the development process does not increase the risk of disasters;**
- **Noting how the Asia-Pacific region is experiencing a disproportionately large share of disaster impacts versus other regions of the world; and**
- **Introducing policy issues related to improving DRM by utilizing information and communication technologies (ICTs).**

1.1 What is a Disaster?

The United Nations Office for Disaster Risk Reduction (UNISDR) defines disaster as "a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources".[2] In other words, when the impact of disruption goes beyond the control of human beings, that particular situation can be defined as disaster. Disaster impacts may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, socio-economic disruption, and environmental degradation.

Disaster impacts on human lives and the environment remind us of the intimate linkage between disaster and development. On the one hand, disasters stall development and can erode and destroy livelihoods. Disasters affect social and economic investments aimed at eradicating poverty and hunger; providing access to education, drinking water, sanitation and safe housing; protecting the environment; and securing employment and income. On the other hand, unsustainable development practices increase disaster risks. Unsustainable practices include encroachment into high-risk areas due to rapid urbanization, construction of unsafe shelters, pollution, loss of biodiversity, land degradation, and social discrimination.

* Rapid-onset disasters include earthquakes, volcanic eruptions, fires, cyclones, tsunamis and flash flooding. Slow-onset disasters are those that build up over weeks, months or even years; an example of a disaster of this type is brought on by drought. Disasters may also be exacerbated by climate change impacts upon temperature and precipitation; these in turn may alter the frequency and intensity of rain-triggered landslides, floods, and droughts and sea-level rise increases the risk of coastal flooding and storm surge.

1 UNDP, *Reducing Disaster Risk: A Challenge for Development* (New York, UNDP, 2004), p. 9, http://www.undp.org/cpr/whats_new/rdr_english.pdf.

2 UNISDR, *2009 UNISDR Terminology on Disaster Risk Reduction* (Geneva, United Nations, 2009), http://www.unisdr.org/we/inform/terminology.

1.2 What is Disaster Risk?

Disaster risk is a combination of potential hazards, existing vulnerabilities and capacities. The common notion of disaster is of a situation or event that has occurred from potential threats (i.e., hazards). The existing hazards are considered to be the triggering factors of disasters. UNISDR classifies hazards in terms of origin:

- **Natural hazards** – Natural processes or phenomena occurring in the biosphere that may constitute a damaging event. These are further subdivided into:
  - ✓ **Hydro-meteorological,** for example floods, debris and mudflows, tropical cyclones, storm surges, wind, rain and other severe storms, blizzards, lightning, drought, desertification, wildland fires, temperature extremes, sand or dust storms, permafrost and snow avalanches.
  - ✓ **Geological**, for example earthquakes, tsunamis, volcanic activity and emissions, mass movements, landslides, rockslides, liquefaction, sub-marine slides, surface collapse and geological fault activity.
  - ✓ **Biological,** for example outbreaks of epidemic diseases, plant or anima l contagion and extensive infestations.

- **Technological hazards** – Danger associated with technological or industrial accidents, infrastructure failures or certain human activities (e.g., industrial pollution, nuclear release and radioactivity, toxic waste, dam failure, accidents, explosions, fires, spills).

- **Environmental degradation** – Human-induced processes that damage the natural resource base or adversely alter natural processes or ecosystems (e.g., land degradation, deforestation, desertification, wild land fires, loss of biodiversity, land, water and air pollution, climate change, sea level rise, ozone depletion).[3]

It is important to note that natural hazards alone do not lead to disasters . Hazards like earthquakes and storms are naturally occurring phenomena. It is when the occurrence of hazards interacts with vulnerabilities that a disaster may result. For example, poverty is an important variable related to vulnerability as the poor and landless tend to settle on unsafe land (such as flood plains or unstable hillsides) to be closer to economic centres that hold jobs, good schools and health facilities. Raising the poor's awareness of the dangers (of flooding or landslides, for example) is not enough, as they

Box 1. Some key definitions

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.

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.

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 personnel or collective attributes such as leadership and management. Capacity may also be described as capability.

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

3 UNISDR, "UNISDR- UN Office for Disaster Risk Reduction," http://www.unisdr.org/eng/media-room/facts-sheets/fs-hazard-clasification.htm.

face a bigger daily struggle to earn money and find cheaper access to health and education services. As slum populations increase, every hazard can potentially affect hundreds of poor families at a time, leading to a state of disaster either from deaths or economic disruption or both. Climate change is affecting the frequency and magnitude of climate-related disasters (to learn more about this, refer to Module 10 *ICTs, Climate Change and Green Growth*). Eventually, actors and stakeholders in development and DRM have had to tackle development failure and disaster risk together.

A country may raise its capacity to resist or recover fast enough, so that a hazard event has little impact on it (and therefore does not turn into a disaster). For example, a study of comparative resilience in the Caribbean and Central America found that Cuba usually had few deaths due to natural disasters when compared to neighboring countries. Cuba's resilience was related to the country's structure for disaster assistance, modes of information dissemination, and the role of both government institutions as well as communities in hurricane disaster preparedness.[4]

1.3 Disaster Risk Management and Disaster Risk Reduction

This section highlights the shift in the conceptual framework and practices in managing disaster risks over the past three decades. It also describes the global mandate towards reducing disaster risk at the regional, national and local levels.

Disaster risk reduction (DRR) is: "The concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events."[5]

DRM is: "The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster... Disaster risk management aims to avoid, lessen or transfer the adverse effects of hazards through activities and measures for prevention, mitigation and preparedness."[6]

In the 1990s, the global community on disaster management joined together when the United Nations General Assembly designated the *International Decade for Natural Disaster Reduction* (IDNDR) with the objective to decrease the loss of life, property destruction and social and economic disruption caused by natural disasters. At the end of the IDNDR decade, UNISDR came into place with the aim to pursue the initiatives and cooperation agreed upon during the IDNDR.

Meanwhile, the field of disaster management witnessed a paradigm shift in its strategy and approach towards dealing with disaster risks. From the early 1980s to late 1990s, countries focused on providing relief and humanitarian aid as quickly as possible after a disaster, to prevent further loss of life and destruction. At that time, disaster management related policy and programmes were oriented to post-disaster response.

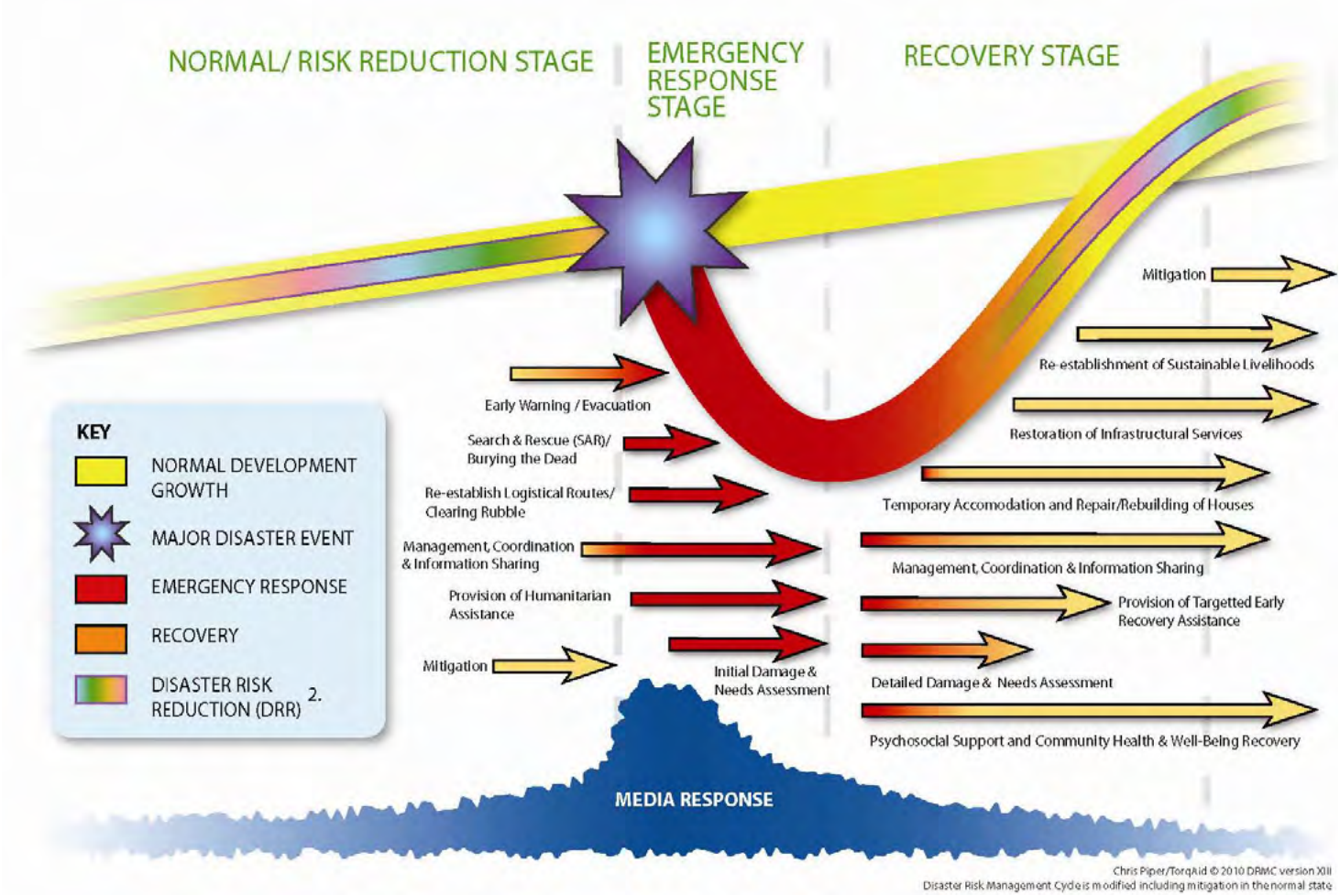
Following the Great Hanshin earthquake (also known as the Kobe earthquake) on 17 January 1995, the global community on disaster management unanimously decided to work on reducing the impact of disasters. Since then, the focus of disaster management on post-disaster events has evolved into a more proactive DRM approach, elaborated in the DRM cycle (see Figure 1).

4 Holly Sims and Kevin Vogelmann, "Popular Mobilization and Disaster Management in Cuba," *Public Administration and Development*, 22, (2002), pp. 389-400.

5 UNISDR, 2009 *UNISDR Terminology*

6 UNISDR, 2009 *UNISDR Terminology*.

Figure 1. Disaster Risk Management Cycle



Note: Based on the TORQAID model, slightly modified to include two arrows on mitigation.

The cycle in Figure 1 is modeled as part of an upward development trajectory. In order for development to be sustainable, DRM is incorporated into development activities in what is called the "normal stage". Disaster mitigation and disaster preparedness take place simultaneously at this stage. In the event of a disaster, the development trajectory is brought down and disaster response dominates the DRM activity. Disaster recovery is planned and executed with the objective of bringing the affected communities back to a sustainable development path.

Media is modeled as part of DRM in that it has a critical role in keeping the public aware of disaster risks and how to reduce these during the normal stage. Media is required to broadcast early warning and provide humanitarian updates of disaster events, as well as report on post-event recovery so that the public is kept informed of the efforts by government and other stakeholders.

As the development discourse has undergone a series of significant changes, the DRM cycle has also seen dramatic transformation—from event-based action to process-based preparedness and mitigation; and from a top-down approach controlled by central government to the participation of multiple stakeholders, including citizens and affected communities in the DRM process. This cycle suggests that if DRM is integrated as part of a sustainable and inclusive development process, the loss and damage incurred as a result of disasters would be reduced.

Bangladesh has been able to reduce human casualties from cyclones by spending modest sums on shelters, developing accurate weather forecasts, issuing warnings and arranging for evacuations.[7] All these actions cost less than the humanitarian aid provided when cyclones strike or the construction of large-scale embankments that would potentially have been less effective. This example is itself a reflection of a change in disaster management policy from relief to proactive DRM.

The DRM approach is now widely accepted with the adoption of the *Sendai Framework*, a 15-year plan to more effectively protect people, communities and countries, and to build resilience. A total of 187 United Nations member States adopted the framework at the 3rd World Conference on Disaster Risk Reduction in 2015.[8]

The *Sendai Framework for Disaster Risk Reduction 2015-2030* (*Sendai Framework*) is a 15-year, voluntary, non-binding agreement that aims for the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries. It recognizes that the State has the primary role to reduce disaster risk, but also asserts that responsibility should be shared with other stakeholders including local government, the private sector and other stakeholders.

The *Sendai Framework* has seven global targets for disaster risk reduction by 2030:

Box 2. What is UNISDR?

UNISDR is the focal point in the United Nations system for the coordination of DRR and assurance of synergies among the DRR, economic and humanitarian activities of the United Nations system and regional organizations and stakeholders. Furthermore, UNISDR has the task of supporting the implementation, follow up and review of the *Sendai Framework for Disaster Risk Reduction 2015 – 2030* Learn more at http://www.unisdr.org/who-we-are/mandate

The *Sendai Framework* recognizes the contribution of information technology for the assessment of disaster risks, early warning, hazard monitoring, and for developing multi-hazard solutions for managing disaster risk.

(1) Substantially reduce global disaster mortality

(2) Substantially reduce the number of affected people globally

(3) Reduce direct disaster economic loss in relation to global gross domestic product (GDP)

(4) Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities

(5) Substantially increase the number of countries with national and local disaster risk reduction strategies

(6) Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this Framework

(7) Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people

7 United Nations and The World Bank, *Natural Hazards and UnNatural Disasters: The Economics of Effective Prevention* (Washington D.C., The World Bank, 2010), p. 2, http://www.gfdrr.org/gfdrr/nhud-home.

8 Learn more about the Sendai Framework at: UNISDR, "Sendai Framework for Disaster Risk Reduction," http://www.unisdr.org/we/coordinate/sendai-framework.

1.4 Disaster Trends in Asia and the Pacific

According to a United Nations report, countries in Asia and the Pacific are more prone to disasters than those in other parts of the world, with the region experiencing over 40 per cent of the 3,979 disasters that occurred globally between 2005 and 2014, resulting in almost 60 per cent of the total global deaths related to disasters and severe economic damage (45 per cent of global total damages). The Asia and Pacific region is also home to 80 per cent of those affected by disasters globally.[9]

Table 1 shows that for the period 2000 to 2015, earthquakes and tsunamis killed the most people and created the most damage, while floods affected the most people in the region.

Table 1. Disaster types and their impact, Asia and the Pacific, 2000-2015

Events	Deaths	People affected (millions)	Total damage (millions USD)
Earthquakes and tsunamis	483,717	98	416.8
Storms	175,331	502	164.4
Floods	61,644	1,324	257.0
Others	38,385	802	47.6
Total	759,563	2,726	885.8

Source: The CRED International Disaster Database. Available on http://www.emdat.be/ (Accessed January 2016)

Over the same period, South-East and South Asia had the greatest number of disaster events (Table 2). These regions also experienced the most fatalities. However, East Asia suffered more both in terms of the number of people affected and economic damage. Considering their smaller land mass and population size, both human and economic damages are also significant among the Pacific Island states.[10]

Table 2. Disaster events and impacts by sub-region, 2000-2015

Region	Events	Killed	Affected ('000s)	Damage (USD, millions)
Central Asia	83	618	9 155	1.5
Western Asia	185	3 018	7 006	10.8
Pacific (Oceania)	242	2 208	2 297	55.2
East Asia	701	136 516	1 640 969	629.2
South Asia	764	256 014	827 532	95.0
South-East Asia	777	361 189	239 446	94.1
GRAND TOTAL	2752	759 563	2 726 405	885.8

Source: The CRED International Disaster Database. Available from http://www.emdat.be/ (Accessed January 2016)

9 ESCAP, Disasters without Borders: Asia-Pacific Disaster Report 2015, p. iv.

10 Ibid. For specific statistics and country examples see Chapter 2: Socio-economic impacts of disasters, pp. 21-37.

1.5 Policy Considerations

The use of ICTs brings benefits to countries seeking to reduce disaster risks in innovative ways. ICTs have become essential to the effective management of all stages of the DRM cycle and are widely used for:

- Collecting data and information in databases to manage logistics during emergencies as well as for mapping, modeling and forecasting.
- Developing knowledge and decision support tools for early warning, mitigation and response planning.
- Sharing information, promoting cooperation, and providing channels for open dialogue and information exchange.
- Communicating and disseminating information, particularly to remote at-risk communities.
- Teaching, learning and raising awareness are all critical for developing a "culture" of DRR, as well as building specific skill sets required by disaster managers.
- Managing disaster risks by utilizing available ICT tools, including the Internet, phones, television and radio, to alert communities of impending disasters, coordinate response and rescue, and manage mitigation programmes and projects.

The advancement of ICTs has made DRM easier, but procuring the technology alone is insufficient-it requires a mix of political, cultural and institutional interventions, and coordination between governments, corporate sector, civil society, academia, media agencies and volunteers. ICT for DRR initiatives are more about people and processes than about the technologies. It is about identifying needs, gaps and capacities and assessing which technologies will help meet a project's objectives, or one may find at that point in time that ICTs are not required to effect change and achieve goals.

There is growing recognition on the need for a culture of communication that values proper information management and inclusive information sharing. Thus, the presence of essential ingredients for successful programming such as strong leadership, political commitment, multi-stakeholder participation, and a capacitated human resource pool, are fundamental to the success of ICT for DRR interventions.

ICTs that have proved indispensable to DRM include but are not limited to: mobile technology, the Internet and online social media tools, space-based technologies such as remote sensing and satellite communications, and different types of radios, including amateur radio and satellite radio.

Policymakers are encouraged to consider the following issues when developing strategies and plans for identifying and using ICT for DRM:

Incorporating ICT for DRM as part of sustainable development efforts – ICT for DRR policies and measures need to take into consideration potential impact on society, the environment and the economy, and ensure that interventions do not increase people's vulnerability to hazards. There is also a growing momentum towards the integration of climate change abatement and DRM into sustainable development policies. ICTs are indispensible tools for climate change abatement as illustrated in *Academy Module 10* and should be incorporated in strategies for climate change abatement.

Providing an enabling policy environment – National governments play a vital role in providing an enabling environment for leveraging the potential of ICTs in DRR through appropriate policies and institutional arrangements. Policies and legislations need to be in place to promote DRR measures, enhance ICT accessibility, and bridge the fields of ICT and DRR by ensuring cooperation between the two fields in developing innovative solutions that build disaster resilience. Policies to ensure interoperability and compliance with ICT standards are also crucial.

Communicating with at-risk communities – Greater emphasis and priority needs to be given to the communication with people affected by disaster at all stages of DRM. Not only will this lead to more effective outcomes, but more importantly, by giving vulnerable people the right information, they can take greater control of their own lives. Instead of imposing definitions and solutions on people considered vulnerable, their perception and knowledge of risk, and existing coping strategies should be discussed. ICT for DRR interventions should focus on strengthening their capacities to address any gaps and challenges that communities have themselves identified.

Increasing ICT accessibility – Universal access to ICT services will require favourable policies and regulations, that may need to be supported with resources dedicated to reaching users located in un- and under-served areas. While expanding the ICT infrastructure, their resilience to disasters should also be considered, incorporating back up services, and diverse and redundant communication channels.

Advancing information accessibility – There is currently abundant information available globally on DRR and DRM, but that does not necessarily translate into its widespread availability or utility. Information accessibility limited by different forms of discrimination and marginalization including due to gender, disability, literacy, age, religion, race and caste needs to be addressed. It is also important to ensure that content is well targeted for the users. In many places and cultures, there is little relevant information conveyed in local languages or suited to the actual living conditions of people exposed to natural hazards. Language barriers must also be overcome for existing information to be accessible.

Encouraging standardization – A standard is "a framework of specifications that has been approved by a recognized organization or is generally accepted and widely used throughout by the industry".[11] Standardization is important for the way data is collected, stored and used, allowing the same set of data to be displayed in multiple ways. Standardization is also required for the way in which the data is communicated, as a means for information exchange and collaboration. Standards reduce training, and system and data conversion costs; and ensure that the next purchase of software and systems is not dictated by the last purchase, thus increasing choices related to information and services.

Questions To Think About

What is normal? It is reasonably preferable to think of disasters as a deviation from a normal state of development. However, we argued in this section that disasters are the result of society failing to manage risk or account for risk within its development activities. Therefore, disasters are the norm for societies that fail to address their cultural values, policies, government institutions, and private activities that increase their disaster risks. Would you agree?

11 Nah Soo Hoe, *FOSS: Open Standards*, e-Primers on Free/ Open Source Software (Bangkok, UNDP Asia-Pacific Development Information Programme, 2006), p. 1, http://www.iosn.net/open-standards/foss-open-standards-primer/foss-openstds-withcover. pdf.

Something To Do

Check out the *Words into Action: Implementation guides for the Sendai Framework* (http://www.preventionweb.net/drr-framework/sendai-framework/wordsintoaction/).

Further Reading

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2. THE NEED FOR INFORMATION IN DISASTER RISK MANAGEMENT

Information bestows power. At-risk communities need information as much as water, food and medicine, or shelter before, during and after disasters.

Markku Niskala, Secretary General
International Federation of Red Cross and Red Crescent Societies (IFRC)

This section aims to provide a framework for matching available technology with DRM processes by:

- **Providing an overview of the information needs in different disaster management activities;**
- **Discussing risk communication as a framework for the exchange of information with the public;**
- **Providing examples of the specific needs in disaster response and post-disaster recovery and reconstruction with ICT solutions employed to answer those needs; and**
- **Providing an overview of ICT solutions.**

Access to reliable, accurate, and timely information at all levels of society is crucial immediately before, during, and after a disaster. Without information, individuals and institutions are often forced to make crucial decisions based on sketchy, conflicting reports and best guesses. Information on disaster risk and disaster events must also be shared with the general public as stakeholders in the DRM process. ICTs have their advantages in information sharing and management that can be utilized to improve DRM.

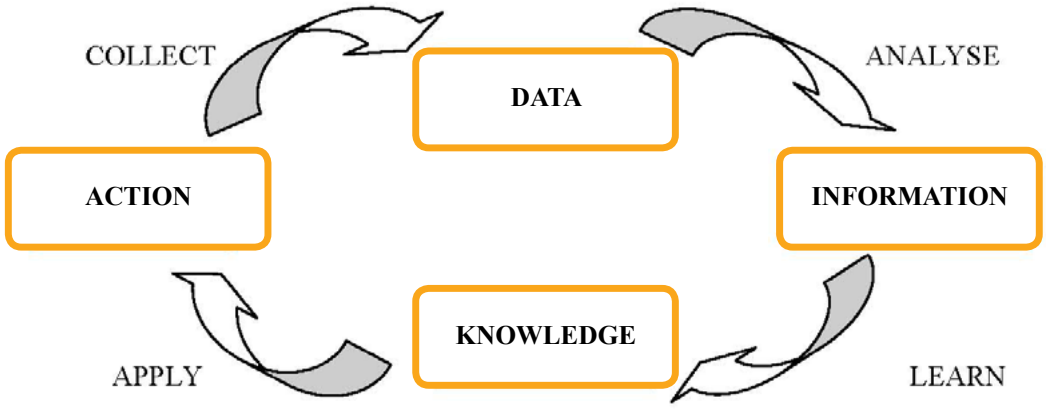
2.1 Information Needs in Disaster Situations

In general, it is recognized that different DRM measures have different information needs for different audiences. Section 1 introduced how the effectiveness of disaster reduction and response rely greatly on the effectiveness of managing relevant information. Activities for prevention, mitigation, preparedness planning and recovery planning require baseline data about the country and its major risks for conducting risk assessment and analysis. Activities for disaster response, rehabilitation and reconstruction need real-time information about the impact of a disaster and the resources available to combat it. Information needs to be readily collected, processed, analysed, and shared in order for stakeholders to respond effectively.

Countries should also have disaster information strategies to manage critical baseline information, which may be used for pre-disaster preparedness, during-disaster emergency response, and post-disaster needs for damage and loss assessment, rehabilitation and reconstruction. Such baseline information could be collected through intensive risk mapping and assessment of major disaster prone areas.[12] The Information Management Cycle, shown in Figure 2, is one way to understand this process.

12 ESCAP and UNISDR, *Protecting Development Gains: The Asia-Pacific Disaster Report* (2010).

Figure 2. Information Management Cycle



Data are measurements or observations of a variable, including numbers (e.g., number of internally displaced persons), words (e.g., majority ethnic group of the internally displaced persons), or images (e.g., photo of the latrines at the camp). By itself, data is not useful. Through data analysis, the raw data becomes information through the act of extracting useful information for decisions and actions. Examples include: "The community of displaced persons is 60 per cent bigger than the host community and are from a different ethnic group from the host population. Their camp has only one latrine for every 80 families."

Information becomes knowledge of disaster risk through a learning process, and timely and properly applied knowledge turns into practical activities on the ground. Practical activities in turn will generate new data that can be collected and analysed. Therefore, the whole information management process is not a linear; rather it is a continuous cycle.

Table 3 provides a brief listing of the different information needs for the four phases of DRM.

Table 3. A snapshot of different information needs in different disaster management activities

Major information needs	Examples of actions that may be taken based on available information
Mitigation • Development plans and decisions at the national, local and community levels • Social, demographic and economic characteristics • Land-use plans, environment management plans • Utility services network information • Hazard and vulnerability maps • Risk zones • Geologic and hydro-meteorological information • DRM plans	• Identify spatial and temporal variation in hazard severity, occurrence and likelihood and/or variations in vulnerability • Identify service and infrastructure assets and gaps • Identify and communicate high risk "hotspots" where disaster impacts are most likely to be severe • Identify appropriate structural and/or non-structural mitigation measures and prioritize resources • Evaluate appropriateness of land-use and development plans • Target public outreach campaigns and choose appropriate messages, sources, and channels • Recommend appropriate codes and ordinances • Promote risk education among decision makers, highlighting how development decisions can impact risks

Preparedness • Country hazard profiles • Locations of shelters and critical infrastructure • Hazard & vulnerability maps • Risk zones • Populations at risk • Access to telecommunication & electricity services • Equipment, emergency personnel and volunteers for disaster response	• Identify spatial and temporal variation in hazard severity, occurrence and likelihood and/or variations in vulnerability • Identify appropriate places for resource stockpiling, staging areas, evacuation routes, and Emergency Operations Centres • Identify service and infrastructure assets and gaps • Improve warning strategies by identifying appropriate channels, sources, and messages before an event • Improve evacuation planning by identifying potential zones, shelters, routes and the location of populations with special evacuation needs • Develop and visualize a hazard and impact scenario during an exercise • Conduct public education campaigns, including incorporating disaster risk awareness into school curricula • Conduct emergency exercises and drills
Response • Hazard and vulnerability maps • Geospatial information on the disaster event: "Where is it? What is in the area? How do I get there?" • Situation update: affected populations, persons needing rescue, roads, shelter, etc. • Information regarding the latest developments in the relief efforts	• Target alerts using appropriate channels, sources and messages • Anticipate likely impacts across areas of interest • Anticipate likely short-term needs across areas of interest • Identify and communicate appropriate shelter and mass care locations • Familiarize disaster response teams with areas of interest • Provide a baseline to clearly characterize short-term disaster impacts • Provide a baseline to monitor progress of response activities • Conduct loss and damage assessment • Assist the public to connect with family, friends and colleagues in stricken areas
RecoveryandReconstruction • Damage and needs assessment • Same information needs as for mitigation	• Identify and communicate locations for recovery assistance centres • Provide a baseline by which to identify new hazards and/or patterns in vulnerability • Evaluate appropriateness of redevelopment plans • Identify appropriate mitigation measures • Identify appropriate changes in preparedness and response activities • Provide a baseline to clearly characterize long-term disaster impacts • Provide a baseline by which to monitor progress of recovery activities

The next sub-sections will try to provide a picture of the critical need for information sharing with the general public.

Disaster Response

For people who are caught up in emergency situations, the need for information is often acute. Frequently, they are separated from their families, lack shelter and adequate food and are scared and confused by the events occurring around them. Programming tailored to the needs of such people can provide an essential information lifeline.

Department for International Development, United Kingdom[13]

13 Department for International Development, "Working with the Media in Conflicts and other Emergencies," DFID Policy Paper, August 2000, http://reliefweb.int/sites/reliefweb.int/files/resources/C8ECCFBA7563F7F4C1256D570049D0B4-DID-mediaandconflict-aug02.pdf.

Following the 2004 Indian Ocean tsunami, a large number of people expressed their dismay that they did not have enough information about aid and aid processes. For some, this meant they felt they did not have or understand options. During the immediate aftermath of a disaster, people need simple information. What just happened and where are their family members and friends? However, over time other equally critical information needs emerge. For example, people may need to know the location of food and water, how to access hospitals in the area, how to prevent disease or ascertain the timeline for receiving compensation. In other words, people begin to seek for emergency response and evacuation information such as available relief, services and compensation. Therefore, expectation management through effective communication is vital during any emergency situation whereas ineffective communication at this stage is likely to create false expectations and misunderstandings about what assistance is forthcoming and about the role of the actors, including government and other aid agencies, in question.

Another important aspect of information and communication during disaster response is that information deprivation actually causes stress and exacerbates trauma.[14] In Sri Lanka, after the 2004 tsunami, many people feared the waves believing that were a divine punishment; the Belgian Red Cross helped dispel these myths by explaining the science behind the disaster.

Information and knowledge have always been key elements in humanitarian action but recent emergencies and disasters have demonstrated how vital its role is in providing a basis for effective and informed advocacy, decision-making and resource allocation for affected population as well as humanitarian actors. Timely, accurate and independent/objective/impartial information is central to saving lives and strengthening recovery; the power lies in its effective management, analysis and application.

The use of mobile phones in Disaster Response

According to the International Telecommunication Union (ITU), the total number of mobile phone subscriptions reached 7 billion in 2015, with rapidly increasing penetration rates in developing and least developed countries. Asia and the Pacific region had the largest mobile phone market share in 2010, with estimates at 278 million mobile broadband subscriptions and over 2.6 billion mobile phone subscribers in 2010.[15] Improved mobile connectivity has in turn triggered growth of non-voice applications and services, including text and picture messaging, Internet access and mobile banking.

Mobile phones have been playing a part in all stages of the DRM cycle, from early warning during the pre-disaster period, one-way and two-way communication during the actual disaster, to recovery in the immediate aftermath. IFRC and other organizations have used mobile phones to allow affected families to re-establish contact or confirm to relatives that they are safe during the immediate aftermath of a disaster. For example, in Banda Aceh, Indonesia, Red Cross volunteers helped reunite 3,400 tsunami survivors with their families—often using satellite phones. Mobile phones are also increasingly used in improving transparency and accountability of aid delivering processes.

14 IFRC, *World Disasters Report 2005: Focus on information in disasters*, 2005.

15 ITU, "Key Global Telecom Indicators for the World Telecommunication Service Sector," http://www.itu.int/ITU-D/ict/statistics/ at glance/KeyTelecom.html.

Project 4636 in Haiti

Project 4636[16] was established in Haiti after the 2010 earthquake to meet the needs of the affected population through the use of Short Message Service (SMS). People were able to send SMS messages about their situation and needs to the short code "4636", which Digicel, one of Haiti's major mobile phone providers, made available to the public for free. Through collaboration among numerous governmental and non-governmental organizations and the use of data standards, these messages were forwarded to the Haitian diaspora living in the USA who then translated and added location specifics before routing this information to relevant response organizations to provide assistance.

With the short code 4636 and the SMS application in place, many initiatives emerged around this ICT tool. For example, the Thomson Reuters Foundation, working with the Innovative Support to Emergencies, Diseases and Disasters (InSTEDD) Emergency Information System platform, used the Mission 4636 SMS short code for a public health-focused SMS broadcast service, creating a one-way service to send public health messages regarding hygiene, shelter, and security to approximately 26,000 subscribers.

The Haiti case study offers an unusual example of SMS being deployed as both a one-way and a two-way communication system. Although in retrospect: "Evidence argues that the same code shouldn't be used for both purposes. Haitians who heard reports that they could channel requests for assistance through 4636 were frustrated when it seemed that one-way messages were coming back in response."[17]

Despite this confusion, overall results of the SMS public health campaign seem to have been positive. In a telephone survey after the campaign, it reported positive responses from the 450 subscribers who participated in the survey. More than 97 per cent said information received from the SMS 4636 service was practical and trustworthy, particularly information about health. More significantly, 74 per cent of subscribers said they changed their behaviour based on information provided in an SMS 4636 message.[18]

While mobile technology presents many useful characteristics for DRM, there are still a number of limitations to be taken into consideration. Mobile networks are subject to congestion, which can lead to delays in receiving messages and inability to make calls. Early warning, for instance, can be more effectively disseminated via other broadcast technologies that cover wider geographical target areas, or via direct warnings such as sirens. In the case of Haiti, the short length of text messages could at times be a source of confusion and misunderstanding, resulting in the inability of aid requests to be effectively transmitted to relief organizations.[19]

16 Project 4636, "Mission 4636," ttp://www.mission4636.org/.

17 Nelson, et. al., "Media, Information Systems and Communities: Lessons from Haiti," (2011), p. 17, http://reliefweb.int/sites/reliefweb.int/files/resources/F156DD1E2F9D2D0085257815005DD82F-Full_Report.pdf.

18 Ibid.

19 Ibid., p. 22.

CommunicationSupportandSocialMedia

During the initial stage of most emergencies, information is scarce and often unreliable. Normal information channels, such as radio stations and mobile phone networks may become suddenly unavailable, which means information becomes inaccessible to those most affected. To address the need for communication support in times of disaster, Télécoms Sans Frontières (TSF)[20] has been established and will deploy a team from one of its three bases (Pau, France; Bangkok, Thailand; and Managua, Nicaragua) to reach an emergency location within 24 hours. TSF provides communication tools to all actors on the ground including United Nations and Non-Governmental Organizations (NGOs), facilitating coordination of the relief and response efforts. In addition, TSF provides free phone calls to the people affected by the disaster.

Recent technological innovation has also improved the quality and quantity of disaster response measures. One of the examples is the increasing use of social media—such as Facebook, Twitter and Flickr. Social media is not only an effective tool for monitoring and engaging public discourse during the crisis process, but also enables a cultural shift regarding how the public views its role as an empowered contributor. Emergency management and crisis communication have become more participatory.

Box 3. Participatory communication

Participatory communication is people-centred communication that recognizes varied responses from audiences and allows people to ask questions and to express their viewpoint.

Traditionally, public information was considered as a one-way distribution of information. From the perspective of recipients, this is an inadequate and outdated idea derived from the assumption that if the right messages are sent to the target audiences, they will automatically generate "effects". Two-way, participatory communication allows people to provide a vital source of data concerning needs, fears, rumours and perceptions, which in turn contribute to an effective response.

Facebook and Typhoon Megi in the Philippines

Aid officials in the Philippines have credited social media sites like Facebook and Twitter with keeping the number of deaths caused by Typhoon Megi to only 10. Thousands of people were persuaded to move to safer places or take precautionary measures before Megi struck on 18 October 2010. Officials said: "The value of the alerts to us was that we managed to send out the message early." Alexander Rosete, a spokesman for the Philippines National Red Cross, told the Integrated Regional Information Networks: "Now that we are using the Internet, the services are free of charge, and we send messages at no cost to us. It's also more reliable and faster because nearly everyone's on social networking sites."

The Philippines is no stranger to social networking. The country ranks eighth in the world in terms of the number of Facebook users—with 16.8 million registered users, according to CheckFacebook.com, an independent website that tracks social media trends. Numerous SMS alerts also ensured the public knew exactly when and where Megi was expected to make landfall.[21]

20 TSF, http://www.tsfi.org.

21 "In Brief: Social media network helps prevent disaster," *IRIN News*, 19 October 2010, http://www.irinnews.org/Report.aspx?ReportID=90821.

With the development of social media tools, members of the public are able to be more actively engaged in the process of information management. This is leading to the innovation of crowdsourcing, where tasks can be distributed to a large group of volunteers to complete. Crowdsourcing is also used for obtaining feedback and information from the public. Because of the global awareness of major disasters, there are a number of initiatives promoting crowdsourcing as a solution for disaster response information management. Examples include enabling members of the public to report their needs in a disaster, or recruiting volunteers from around the global to help process data such as translating text or analysing maps.

Disaster response involves many actors including government emergency technicians, national and local leaders, trained volunteers, participating civic organizations such as Red Cross and Red Crescent Societies, the media, community organizations, and members of the international community. Managing disaster response requires a system for pulling together all these actors in harmonious efforts, and because each actor's effectiveness depends on the speed and usefulness of shared information, ICT has a role to play in effective disaster response. These ideas will be elaborated in Section 5: ICT for Disaster Response.

Disaster Recovery and Reconstruction

Box 4. No one was prepared for this. People are angry and afraid.

The monsoons have never happened like this before, people have been terrified and have had to be evacuated. In the Nowshera area, which has been worst hit, buildings have been submerged up to the rooftops and this morning the rain started again. The worst thing is that the health infrastructure has been hit and all the contingency plans have been affected.

Those warehouses of the United Nations Children's Fund containing medical supplies for two months were completely washed away mostly on the second day.

The main roads are now open—it was not possible to get out of Peshawar until yesterday—but the roads to the villages are still blocked and some 30,000 people are trapped.

Those who have been rescued by boats and helicopters appreciate the role of the military but now they don't know where to go. They are asking: "Why are you leaving us here? Where are the tents? Where are the supplies? Where is the water?"

The worst problem for them is water. The wells have been contaminated by floodwater, lots of animals were trapped by floods and their bodies are decomposing.

People are angry but if you look at the scale of the problem, the government authorities and the relief agencies were never prepared for this, they were never expecting this.

There are rumours that the Warsak dam is at risk although the government is telling people not to worry and that the dam is intact. But people are afraid that things can change all of a sudden.

The above excerpt is from an article describing what one man witnessed while helping with the health response in Peshawar, Pakistan.[22] This case illustrates that government must provide for two-way risk communication in order to listen to the people's needs, and provide timely and appropriate response to their demands.

The need for access to information and communication does not end when the immediate aftermath of a crisis gives way to the long-term challenge of reconstruction. Information is essential as communities aim to return to a state of normalcy, illustrated in the DRM cycle above. For example, once the basic needs are met, disaster survivors would be looking for information on how to get back to work, how to participate in reconstruction, and how to influence the recovery agenda of aid organizations and governments. Technologies used at earlier stages of disaster response can and should be leveraged to serve longer-term reconstruction and development goals. Databases can be developed to match work needs with employment and investment opportunities as these become available, for instance.

Risk Communication

Risk communication is an interactive process of exchanging information and opinions among individuals, groups, and institutions; often involving multiple messages about the nature of risk, or expressing concerns, opinions, or reactions to risk messages or to legal and institutional arrangements for risk management. Sound and thoughtful risk communication can assist public officials in preventing ineffective, fear-driven, and potentially damaging public responses to serious crises. In addition, appropriate risk communication procedures foster the trust and confidence that are vital in a crisis situation.

By asking the following questions, one can better plan for communicating to the public:

- What is the crucial information to convey in initial messages in order to prompt appropriate public responses after a crisis situation?
- What are the messages to be delivered prior to, during, and after an incident?
- What are the obstacles to effective communication and how can they be minimized?
- What are the opportunities for effective communication and how can they be maximized?
- What questions can be anticipated from the public in these risk situations?
- What are the news media's responsibilities and how can they be assisted in fulfilling these responsibilities?

Constructive communication will be determined, in large part, by whether audiences perceive the communicator (such as the head of a disaster management agency or its media liaison) to be trustworthy and believable. Therefore, earning trust and building credibility are critical in risk communication.

Five Rules for Building Trust and Credibility

1. Accept and involve the public as a partner. Work with and for the public to inform, dispel misinformation and, to every degree possible, allay fears and concerns.

2. Appreciate the public's specific concerns. Be sensitive to people's fears and worries on a human level. Do not overstate or dwell on tragedy, but do empathize with the public and provide answers that respect their humanity.

22 Mark Tran, "Pakistan floods: No one was prepared for this. People are angry and afraid," *The Guardian*, 3 August 2010, http://www.guardian.co.uk/world/2010/aug/03/pakistan-floods-aid-worker-eyewitness.

3. Be honest and open. Once lost, trust and credibility are almost impossible to regain. Never mislead the public by lying or failing to provide information that is important to their understanding of issues.

4. Work with other credible sources. Coordinate your information and communication efforts with those of other legitimate parties.

5. Meet the needs of the media. Work with the media to ensure that the information they are providing the public is as accurate and enlightening as possible.

Public Information and the Role of Media

Media can play an important role both in public education, disaster preparedness, as well as disseminating advice in the aftermath of a crisis. Through educating and empowering affected communities with relevant knowledge, thereby enabling them to influence public action and policy towards disaster preparedness and mitigation, the media can contribute to reducing the loss of life and property.

During the initial period of a disaster event, the sharing of useful information with affected populations in languages they understand, through media they trust, can provide a life-saving resource. Therefore, it is necessary to have a prior understanding of the best channels through which populations in disaster prone areas obtain information. Local media should certainly be one of the key channels to provide immediate information to audiences in their local language. During disaster preparedness planning, disaster managers can take steps to ensure that local media in disaster prone areas have the capacity to mobilize or resume their work quickly and to deliver educational services to the public in emergency situations. Along with local media, there are also many local communication sectors, such as local religious networks, local civil society groups, indigenous public relations agencies, and marketing companies, which can provide culturally sensitive and effectively targeted information with a detailed understanding of local risks and sensitivities.

2.2 ICT Solutions

ICTs are providing an increasing number of solutions across all government and commercial sectors including DRM. An ICT solution generally comprises technology, software and data standards.

Technologies

There is a huge variety of different technologies available that can add value to DRM interventions, and often solutions will combine various technologies. The technologies should always be appropriate for the user, even if this means only using pen and paper.

Databases. Databases are used to store, analyse and retrieve data in electronic form; they will usually be a part of any ICT solution.

Web Applications. Web applications are popular technology for providing user interfaces with ICT solutions. They can be accessed through a Web browser such as Internet Explorer or Firefox, meaning that no additional software needs to be installed on a user's computer. They are flexible and can be configured to be available on the public Internet, on a closed intranet and even set up on a single computer. Some mobile phones and other devices are also able to access Web applications.

Geographic Information System (GIS). "A computer system capable of storing, manipulating, and displaying geographically referenced information… Practitioners also regard the total GIS as including operating personnel and the data that go into the system."[23] Because much of the information related to DRM has a geographic component to it, GIS will be a part of most ICT solutions for DRM.

Sensors. Devices can be used to monitor hazards and provide alerts when hazards occur. Examples include weather satellites, river water gauges, ocean buoys for detecting tsunamis and seismographs for detecting earthquakes. It is important to consider these sensors as part of the complete ICT solution that will transmit the data from the sensor and notify relevant officials or populations. Remote sensing refers to the process of recording information from sensors mounted either on satellites or aircraft.

Radio Broadcasts. Broadcasts over existing radio stations can be an effective way to share information with the public. Radio is considered an "old" ICT but should not be forgotten with the advent of many new technologies. Access to radio can be shared easily and relatively cheaply among many people, and serves both literate and illiterate populations. Broadcast radio continues to be extensively reached in Asia and the Pacific and has been used to disseminate early warning messages, as well as for awareness raising and community education.

Mobile Phones. Mobile phones have a number of different uses for ICT solutions for DRM beyond their functionality for voice communication. Cellular broadcasting can be used to display messages on all mobiles phones within a geographical cell. SMS, or text messages, can be used to collect information from the public and is often more robust than voice communication in the aftermath of a disaster when the telecommunications infrastructure may be damaged or overloaded. Increasingly, mobile phones are able to connect to the Internet, which enables richer sharing and reporting of information. Mobile phones are also becoming smarter and contain similar functionality to computers, as well as cameras and Global Positioning System (GPS), enabling them to be used as data collection devices.

Social Media. Social media is a technology that enables people to easily create and share their own news, photos, videos and other information within their social networks and publically on the Internet. The use of social media in the aftermath of a disaster is briefly discussed in Section 2.1. Social media challenges traditional information flows in DRM activities. In the past, information about populations affected by disasters may have been collected and verified by professional responders working for authorized agencies. Now this information can be reported by the population themselves. However, as these reports, often unstructured and unverified, may be reported by a great number of people, an information overload may occur. Stakeholders involved in DRM activities need to consider how they can best engage with social media and utilize it in their ICT solutions. Apart from broadcasting breaking news and their use during times of crisis, social media tools have also been used in other stages of the DRM cycle—for early warning, recovery coordination, raising funds, generating awareness, campaigning and strengthening capacities. They also provide alternative avenues for psycho-social support to survivors.

23 US Geological Survey, "What is a GIS?," http://webgis.wr.usgs.gov/globalgis/tutorials/what_is_gis.htm.

Software

Any ICT solution will most likely contain software components. There are different options available to supply software:

Commercial off-the-Shelf Software. Commercial off-the-shelf software is developed by companies and then sold or licensed to other organizations. It offers the advantages of a tested solution and the possibility of customizing a solution to fit an organization. The cost for the software may be in the form of a single payment or an ongoing licensing fee. These may also include some sort of service agreement to provide a certain level of support and ongoing modifications.

Box 5. Sahana Open Source Disaster Management System

Sahana is a Free and Open Source Disaster Management system. It is a Web-based collaboration tool that addresses the common coordination problems during a disaster from finding missing people, managing aid, managing volunteers, to effectively tracking government groups, NGOs and the victims themselves. Learn more at http://www.sahanafoundation.org/about.

Custom Built. Sometimes it may be considered more efficient to develop custom software for an ICT solution. This could either be done by in-house software developers employed by an organization or an external consultant or company. When developing custom solutions, it is important to ensure that the organization has the ability to provide ongoing support to the solution and address additional issues that may arise after the software is deployed. This consideration should be factored into the budget of the project. If the original developers are no longer available, it will be much more difficult for a new developer to provide additional support. In some cases, developers of custom solutions may retain ownership of the source code of the software, which will prevent any other developer from working on the solution.

Free and Open Source Software. Free and Open Source Software can be used, copied, studied, modified, and redistributed without restriction. These freedoms that are for all—developers and users—are highly significant to DRM as FOSS allows immediate access, ownership, and control of the ICTs. It is often supported by communities, which may include companies, volunteers, academics and non-profit organizations working in collaboration to develop software that is mutually beneficial. The Sahana Open Source Disaster Management software is one of an increasing number of solutions available for DRM (see box 5). Some degree of customization may be provided under a contractual agreement, and may be obtained from a variety of different companies and organizations.

Data Standards

As ICT solutions become more common and interact with various people and organizations, problems will arise if the information to be shared are in different, and possibly incompatible, formats. Data standards assist in integrating ICT solutions by ensuring that data can be shared in a format by different software packages without the need for manual conversion. This is especially important for ICT solutions for DRM, as they may be utilized by many agencies that may have their own existing ICT systems.[24]

24 Examples include: 1) Common Alerting Protocol, which provides a general format for exchanging emergency alerts and public warnings between different alerting technologies, see: Oasis, "Common Alerting Protocol, v. 1.1," http://www.oasis-open.org/committees/download.php/15135/emergency-CAPv1.1-Corrected_DOM.pdf; and 2) Emergency Data Exchange Language, which is a suite of data standards for sharing messages between emergency response agencies, see: Oasis, "Emergency Data Exchange Language (EDXL) Distribution Element, v.1.0," http://www.oasis-open.org/committees/download.php/17227/EDXL-DE_Spec_v1.0.html.

Standards that are open and non-discriminatory are preferred because there is no dependence on any single entity. All types of products can implement them and all interested parties can partake in their development. The Internet is a great example as its foundation is based on open standards such as TCP/IP and HTTP.

Lifecycle

The lifecycle of an ICT solution needs to be considered in the context of the different types of DRM interventions. It is good to take note of the concept of a lifecycle because it is possible for organizations to assume that a solution can be immediately installed, and that it will always perform as it is meant. An ICT solution may be seen as going through these stages: (1) Requirements and Specifications, (2) Implementation and Training, and (3) Maintenance.

Stage 1: Requirements and Specifications

The first stage of developing any ICT solution is to identify the problem to be solved and collect requirements for the solution. These will then be used to help identify the technologies that are required and develop a specification describing the solution that will be implemented.

Stage 2: Implementation and Training

It is essential that users of an ICT solution are well trained so that they are familiar, able and willing to use it in their work. ICT training is usually best given after a solution's component has been installed. For example, field personnel can be trained on how to read sensors and record data, or technical staff at the offices in a ministry can be trained to use a database.

In some circumstances, users and beneficiaries of the ICT solution can be involved in testing and providing feedback on the new tool prior to its deployment. This will take more time but can contribute to developing a more effective product that meets the needs of users.

An ICT solution for disaster response may not be used often, so training on its use may need to be repeated periodically to ensure that the learning is not lost. An effective method of training is to run a simulation or drill of the use of the solution. If members of the public are also engaged with the solution, such as implementing an early warning system or an emergency information hotline, then it is important that they have been made aware of it, understands its use, and know the appropriate actions to take based on the information received.

Stage 3: Maintenance

The infrastructure of any ICT solution needs to be maintained in order for it to reliably operate. All hardware, such as computers, servers and communications equipment have a finite lifespan, after which, failure becomes increasingly likely. Often errors or bugs may be found in software after the initial deployment, or additional features or modifications will be required. It is important to consider how these will be implemented.

It is also important to ensure that there are appropriate backups of all DRM information in multiple locations to ensure that if there is a loss of data, the system can be efficiently recovered. After the 2010 earthquake in Haiti, a significant amount of government information was lost when its offices collapsed.

Questions To Think About

- How can we work with media effectively and efficiently?
- Which technologies are already used in your country? What are the benefits and challenges in the use of these particular technologies in your country?

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3. ICT FOR DISASTER MITIGATION

An ounce of prevention is worth a pound of cure.

Benjamin Franklin[25]

This section aims to introduce the information needs in disaster mitigation by:
- **Providing an overview of disaster mitigation;**
- **Emphasizing how ICTs can provide supporting information for disaster mitigation; and**
- **Providing examples of ICT use in disaster mitigation activities.**

Disaster mitigation is the effort to reduce the loss of life and property by lessening the impact of disasters. The adverse impact of disaster often cannot be prevented fully, but its scale or severity can be substantially reduced by various strategies and actions.[26] ICTs are effective tools for improving mitigation efforts, including the formulation of mitigation strategies and their implementation.

3.1 Disaster Mitigation

The principal objectives of mitigation are to save lives, minimize economic loss and disruption, reduce vulnerabilities, and lower the level of conflicts. It involves long-term measures to lessen the effects of disaster-causing phenomena, and should be part of the development efforts as depicted in the DRM cycle.

Mitigation attempts to reduce the impacts of disasters on the elements at risk; these elements include people, homes, business establishments, cultural heritage, equipment and material, infrastructure, farmland and livestock. Mitigation strengthens structures to protect these from disaster events. Mitigation also helps business and industry avoid damages to their facilities and remain operational in the face of catastrophe. Table 4 illustrates how different hazards have differing mechanisms of destruction, affect different types of structures and living things, and require different strategies for mitigating their impacts.

Mitigation is fundamental to reducing vulnerabilities. The following are some examples of the value of mitigation:

- Mitigation creates safer communities by reducing loss of life and property damage. For example, the rigorous building standards adopted by 20,000 communities across the United States are saving the country more than USD 1.1 billion a year in prevented flood damages.

25 Benjamin Franklin (1706-1790) was not only an author, publisher, inventor, and politician, he was also a civic-minded person. While living in Philadelphia, USA, he helped establish a hospital, the Philadelphia's Union Fire Company, and the Philadelphia Contribution for Insurance Against Loss by Fire. The quote from Franklin was fire-fighting advice.

26 UNISDR, *2009 UNISDR Terminology.*

Table 4. Comparison of the mitigation strategies for selected hazards

Hazard	Mechanism of destruction	Elements most at risk	Main mitigation strategies
Floods and water hazards	• The currents of moving or turbulent water can knock down and drown people and animals in relatively shallow depths. • Debris carried by the water can damage structures. • Mud, oil and other pollutants carried by the water are deposited and ruin crops and property. • Flooding destroys sewerage systems, pollutes water supplies, and may spread disease.	• Anything sited in floodplains • Buildings of poor construction • Sewerage, power, water supply • Food stocks, equipment and machinery reached by the water • Penned livestock and agriculture	• Land-use control • Flood hazard zonation • Structural mitigation (polders, retention ponds, embankments, flood gates, flood ways, dams) • Elevated housing and buildings • Flood insurance
Volcanic eruption	• Gradual or explosive eruption, ejecting hot ashes, pyroclastic flows, gases and dust may bury or burn structures, forests and infrastructure close to the volcano. • Some gases are poisonous if inhaled. • Dust may carry for long distances and fall as a pollutant on other settlements. • Ice-melt from snow-capped volcanoes causes debris flows and landslides that can bury buildings.	• Anything close to the volcano • Combustible roofs or buildings • Water supplies can be contaminated by dust fall-out • Weak buildings may collapse under ash loads • Crops and livestock	• Land-use control • Volcanic hazard zonation • Promotion of fire-resistant structures • Engineering of structures to withstand additional weight of ash deposit
Land instabilities	• Either by the ground moving out from beneath people, animals or objects or by burial. • Cracks in the ground split foundations and rupture buried utilities. • Boulders collide into structures and settlements. • Debris flows fill valleys, bury settlements, block rivers (possibly causing floods) and block roads. • Liquefaction of soils due to earthquakes causes structures to sink or fall over.	• Settlements, buildings, and buried utilities on steep slopes, on soft soils, along cliff tops, at the base of steep slopes, on alluvial outwash fans, or at the mouth of streams emerging from mountain valleys • Buildings with weak foundations	• Land-use control • Volcanic hazard zonation • Engineering of structures to withstand or accommodate potential ground movement • Flexible buried utilities • Relocation of existing settlements or infrastructure

Source: "Disaster Mitigation," in *Disaster Management Training Programme,* 2nd ed. (UNDP, 1994), pp. 19-23, http://www.proventionconsortium.org/themes/default/pdfs/DisasterMitigation.pdf.

- Mitigation allows individuals to minimize post-flood disaster disruptions and recover more rapidly. For example, in the United Sates, homes built to the standards of the Federal Emergency Management Agency's National Flood Insurance Program incur less damage from floods. And when floods do cause damages, flood insurance protects the homeowner's investment, as it did for more than 200,000 Gulf Coast residents who received over USD 23 billion in payments following the 2005 hurricanes.

- Mitigation lessens the financial impact on individuals, communities and society as a whole. For example, a recent study by the Multi-hazard Mitigation Council (a council of the National Institute of Building Sciences, USA) shows that each dollar spent on mitigation saves society an average of four dollars.

3.2 Mitigation Measures

Mitigation measures should be viewed as the means to decrease demands for disaster response resources. Mitigation measures encompass engineering techniques and hazard-resistant construction, as well as improved environmental policies and public awareness. Therefore, mitigation measures can be divided into two types: (1) structural mitigation measures, and (2) non-structural mitigation measures.

Structural mitigation measures include construction of barriers, physical modification, resistant construction, and development and implementation of building codes. Non-structural mitigation measures include land-use planning/zoning, risk mapping, environmental protection regulations, insurance programmes, tax incentives, and community awareness and education programmes.

Table 5 compares death, damage and economic loss caused by earthquakes in three different countries. Analyses show that mitigation is strongly related to a lower overall economic loss. Haiti and New Zealand experienced comparable earthquakes in terms of magnitude, with markedly different impacts. Haiti is characterized by poor enforcement of building codes, whereas New Zealand has stringent application of building codes. The massive Chile earthquake triggered a tsunami, and should have been catastrophic in comparison to the Haiti earthquake, but strong building codes and land-use planning kept the death toll low. In addition, Chile has the highest proportion of insurance coverage in Latin America, and most of the claims were paid in less than a year with no insurance company going bankrupt.[27] In addition to insurance, Japan also had significant investments in risk assessments, early warning systems and sea walls against tsunamis, evacuation drills, and cutting-edge technology that allowed its high-speed bullet trains to safely stop at the slightest ground movement.[28]

27 World Bank, 2012. "The Sendai Report: Managing Disaster Risks for a Resilient Future." https://www.gfdrr.org/sites/gfdrr/files/publication/Sendai_Report_051012_0.pdf

28 Japan Times, "90% of disaster casualties drowned," April 21, 2011; http://www.japantimes.co.jp/news/2011/04/21/news/90-of-disaster-casualties-drowned

Table 5. Comparison of damage caused by recent earthquakes

Date & Place	Magnitude	Number of deaths	Total estimated economic loss and damage	Losses as % of GDP	Insured Losses as % of GDP 100 to 200
12 January 2010, Haiti	7.0	222 570	USD 8 billion	100 to 200	0.2 billion
27 February 2010, Chile	8.8	562	USD 30 billion	10 to 15	8 billion
04 September 2010, New Zealand	7.0	0	USD 6.5 billion	3	5 billion
10 March 2011, Japan	9.0	20 896 (mostly due to drowning)[29]	USD 210 billion	4	37.5 billion
25 April 2015, Nepal	7.8	8 633	5.2 billion[30]	33	0.16 billion[31]

Source: Magnitudes of earthquakes and number of deaths taken from USGS Earthquakes Hazard Program, http://earthquake. usgs.gov/earthquakes/eqinthenews. Data on deaths, damage and insured losses taken from the International Disaster Database, http://www.emdat.be.

Note: Dates in UTC

3.3 Information Needs for Supporting Decisions over Mitigation Measures

For effective mitigation measures access to reliable, accurate, and timely information at all levels of society is important. Without information, it is very difficult for individuals and institutions to make decisions about appropriate measures needed to reduce the adverse impact of disaster. The ability of leaders, decision makers or administrators to make sound mitigation decisions can be greatly enhanced by the cross-sector integration of information through risk analysis.

For example, to understand the full short- and long-term implications of floods and to plan accordingly requires the analysis of combined data on meteorology, topography, soil characteristics, vegetation, hydrology, settlements, infrastructure, transportation, population, socio-economic conditions and material resources. The key components of a disaster mitigation information database would be:

- Hazard assessment and mapping
- Vulnerability assessment
- Demographic distribution and characteristics
- Infrastructure, lifeline and critical features
- Human and material resources
- Communications facilities

29 Gov. of Nepal, 2015. Nepal Earthquake 2015 Post Disaster Needs Assessment: Vol. A: Key Findings. http://www.worldbank.org/content/dam/Worldbank/document/SAR/nepal/PDNA%20Volume%20A%20Final.pdf

30 SwissRe, “Preliminary sigma estimates for 2015: global catastrophes cause economic losses of USD 85 billion,” 18 December 2015; http://www.swissre.com/media/news_releases/Preliminary_sigma_estimates_for_2015.html

31 ibid

The primary goals of mitigation are casualty reduction and property damage minimization. Strategies have been expanded to include empowerment of and direct participation by those potentially affected. Because mitigation measures are often politically controversial, there have been attempts to obtain wider citizen and interest group involvement and commitment.

Often, authority for mitigation measures is dispersed among many agencies, at several levels of government; expertise is also scattered among many other organizations. A concerted effort is needed to draw together the expertise and perspectives of a broad array of professional societies, voluntary organizations, trade associations, industry standard-setting groups, media outlets, and others with a special interest in and concern about the impacts of hazards. A cooperative effort can help in evaluating ideas and bringing the best ones to the attention of government bodies and the general public.

Many mitigating measures must be implemented at local levels. A key constraint at this level is the lack of local political decision makers' commitment to mitigation. They often do not see the management of natural hazards as a priority, given the myriad of more pressing public policy problems they face, such as unemployment. As a result, insufficient inspection of initial installations and enforcement of standards may result, even when building and zoning requirements have been enacted.

3.4 Use of ICTs in Disaster Mitigation

ICT for Risk Knowledge, Innovation and Education

Information by itself is not knowledge. Just being aware of a danger does not automatically lead to a reduction of the risks. It is therefore imperative to train and promote continuous learning in vulnerable communities towards enhancing their capacity in finding appropriate risk reductionsolutions and techniques. It is also important to promote risk education among decision makers, highlighting the way a "development" decision can impact risks. This is because many decisions affecting vulnerable communities are driven by external decision makers, including national and local governments and private companies. In some cases, these decisions are even taken in another country (particularly in the case of trans-boundary river management that can lead to flooding in the lower part of the watershed).

The potential of e-learning, distance education, open learning or online learning tools that make use of the Internet and multimedia technologies (combining video, sound, animation, text and graphics) to impart DRM and mitigation knowledge should be tapped. One example is the World Bank Institute's distance learning programmes on DRM, including courses on mitigation topics such as "Safe and Resilient Cities", "Introduction to Disaster Risk Management" and "Disaster Risk Finance".[32]

Media agencies for television and newspaper can play key roles in raising public awareness. Although media coverage is still largely focused on major disaster events and the immediate dramatic aftermath, there is a growing recognition of the need to include media representatives and journalists in mitigation programmes and targeted as a group for training to encourage reporting on DRR before a disaster occurs. The challenge is in sustaining public interest, and keeping important stakeholders actively interested and engaged in the efforts, in times of calm. But it is the time between disasters when DRM capacities must be strengthened if future losses are to be avoided.

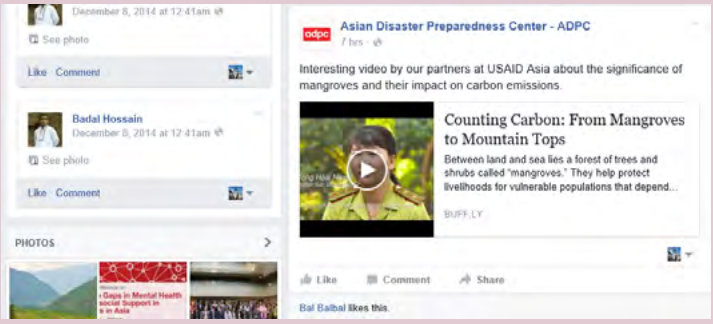
32 Information about the courses can be found at Open Learning Campus, https://olc.worldbank.org.

Case Study: Social media builds community disaster resilience

Social media has demonstrated its value in disaster risk reduction, emergency management as well as community development. Social media is used to inform others of disaster risks thereby minimizing the residual risks. They serve to facilitate discussions and plan ways to minimize risk, coordinate and manage activities, and to improve post-event learning. Crowd sourcing of emergency intelligence, providing assistance during preparations, dissemination of warnings and alerts, and coordinating community level response and recovery are all possible through social media use.

For example, the Asian Disaster Preparedness Center Facebook page is aimed at providing its followers with a platform for knowledge sharing throughout the region. Ground level good practices and other relevant information shared here can serve communities, community leaders and key stakeholders to understand how to be better prepared.

By leveraging the various forms of social media, social networking, leadership and support systems are strengthened at the community level and people can more readily get the support they need during and after disasters. These peer-to-peer interactions are more empowering especially at the community level and tend to result in a build-up of social capital or resources integrated into social networks. This social capital can spur the initial push needed to move forward after a disaster event. Communities can rely on each other to recover faster with less assistance from central governments and others.



The Role of ICTs in Supporting Decisions on Mitigation Measures

One of the important steps towards disaster impact reduction is to correctly identify and analyse the potential risk and required measures to mitigate or prepare for emergencies. ICT can play a vital role in collecting data using various specialized instruments, combining geologic data with socio-economic data and analysing the spatial distribution using satellite images taken from space. GIS is very efficient at risk analysis because it is capable of highlighting dangerous areas, linking these to the vulnerabilities of on-site communities, and estimating the size of the population segment potentially affected by disasters.

When hazards are viewed on a GIS with other mapped data, such as buildings, residential areas, rivers and waterways, streets, pipelines, power lines, storage facilities and forests, disaster management officials can formulate mitigation, preparedness, response and possible recovery needs. For example, a comprehensive GIS database can help city authorities to demolish or repair vulnerable buildings in the face of risks from earthquakes by selecting and identifying individual buildings requiring attention.

ICTs are also used for computerized modeling in fields important to disaster mitigation, such as urban and regional planning, engineering, architecture, economics, and finance. Risk insurance is one area where financial models, hazard models, and GIS come together for estimating potential damage and loss, and designing the appropriate insurance schemes.

Catastrophe Simulation

Catastrophe Simulation[33] (CATSIM) can assist policymakers in developing public financing strategies for disaster risk. Developed by the International Institute for Applied Systems Analysis (IIASA), CATSIM models the respective costs and consequences of financing alternatives on important economic indicators. The model is equipped with a graphical interface that allows the user to select risk parameters related to hazards, vulnerability and the elements exposed. The software has two modules, one for assessing risk, and another for analysing the costs and benefits of different financial strategies to manage risk.

ICTs in Risk Assessment

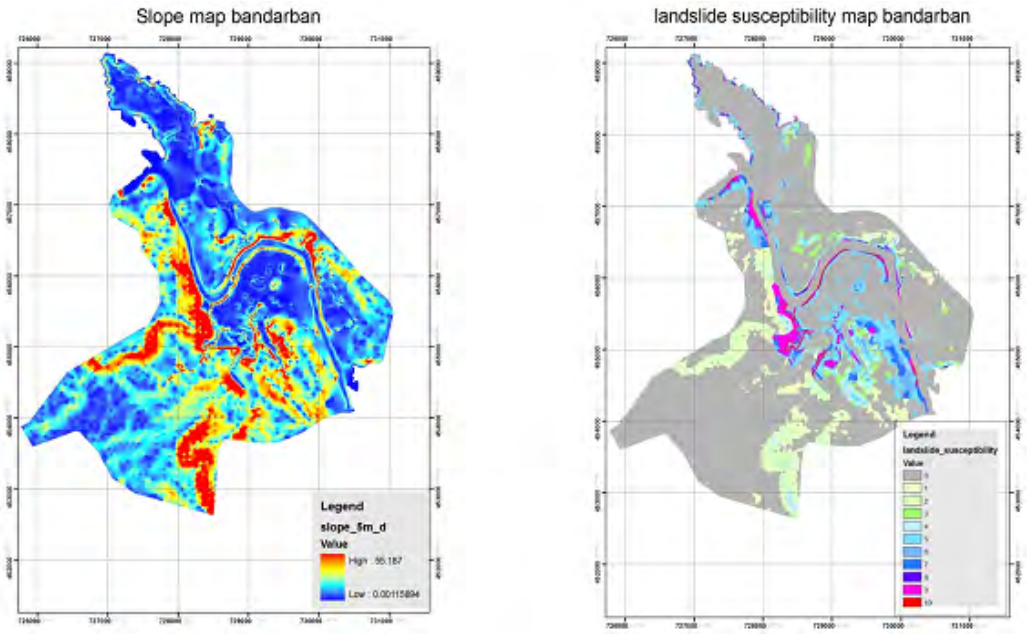
Risk assessment answers the fundamental question: "What would happen if a hazard event occurred in my area?" The process of conducting risk assessment is based on a review of both the technical features of hazards, such as their location, intensity, frequency and probability; and also the analysis of the physical, social, economic and environmental dimensions of vulnerability and exposure, while particularly taking into account the coping capabilities pertinent to the risk scenarios.

GIS is one of the best comprehensive platforms for furnishing multi-layer geo-referenced information. These include hazard zoning, incident mapping, natural resources and critical infrastructure at risk, population at risk, and damage and loss estimation. More than traditional systems, GIS-based databases make decision-making processes easier and more effective. The most important role of GIS here is the detailed database that plays a vital role in planning and implementation of large-scale preparedness and mitigation initiatives.

The Comprehensive Disaster Management Programme under the Ministry of Food and Disaster Management of Bangladesh took the initiative for an earthquake hazard and risk assessment of three major cities (Dhaka, Chittagong and Sylhet) in Bangladesh. GIS was used for overall activities starting from base map preparation, hazard mapping, vulnerability mapping, and damage and loss estimation. The Government of Bangladesh has already taken initiatives for identification of evacuation space and routes based on this vulnerability mapping. Thanks to GIS database and mapping, decision makers were able to identify the evacuation spaces and routes more effectively.

33 IIASA, "Financial Risk Management (CATSIM)," ttp://www.iiasa.ac.at/Research/RAV/Projects/catsim.html.

Figure 3. Landslide Susceptibility Maps of Bandarban



Source: Maps courtesy of ADPC.

Use of GPS and GIS for Hazard and Risk Assessment

Spatial databases were developed for the landslide assessment for the towns of Rangamati, Bandarban and Khagrachari in Bangladesh to assist hazard and vulnerability assessment. All important physical features of the city were considered during the database development. Satellite images of the towns were obtained, followed by the digitization of physical features, such as roads, building outlines, water body boundaries, and river boundaries. Field work was undertaken to verify the accuracy of the coordinates of the features with the help of surveying technology such as GPS, as well as to collect disaster-relevant data about buildings and infrastructure. The data was added to a GIS and then a base map was prepared for use.

Contour maps, geomorphologic maps, and groundwater table data were digitized and combined into a computerized three-dimensional map known as a digital elevation model. The geomorphologic map, groundwater table data, and borehole data were integrated by the GIS to produce the landslide susceptibility map. This susceptibility zone is matched with the critical acceleration after the peak ground acceleration map is produced.

Figure 4. Some steps for base map preparation

A satellite image used to make the base map

Setting coordinates for reference points in images using GPS technology

Digitizing a scanned map

Disaster-related data collected during field work added into the attribute database of the digitized features

Source: Photos and images courtesy of ADPC.

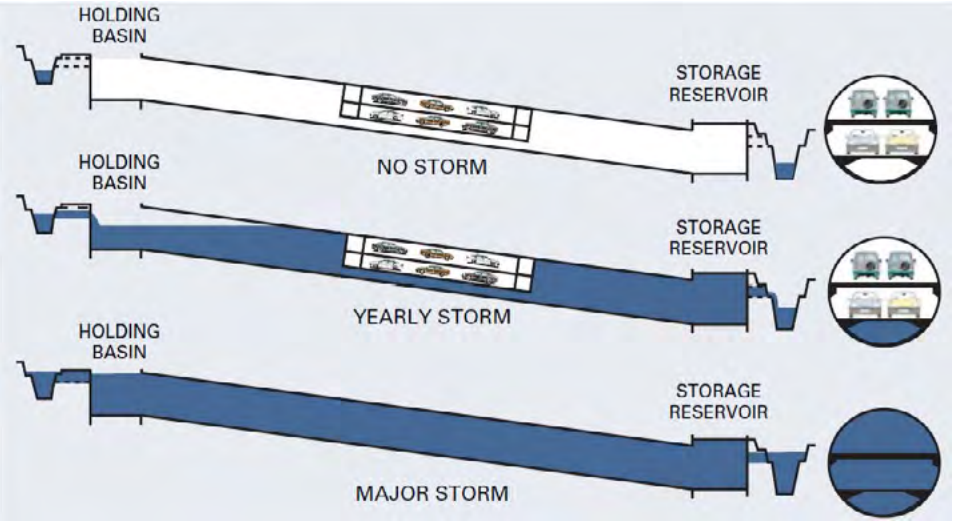
Hazard maps and risk maps can be "converted" or "translated" into policy instruments of non-structural disaster mitigation, such as land-use policies, zonation, and building codes. These maps can also guide the design of structural mitigation measures (e.g., flood diversions or hillside stabilization) through the analysis of where these should be located. Instruments for telemetry, or the automatic transmission and measurement of data from remote sources by wire, radio or other means, were combined in a creative example of flood mitigation in Kuala Lumpur, Malaysia.

The SMART Tunnel

Kuala Lumpur's Stormwater Management and Road Tunnel (SMART) diverts potential floodwater away from the city's financial district through a 9.7 km long, USD 514 million tunnel. The system is a combination of weirs, flood gates and holding ponds. The unique aspect of this flood mitigation project is that it has a traffic bypass tunnel in the middle third section that has two traffic decks, each connected to flood gates that control the amount of water entering the road tunnel. As the volume of water that needs to pass through the tunnel increases, the road tunnels are closed one at a time, and water is allowed to enter. A sophisticated Flood Detection System is installed to provide adequate warning time to evacuate traffic, to minimize traffic disruption, and operate tunnel floodgates. It is composed of a network of automatic recording rain gauges, river flow/level gauging stations, real-time telemetry and operating system, and a set of hydrological and hydraulic forecast models running on computers.[34]

34 Saw Hin Seang, "A Case Study of Mitigating Flooding in City Center of Kuala Lumpur," paper presented at the ESCAP Expert Group Meeting on Innovative Strategies Towards Flood Resilient Cities in Asia-Pacific, 21-23 July 2009, Bangkok, Thailand, http://www.unescap.org/idd/events/2009_EGM-DRR/index.asp.

Figure 5. Three modes of operation of the SMART Tunnel



Source: World Bank, *Natural Hazards, Unnatural Disasters: The Economics of Effective Prevention*, 2010.

3.5 Policy Considerations

The 2015 Sendai Framework has several recommendations for meeting the global goals for disaster risk reduction, many of which are relevant to disaster mitigation. Here is a selection of the recommendations:

- *Promote the collection, analysis, management and use of relevant data and practical information and ensure its dissemination, taking into account the needs of different categories of users, as appropriate;*
- *Develop, periodically update and disseminate, as appropriate, location-based disaster risk information, including risk maps, to decision makers, the general public and communities at risk of exposure to disaster in an appropriate format by using, as applicable, geospatial information technology;*
- *Promote real time access to reliable data, make use of space and in situ information, including geographic information systems (GIS), and use information and communications technology innovations to enhance measurement tools and the collection, analysis and dissemination of data;*
- *Promote and improve dialogue and cooperation among scientific and technological communities, other relevant stakeholders and policymakers in order to facilitate a science policy interface for effective decision-making in disaster risk management;*
- *Ensure the use of traditional, indigenous and local knowledge and practices, as appropriate, to complement scientific knowledge in disaster risk assessment and the development and implementation of policies, strategies, plans and programmes of specific sectors, with a cross-sectoral approach, which should be tailored to localities and to the context;*
- *Promote investments in innovation and technology development in long-term, multi-hazard and solution-driven research in disaster risk management to address gaps, obstacles, interdependencies and social, economic, educational and environmental challenges and disaster risks;*

- *Promote national strategies to strengthen public education and awareness in disaster risk reduction, including disaster risk information and knowledge, through campaigns, social media and community mobilization, taking into account specific audiences and their needs.*[35]

Satellite images, GPS technology and GIS can contribute to the development of risk assessments for use in land-use planning, in the regulation of construction activities, and national and sector development planning.

However, some of the challenges of using GIS include the lack of trained personnel; difficulties in exchanging data between different systems; and the quality and detail of the data required by GIS analysis.

These challenges are confirmed in the *2011 Global Assessment Report*, which looks at some of the underlying challenges of conducting risk assessments that need to be resolved at the regional and national levels. It states:

> Countries from all geographic and income regions reported three main obstacles to undertaking comprehensive risk assessments: limited financial resources; lack of technical capacity; and a lack of harmonization among the instruments, tools and institutions involved. Most countries also reported limited availability of data on localized losses, and difficulties connecting local disaster impact assessments with national monitoring systems and loss databases.[36]

Questions To Think About

For a major hazard threat, how can ICTs support decision needs for structural and non-structural mitigation in your country, locality, or sector?

Something To Do

UNISDR has an interesting simulation game on its website called Stop Disasters! Racing against time and with a limited budget, you will be asked to try to protect lives and property using different mitigation options against five disaster scenarios: earthquake, flood, hurricane, tsunami and wild fire. If you are ready to play, go to http://www.stopdisastersgame.org/en/home.html.

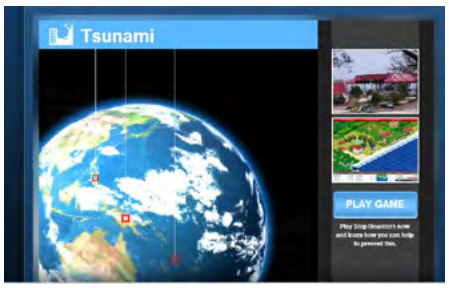


Figure 6. Screen shot of Stop Disasters! Website

35 UNISDR, *Sendai Framework for Disaster Risk Reduction 2015-2030*.

36 UNISDR, *2011 Global Assessment Report on Disaster Risk Reduction*, p. 80.

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4. ICT FOR DISASTER PREPAREDNESS

By failing to prepare, we prepare to fail.

Benjamin Franklin

This section aims to introduce information and communication needs in disaster preparedness by:
- **Providing an overview of disaster preparedness;**
- **Emphasizing how ICTs can provide supporting information for disaster preparedness planning; and**
- **Providing examples of ICT use in disaster preparedness activities.**

4.1 Disaster Preparedness

Disaster preparedness refers to the readiness of governments, organizations, and communities to respond constructively against the threats from hazards, in order to minimize the negative consequences for lives and properties.[37] It is a set of pre-disaster activities that are undertaken in anticipation of a disaster to ensure appropriate and effective actions in the aftermath. Activities result from a process of hazard risk analysis and capacity/vulnerability assessment.

Preparedness is an important part of the DRM cycle because it is not always possible to eliminate disaster risk. However, the extensive experience and practice in the past few decades have demonstrated that the damage caused by any disaster can be minimized largely by appropriate preparedness and prompt action. The disaster preparedness measures can be described as logistical readiness, and the technical and managerial capacity of governments, organizations, and communities to deal with disasters. Preparedness measures include:

- Preparedness plans
- Evacuation plans and training
- Mutual aid agreements
- Emergency simulation exercises
- Warning systems
- Emergency communication systems
- Emergency personnel/contact lists
- Resource inventories
- Public information/education

The Role of ICTs in Disaster Preparedness

ICTs provide vital support for disaster preparedness through observation, monitoring, recording, classifying, analysing, sharing, networking, communication and warning dissemination.

In a disaster situation, there is no doubt that timely warning allows people to take actions that save lives, reduce physical and economic damage and minimize human suffering. However, the best practice of early warning systems needs widespread and consistent availability of current and accurate data for monitoring potential hazards, and assessing risks. Available data and information should then be effectively transmitted from origin to the relevant users. ICTs play a key role in facilitating the collection and flow of real-time data and information. Space-based technology has proved invaluable for DRM. Where ground-based ICTs are vulnerable to disaster, space-based technology remains largely unaffected during a disaster.

37 Douglas A. Troy, et. al., *Enhancing Community-based Disaster Preparedness with Information Technology: Community DisasterInformation System* (March 2008), http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2239245/.

Many emergency communication systems use satellite phones and/or satellite radios either as back up or one of the means for two-way communication during disasters as these technologies will remain functional when terrestrial networks fail. High-speed Internet access can be switched to satellites in the event of a disaster. Satellite communications have also been used to reach the "last mile" in remote communities where terrestrial or wireless networks are not available and not considered commercially and technologically viable to establish. Combining remote sensing satellites with communication satellites can be useful in ensuring that data generated by satellites reach disaster managers and planners.

Remote sensing and satellite systems and services remain very costly and unaffordable for many countries. However, a number of collaborative initiatives are working to overcome these constraints. For example, the Global Earth Observation System of Systems (GEOSS) supports satellite access to environmental data at all stages of the DRM cycle. In recent years, commercial companies Google and Microsoft have started incorporating maps and satellite imagery into disaster-related applications, delivering compelling visualization and providing easy tools that everyone can use.

See *Academy Module 10* for more details on space-based technologies and other advanced technology used to monitor environmental change and human impact, such as Wireless Sensor Networks.

Preparedness Plan

A disaster preparedness plan is a set of instructions that a disaster management authority can follow to issue directions to their rescue and relief teams and affected people. This speeds up the rescue and relief operations and boosts the morale of survivors. Disaster preparedness plans are also useful pre-disaster operations, when warnings have been issued. With standard operating procedures elaborated in the disaster preparedness plan, time is saved that might otherwise have been lost in consultation with senior officers and obtaining formal approval for issuing alerts.

Disaster preparedness planning involves predicting the risk of natural hazards and possible impacts. GIS plays a crucial role in managing the data collected and visually presenting the results from the data analysis in the form of maps and charts. They have proved to be essential for disaster preparedness planning to develop contingency scenarios, as well as identify evacuation routes, shelters outside the hazard zone, and resources available (people, equipment, supplies) in the area and its vicinity that can be mobilized in the event of a disaster.

Development of an Earthquake Preparedness Plan in Bangladesh[38]

With the support of the Comprehensive Disaster Management Programme, the Bangladesh government prepared a city-level earthquake contingency plan for its three cities—Dhaka, Chittagong and Sylhet. The contingency plan was prepared based on the earthquake risk scenarios developed through the hazard and vulnerability assessment in terms of the scale and extent of damage and disruption that may result from potential earthquakes. The earthquake hazard and vulnerability assessment was executed using a customized HAZUS[39] software package.

38 Comprehensive Disaster Management Programme, "City Level Earthquake Contingency Plan for Dhaka, Chittagong and Sylhet," (Disaster Management Bureau, 2009).

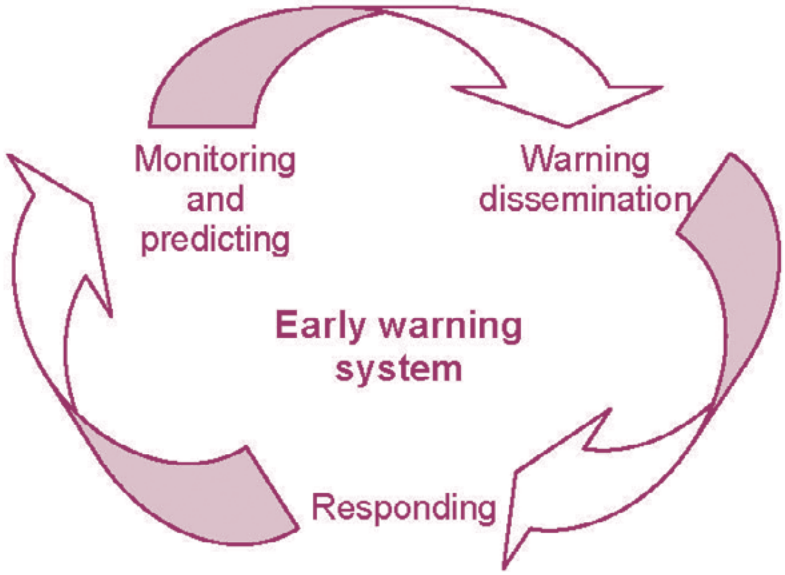
39 Hazus is a standardized methodology developed for the United States by the Federal Emergency Management Authority. Hazus uses GIS technology to estimate physical, economic, and social impacts of disasters from earthquakes, floods and hurricanes.

4.2 Potential Application of ICTs in Disaster Preparedness

End-to-End Early Warning

Early warning is "the provision of timely and effective information, through identified institutions, that allows individuals exposed to hazard to take action to avoid or reduce their risk and prepare for effective response."[40] The objective of early warning systems is to empower individuals and communities threatened by hazards to act in sufficient time and in an appropriate manner to reduce the possibility of personal injury, loss of life, and damage to property and the environment. It allows the public and emergency responders to take preemptive and protective action to avoid harm.

Figure 7. Operational aspects of an early warning system



Source: Veronica F. Grasso, *Early Warning Systems: State-of-Art Analysis and Future Direction*, Draft Report (United Nations Environment Programme, n.d.), p. 7, http://na.unep.net/geas/docs/Early_Warning_System_Report.pdf.

An early warning system is described as end-to-end if it connects the technical and societal components of warning through identified institutions. The effectiveness of an early warning system will depend on the detection technology, as well as socio-economic factors that dictate the manner in which people at the local level can understand and react to disasters.

The development and design of an early warning system includes:

- Understanding and mapping the risk
- Monitoring and forecasting impending events
- Processing and disseminating understandable warnings to the disaster management authorities and the communities
- Understanding the warnings with capability to respond and preparedness to act (by authorities and by those at risk)

40 UNISDR, *2009 UNISDR Terminology*.

Rapid Response and Early Warning System in Istanbul, Turkey[41]

The Istanbul Earthquake Rapid Response and Early Warning System is operated by Bogazici University with the support of the Governorate of Istanbul, First Army Headquarters and Istanbul Metropolitan Municipality. The system consists of 100 motion recorders stationed in the metropolitan area of Istanbul. Some recorders are located as near as possible to the fault that is most likely to cause an earthquake, and a large proportion have been placed on critical structures. Each recording unit is equipped with a communication capability that can pass relevant data back to a data processing centre. The data processing centre utilizes the data on earthquake motion, and combines it with building data previously collected. It then prepares an initial damage assessment report. This report is then passed out as rapid response information and early warning to all key stakeholders.

There are many ICTs, both traditional and modern, that are available and an early warning system may use more than one ICT application in parallel.

ICT for Monitoring and Prediction

Remote sensing and GIS have become integrated, well-developed and successful tools in disaster preparedness in the form of monitoring, forecasting, predicting, measuring and mapping of various impending disaster events and helping disseminate early warning. Satellites offer accurate, frequent and almost instantaneous data over large areas anywhere in the world. When a disaster strikes, remote sensing is often the only way to view what is happening on the ground.[42]

Table 6. Remote sensing and GIS applications for disaster preparedness

Hazard	Application
Flood	Flood detection, rainfall measurement, flood mapping, early warning
Cyclone	Long-range climate modeling, weather observation, weather forecast, early warning
Drought	Weather forecasting, vegetation monitoring, crop requirement mapping, early warning
Earthquake	Geo-dynamic measurement of strain accumulation
Landslide	Rainfall and slope stability monitoring
Volcanic eruptions	Detection and/or measurement of gaseous emission

ICT for Warning Communication and Dissemination

Voice and data communication continue to be of crucial importance in the context of early warning and DRM. ICTs play an important role in risk communication, and dissemination of information to the organizations in charge of responding to the warning and to the community.

There are many communication tools that can be effectively used for disaster warning purposes. The traditional tools such as radio and television are ideal for one-way mass communication, as they have high penetration rates in most countries, although they are less effective at night. With the rapid growth in mobile phone subscriptions, the mobile phone is an essential communication device as described previously.

41 The information was obtained from an article by Erdik, Department of Earthquake Engineering, Bogazici University, Istanbul.

42 Science and Development Network, “Remote sensing for natural disasters: Facts and figures,” http://www.scidev.net/en/features/remote-sensing-for-natural-disasters-facts-and-figures.html.

Cell broadcast (CB), a mobile technology is being tested for early warning. It has several advantages over SMS. While SMS is a one-to-one and one-to-a-few service, CB is a one-to-many geographically focused messaging service, which means that messages can be tailored to multiple phone subscribers located within a give part of its network coverage area at the time the message is broadcast. CB is also not as affected by traffic load; therefore, it may be used during a disaster when load spikes tend to crash networks.

For countries with high mobile penetration, CB is an inexpensive technology that requires no further infrastructure as it uses the existing mobile telecommunication system. Policymakers should, however, be aware of the limitations. For instance, to receive alerts through CB, the user must have a CB-enabled phone that is switched on and set to receive the CBs; and it is not infallible to hazardous events—disruption of the mobile telecommunication system would hamper optimal functioning of the CB system.

In Bangladesh, the Disaster Management Information Centre piloted early warning dissemination through CB in two districts—Sirajgonj (for floods) and Cox's Bazaar (for cyclones). Agreements were signed with two mobile operators—Grameenphone and state-owned Teletalk— to send instant messages to their subscribers. Based on the result of the pilot, this technology will be expanded to other high risk areas of Bangladesh through the Comprehensive Disaster Management Programme.[43]

Other ICT devices that are well established among disaster preparedness and management organizations include fixed-line phones, satellite phones, satellite radio, amateur radio, community radio, Wireless Local Loop, Web service (Internet/e-mail), computers, GPS and other Global Navigation Satellite Systems.

There are countless examples of applications of these communication tools that have saved many lives during disaster. The relevant authorities in Bangladesh have developed an innovative warning signal system and necessary steps to disseminate the warning in easily understood language through radio at least two days before a cyclone hits, hence mitigating the loss of lives and property every year in Bangladesh. A timely telephone call—warning about the impending Indian Ocean tsunami in 2004—was said to have saved the entire population of about 3,600 inhabitants of Nallavadu village in India. During the 2005 Hurricane Katrina disaster in the USA, many residents of affected coastal areas were unable to make contact with relatives and friends using traditional land phones. However, they could communicate with each other via SMS more easily when the network was functional.

The cyclone warnings received by Bangladesh and issued by India's Regional Specialized Meteorological Centre (RSMC) are transmitted in two stages. The first stage warning, known as "Cyclone Alert", is issued 48 hours in advance of the expected commencement of adverse weather over the coastal areas. The second stage warning, known as "Cyclone Warning", is issued 24 hours in advance. Cyclone warnings are disseminated through a variety of communications media, such as radio, television, print media, telephone, fax, telex, telegram, and the police wireless network. A specially designed Cyclone Warning Dissemination System, which works via the Indian National Satellite (INSAT) system,[44] provides area-specific service even when there is a failure of conventional communication channels.

43 "Disaster-prone Bangladesh trials cell phone alerts," *Reuters*, 24 June 2009, http://in.reuters.com/article/businessNews/idINIndia-40562420090624.

44 Commissioned in 1983, INSAT is the largest domestic communication system in the Asia-Pacific Region that contributes to telecommunications, broadcasting, meteorology, and search and rescue operations. It is a joint venture of the Department of Space, Department of Telecommunications, India Meteorological Department, All India Radio and Doordarshan.

Cyclone Monitoring in the Bay of Bengal and Early Warning in Bangladesh[45]

The Regional Specialized Meteorological Centre(RSMC) in New Delhi, India is one of the five centres recognized by the World Meteorological Organization (WMO) under a global system for monitoring tropical cyclones. It keeps a constant watch on the Arabian Sea and the Bay of Bengal for the likely genesis of tropical cyclones with the help of satellite imagery, particularly those from the Indian geo-stationary satellite, INSAT.

Based on an international commitment through the WMO/ESCAP Panel on Tropical Cyclones, RSMC New Delhi issues tropical cyclone advisory messages four to eight times a day to the panel member countries when a tropical cyclone is in the Bay of Bengal or the Arabian Sea. The ESCAP Panel countries are Bangladesh, Maldives, Myanmar, Oman, Pakistan, Sri Lanka and Thailand.

In November 2007, a message was relayed by RSMC New Delhi to the authorities of Bangladesh 72 hours before Cyclone Sidr hit Bangladesh. This prompted the Bangladesh government to sound the alarm. A simple early warning system that used local volunteers shouting through megaphones to warn people about the impending cyclone saved thousands of lives.[46]

The lack of access to ICTs and connectivity is a critical bottleneck in establishing end-to-end early warning systems. It is therefore important to stress the need for a mix of technology and a combination of technological and non-technological solutions to reach the last mile. Non-technological solutions that have been successfully used include megaphones (mentioned in the case study above), hand sirens, loudspeakers and bells. The appropriate mix of communication channels will need to be determined by the communities themselves through a participatory planning process.

Resource Inventories

A comprehensive resource inventory on the availability and location of resources is very important for mobilizing the specialized equipment and skilled human resources for disaster response. An organized system is essential for disseminating the information. GIS and the Internet are useful tools for the preparation and sharing of resource inventories.

Online Inventory of Emergency Resource, India[47]

Under the National Disaster Management Framework for the country, the Ministry of Home Affairs (MHA)) of India in collaboration with the UNDP has developed an online inventory of emergency resources called the India Disaster Resource Network (IDRN).

The IDRN is a Web-enabled and GIS-based national resource inventory for the collection and transmission of information about specific equipment, human expertise and critical supplies database at the district- and state-levels (http://www.idrn.gov.in). It provides information on the availability of resources essential for disaster response. The user can choose one or multiple activities, categories, items, states or districts, and sources of equipment as well as find a detailed report on these data. The reports generated by the system provide information such as relating to availability, contact details, quantity availability, location, operator provision and transport options. The IDRN is a live system and the inventory is updated every quarter.

45 India Meteorological Department, "Cyclone Warnings," http://www.imd.gov.in/services/cyclone/cyclone-warning.htm.

46 "Bangladesh: Megaphones save thousands," *IRIN News*, 23 November 2007, http://www.irinnews.org/Report.aspx?ReportId=75470.

47 Ministry of Home Affairs, Government of India, *ICT for Disaster Risk Reduction: The Indian Experience* (n.d.), http://www.ndmindia.nic.in/WCDRDOCS/ICT%20for%20Disaster%20Risk%20Reduction.pdf.

Public Information and Education

People's willingness or ability to take appropriate actions when warnings are received can be affected by various factors, many of which can be overcome through preparedness. People are more likely to pay attention to warnings if they have been educated about the risks in advance and know what actions to take. Public education campaigns, including incorporating disaster risk awareness into school curricula, can contribute to a culture of safety. For schools with computers and Internet connectivity, these ICT tools can be incorporated into raising disaster risk awareness, for example through "SchoolNets"—a recognizable national or regional network of teachers, students and communities who learn together, share experiences and support each other. A number of radio programmes such as Afghanistan's New Life Project are used to promote disaster preparedness. Sri Lanka has explored the use of television soap operas to raise public awareness on landslide risks.

The Internet provides a versatile platform for public information and education on disaster. It provides improved access to DRM knowledge resources, including disaster preparedness and emergency management, as well as real-time data from sources such as weather stations, earth observation systems and satellites. A well-defined website is a cost-effective means of rapid, automatic, and global dissemination of disaster-related information. Access to the Internet permits continuous updates of disaster information, accounts of human and material resources available for response, and state-of-the-art technical advice, all or which contributes to disaster preparedness.

But preparedness does not just end with the provision of information. There is a growing recognition that vulnerable communities can and should be engaged in developing their disaster preparedness and response plans, be involved in regular drills to test the effectiveness of the early warning dissemination processes and responses, and even participate in the design of early warning systems and preparedness programmes.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) Bangkok office has developed a website (http://www.unescobkk.org/education/promoting-rights-and-freedoms/post-conflictpost-disaster-responses/natural-disaster/) to serve as a portal on Internet resources about education for natural disaster preparedness.

The unified hashtags (#) in the Philippines

Recognizing the increased use of social media such as twitter during disasters and , the Philippine government initiated the use of unified hashtags to make sure that tweets, for example, are sorted together into more coherent groupings to increase social media's effectiveness for development. A hashtag is "#" sign followed by the keywords relating to a disaster such as #RescuePH.

Having a standardized system helps first responders to use supporting software applications to identify needs more quickly and to reduce the amount of time needed to find critical messages in the deluge of social media updates, which usually take place during disasters. They help to deal with the challenges of big data with easy to implement solutions that require some training efforts by the government to educate people.

News organizations and media personnels are urged to support the use of hashtags that are already widely used by the public. Databases and lists used by the relevant government agencies and other front line workers are also linked to the hashtag keywords to maintain coherence.

Reports with the #rescuePH hashtag are captured in a database containing the details of those in need of rescue, which are sent to disaster management focal organizations: the National Disaster Risk Reduction and Management Council (NDRRMC), the Philippine Coast Guard (PCG), and the Department of Transportation and Communications (DOTC). The administrators have to filter out erroneous or malicious reports to ensure that efforts are not wasted.

Unified hashtags are attributed to a report published by the United Nations Office for the Coordination of Humanitarian Affair (UN OCHA) entitled, *Hashtag Standards for Emergencies*. The report recommends three hashtags that should be standardized and used during disasters: 1) a specific hashtag for the name of the disaster, 2) one for public reporting, and 3) one for emergency response needs. Global positioning systems (GPS) coordinates should be collected along with the reports in order for responders to find locations where people need help.

Sources: Timo Luege, "Towards Standardized Hashtags in Disaster Response," 10 Nov 2014; https://www.techchange.org/2014/11/10/disaster-response-standardized-hashtagsJessica MacLean, "Can Standardised Hashtags Be Effective In Emergency Responses?" 24 March 2015; http://emergencyjournalism.net/can-standardised-hashtags-be-effective-in-emergency-responses

4.3 Policy Considerations

It is noteworthy that ICT tools and systems have played crucial roles in five key aspects of disaster preparedness:

- In monitoring the risks and capturing data and information in databases.
- In supporting decision-making particularly through the use of GIS technologies to analyse and present disaster risks and help plan preparedness measures.
- In communicating the risks and issuing disaster alerts and warnings.
- In educating and raising the awareness of relevant government authorities and affected communities on the importance of disaster preparedness, and the steps to take during emergencies.
- In providing a platform for collaboration and sharing of knowledge, experiences, thoughts, as well as facilitating people's participation in the preparedness planning process.

Some ICT tools may be more effective than others, depending on the nature of the disaster, the region affected, the socio-economic status of the affected community and the political system.

A mix of technology and a combination of technological and non-technological solutions may be required. The appropriate mix of ICT applications will need to be determined by the stakeholders themselves, including the vulnerable communities, through a participatory process.

It is important that:

- The communications infrastructure hardware is reliable and robust, especially during the disaster event.

- Regular interactions occur among the main actors, such as the scientific community, stakeholders, decision makers, public and the media in disaster preparedness and early warning processes.

ICTs are effective in enhancing global, regional and national cooperation in early warning, where global information networks such as those of the Food and Agriculture Organization of the United Nations (FAO), UNISDR and WMO support national and local early warning systems.

ICTs are also indispensable for regular two-way communication between national and local authorities and the communities, as the role of communities in early warning is increasingly being recognized as important, particularly in their participation in monitoring hazards (e.g., in reading flood markers and rain gauges, and transmitting data in real time over handheld, two-way radios with a city flood-monitoring station).

Effective channels of communication are required to complement technical warnings with communities' local and indigenous knowledge of early warning signs (e.g., color of river water, size and type of river debris, and animal behaviour); and for communities to provide feedback to the warning providers about how they understood the warnings and how warnings might be made more actionable or comprehensible.

Even with well-coordinated structures and well-crafted messages, dissemination of early warning messages to remote areas is still difficult in many places and requires a combination of technological and non-technological solutions. There is no "one size fits all" solution to last-mile communication—the participation of community members in deciding the appropriate communication tools and processes is essential to ensure that warnings reach them in a timely manner.

Questions To Think About

Early warning is targeted to reach the last mile—the people who need it most. They are the local communities and groups who, because of their age, gender, culture or income are not usually reached by disaster preparedness. How can ICTs be applied in your country so that early warning can reach the last mile?

Something To Do

Download or watch videos online on disaster preparedness called "Strength in Numbers: The Barangay as Building Block" (2008) set in Dagupan City, Philippines:

- Link to part 1: http://www.youtube.com/watch?v=KWbw9EcNNIM
- Link to part 2: http://www.youtube.com/watch?v=2Nme8lhLxjg

Further Reading

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5. ICT FOR DISASTER RESPONSE

This is not an easy business folks, … Disaster management is not a matter of reading a guide book and then showing up in the middle of a small town that has just been blown off the map by tornadoes.

Mike Brown, Coach, National Basketball Association

This section aims to introduce the information and communication needs in disaster response and relief by:

- Providing an overview of disaster response management;
- Introducing the concept of a disaster response coordination centre;
- Describing information management during disaster response;
- Providing examples of ICTs that can meet the information and communication needs during disaster response; and
- Providing guidance on the applicability of specific ICTs.

5.1 Disaster Response Management[48]

Disaster response is a set of activities undertaken to deal with the effects of a specific disaster event, including search and rescue, evacuation, medical care, provision of emergency water, food and shelter, debris removal, and stabilization of unsafe buildings and landforms. Disaster relief forms a part of disaster response, and is the set of activities aimed at supplying affected populations with goods and services to ensure their immediate survival.

In general, disaster events will usually be relatively unexpected, involve substantial distress and trauma, have a potentially overwhelming scale of effects, and have a strong potential for becoming worse if there is no appropriate intervention. In line with these general aspects of disaster events, disaster response can bear some or all of the following characteristics:

- Many urgent and significant tasks involving injuries, deaths and/or property loss/damage
- Large numbers of personnel and agencies required
- High level of public interest and/or controversy
- Many examples of information mishandling
- Potential for some key tasks to be overlooked or under-resourced
- Potential for some key tasks to be over-resourced
- Potential for some of the available key resources to not be used

Bearing in mind the characteristics listed above, disaster response management requires key personnel to:

- Identify the range of problems occurring
- Set priorities and generate appropriate solutions to identified problems
- Implement agreed upon solutions while often working within tight timelines
- Monitor and review the situation and the actions being taken
- Keep comprehensive records of information received, decisions taken and actions carried out

48 This section is drawn from ADPC's Regional Training Course on Disaster Management. For more information, see http://www.adpc.net.

More specifically, disaster response management requires the following to be carried out by the relevant agencies, which will usually be a combination of the government sector, private sector and NGO/International Non-Governmental Organization (INGO) sectors:

• Undertake warning and alerting • Combat the effects of the hazard • Rescue persons trapped or in danger • Provide first aid and other treatment for casualties • Reduce further damage to property • Assess damage • Conduct evacuations, if warranted	• Begin the restoration of lifelines and key facilities • Provide information to the public • Provide immediate physical or financial assistance • Provide relief goods and temporary housing • Plan to begin restoration of the economy • Plan to establish reconstruction and rehabilitation processes

Stages of a Disaster Response Event

A disaster response operation usually proceeds through three broad stages with the following general activities:

1. **Initiation** – Relevant ministries/agencies/services/authorities are notified whenever information has been received, which indicates that an emergency is possible, or is occurring. The Disaster Response Coordination Centre (DRCC) and all organizations that have received the initial information then initiate their emergency procedures. Where the onset of a disaster is gradual there is usually ample time to collect information and make decisions on which actions should be taken. However, some emergencies occur with a sudden impact, and in these cases the initial stages are likely to involve heavy workloads and a rapid build-up in activity. Earthquakes, chemical spills, explosions, and air crashes are examples of this type of emergency.

2. **Mobilization** – Ministries/agencies/services/authorities deploy their resources in response to identified needs.

3. **Stand-down** – A number of activities need to take place at the conclusion of the emergency, when response organizations have completed their allocated tasks. This normally includes the following activities:

    - Checks to account for all human and physical resources;
    - Psychological support for staff;
    - Maintenance and repair of equipment; and
    - Conducting operational debriefs.

Disaster Response Coordination Centre (DRCC)

A DRCC is a facility, adequately staffed and equipped, from which a disaster can be managed in an appropriate and effective manner. In general, a DRCC should:

- **Provide strategic direction** – As all key decisions will be made in the DRCC it will be possible to influence the management of the response in a strategic overall manner. The DRCC should continuously monitor the disaster and adjust to changes accordingly.

- **Manage information** – The DRCC provides a central information facility for the whole response effort, and should have the capability of providing an entire picture of the response and relief effort. It will need to obtain, process and distribute information in order to achieve this.

- **Facilitate task and problem management** – The DRCC can be used to identify tasks and problems, decide the best courses of action, implement plans of action and manage resources.

- **Forward planning** – The DRCC can be used to identify possible future tasks and problems, as well as to develop longer-term strategies for dealing with the impact of the event.

The goal is for the relevant government agencies, private organizations, NGO/INGOs and communities to respond in order to undertake urgent action to save lives and property, and to stabilize the situation so that further damage and loss do not occur. This response may take up to a few hours, a few days, or even a few weeks under some circumstances. Some DRCCs utilize ICTs to manage disaster response.

Typical Functional Groupings

Typically, the key functions within a DRCC will include decision-making, task implementation, information management, technical analysis, logistics and administration. Each of these functions depends on sound information management, and therefore requires appropriate ICT support. The broad responsibilities of these functional groups are shown in Table 7.

Table 7. Responsibilities of the functional groups of a DRCC

Functional Groups	Broad Responsibilities
Decision-Making	Overall direction and control of the DRCC
Implementation	Identification of operational needs; development and implementation of operational plans
Information Management	Support for information collection, storage and distribution
Technical Analysis	Analysis of information received by the DRCC
Supply and Logistics	Management of logistics in relation to the provision of emergency goods and relief supplies, and the deployment of resources
Administration Support	Provision of financial, administrative and staff welfare services

As can be seen from Table 7, the Information Management Group has a key supporting role for the management of information within the DRCC, as shown in table 8.

Table 8. Functions and responsibilities of the Information Management Group

	Functions	Specific Responsibilities
1	Collect Information	Ensure that information is collected from all persons in the DRCC and from all relevant sources external to the DRCC
2	Store Information	Ensure that all information obtained is stored in a manner that enables it to be accessed by DRCC staff and others as required
3	Distribute Information	Ensure that information is distributed to all those who require it within the DRCC and in external agencies
4	Disseminate Public Information	Under the guidance of the Implementation Group, ensure that appropriate information is disseminated to the public
5	Media Liaison	Maintain regular contact with the news media, distribute media releases and arrange media conferences as required

Humanitarian Supplies Management System (SUMA)[49]

SUMA is an information management tool. The purpose of this system is to improve the management of humanitarian aid, by strengthening the national capacity for managing relief supplies and bringing them to the affected persons in an adequate and convenient way.

SUMA uses simple software to track items from the moment donors commit to sending supplies until they are distributed effectively to the affected population. It has the following main components:

- SUMA Central – Used by authorities managing a disaster or emergency
- SUMA Field Unit – Used at the points of entry or reception sites, such as borders, water or river ports, and large storage centres (centres where supplies arrive during emergencies, such as airports, collection stands, etc.)
- Stock Management – Registers the arrival and the delivery of supplies at the storage centres or warehouses

SUMA has the ability to create reports with the information collected at the field units. These reports build transparency and accountability by creating visibility throughout the supply chain. Once published, donors, organizations, local governments and aid recipients can identify where the help is coming from, whom it has been given to, and the priority given to the needs identified. Politicians and organizations have found this feature valuable in countering criticisms and charges of mismanagement. This ability to show transparent management often helps build morale and trust in the aftermath of a disaster.

Communications Facilities

The effectiveness of the DRCC will be severely limited if it does not have adequate communications facilities. Information management relies on having a communication system, and any restriction in communication will necessarily limit the required collection and dissemination of information. The following are the technology options for emergency and risk communications, their uses and vulnerabilities:

49 Find out more about SUMA at http://www.disaster.info.desastres.net/SUMA/.

Public Switched Telephone Network (PSTN) – The PSTN is sometimes called the Plain Old Telephone System. This name gives the misleading impression that it provides only public telephone service. The global cable and switch network was built to serve telephones, but in reality it carries nearly all telecommunication signals making the transmission of other applications and services possible, such as the Internet. Failure of the PSTN results in more losses than that of the telephone service. For this reason, those involved in emergency response must have a clear understanding of the operations of these networks and what can interfere with such network functioning.

Local Wireline Distribution – In many places, telephone lines are open wires, or cables with numerous pairs of wires suspended from poles. Such pole routes are themselves vulnerable to disasters involving high winds and earthquakes. Any disaster causing just one of the poles on the route to fall down, or the cable to be cut even at one point, will disrupt the circuit. Restoring service may take days, especially if the roads are inaccessible. A preferred approach is to have cables buried underground in ducts, thus reducing their vulnerability. It is advisable to have all disaster management centres connected through underground cables as this significantly reduces the risk of loss of service.

Wireless Local Loop – Wireless local loop is a system that connects subscribers to the local telephone station wirelessly. It uses radio signals to complete the last mile between subscribers and the PSTN. Some operators offer access to their switches via wireless local loop solutions that rely on local Radio Base Stations (RBS). These provide a radio link to fixed radio units in the home, which in turn connect to telephones in the home or business. In some locations it provides lower cost and quicker installation than traditional wire line local loop.

Cellular Network – Mobile phone service is provided by a large network of ground-based RBS. Typically each one provides for at least three “cells”. When mobile systems are designed, they optimize coverage and capacity, but can have local congestion problems in times of emergencies. For this reason, mobile phones should not be considered a primary communication means for any DRM purposes. Furthermore, RBS may fail if the fixed lines or microwave links that connect them to mobile switches fail, if the PSTN network they are dependent upon fail, or if their ground mains power system fails and the batteries run out (after about eight hours or so).

Private Network – The term “private network” is used here to describe communications facilities available to specialized users like fire brigades, police, ambulances, utilities, emergency teams, civil protection, transport, government, ministries and defense. These networks can also be used by business, corporate and industry users. The network is usually owned by the private users themselves who can share it eventually in a multi-organizational environment. The users usually manage their private network, while in some cases an operator manages it for private customers.

These networks come in different forms. They can be wired or wireless, they can share public networks resources, and they can be fixed or offer mobility. They can be classified as: Land Mobile Radio networks, maritime networks, aeronautical networks, Virtual Private Networks and satellite networks.

- **Land Mobile Radio Service** – Access to private Land Mobile Radio networks is reserved to a closed group of mobile users who make short exchanges of voice and data of an operational nature during day-to-day, emergency and disaster situations for public protection and disaster relief. Such networks offer very short call set up times, simultaneous voice and data, mobility, high robustness and ease of use in harsh urban, wide areas and mountainous environments. Coverage ranges from one cell of a few metres to large countrywide areas; they can also be set up quickly. A family of standards and technologies can be combined to offer the required voice and data service to cater to specific varying needs for civil protection, police, and emergency teams (such as security level, the data rate of information, and the type of terrain of the critical mission). Systems are categorized as narrow, wide and broadband according to the increasing width of their radio channel and to the data rate offered.

- **Maritime Radio Service and Aeronautical Radio Service** – Both services use frequency bands on defined channels. The Maritime Radio Service uses the Global Maritime Distress and Safety System for ships and marine rescue centres for the purpose of safety of life at sea. The Aeronautical Radio Service has additional bands allocated for radio navigation equipment such as those used by instruments during flight.

- **Virtual Private Network** – Many medium and large organizations operate their own network interconnecting computers for e-mail service, database access and intranet. The servers of the company are connected to the office computers by means of a Local Area Network, which in some cases may cover various premises of an enterprise. Such an arrangement is known as a Wide Area Network. The links can be wired or wireless, local or remote.

- **Satellite Very Small Aperture Terminals (VSAT)** – One way to improve the chances that an enterprise system will remain operational during a disaster is to connect via satellite. This will make the company free from both a failure of terrestrial infrastructure and congestion of the PSTN. The antennas determining the aperture, typically range in size from less than 1 metre to 5 metres, depending on the frequency band used. They are mostly designed for fixed installation, but so-called “flyaway” systems are available for disaster recovery purposes. In general, subscribing to a VSAT service means the purchase of a group of channels for a fixed period. No other user will be sharing these channels, and the subscriber is guaranteed the use of these channels even when systems such as PSTN and mobile satellite are congested. This is a preferred alternative, but the cost is high and it may be economical only as part of a larger system.

- **Satellite Terminals and Satellite Phones** – Several systems, differing in their technological concept and their applications, are available for use in emergency operations. For the user, the difference is primarily in the size of the equipment and the coverage required. Some handsets and portable terminals may have GPS and database functions that add value to field teams working at isolated, remote and mountainous areas. The Global Mobile Personal Communication System allows the use of equipment very similar to terrestrial mobile phones and is particularly suitable for situations where a high degree of mobility is required, with mostly omnidirectional antennas that need not be aligned accurately. Most systems operate with billing procedures through SIM cards, allowing control and attribution of communication cost and international roaming on the Global System for Mobile Communication (GSM) networks with which the service providers have respective agreements. Due to the relatively high tariffs, in particular for connections between satellite terminals of different systems, the public satellite networks are attractive only for the initial response phase, but they should not be used as primary means in longer-term operations.

When Telecommunications Infrastructure Is Not Enough[50]

A good telecommunications infrastructure is in place in Bangladesh consisting of satellite/microwave, optical fibre, VSAT, and mobile phones, operated by both government and private players. The telecommunications coverage is quite satisfactory, although it does not cover Sundarban and some hill tracts in Chittagong where the population density is quite low. For effective DRM, an integrated system is indispensable, both in terms of communication channels as well as involving diverse groups of stakeholders. So far in Bangladesh, government agencies work independently in an emergency situation, depending on the type of disaster they need to deal with. The telecommunications infrastructure itself is vulnerable to damage from natural hazards at critical points. This was evidenced by the collapse of a vital microwave tower at the port city of Chittagong during the April 1991 cyclone, interrupting national and international telecommunications networks; and when floodwater entered communications cable ducts in many districts during the 2004 floods. A more common problem is power failure during disaster events, cutting off mobile phone communication.

5.2 Information Management

Effective and efficient information management is vital for the successful execution of a disaster response operation. It is more than having communications equipment available to the people who are operating in the DRCC, or to those who are communicating with it. Rather, the importance of information management lies in the fact that information needs to be efficiently and accurately passed between people and agencies in order to plan and implement appropriate response actions.

Disaster events, however, can significantly diminish the ability of those involved to handle information efficiently and effectively. This could be due to the need to cope with excessive volumes of information, or the fact that the consequences of information transactions may be acute or even life threatening. There may also be severe time pressures or large-scale equipment failures.

For all these reasons, there must be a simple and robust information management system available to DRCC personnel to ensure that information is collected, collated and disseminated in the most effective manner possible.

Types of Information

Information can be classified into different types that are significant for DRCC personnel in an emergency, including:

- Baseline information about the communities affected by the hazard;
- Baseline information about government plans, capabilities and resources;
- Information about the hazards involved in the emergency;
- Information about the impact of the emergency; and
- Information about the affected population's needs and wants.

50 Manzul Kumar Hazarika, Dwijendra Kumar Das and Lal Samarakoon, "Integrated Information and Communication System for Emergency Management in Bangladesh," in *ICT for Disaster Risk Reduction*, ICTD Case Study 2, APCICT, ed. (Incheon, APCICT, 2010), pp. 76-85, http://www.unapcict.org/ecohub/ict-for-disaster-risk-reduction-1.

Some of this information will be accumulated before the disaster occurs, and made available in the DRCC for use as required during the emergency. Other information will be linked to what is happening in the disaster event, and will come into, or go out from, the DRCC via messages, briefings and meetings.

The management of this disaster-linked information is the focus of this section, particularly the methods by which information moves into, around and out of the DRCC, and is accessed by those who need it.

Messages

Messages are a key part of the information management process, as they are the means by which a significant amount of information moves into, and out of, the DRCC. The effectiveness of the methods used to manage messages, therefore, will have a critical impact on the effectiveness of the overall information management process in the DRCC. A message may be received or dispatched by anyone within the DRCC, and can come into, and go out of the DRCC verbally (delivered by messengers, or via landline telephone, radio or mobile phone) or in written form (delivered by messengers, or via facsimile machine, mobile phone as text messages, or e-mail).

Some messages will be received by a central handling point in the DRCC (the registry), and some will be received directly by individual action officers within the DRCC. Similarly, some messages will be sent out directly from individual action officers, and some will be sent through the registry. A system must be developed to ensure the rapid and reliable handling of messages. It must be thoroughly understood by all those who use and operate it, to ensure it is as effective as possible in supporting information management in the DRCC during emergencies.

A standard DRCC message form should be used for all communication with the DRCC. This standard message form can be used for recording and communicating all relevant information arising from a disaster. An exception is made, however, in the case of a situation report. This is a factual report on the current situation and needs to have a consistent format because of its wide distribution and the fact that it is updated regularly during the course of a disaster event. A situation report will usually contain the following key headings:

- Incident/Emergency/Disaster (What happened? Where? When?)
- Overview of immediate effects from impact of event
- Estimate of problem (Size? Scope? Area? Numbers involved?)
- Resources (What has been done to date?)
- Who and what is involved, what additional resources are available but uncommitted, existing location of key resources
- Tasks being undertaken by particular resources, expected changes in location, tasks proposed
- Tasks completed since last report
- Evaluation (What is proposed to be done?)
- Overview of the disaster and the effects of operations undertaken to date
- Future intentions, both short and long term
- Additional resources required

Logs

All DRCC staff should maintain a personal log. These logs should be used to record all significant messages, actions and decisions. All message originators need to use their logs to make entries recording the sending of messages. Persons receiving messages should also make entries in their personal logs noting the main details of the messages they receive. Information can be transferred verbally if required, but in this case the sender and the recipient should still record the necessary details in their respective logs.

Standard DRCC Information Records

The following is a list of the files and documents that should be maintained in the DRCC, as a minimum:

Files	Documents	
• Situation reports • Media releases • Messages sent • Messages received • Damage assessments • Needs assessments • Pledges	• Emergency plans • Operations manuals • List of key officials, including details of their organizations, business and home addresses, telephone numbers and e-mail addresses • Agency organization charts • Resource inventories	• Maps • Aerial photos • Community data, including population, resources, commercial activities, etc.

Origen Emergency Management System[51]

This is an emergency management system for New Zealand's Civil Defence Crisis management centres. The system has the following features:

- Secure logon that provides access permissions and audit control
- User defined controls for incident categories, personnel, and entities
- Message entry and maintenance
- Message links and dependencies
- Message management and tracking
- Task entry, tracking and management
- Response entry and management
- Emergency procedures library
- Letter and mail merge facilities to MS Office
- Full audit and tracking reports to screen or printer
- Stand alone PC and Network support with data synchronization

Use of Displays

Displays are tools to summarize information and facilitate rapid analysis and action. Displays must be easily understood by all persons in the DRCC to ensure that they are useful, and can assist in the process of meeting needs and allocating resources. Displays are to be updated as regularly as practical, because current information is critical for ensuring that effective and timely actions are taken. All displays should therefore be marked "CORRECT AS AT…" with the appropriate date/time entered when display information is changed, updated or adjusted.

The following are common types of displays used in a DRCC. They could be ICT based, using projectors or television screens, or could be prepared using paper or whiteboards if electronic facilities are not available:

- Contact Display – This is used to record important contact numbers being used during the disaster.
- Resources Display – This is used to show resources already committed, as well as some of those available for deployment, including location, quantity, period applicable, etc.

51 Origen Enterprise Solutions, "Emergency Management System," http://www.origen.co.nz/index.asp?1=ems.

- Situation Display – This is used to summarize the current situation for the various key locations affected by the disaster. This board is to be constantly updated during disaster operations, and will form the basis of information released to the public and the media.
- Damage Summary – This contains an overview of the cities, towns and villages that have reported damage, the time it was reported, and the extent of the reported damage.
- Report Display – This provides a list, with release times, of current situation reports, operation and administrative orders, technical summaries and media/public information releases.
- Access/Egress Display – This is used to show details of major roads, airfields, helipads, etc. that may be used/open/closed during the disaster operation, particularly the designated access route/s and egress route/s. Note: this information can also be shown on a map, depending on the needs of the situation.
- Activity Display – This shows details on major activities scheduled.
- Status Display – This display summarizes the number of deceased, injured, trapped, evacuated and homeless, and their location, as well as summarizes the number unaccounted for. It is used in conjunction with the Situation Display.

Maps

Maps are an important information resource for the DRCC. Two main uses of maps are:

- The situation map – This is a map of the event area marked with details of the developing threat, hazard or known information regarding the disaster.
- The access map – This is marked with details of the routes that can be used by disaster response traffic, evacuation vehicles and the general public. The map may also include other coordination information concerning the event area, such as location of temporary shelters.

DesInventar Disaster Information System[52]

DesInventar is a free and open source Disaster Information System that allows users to store, query and analyse post-disaster damage and loss assessments, as well as needs assessments. DesInventar is typically used during the response, early recovery and reconstruction phases, although it is also being used as a historical disaster damage/loss information system to better understand the past and potential risks faced, and thus support decisions in DRM. DesInventar has the following features:

- Allows the creation of multi-hazard, multiple-disaster, historically disaggregated disaster information databases
- Provides wide accessibility, protection and built-in analysis tools, including statistical, tabular, graphical and spatial analysis tools
- Is flexible and easily customizable, supports multiple languages, and non-disaster field categories can be added to the database

Its specific capabilities include:

- Pre-defined, built-in disaster datacard with basic disaster effects
- Simple database extensibility allowing for the configuration of generic surveys required to collect damage/loss/needs assessments in post-disaster situations

52 W3C, "EMSystems: LA RED/ UNDP-GRIP DesInventar," http://www.w3.org/2005/Incubator/eiif/wiki/EMSystems#LA_RED.2F_UNDP-GRIP_DesInventar.

• Simple interface with GIS systems at two levels, as internal geographic files (shapefiles) or interfacing with Web mapping enabled systems
• Full integration with Google Maps and Google Earth tools for spatial data exchange
• Full data export/import functions
• Full support for major database platforms

DesInventar was used in the following events:

• Hurricane Mitch (Honduras and Nicaragua), 1998
• Armenia (Colombia) earthquake, 1999
• El Niño North Peru floods, 1997
• South Peru earthquake, 2001
• Indian Ocean tsunami (Indonesia, Maldives and Sri Lanka), 2004
• East Timor uprising (social conflict disaster), 2006
• Cyclone Nargis (Myanmar), 2008

Crowdsourcing Crisis Information

Traditional humanitarian information management systems are typically closed and controlled. Currently, many stakeholders use an information management system to fulfill information gathering following pre-arranged protocols. These protocols can be limiting for the following reasons:

- There are restrictions on who can provide inputs to the system, potentially reducing the quantity of collected and reported data
- The procedures involved can be unduly time-consuming, causing delays in the allocation of resources to tasks
- Collected information can become obsolete if too much time elapses between when it is collected and when it is used for decision-making

Information of all types has to be quickly processed during disaster operations. In this context, social networking and crowdsourcing websites could become powerful tools for collecting and sharing information during disaster events.

Online social networking sites such as Facebook and Twitter are now becoming extremely popular and, since 2009, have been progressively changing the ways in which information is delivered during disasters. These websites allow users to communicate with other people by sending messages or sharing pictures through a computer or a mobile phone, and enable a “many-to-many” form of communication.

Disasters can lead to breakdowns in telephone services, which have led to social media being utilized more frequently during the period of response and relief. Anyone with a computer (or smart phone) and an Internet connection can create, distribute and retrieve critical information. Friends and families of those affected by disasters are using social networking sites to seek information and assistance. Mainstream news organizations are also utilizing it for news and information. The scope for effective relief could be broadened , especially if humanitarian agencies and policymakers as well as affected populations take advantage of these technological opportunities.

Twitter

Twitter is an example of how social media can be a powerful medium for real-time updates and photos during disasters. This micro-blogging platform can be a valuable resource for both survivors and aid workers.

- In June 2009, during the Iranian post-election protest, Twitter became a crucial tool for information sharing between the protesters and the outside world, and even a source for the media.
- After the Haiti earthquake, Twitter provided first-hand accounts of breaking news and images.
- Within an hour of the 2011 Japan earthquake, more than 1,200 tweets a minute were coming from Tokyo. Within about a day, a total of 246,075 Twitter posts using the term "earthquake" had been posted.[53]

Ushahidi[54] is an open source platform that combines existing applications such as SMS, Twitter and Google Maps to crowdsource, collect, visualize and map crisis information. People can post individual reports that are then aggregated and presented in a useful way. Ushahidi has mostly been used in conflict situations in Kenya, Afghanistan, Colombia, Democratic Republic of the Congo, Gaza, India, Lebanon and Mozambique, but has also been implemented during the earthquakes in Haiti and Chile in 2010, and the earthquake in Japan and New Zealand in 2011.

Opening the reporting of crisis information to anyone with technology presents exciting opportunities and important challenges. Compared with traditional humanitarian information management systems, information collected on Ushahidi can be communicated directly to those who most need it. Ushahidi also includes a subscription option that allows individuals to subscribe to alerts in specific locations by SMS or e-mail.

Nonetheless, crowdsourcing presents some challenges. If the affected community is not trained on how to report their situation and needs, there can be an overload of unverified information. It could also raise expectations within affected communities that relief will be supplied. There is also concern that crowdsourcing relies on the voluntary support of individuals, but there needs to be a way to guarantee that volunteers are available and have the required skills to perform the task effectively. Finally, not all members of a population will have access to the technology and knowledge to participate.

Some key challenges include ways to rapidly verify the accuracy and reliability of the information collected and posted, and making sense of a lot of information in a short time. Options for near real-time validation techniques include:

- The submission of information to Ushahidi could be restricted to trusted individuals. This approach could be described as "bounded" crowdsourcing.
- Information goes through "auto-validation", when multiple sources describe the same event.[55]

53 Harry Wallop, "Japan earthquake: how Twitter and Facebook helped," *The Telegraph*, 13 March 2011, http://www.telegraph.co.uk/technology/twitter/8379101/Japan-earthquake-how-Twitter-and-Facebook-helped.html.

54 Ushahidi, http://ushahidi.com/. See also, http://en.wikipedia.org/wiki/Ushahidi.

55 Diane Coyle and Patrick Meier, *New Technologies in Emergencies and Conflicts: The Role of Information and Social Networks* (Washington, D.C. and London, UN Foundation-Vodafone Foundation Partnership, 2009), http://www.unfoundation.org/press-center/publications/new-technologies-emergencies-conflicts.html.

Floods in Pakistan[56]

During the extensive flooding experienced by Pakistan in mid-2010, ICT, including space-based applications, enabled the Government and the international community to rapidly scale up emergency assistance in the vast geographical area affected by the disaster.

Satellite images taken on different dates and GIS databases were used extensively for situation analysis by almost all the international humanitarian agencies. The dynamics of the flood waves were captured by a constellation of 17 orbiting satellites with more than 22 imaging sensors on board. These products were available free of charge to end users for most of the critical days following the disaster. Furthermore, cooperative mechanisms at the international and regional levels, such as the International Charter on Space and Major Disasters, Sentinel Asia, the United Nations Platform for Space-based Information for Disaster Management and Emergency Response and the Operational Satellite Applications Programme of the United Nations Institute for Training and Research, provided free access to value added high resolution satellite data that were made available and compiled by Government and private space agencies.

Earth observation satellites were used extensively, not only for rapid humanitarian response and early recovery, but also for flash appeals. The Pakistan Initial Floods Emergency Response Plan, which sought almost USD 460 million in contributions, was launched by the United Nations on 11 August 2010. The appeal was based on GIS and remote sensing data of the affected areas, which were used to help mobilize international aid and support.

At the ground level, mobile phones in particular, proved most helpful in the dissemination of early warning messages in the long stretches of the Indus flood plain basin from north to south, which encompasses a geographical area of about a million hectares. An emergency telecommunications cluster was put in place to enhance the response capacity of the Government of Pakistan, the United Nations response team and NGOs. The World Food Programme (WFP) provided the first line of ICT support to the United Nations system in Pakistan. WFP, through its Fast Information Technology and Telecommunications Emergency and Support Team, provided the Government of Pakistan with direct assistance in evacuation and search and rescue efforts.

In addition to these in-country efforts, the social media facilitated communications and flash appeals between the internal population and the diaspora. Images of the devastation were transmitted to mobile personal devices around the globe unceasingly, while at the same time helping to keep world attention on the tragedy, despite the relatively long duration of the disaster (three to four months).

56 This case study is extracted from: ESCAP, "Mainstreaming innovative information and communications technology in disaster risk reduction: Expanding connectivity to disaster-affected communities through the innovative use of information and communications technologies and disaster-related information," Committee on Disaster Risk Reduction, Second session, Bangkok, Thailand, 29 June-1 July 2011, pp. 10-11, http://www.unescap.org/idd/events/cdrr-2011/index2cdrr.asp.

5.3 Policy Considerations

The capacity of disaster response systems in Asia and the Pacific generally needs to be enhanced. Emergency communication capacity is critical to ensuring the effectiveness and efficiency of disaster response actions. Such capacity includes:

- Restoration or establishment of telephony and Internet services, particularly wireless connected services
- Rapid deployment of stand-by communication means to ensure communication among field teams and relevant headquarters
- Expansion of handling capability of local cellular mobile systems to accommodate a sudden increase of local and outbound traffic
- Ensuring Internet bandwidth for networking relevant information, decision supporting systems, conference and tele-health services, and news reporting
- When necessary, such capacity may also include restoration and expansion of flight control communications

It is recommended that the first deployment of key emergency communication systems and services to the rescue sites be made within 24 hours, in order to assist rescue teams with search and rescue tasks during the first 72 hours after a disaster strikes.

To fully meet such needs is generally beyond the capability of local governments and service providers. Aside from measures to improve the resiliencies of local service networks, most capacities mentioned would require interventions from the national government with support from regional and international agencies.

The following lists key emergency communication systems and services that are most widely used in countries of Asia and the Pacific, and it is recommended that their capacities are strengthened as a priority.

- **Satellite mobile** is considered the most convenient and rapidly deployable means for telephony and Internet access in most disaster response actions. Some dual module handsets may automatically switch between satellite and cellular mobile systems, which can greatly reduce the cost when cellular mobile service is available. Inmarsat and Iridium are among existing satellite mobile services in the region, globally covered through multi-satellite constellations, and Thuraya's two geostationary satellites covering most Asian and west Pacific countries may charge lower call costs.[57]

- **Cellular mobile** is the most commonly used communication means nowadays. The early restoration or establishment of such services may provide the cheapest and broadest telephone and wireless services to the field teams. When connection to the outside is not available, such capacity should be able to support local services. To improve the communication quality that may deteriorate due to the sudden increase of traffic, timely expansion of the handling capacity of mobile systems is important.

- **The Internet Protocol platform** can meet many communication needs. When coupled with wireless facilities, it may provide the most convenient communication services at the lowest cost. It facilitates networking of relevant information systems, connecting local cellular mobile base stations to their networks, organizing video conferences, accessing tele-medicine support, and making international calls.

57 See the web page of the satellite services for more information: Inmarsat (http://www.inmarsat.com/), Iridium (http://www.iridium. com/default.aspx) and Thuraya (http://www.thuraya.com/).

- **VSATs** with satellite broadband services can provide connectivity when ground-based broadband Internet is not available. Many communication satellites provide such services with different geographical coverage and technical systems, and many VSATs are available for rapid deployment, including those that can be air-dropped and carried by manpower to extreme geographically difficult mountainous areas. Among these satellite broadband services, Thaicom's IPStar satellite may provide the cheapest bandwidth to many Asia-Pacific countries.[58]

- **Emergency communication vehicles** have been deployed in many disaster response actions, and most of them are equipped with satellite communications capability. Some of them aim to provide comprehensive communication services, including cellular mobile services; some are to support private networks of field teams; and some are to provide satellite connection for high rate data transmission, including those for television transmission.

- **Satellite short-message service** provided by China's Compass satellite navigation and positioning system demonstrated its value after the Wenchuan earthquake in May 2008, when it was the most reliable communication means during that time.

- **Citizen band radio** is used by many disaster response teams for their internal voice communication.

- **Navigation and positioning** capacity is another important technical support capacity for field rescue and mitigation actions during major disasters. It allows for the field teams to determine their positions in the most seriously affected disaster areas. Satellite positioning through the GPS system has become more popular in recent years, as many mobile handsets are now equipped with GPS positioning functions. In the coming years, more satellite navigation and positioning systems will be available to the Asia-Pacific region, including those developed regionally by China, India, Japan and the Russian Federation. China's Compass system may also provide satellite SMS to a broader public.

A related policy issue around improving communication is the resilience of the ICT infrastructure itself. Enhancing the resilience of existing communications infrastructure has been a major disaster preparedness measure in many countries in the Asia-Pacific region, where telecommunications authorities have established policies and response arrangements as part of national disaster reduction strategies and response plans. In addition, service providers have taken actions to make their communications infrastructure more resilient to major disasters.

Enhancing the resilience of existing terrestrial communications infrastructures may be achieved in the following ways:

- Higher construction standards for mobile base stations and wireless transmission towers in high disaster risk areas
- Higher power backup capacities
- Well established response plans to motivate human and technical resources for rapid restoration of possible damages
- Ensured scalability to meet the sudden increase of traffic that may happen during emergency disaster responses

Network resilience may by enhanced through increasing the network redundancy, and utilizing satellite communications as major backup means to enhance the resilience of the communications infrastructure.

58 See Thaicom, http://www.thaicom.net/eng/satellite_thaicom4.aspx.

Finally, countries may not be able to provide for all of their information needs during times of disasters. International or regional cooperation in deploying ICTs to countries hit by disasters is vital, particularly in providing access to data and equipment for use during disaster response.

Satellite imagery, which for many developing nations is expensive, is one example where international cooperation is providing access in times of crisis.

Ten major space agencies in the world are the members of the International Charter on Space and Major Disasters, which has more than 21 earth observation satellites as its resource to provide the world remote sensing data for disaster response. Many earth observation satellites are also satellite resources that can be requested through the Charter. Data acquisition and delivery take place on an emergency basis. Throughout each disaster process, assigned experts manage the data ordering, handling and application needed to assist users. The Charter is to be activated by its Authorized Users, who are the space agencies and civil protection, rescue, defense or security bodies from the countries of Charter members; and authorized United Nations entities and international organizations, such as the United Nations Office for Outer Space Affairs, United Nations Institute for Training and Research (UNITAR) Operational Satellite Applications Programme and the Asian Disaster Reduction Center (ADRC).

Sentinel Asia is a similar initiative under the Asia-Pacific Regional Space Agency Forum for providing disaster-related satellite information and products to the Asia-Pacific region, through its website.[59] Sentinel Asia is led by the Joint Project Team, which currently consists of 54 organizations from 22 countries and nine international organizations. Many spaced-based images are currently provided by five earth observation satellites. Observation requests for major disasters in the Asia-Pacific region can be submitted by member organizations of the ADRC or representative organizations of the Joint Project Team of Sentinel Asia.

With the importance of emergency communication in the aftermath of a disaster, this is another area where international organizations are ready to provide assistance in. TSF is one of the organizations already mentioned above. ITU is another organization that is ready to deploy mobile satellite terminals and various other communications equipment to help restore vital communications links for the coordination of relief operations. This is part of the ITU Framework for Cooperation in Emergencies that has benefited from the contribution of funds and equipment from its partners—FedEx, ICO Global Communications, Inmarsat, Iridium, TerreStar Global, Thuraya and Vizada.

When disasters strike, private companies also play a significant role in response efforts, and in rebuilding the economy. Companies in the communications industry in particular have been known to donate communications equipment, repair the communications infrastructure or provide alternative communications systems in case the infrastructure is damaged. Ericsson implements an Ericsson Response Programme that not only provides communication solutions at times of disasters, but is involved in research and awareness raising. Ericsson also contributed to the development of IFRC's Disaster Management Information System. Other companies such as Motorola and Qualcomm have partnered with governments and NGOs in providing emergency communication devices such as satellite phones, and various networking solutions. Engaging in partnerships with the private sector at the emergency response planning stage is essential in order to ensure better coordinated response operations during emergencies. Partnerships with the private sector to support longer-term mitigation and preparedness activities should also be explored.

59 Sentinel Asia, https://sentinel.tksc.jaxa.jp/sentinel2/topControl.action.

There are other issues surrounding the use of remotely-sensed data. These include frequency of satellite passes (for monitoring), cloud cover impeding comprehensive collection of data, the trade-off between amount of detail and size of the coverage, and ease of use for emergency managers. These have to be considered, even as the benefits of the rapid acquisition of data must be remembered.

Questions To Think About

1. List three different types of information that are significant for DRCC personnel in a disaster.

2. Analyse your answers: Which of these can be managed by a computerized system located in the DRCC?

Further Reading

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UNDP. *Emergency Information Management and Telecommunications*. Disaster Management Training Programme 2nd ed.,1994.

US Department of Homeland Security. *National Emergency Communications Plan*. July 2008. http://www.dhs.gov/xlibrary/assets/national_emergency_communications_plan.pdf.

6. ICT FOR DISASTER RECOVERY AND RECONSTRUCTION

Post-disaster reconstruction begins with a series of decisions that must be made almost immediately. Despite the urgency with which these decisions are made, they have long-term impacts, changing the lives of those affected by the disaster for years to come.

World Bank[60]

This section aims to introduce information needs in disaster recovery and reconstruction by:

- **Providing an overview of disaster recovery and reconstruction;**
- **Emphasizing how ICTs can provide supporting information for disaster recovery planning; and**
- **Providing examples of ICT use in recovery or reconstruction activities.**

6.1 Disaster Recovery and Reconstruction

Recovery refers to: "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."[61]

Reconstruction refers to: "The restoration and improvement, where possible, of facilities, livelihoods, and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. It is focused primarily on the construction or replacement of damaged physical structures, and the restoration of local services and infrastructure."[62] The reconstruction process usually comes under recovery tasks.

Recovery activities begin soon after an emergency situation has ended; and they can last from a few weeks to a few years, depending on the magnitude and type of disaster, and the destruction. Recovery and reconstruction affords an opportunity to develop and apply DRR measures and to "build back better", which focuses not only on restoring normalcy but also on building disaster resilience in order to reduce the risk of future disasters.

The main phases/activities under disaster recovery and reconstruction include: recovery and reconstruction strategy formulation, damage and needs assessment, implementation mechanism, and monitoring and evaluation.

60 Abhas K. Jha, et. al., *Safer Homes, Stronger Communities: A Handbook for Reconstructing after Natural Disasters*(Washington, D.C., The World Bank, 2010), http://go.worldbank.org/W5D9JZU2Y0.

61 UNISDR, *2009 UNISDR Terminology*.

62 Abhas K. Jha, et. al., *Safer Homes, Stronger Communities*, p. 365.

6.2 Formation of Information Management and Coordination Agency

Once the disaster has occurred, governments must decide on the lead agency to coordinate information management at the national level. This will facilitate coordination of the whole recovery and reconstruction process within the country, as well as internationally in dealing with donors. When information is gathered and collated at a central location, the agency can provide a more complete and higher quality set of information for decision-making. Information can be managed using database systems (manually operated or computerized).

In some instances, the local government may also designate an information management coordinator to liaise with the central information management agency as local level inventories are very useful.

Another task to be accomplished by the information management and coordination agency is to work closely with organizations implementing recovery and reconstruction, to define information needs for assessment and monitoring (basic data, GIS data and maps, available sources, needs for government intervention, etc.) For this task, information collected by the local agencies can be added to the central database. Portable GPS devices and mobile phones can be deployed to collect, transmit and upload information from the field to central databases.

Box 6. Formation of "Task Force for Rebuilding the Nation" after the tsunami in Sri Lanka

Recovery and reconstruction after the 2004 Indian Ocean tsunami in Sri Lanka was spearheaded by the Task Force for Rebuilding the Nation, which was formed under the Presidential Secretariat to ensure coordination between all tsunami related projects and to minimize the burden on stretched government departments. The major assignments of the Task Force included the following:

- Coordinate, facilitate and assist the implementing organizations, i.e., line Ministries, Departments, District and Divisional level Government Institutions
- Coordinate donor assistance, fund raising activities and other financial avenues to enable implementing organizations to achieve rebuilding objectives
- Facilitate expeditious procurement process to commence projects quickly
- Enable implementing organizations through capacity building

6.3 Use of ICTs in Disaster Recovery and Reconstruction

As in other DRM phases , ICTs play a vital role in carrying out activities under recovery and reconstruction. This starts with the formation of an Information Management and Coordination Agency immediately after the disaster and maintaining it up to the end of the recovery and reconstruction stage. ICTs can improve both the speed and quality of agency interventions, including post disaster assessments, recovery planning and monitoring, and project/programme design and implementation. The choice of ICTs used, however, should be determined by their ability to function even with limited communication services.

The quality of ICT infrastructure before a disaster, will affect recovery and reconstruction. Decision makers should understand the weakness in the existing ICT systems and any data gaps; and clearly identify the areas to be future enhanced to fill the gaps. Too often, those needs are gradually placed at a low priority once the disaster is forgotten.

Damage, Loss and Needs Assessment

A recovery and reconstruction strategy is shaped by the information gathered during and after the disaster through various types of assessments.

The systems and methods used during crisis situations to collect critical information are different than in normal times. Identifying and deploying appropriate public, private and volunteer resources in a coordinated and timely manner depends on factors such as the commitment of political leadership and availability of resources.

Among the methods used for damage and loss assessment, the methodology developed by the United Nations Economic Commission for Latin America and the Caribbean (UNECLA) provides a standardized assessment of the direct and indirect effects of a disaster event, and their consequences on the social well-being and economic performance of the affected country or area. The assessment is based on collected data of damages from both paper and digital information sources such as survey questionnaires, press articles and interviews. ICT tools are then required to rapidly and systematically assess the significance of damages and losses, help define reconstruction strategies, set up a basis on geographical terms and sectors, and help define priorities.[63] The methodology was first developed in the 1970s, and recently, it has been expanded to include recovery needs.

Earth Observation Technology to Survey Collapsed Structures[64]

Earth observation technology was deployed to survey the collapsed structures after the 2004 Indian Ocean tsunami struck Banda Aceh, Indonesia. By defining a primary impact zone and using observations of before-and-after satellite imagery, an estimate of the extent of damage and destruction was obtained. The first step was to estimate the range of heavily damaged structures in the defined impact zone. Pre- and post-event imagery was available for a limited area. All observable existing structures pre-event were counted in specific areas, and an estimate was reached of 5.6 structures per hectare, and an estimated density of four structures per hectare was applied for areas where pre-event images were not available. The resulting analysis led to an estimate that 82 per cent of structures had collapsed. This represents a total of 29,545 collapsed structures.

Strategy Formulation

One of the first priorities after a disaster, is to define recovery and reconstruction strategies focusing on early recovery. The next priority is to plan policy formulation considering social and economical needs. During the planning process, serious consideration should be given to identifying the most critical data required for planning and implementation. This will include:

63 For a good introductory reference, see: Asian Development Bank, *Damage, loss and needs assessment: An introduction for staff of the Asian Development Bank*, Draft (April 2009), http://www.adb.org/Documents/Guidelines/Damage-Loss-Assessment/default.asp.

64 Abhas K. Jha, et. al., *Safer Homes, Stronger Communities*, p. 263.

• Social, demographic and geographic information • Land-use and physical planning • Utility services network information • Housing data (occupancy, tenure, structural data) • Infrastructure details • Disaster plans at local and national level	• Information on hazard, vulnerability, risks and zones of the area • Technical data on lands (geo technical, ground water table, etc.) • Natural resources, environment and environmental management plans • Information on archaeological sites and sites for conservation • Economic data (livelihood of people, agriculture, industries, etc.)

The information should be available within a very short time, and the time pressure creates a need to balance speed and accuracy. In this planning process, ICTs are used to combine information from numerous sources to assist in obtaining timely and accurate processed information that helps in formulating relevant policies. Maps produced using GIS can visualize patterns, trends and correlations. Additionally, information from different sources can be superimposed using GIS to identify risks and investment priorities, and to establish baselines for reconstruction.

Implementation of Recovery and Reconstruction Projects

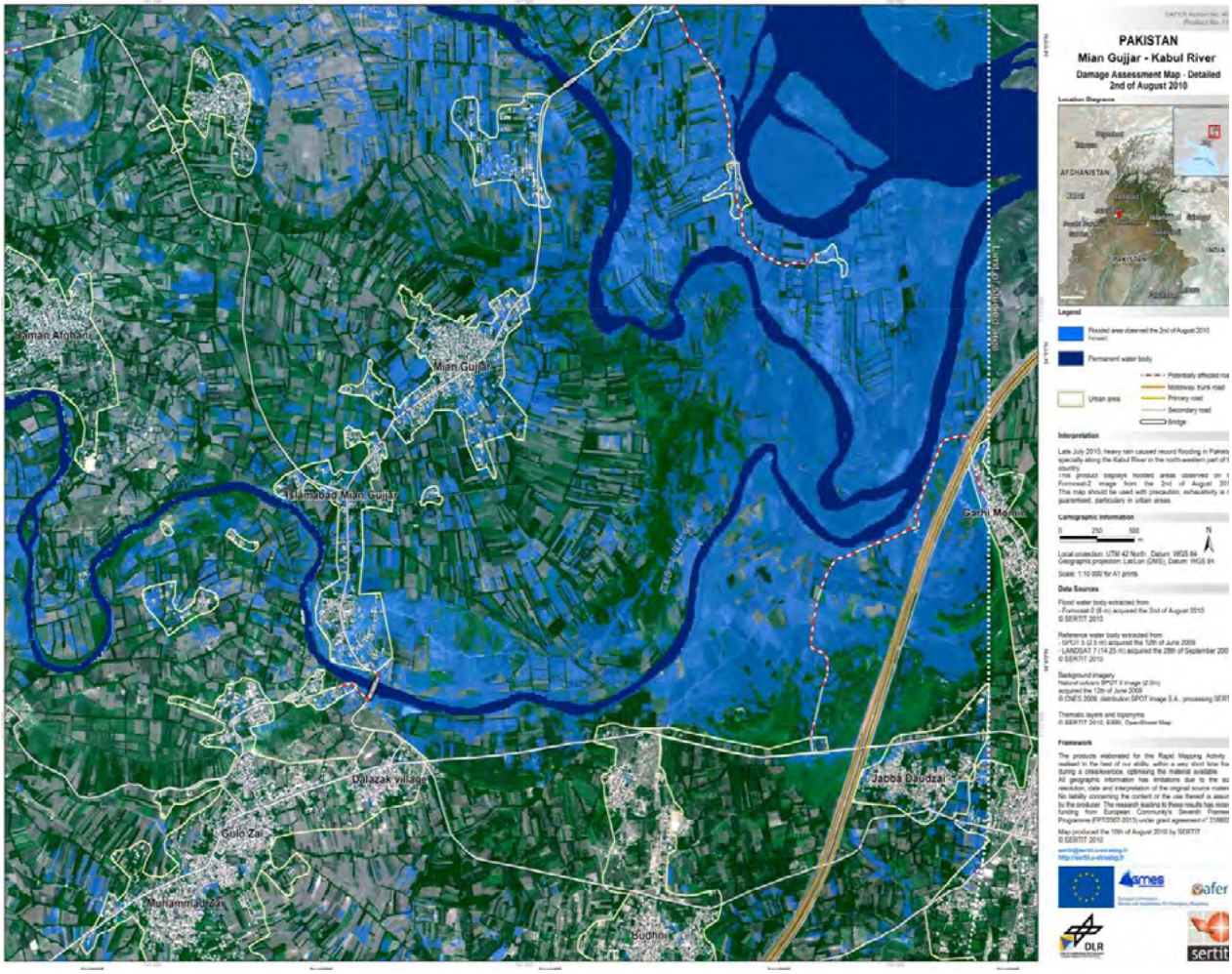
During implementation stage, the information management and coordination agency should have continuous dialogue with the agencies involved in relief and reconstruction, and with local communities so that transparency and partnership-building during the process is maintained. Basic ICTs such as mobile phones and e-mail services are possible options for complementing the face-to-face interactions, and can help maintain regular dialogue. ICT applications are also widely used in managing recovery and reconstruction projects. See *Academy Module 7* for details of managing projects that use ICT-based solutions to meet strategic needs and/or introduces processes and methodologies that are supported by ICTs.

Databases to track beneficiary cash transfers (2004 Indian Ocean Tsunami, Banda Aceh, Indonesia)[65]

Databases were developed by a number of organizations to track the flow of assistance funds after the 2004 Indian Ocean tsunami. The British Red Cross Society in Aceh, Indonesia, invested in the design of a database to track programme resources. The database also proved useful for tracking and managing beneficiary cash transfers for shelters. The database linked all stages of the post-disaster assistance process, from registration of beneficiaries to instructing banks to disburse progress payments. The database could also link the various elements of the recovery programme including shelter, livelihoods recovery grants and registration for land title.

65 Ibid., p. 262.

Figure 8. A satellite image of a section of the Mian Gujjar-Kabul River taken on 2 August 2010



Note: This was used to rapidly identify flooded areas (in bright purple) and potentially affected roads (shown as white and purple dashed lines).

Monitoring and Evaluation of Reconstruction Projects

For monitoring and evaluation, computerized varieties of management information systems are widely used. These systems primarily monitor the physical progress against meeting reconstruction and/or resettlement objectives. Overall, they can contribute to the sustainability of outputs and project benefits.

There are widely used pre-set systems for project monitoring. The Donor/Development Assistance Database[66] is one of the Web-based tools that can be used for monitoring and tracking donor assistance locally as well as internationally. It is a tracking, analysis and planning tool for use by national governments and the broader donor community that: "Enables stakeholders in the development process to capture the most critical international assistance data on a donor and project specific basis, including pledges, committed and disbursed amounts, sector and region of implementation, project description, key performance indicators, implementing agencies and other contacts."[67]

66 See Synergy International Systems, "Development Assistance Database," http://www.synisys.com/index.jsp?sid=1&id=36&pid=23&lng=en.

67 Development Assistance Database – fact sheet, (n.d.).

6.4 Policy Considerations[68]

During the whole process of recovery and reconstruction, there are different types of ICT tools that can be used as per the situation. However, in a large-scale disaster, where countries seek international assistance, a number of challenges will have to be faced and resolved:

- Duplication of data processing due to lack of coordination among working teams
- Not all post-disaster information is collected as per a plan, but rather in an improvised manner
- Political and legal set-up of the country: Certain countries prevent the use of high-tech ICTs without government approval, or forbid the use of trans-border communications equipment. Decisions are connected with security (e.g., Myanmar allowed a very limited number of organizations to intervene during Cyclone Nargis)
- As per the prevailing laws and regulations in the country, if the disaster occurred in high security areas, the situation further restricts humanitarian assistance and recovery efforts (e.g., restrictions on the use of mobile phones in certain areas after the Pakistan earthquake in 2005)

A notable policy breakthrough in emergency communication is the Tampere Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations that came into force on 8 January 2005. Through this Convention, regulatory barriers that impede the use of telecommunication resources for disasters are waived. The Tampere Convention was ratified by Pakistan in March 2009, bringing the total to 47 signatories.[69]

Policymakers should consider the following:

- Integrate appropriate ICT use widely in disaster response while avoiding ad hoc systems or systems that require a high level of technical capacity.
- Incorporate specialists with ICT experience in assessment and project teams to promote full use of emerging ICTs in recovery and reconstruction.
- Ensure that ICT systems are compatible with existing government systems, particularly if they will continue to be used after the disaster.
- Involve stakeholders in assessment, validation, monitoring, and other reconstruction-related activities by using accessible, collaborative technologies, including social media tools.
- Support the use of open systems and standards to ensure interoperability. Require developers to standardize and geo-reference information through specifications in contracts and terms of reference.
- Promote the use of field-level ICT systems that assist reconstruction project management, provide transparency to affected communities, and permit the unification of data.

68 The policy considerations in this section are drawn heavily from Abhas K. Jha, et. al., *Safer Homes, Stronger Communities*, Chapter 17: Information and Communications Technology in Reconstruction.

69 ITU, "The Tampere Convention - A Life-Saving Treaty," http://www.itu.int/en/ITU-D/Emergency-Telecommunications/Pages/TampereConvention.aspx. For the Tampere Convention, see http://www.itu.int/en/ITU-D/Emergency-Telecommunications/Documents/Tampere_Convention/Tampere_convention.pdf. See also Annex II.

- Encourage government to develop resilient information systems that can be readily restored after a disaster, and to establish agreements with local and international ICT-related stakeholders that specify mechanisms for post-disaster cooperation.

- Encourage governments to establish policies and laws that provide the right to information on hazards and risks, after a disaster and at other times, to support the incorporation of DRR measures in planning and construction.

Questions To Think About

- How can ICTs channel the appropriate information to government disaster recovery efforts?
- What are the risks and challenges in using ICTs in disaster recovery and reconstruction?
- Can crowdsourcing be used to improve recovery and reconstruction?

Something To Do

Visit the *Safer Homes, Stronger Communities* accompanying website of the Global Facility for Disaster Reduction and Recovery (GFDRR). Chapter 17 is about the use of ICTs in reconstruction, and can be found at: http://www.housingreconstruction.org/ housing/Chapter17.

Further Reading

Bollin, Christina, and Shivani Khanna. *Review of Post Disaster Recovery Needs Assessment and Methodologies*. United Nations Development Programme (UNDP), 2007. http://www.recoveryplatform.org/assets/publication/Post%20 Distaster%20Recovery%20Needs%20Assessment%20and%20Methodologies.pdf.

De Ville de Goyet, Claude. Information Gaps in Relief, Recovery, and Reconstruction in the Aftermath of Natural Disasters. In *Data on Disasters: Establishing effective systems for relief, recovery and reconstruction*. Samia Amin and Markus Goldstein, eds. Washington D.C.: The World Bank, 2008. pp. 23-58. http://siteresources.worldbank.org/INTPOVERTY/Resources/335642-1130251872237/9780821374528.pdf.

Jha, Abhas K., and others. *Safer Homes, Stronger Communities: A Handbook for Reconstructing after Natural Disasters*. Washington, D.C.: The World Bank, 2010. http://go.worldbank.org/W5D9JZU2Y0.

7. BUILDING REGIONAL AND INTERNATIONAL NETWORKS

Recognizes the urgent need, as evidenced by the devastation caused by the earthquake and the tsunami in the Indian Ocean, to strengthen national systems and to expand existing mechanisms for sharing of information and best practices in disaster detection, early warning, prevention, and assessment of natural disasters and for disaster relief, post-disaster rehabilitation and reconstruction.[70]

This section aims to introduce the importance of regional and international networks by:

- **Describing the reasons for forming cross-nation networks for disaster risk reduction;**
- **Showing examples of how networks can assist in reducing disaster risks; and**
- **Providing examples of how networks facilitate the access to information and ICTs.**

Table 9. Impacts of the 2004 Indian Ocean Tsunami

Country	Number of People			
	Killed	Injured	Homeless	2003 population (in millions)
India	16 389	7 187	210 000	1 064.400
Indonesia	221 291	149 559	539 385	214.700
Maldives	108	1 300	12 482	0.293
Sri Lanka	35 386	23 033	380 000	19.200
Thailand	8 221	8 457	58 550	62.000

Source: ADPC, *Regional Analysis of Socio-Economic Impacts of the December 2004 Earthquake and Indian Ocean Tsunami* (Bangkok, 2006), p. 8, http://www.drrprojects.net/drrp/default/download/drrpp_file.file.88e523b56d8fe389.526567696f6e616c416e616c79736973206f66205473756e616d692e706466.pdf.

Lessons from the 2004 Indian Ocean Tsunami

On 26 December 2004, a 9.0 Mw earthquake occurred in the Indian Ocean off the island of Sumatra in Indonesia. Within days, the scale of the impact was revealed to a concerned world. The 2006 assessment of the tsunami's socio-economic impacts painted a grave picture (see Table 9). Could a regional effort for tsunami disaster preparedness improve the preparedness of the affected countries? The answer is yes, because it is possible to develop an ocean-wide monitoring, prediction and alerting system for a more efficient disaster response.

70 Common statement of the Special Session on the Indian Ocean Disaster: risk reduction for a safer future, World Conference on Disaster Reduction, 18-22 January 2005, Kobe, Hyogo, Japan, http://www.unisdr.org/2005/wcdr/intergover/official-doc/L-docs/special-session-indian-ocean.pdf.

Point in fact, the earthquake was detected by the USA Pacific Tsunami Warning Center, but the centre could not determine if a tsunami was triggered as it did not have tsunami detection instruments in the Indian Ocean. They could only send a tsunami bulletin to Pacific coast countries about the possibility of a tsunami in the other ocean, and coordinate alerts and technical support through US Embassies in the Indian Ocean coastal countries. Perhaps what makes this lack of information more glaring is the fact that the Pacific Tsunami Warning and Mitigation System (PTWS) was established and has been operating since 1965, but there was no corresponding network for the Indian Ocean in 2004.

An analysis of the event identified information gaps as coming from five major sources:

1. An inability to detect the tsunami (no hazard detection)
2. The inability to forecast the potential impacts for the countries surrounding the Indian Ocean (hazard monitoring)
3. The lack of a system to relay a tsunami alert (risk communication)
4. Not knowing how to react to an alert, even with some lead time to respond (disaster preparedness)
5. Not knowing how to reduce the risk of disaster from a tsunami[71]

All these gaps are presently being addressed by the current institutions for tsunami warning and mitigation. In a sense, the 2004 Indian Ocean tsunami has been a global reminder to form networks among countries, agencies, NGOs and donors, whether their primary involvement is in DRM or disaster response.

This case study highlights the key reasons that motivate network formation:

- **The scale of the DRM effort goes beyond the boundaries of one country.** There are many instances when several states share the same ocean, river basin or mountain chain. Regional and international cooperation can facilitate the mutual environmental protection and sustainable use of the shared geographic feature. In the case of the tsunami, the shared common feature is the Indian Ocean where tsunamis may occur. In the case of climate change resilience, the argument is that all people share the same planet, and therefore all countries have a mutual stake in the development of shared strategies and coordinated implementation of climate resilience programmes.

- **The DRM effort requires considerable investment in technology and/or data acquisition.** In the previous section, the ability to acquire data and invest in technology has been recognized as a challenge for developing countries who wish to use ICT technologies. Computer models and GIS applications can be bought, but these are data-hungry, and the data required to run them are expensive. In fact, DRM requires a regular updating of data sets, because human activity usually has an effect on the level of exposure to a hazard, the degree of vulnerability, and the capacity to face a hazard. Therefore, disaster risk is never constant, and disaster data sets become quickly outdated. Modalities for sharing data, sharing equipment and sharing expertise via a common resource pool is a way to assist developing countries overcome this particular challenge.

- **DRR information has the potential for positive externalities.** The benefits of using DRR information (such as knowing how to reduce the risk of disaster from a tsunami event) can be gained by the members of a network who have access to the same information, even if they were not part of the original investment of time, money and effort.

71 UNESCO-IOC, UNISDR/PPEW, WMO, *Assessment of Capacity Building Requirements for an Effective and Durable Tsunami Warning and Mitigation System in the Indian Ocean: Consolidated Report for 16 Countries Affected by the 26 December 2004 Tsunami*, UNESCO-IOC Information document No. 1219 (Paris, UNESCO, 2005), http://www.jodc.go.jp/info/ioc_doc/INF/144508e.pdf.

7.1 Forming Networks for Transboundary Disaster Risk Management

There are many instances when DRM professionals face hazards whose process of creating an effect is not contained within a single country. The simplest example is the potential for a tsunami in any of the oceans (Indian, Pacific and Atlantic) to reach all shores. A dynamic example would be a watershed of a mighty river, where economic activities by countries located upstream (such as water utilization, dumping of pollutants, or construction of dams) would have an impact on the water volume and quality as the river flows to the countries located downstream. A complex example would be a pandemic, where health hazards such as the avian and human influenza virus (H1N1) or the corona virus that causes the illness called severe acute respiratory syndrome are able to pass quickly from person to person, and are assisted in their spread by the mobility of migratory animals and humans.

Countries could therefore enter into agreements to work together towards common goals, and DRM or DRR could be one of the main goals or one of the objectives. See Annex II for a list of global and regional initiatives related to DRM. ICT applications could facilitate the efforts towards goals or objectives.

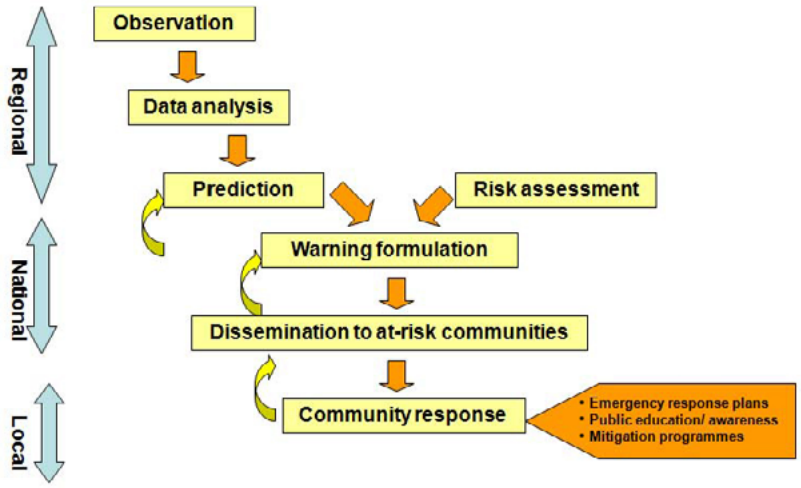
Tsunami Warning and Mitigation Systems

The Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS) is a subsidiary body of the Intergovernmental Oceanographic Commission of UNESCO (UNESCO-IOC). It has been in operation since 1965, and is currently composed of 32 Pacific member States:

> Australia, Canada, Chile, China, Colombia, Cook Islands, Costa Rica, Democratic People's Republic of Korea, Ecuador, El Salvador, Fiji, France, Guatemala, Indonesia, Japan, Malaysia, Mexico, New Zealand, Nicaragua, Panama, Papua New Guinea, Peru, Philippines, Republic of Korea, Russian Federation, Samoa, Singapore, Thailand, Tonga, Tuvalu (provisional), United States of America and Viet Nam.
>
> The Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS) was formed in response to the 2004 Indian Ocean tsunami. The UNESCO- IOC received a mandate from the international community to coordinate the establishment of the system during the course of several international and regional meetings. It currently comprises 16 Indian Ocean member States: Bangladesh, Comoros, Indonesia, Kenya, Madagascar, Malaysia, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Seychelles, Somalia, Sri Lanka, Tanzania and Thailand.

Tsunami warning systems are owned and operated by member States. The function of a system is to continuously collect, distribute and interpret all available seismic and sea level data for the existence and propagation of a tsunami. It must issue timely and clear warnings for its area of operation, and exchange these data and information with other national and international centres. It has complementary and sustained activities in tsunami hazard risk assessment, tsunami warning training, emergency response, and preparedness. Participating countries receive international tsunami warnings from the Pacific Tsunami Warning Center and the Japan Meteorological Agency, and most countries receive these warnings at facilities with back-up systems for receiving warning messages that operate 24 hours a day, 7 days a week.

Figure 9. Components of an end-to-end early warning system



In 2004, the systems for communicating alerts and the procedures for responding were relatively well-developed for the Pacific Ocean but not for the Indian Ocean. In fact, all other tsunami warning systems—for example the Indian Ocean (IOTWS), Mediterranean (North-East Atlantic, the Mediterranean and Connected Seas Tsunami Warning and Mitigation System [NEAMTWS]) and the Caribbean (Caribbean Tsunami Warning System [CARIBE EWS]) regions—were begun only after the 2004 Indian Ocean tsunami event. However, the important milestone here is that these systems were eventually established, and always as part of the umbrella of organizations of the IOC and the relevant regional sub-commission, and always nested within the various DRM and emergency response actors and regional intergovernmental associations (such as the Association of Southeast Asian Nations [ASEAN] and the South Asian Association for Regional Cooperation [SAARC]) in their respective regions.

The Mekong River Commission

The Mekong River Commission (MRC), established in 1995 among four riverine countries (Cambodia, Lao PDR, Thailand and Viet Nam), not only promotes a framework for sustainable utilization and joint management of the Mekong river, but it also has an information management component to support the countries' mutual objectives for the river.

The MRC is a river basin organization based on "The Agreement on Cooperation for the Sustainable Development of the Mekong River Basin". The MRC countries agreed to cooperate in the management of Mekong water resources for their mutual benefit; and to harness the economic potential of the Basin's water resources in a sustainable manner. The People's Republic of China and Myanmar are dialogue partners of the Commission.

The information products it develops for DRM include flood forecasts, water level monitoring and water flow monitoring, and modeling of climate change impacts on the Lower Mekong Basin. In 2002, the MRC and China signed an agreement to share hydrological data. The data provided by China has since become a core component of the MRC's flood forecasting and river monitoring activities.

The MRC promotes regional cooperation in order to implement the agreement by serving its member countries in supporting decision-making and promoting action on sustainable development and poverty alleviation. It also helps member countries to exchange information and formulate a joint basin development plan. Applying the principles of Integrated Water Resources Management, the Commission aims to encourage balanced and *coordinated* developments and investments in irrigation and drought management, navigation, hydropower, flood management, fisheries, watershed management, environment, and tourism.

Box 7. What are the SDGs?

Adopted by world leaders on 25 September 2015, *Transforming our world: the 2030 Agenda for Sustainable Development*, is a set of 17 goals and 169 targets on global socio-economic and environment to be achieved by 2030. This 2030 Agenda for Sustainable Development builds on the Millennium development Goas, to end poverty, fight inequality and injustice, and tackle climate change. Learn more about it at http://www.un.org/sustainabledevelopment/sustainable-development-goals/

The Commission has an Information and Knowledge Management Programme (IKMP) whose primary role is as an information and knowledge service provider. In general, it is tasked with: (1) the development of data, information and knowledge management systems; (2) proactive exchange, sharing, networking and collaboration; and (3) ensuring the full use of the knowledge potential of MRC staff and riparian countries. The main data types it collects and maintains are hydro-meteorological and other monitored time series, such as water quality and sediment, for example. Spatial data such as GIS products and simulated data and outputs come from a suite of mathematical modeling programmes. It supports the work to achieve the goals of the Commission members.

The IKMP maintains a Decision Support Framework (DSF) to assist planners in assessing both the magnitude of changes brought about through natural and human interventions in the water resource system, as well as the impacts that these will have on the natural environment and upon people's livelihoods. The DSF models the behaviour of the river system under a wide range of different interventions, and can run simulations over a number of years or for a single year or season. The DSF provides a set of computerized analytical tools assess how the behavior of these rivers will affect key environmental and social indicators.

7.2 Forming Networks for Systematic Resource Sharing

Just what is involved in hazard monitoring? Nowadays, there is usually a set consisting of instrumentation, data collection on paper, data storage in databases, theories, computerized models, and the outputs of the analyses of the data. Sometimes, the instrument can be as simple as a rain gauge. Sometimes, trained experts need to go into the field to conduct surveys, and they develop the data. Sometimes, one needs a satellite with onboard sensors.

Returning to the example of the IOTWS, most of the member States would have difficulties in setting up their own system. The scale of the investment required for the instruments, data acquisition, communications network, training and research are considerable. Several ICTs operate in an effective tsunami warning system; these are used for:

- Modeling the propagation of a tsunami wave (using digital data sets modeled with GIS applications).

- Seismic monitoring (through networks for measuring seismic activity that may trigger a tsunami) and sea-level monitoring networks (for detecting tsunami waves generated by an earthquake, volcanic eruption, submarine rockslide, or meteor strike).

- The regional-level dissemination network for IOTWS warnings is the Global Telecommunication System under the WMO. Once an alert is received by a country, the dissemination of alerts utilizes in-country communication networks and technologies.

- Internet technology is used to keep the world informed of tsunami alerts, to disseminate data of past events, to disseminate material on preparedness, and to make visible the risk reduction decisions and activities of each network (PTWS and IOTWS).

- Metadata, information architecture, system architecture, and alert levels are standardized for the Tsunami Warning Systems. This is done to make the flow of information as smooth and rapid as possible.

Extending this process of listing information and system requirements on a per hazard basis, one would find that the monitoring instrumentation is hazard-specific, but the other technologies have similar uses for modeling, forecasting/prediction, warning dissemination, information dissemination, and for information architecture.

At the moment, it may not be reasonable to expect that developing countries can manage monitoring systems by themselves. ESCAP, through its Committee on Disaster Reduction, found that: "In general, disaster management authorities in most developing countries lack technical capacities, particularly in ICT and space technologies for analyzing and interpreting information."[72]

The Committee recommended some priorities to redress the situation with the promotion of regional cooperative mechanisms for sharing information, communication and space-based resources, including emergency communications, at the regional and sub-regional levels to support better disaster preparedness and response by all members.

Annex IV has a list of regional and global cooperation efforts and networks on resource sharing that can be used as a reference. "Resources" refer loosely to persons, assets, materials or capital that can be used for DRM. This can include publications of recommended procedures, systems, and training material.

7.3 Forming Networks to Promote Positive Externalities

DRM relies heavily on information. Information hubs have been established by organizations or have evolved from a variety of initiatives, from research projects to communities of practitioners who became involved in DRM. These activities generally promote the dissemination of information and information products, using Web technology as the medium of communication between information providers and end users. Below are descriptions of some well-established initiatives.

The UNISDR, tasked with enabling communities to become resilient to the effects of hazards and promote the management of risk, launched an online resource platform on DRR, PreventionWeb to enhance knowledge sharing and identify good practices on resilience, Disaster-related data of DesInventar[73] and the Emergency Events Database (EM-DAT) are also available to anyone who has Internet access.

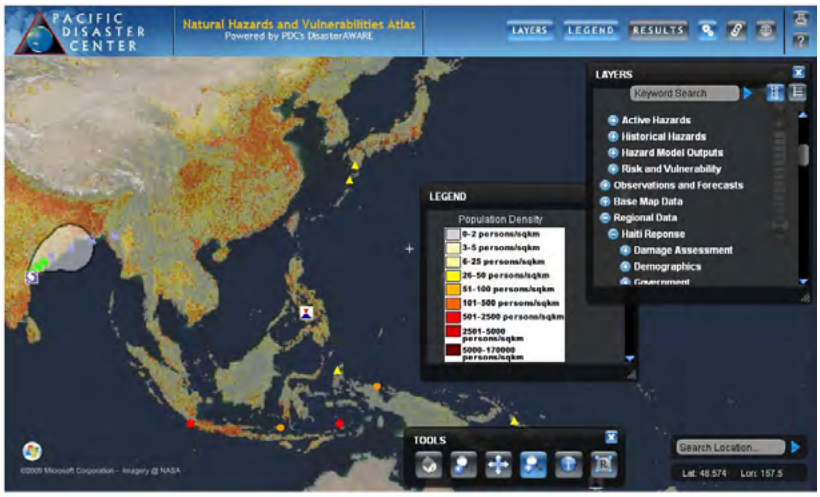
72 ESCAP, "Enhancing Regional Cooperation on Disaster Risk Reduction in Asia and the Pacific: Information, Communications and Space Technologies for Disaster Risk Reduction," Committee on Disaster Risk Reduction, First session, 25-27 March 2009, Bangkok, Thailand (2009), p. 17, http://www.unescap.org/idd/events/cdrr-2009/CDR_5E.pdf.

73 DesInventar is a case study in Chapter 5, ICT for Disaster Response. See also http://www.desinventar.net/DesInventar/index. jsp.

The Emergency Events Database

The Centre for Research on the Epidemiology of Disasters has been maintaining an EM- DAT[74] containing essential core data on the occurrence and effects of over 18,000 mass disasters in the world from the year 1900 to present. The database is compiled from various sources, including United Nations organizations, NGOs, insurance companies, research institutes and press agencies. The database was created after recognizing a lack of international consensus regarding best practices for collecting these data, and variability in definitions, methodologies, tools and sourcing. The database generates the following information: country profiles, disaster profiles, disaster trends, disaster lists, reference maps and data search. These products are made freely available.

Figure 10. Active hazards, recent events and population density visualized in the Natural Hazards and Vulnerabilities Atlas



Online Southeast Asia Disaster Inventory and OSA-Map

The Online Southeast Asia Disaster Inventory (OSADI) is a disaster inventory linked to an application called OSA-Map.[75] Like the Global Risk Data Platform, it allows users to interact with risk-related information such as historical events, hazard layers, and population data, as well as the inventory information that has been collectively entered in the database. This combination of data adds value to individual risk layers. OSA-Map also visualizes dynamic data, such as active hazards, forecasts, and observational data. This enables a user to monitor current conditions within a broader situational context. Other applications include more detailed infrastructure and other elements of interest as well as indicators of social, economic and environmental vulnerability and capacity. Figure 10 illustrates a public application similar to OSA-Map. Training augments the utility of the OSADI tools and supports DRM decision-making. In Marikina City, Philippines, an interactive viewer was developed as part of a larger assessment project.

74 EM-DAT, "The International Disaster Database," http://www.emdat.be/database.

75 Pacific Disaster Center, "Online Southeast Asia Disaster Map," http://pdc.org/osamap/.

AlertNet

During the Rwanda crisis of 1994, the Reuters Foundation became interested in media reports of poor coordination between emergency relief charities on the ground. It surveyed charities on the issue and recognized the need for a service that would deliver operation-critical information to relief charities, encourage relief charities to swap information with one another, and raise awareness of humanitarian emergencies among the general public. The service began with Reuters but it soon developed the AlertNet[76] community whose members must be "non-discriminatory, non-profit civil society organizations that are actively involved in emergency relief". The benefits of membership include an online system for publishing their news from emergency hotspots directly to the website, access to humanitarian news from various media outlets, emergency alerts via e-mail that can be customized according to users' preferred "channels", and Reuters photographs that can be downloaded for use in appeals and publications.

As DRM information sources, Osadi and AlertNet are open for the public use. Based on website statistics, one can see that information-sharing initiatives do fulfill information demands. AlertNet is growing by ten million users every year, according to AlertNet. Monthly pageviews for UNISDR's PreventionWeb was at 164,683 for December 2015.

International institutions have been developing information standards and increasing the reach of technical expertise to assist in decision-making processes. The International Charter, SpaceAid and Sentinel Asia are well-documented for the occasions that they were activated or tapped to provide satellite imagery (see Annex II for a detailed list of international and regional institutions that are using, developing and promoting ICT for DRM).

7.4 Examples of Regional Cooperation

Information systems based on the integrated analysis of relevant information and knowledge about disaster risks and relevant hazard, geographical, economic and social factors have been widely used for effective DRM. The creation and dissemination of early warning relies substantively on the technical systems that are built upon advanced information, communication and space technologies. The successful organization of disaster response relies on the real-time information on the severity and impacts of the disasters, which are obtained complementarily by both ground-based reporting and satellite-based observations. Many countries in the Asia-Pacific region have harnessed these resources for hazard mapping, vulnerability analysis, risk assessment, mitigation, hazard monitoring, early warning, response, and post-disaster reconstruction and recovery efforts.

The deficit of such information and services in many developing countries has created larger gaps in saving lives and properties in the event of major disasters. On their own, high-risk and low-capacity developing countries often lack the technical and financial resources to develop and use ICT tools for disaster response and risk reduction. Regional cooperation and public-private partnerships hold the key to leveraging the capacities and resources available regionally and globally to effectively use ICTs for building resilient nations and communities.

76 AlertNet, http://www.trust.org/alertnet/.

Several United Nations agencies, including ESCAP and ITU, have made efforts to harness these opportunities. For example, ITU has been actively advocating for countries to have a National Emergency Telecommunications Plan (NETP), whether on its own or as part of a national emergency response plan. See Annex IV for critical considerations that need to be made when developing the NEPT.

As the largest regional arm of the United Nations, ESCAP has been promoting regional cooperative mechanisms to assist its members' effective access and affordable use of ICT-enabled technical tools.

Regional Cooperation for Drought Disaster Monitoring and Early Warning

Drought is a major disaster to many Asian countries with huge economic and social impacts on sustainable development and food security. Drought monitoring and early warning capacity of a country may assist the government to become aware of the risks of droughts, to initiate mitigation measures to lessen the impact, and to take actions to prevent them from becoming major disasters. Effective and accurate monitoring and early warning of drought disasters require localized capacities for combined analysis of ground-based observation data, historical records and satellite observation information. This information should be made accessible in a timely fashion and in the form of either original data for capable countries and appropriate products for less capable countries.

With the expressed technical support of China, India, Thailand, FAO, and the cooperation of other stakeholders, ESCAP launched the "Regional Cooperative Mechanism for Disaster Monitoring and Early Warning, Particularly Drought" in September 2010.[77] The mechanism aims to provide substantive technical support to assist countries, particularly less and least developed countries, establish operational capacity for drought disaster monitoring and early warning, through:

- An information portal for sharing of national strategies, profile data and mitigation experiences in drought risk reduction
- A technical supporting platform for provision of no- or low-cost space-based products for drought relevant analysis
- A platform to encourage technology transfer and capacity building, including development of localized products and services

The plan is to focus on other types of disasters, beginning with floods, once the fundamental modalities of the Mechanism are established.

Building Collaborative Emergency Communication Capacities[78]

The ESCAP Committee on Disaster Risk Reduction, at its second session in June/July 2011, considered the development of a regional platform for developing disaster emergency communications capacity. In particular, this would provide institutional and technical support for high-risk, low-capacity developing countries.

77 ESCAP, "Enhancing regional cooperation, knowledge and capacity for disaster risk reduction in Asia and the Pacific," Committee on Disaster Risk Reduction, Second session, Bangkok, Thailand, 29 June - 1 July 2011, p. 10, http://www.unescap.org/idd/events/cdrr-2011/index2cdrr.asp.

78 This sub-section is drawn heavily from: ESCAP, "Mainstreaming innovative information and communications technology in disaster risk reduction: Expanding connectivity to disaster-affected communities through the innovative use of information and communications technologies and disaster-related information," pp. 14-16.

The regional platform's collaborative capabilities could be placed into two major categories: (1) rapidly deployable standby equipment and services for emergency response, and (2) pre-disaster capacity for reporting and early warning.

Such a platform would have the following functions:

- The pooling of, among other things, equipment and human and financial resources needed to build and enhance effective disaster communications management in the region
- The rapid deployment of those resources upon request to assist countries hit by major disasters or experiencing emergencies
- The provision of extensive communications services for humanitarian assistance and rescue operations
- The establishment of a national emergency telecommunications plan and the harmonization of the plan to the extent feasible across countries
- Further awareness raising on and the facilitation of the ratification and implementation of the Tampere Convention with the aim of removing regulatory barriers on cross-border telecommunication resource movements for humanitarian assistance

Asia-Pacific Gateway for Information Sharing and Analysis for DRR and Development

Currently, a number of websites provide information on different aspects of DRR at different phases. Some are with specific focuses on different kinds of disasters, some are on different technical aspects, some are for policy promotion, and some on providing information resources. There is no website containing a concise overview of the relevant information needed for integrating or mainstreaming DRR into different development sectors.

The ESCAP Committee on Disaster Risk Reduction, at its first session in March 2009, recommended that the ESCAP Secretariat promote an "Asia-Pacific Gateway for Disaster Risk Reduction and Development"[79] for information sharing and analysis for DRR, in collaboration with other partners working in the field.

Following the recommendation of the Committee, the Secretariat developed the Gateway as a Web portal that promotes the mainstreaming of disaster risk reduction into development planning to help mitigate the socio-economic effects of disasters. The Gateway targets the information and networking needs of national disaster management authorities and line ministries that play a key role in promoting DRR at both the national and regional levels. The Gateway was launched during the second session of the Committee on Information and Communications Technology, which was held in November 2010.[80]

The Gateway aims to provide member States and organizations with a common platform for information sharing, establishing networks, accessing technical services, and facilitating regional cooperation.

The Gateway will be linked to the DRR Project Portal for Asia and the Pacific[81] and the resource pages of PreventionWeb. This will avoid duplication of work and encourage partnerships; it will also enhance resources and access to disaster risk information.

79 Asia-Pacific Gateway for Disaster Risk Reduction and Development, http://www.disasterriskreductiongateway.net.

80 ESCAP, "Enhancing regional cooperation, knowledge and capacity for disaster risk reduction in Asia and the Pacific," p. 6.

81 UNISDR Asia Partnership on Disaster Reduction, "DRR Project Portal for Asia and the Pacific," http://www.drrprojects.net/drrp/drrpp/home.

Regional Platform for Sharing Space Information Products and Services

Many developing countries in the Asia-Pacific region have established contacts with regional and international initiatives in acquiring space-based data, as well as some capacities in processing earth observation satellite information for DRM. However, most still lack sufficient technical capacities for accessing all these initiatives efficiently and for processing information consistently from different earth observation satellites. Many countries also lack institutional arrangements to synergize existing capacities among different departments as a service network for providing operational services to national disaster management authorities.

Some initiatives have started to provide value-added thematic products to meet the capacity level of less capable countries. Based on these goodwill initiatives, there is the need and the opportunity for development of a regional platform (e.g., the Asia-Pacific Gateway), for more convenient access to and effective utilization of these information and technical resources. This can be achieved through harmonized development and provision of consistent products and services, including assistance to build minimum capacities for substantive national services based on the platform.

The platform will be developed as a core component of the Asia-Pacific Gateway on DRR for information sharing and analysis. It aims to assist regional countries make substantive use of space information products to meet their technical capacities for related disasters at different management stages. Such a platform will be jointly developed by all contributing initiatives to create synergy in the regional countries, particularly for least developed countries, to permit a stable and effective sharing of satellite information resources, and access to value-added products and services.

Questions To Think About

1. Some countries (such as Australia, Japan and the USA) are capable of tsunami detection that can affect their coasts. However, this has not prevented them from joining ocean-wide systems. What could be the advantage of being part of a network of countries such as the PTWS and the IOTWS?

2. Suppose that the MRC did not exist or ceased to exist. What would be the immediate effect for the member States in terms of the accuracy of the flood forecasts that they would generate on their own?

Something To Do

1. Visit the EM-DAT site (http://www.emdat.be/database) and look at your country profile. What is the most frequent type of natural disaster that has happened to your country according to their data?

2. Visit the PreventionWeb.net site (http://www.preventionweb.net/) and try to find some of the publications on ICT and DRR. You can download and read some of the documents.

Further Reading

ESCAP. *Enhancing Regional Cooperation on Disaster Risk Reduction in Asia and the Pacific: Information, Communications and Space Technologies for Disaster Risk Reduction.* Committee on Disaster Risk Reduction. First session, 25-27 March 2009. Bangkok, Thailand, 2009. p. 17. http://www.unescap.org/idd/events/cdrr-2009/CDR_5E.pdf.

_____*Expanding Connectivity to Disaster-affected Communities through the Innovative Use of Information and Communications Technologies and Disaster-related Information.* Committee on Disaster Risk Reduction. Second session, 29 June-1 July 2011. Bangkok, Thailand. http://www.unescap.org/idd/events/cdrr-2011/CDR2-4E.pdf.

_____*2011 Report on Regional Unmet Needs: Early Warning Systems in the Indian Ocean and SoutheastAsia*. Bangkok, 2011. http://www.unescap.org/disaster preparednessfund/2011-report-on-regional-unmet-needs.pdf.

UNESCO-IOC, UNISDR/PPEW, and WMO. *Assessment of Capacity Building Requirements for an Effective and Durable Tsunami Warning and Mitigation System in the Indian Ocean: Consolidated Report for 16 Countries Affected by the 26 December 2004 Tsunami.*

UNESCO-IOC Information document No. 1219. Paris: UNESCO, 2005. http://www.jodc.go.jp/info/ioc_doc/INF/144508e.pdf.

8. CONCLUSION

DRM as a field is a mature user of ICTs, because most of its work is driven by risk information. For instance, risk information is required to:

- Reduce vulnerabilities of specific places or specific sectors
- Place critical infrastructure in safe places
- Demarcate high-risk zones
- Plan for the safe rescue and sustenance of communities at risk
- Avoid delays in the communication of appropriate information for timely actions required to save lives and minimize loss

Yet, it is important to always keep in mind that ICTs are not the solution. They cannot reduce vulnerabilities and build resilience of people and communities if DRM is not practiced. ICTs are tools that can contribute to improving and enhancing DRM. ICTs should, however, never be imposed on DRM and DRR initiatives, especially without an adequate assessment of needs and ICT readiness or how ready a community or nation is in taking advantage of the opportunities provided by advances in ICTs. This includes an assessment of the level of development, access to infrastructure and skills level.

Some key recommendations on the effective use of ICT for DRM include the following:

- Invest in the collection, aggregation and provision of reliable, timely, accurate and consistent information for the people exposed to risk, or people-centred risk information systems. Such systems are not limited to use only in DRM, for these include cadastres, land information systems, and systems for monitoring the decisions and actions taken by government and the private sector that can increase disaster risk.

- Standardize system design, data collection and the flow of communication in emergency situations. Using standardized ways of communicating decreases the likelihood of non-compatibility of systems and of misunderstandings, which are both especially crucial in crisis situations.

- Establish a national (spatial) data infrastructure (a common framework) and clearinghouse (to vet the data) for DRM. This is important because DRM relies heavily on digital data that must eventually cover the national territory. The data it uses must be subject to a process of validation and updated as often as possible (in order to reflect the risk that changes every day). The data infrastructure and clearinghouse proposed can formalize the process of data validation, and promote the multiple use of data and risk information by as many development actors as possible.

- Develop standing orders for times of emergency that require priority access by emergency services personnel to communications.

- Promote disaster preparedness efforts, including the organization of drills in relaying information to and from the DRCC and the disaster sites.

- Disaster management professionals and development actors need to gain familiarity and build their capacity in the areas of DRM, and ICT for DRM. It is also crucial to involve ICT specialists in both pre and post-disaster assessment, planning and monitoring activities to promote full use of ICTs in different stages of the DRM cycle.

- Involve multiple stakeholders in all stages of the DRM, including in assessments, validation, and monitoring and evaluation, by using accessible and collaborative ICTs, including social media tools.

While ICTs are vital in DRM, it can only be effective in the right policy framework that considers development along with the tentative risksnd the risks that development can produce or reduce. The right information policy framework needs to evolve as new technological tools are becoming available at a rapid pace. This framework can set standards for the quality of data collection, age, storage, use, and protection of the privacy of the individuals whose lives and property are reflected in the data sets to avoid the vicious cycle of catastrophic events

The role of government and policymakers in promoting ICT for DRM is to first understand that DRM is a part of good development planning and practice. Without DRM, development gains will not last.

Investing in ICT for DRM can begin with technologies needed for hazard monitoring and risk assessment, and for the development of systems and procedures to produce information relevant to DRR. Ultimately, this is the most expensive investment, particularly for countries that are just about to embark on data collection. However, the information is necessary for land-use planning, infrastructure planning, real estate development, conservation, and other development activities. The investment in risk information will pay for itself because it leads to knowledge that can avoid putting people and structures at the risk of destruction. This will also contribute to fulfilling long-term development objectives such as those in the SDGs.

Something To Do

1. List the key points you learned from Module 9.

2. Make an action plan of how you will bring forward your key learning points from Module 9 into your organization or work.

SUMMARY

This module in the *Academy of ICT Essentials for Government Leaders* module series introduces DRM and the important role of ICTs in assessing disaster risk and reducing its impact.

The first section differentiates between hazards and disasters, and describes the DRM cycle as an important part of development processes.

The second section introduces the different information and communication needs in the different stages of DRM. It also discusses risk communication as an important activity in DRM. ICT components are also presented in the section in order to present a broad picture of what ICT for DRM entails.

The third section on ICT for disaster mitigation briefly describes the practice of disaster mitigation, gives examples of disaster impacts and how these may be reduced using different types of mitigation. The section proceeds to identify the information needs in different disaster mitigation measures, and provides case studies of different ICTs used in disaster mitigation. Policy considerations for supporting disaster mitigation with ICTs are raised at the end.

The fourth section on ICT for disaster preparedness is about getting ready for any disaster risk still present even after mitigation and sustainable development efforts. It describes the information and communication needs therein, and how the advancement of ICTs has created opportunities for improving prediction capabilities and increasing options for robust emergency communication systems. Case studies are used to show how ICTs support disaster preparedness activities. Policy considerations for supporting disaster preparedness with ICTs are raised at the end.

The fifth section on ICT for disaster response emphasizes the information needs in a chaotic emergency situation, how disaster response management establishes a system for coordinating disaster response (to include information management) and coordinating emergency communication. The section has several examples of ICTs used in disaster response activities. Policy considerations for supporting disaster response with ICTs are raised at the end.

The sixth section on ICT for disaster recovery and reconstruction emphasizes the need for managing information about recovery needs and matching these with a coordinated recovery effort among government agencies, NGOs, and the international charity and donor community. The use of ICTs to promote effective disaster recovery is demonstrated by case studies. Policy considerations for supporting disaster recovery with ICTs are raised at the end.

The seventh section explores the importance of regional networks and their contributions for developing standardized and/or coordinated disaster preparedness, for sharing resources, and for other positive benefits to DRR efforts.

ANNEX

Annex I: Regional Disaster Risk Management Initiatives

Initiative	Mandate	Contact Information
Asian Partnership on Disaster Reduction	Regional mechanism involving the relevant regional actors in implementing joint DRR along the lines of the HFA	http://www.unisdr.org/asiapacific/ap-partners/partners-ap-drr.htm
Asian Ministerial Conference on Disaster Risk Reduction (AMCDRR)	Asian disaster management ministers and international organizations official conference sponsored by UNISDR since 2005 in order to reduce disaster risk in the Asian area after the 2004 Indian Ocean tsunami	UNISDR and rotating sponsoring government
Regional Consultative Committee on Disaster Management	A mechanism of the AMCDRR for the identification of disaster-related needs and priorities of Asia-Pacific countries, promotion of regional and sub-regional cooperative programmes, and the development of regional action strategies for DRR priorities set by the AMCDRR	http://www.rccdm.net/
ASEAN Agreement on Disaster Management and Emergency Response	• To provide effective mechanisms to achieve substantial reduction of disaster losses in lives and in the social, economic and environmental assets of the ASEAN member States • To jointly respond to disaster emergencies through concerted national efforts and intensified regional and international cooperation	http://www.aseansec.org

Annex II: International and Regional Institutions for Collaboration on ICT for DRM

Name	Mandate/Function	Scope	Contact Information
The International Charter on Space and Major Disasters	To provide a unified system of space data acquisition and delivery to those affected by natural or human-made disasters through Authorized Users. Each member agency has committed resources to support the provisions of the Charter and thus is helping to mitigate the effects of disasters on human life and property	International (member space agencies)	http://www.disasterscharter.org
Tampere Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations (January 2005)	• Calls on states to facilitate the provision of prompt telecommunication assistance to mitigate the impact of disasters, and covers both the installation and operation of reliable, flexible telecommunication services • Waives the regulatory barriers that impede the use of telecommunication resources for disasters, including the licensing requirements to use allocated frequencies, restrictions on the import of telecommunications equipment, and limitations on the movement of humanitarian teams	International (member States)	http://www.itu.int/ITU-D/emergencytelecoms/tampere.html
UNESCO-IOC	• To promote international cooperation and coordinate programmes in marine research, services, observation systems, hazard mitigation and capacity development • At the regional level, to coordinate the development of tsunami early warning and mitigation systems	Global	http://www.ioc-unesco.org
Global Disaster Alert and Coordination System	To consolidate and strengthen the network of providers and users of disaster information worldwide	Global	http://www.gdacs.org
Global Earth Observation System of Systems	To develop a public infrastructure of a “system of systems” to proactively link together existing and planned observing systems around the world and support the development of new systems where gaps currently exist	Global	http://www.earthobservations.org

Name	Mandate/Function	Scope	Contact Information
International Federation of Digital Seismograph Networks	• To develop common minimum standards in seismographs (e.g., bandwidth) and recording characteristics (e.g., resolution and dynamic range) • To develop standards for quality control and procedures for archiving and exchanging data among component networks • To coordinate the siting of stations in locations that will provide optimum coverage • To pursue free and open access to data • To improve access to data in real time	Global	http://www.fdsn.org
United Nations platform for Space-based Information for Disaster Management and Emergency Response	• To ensure that all countries and international and regional organizations have access to and develop the capacity to use all types of space-based information to support the full DRM cycle • To implement the SpaceAid project, a framework to facilitate fast and efficient access to space-based information for countries, and for international and regional organizations	Global	http://www.un-spider.org
Asia-Pacific Regional Space Agency Forum	• To enhance space activities in the Asia-Pacific region • To share disaster information across the region by the integration of satellite remote sensing and Web-GIS technologies	Asia-Pacific	http://www.aprsaf.org/
Regional Integrated Multi-Hazard Early Warning System for Africa and Asia	To generate, communicate and apply early warning information products	International (member States)	Secretariat: Maldives Meteorological Service Hulhule, 22000, Maldives admin@meteorology.gov.mv

Annex III: Organizations Supporting ICT Solutions for DRM

There are an increasing number of companies and organizations involved in supporting ICT solutions for DRM through both for-profit and not-for-profit operations.

Ericsson (http://www.ericsson.com)
The Ericsson Response Team has worked with various United Nations agencies and NGOs to provide mobile communication solutions such as portable container-based GSM network in Indonesia, Pakistan and Haiti. (See http://www.ericsson.com/article/ericsson-response_965785785_c).

ESi (http://www.esi911.com)
ESi is a company that produces the webEOC (Emergency Operations Centre) and other software packages. They provide digital solutions for the messaging, display boards and other information management requirements of a DRCC.

ESRI (http://www.esri.com)
ESRI is the company that produced ArcGIS and a suite of other GIS applications that can be used in DRM activities.

Google Crisis Response (http://www.google.com/crisisresponse)
Google Crisis Response makes critical information more accessible around natural disasters and humanitarian crises. This initiative is a project of Google.org, which uses Google's strengths in information and technology to build products and advocate for policies that address global challenges.

IBM (http://www.ibm.com)
IBM provides support to governments for DRM activities by donating the expertise and hardware required to implement ICT solutions. IBM has used the Sahana Open Source Disaster Management Software to implement solutions for the local authorities in China following the Sichuan Earthquake in 2008 and as part of preparedness activities in the Philippines. (See http://www.ibm.com/ibm/responsibility/market_profile.shtml).

Innovative Support to Emergencies, Diseases and Disasters (InSTEDD) (http://www.instedd.org)
InSTEDD provides support to organizations involved in health and DRM activities through a range of different ICT solutions that utilize mobile technologies and software to aggregate data to support collaboration and decision-making. InSTEDD has also opened an iLAB in Cambodia to encourage the development of location technology solutions (see case study on Project 4636 in Haiti, section 2.1).

Microsoft (http://www.microsoft.com)
Microsoft has partnerships with a number of humanitarian response organizations and ICT partners, utilizing its existing tools and resources to develop joint ICT solutions for DRM. To read more, go to http://www.microsoft.com/about/corporatecitizenship/en-us/our-actions/in-the-community/disaster-and-humanitarian-response/.

OpenStreetMap (http://www.openstreetmap.org)
OpenStreetMap is a non-profit Web project with the goal to provide a free and open map of the entire world. This map is created from geographical data openly shared by private and government agencies as well as contributions from individuals personally mapping specific locations. Because OpenStreetMap openly shares the raw geographical data, rather than just the map images, it is a valuable resource for ICT solutions for DRM. There is also a Humanitarian OpenStreetMap Team who are committed to providing GIS solutions for disaster response and economic development.

Sahana Software Foundation (http://www.sahanafoundation.org)
The Sahana Software Foundation is a non-profit organization that supports the Sahana Open Source Disaster Management software platforms, and advocates and supports the development of data standards for DRM. The Sahana software platforms have been used in ICT solutions for DRM in a number of countries and are supported by a range of organizations, companies and academic institutions (mentioned as an example of free and open source software in section 2.2).

Télécoms Sans Frontières (http://www.tsfi.org)
TSF was established to address the need for communication support during disasters. Within 24 hours of a disaster they are able to deploy a team from one of its three offices in France, Thailand or Nicaragua. TSF provides communication tools to all actors on the ground including the United Nations and NGOs to facilitate coordination of the relief and response efforts. In addition, TSF provides free phone calls to people affected by the disaster (cited as an organization providing communication support in section 2.1).

Ushahidi (http://www.ushahidi.com)
Ushahidi is a non-profit tech company that develops free and open source software for information collection, visualization and interactive mapping. The Ushahidi platform can be used for crowdsourced crisis mapping by combining multiple streams of information (cited as an example for crowdsourcing crises in section 5.2).

Annex IV: Development of a National Emergency Telecommunications Plan

According to ITU, all countries should have an emergency telecommunications plan, whether on its own or as part of a national emergency response plan, as this is vital in:

- Identification of telecommunication needs in time of emergencies
- Identification of vulnerabilities, and assessment of threats
- Forging of partnerships
- Forward-planning as part of preparedness

An NETP is critical since all other infrastructures in a modern society, e.g., water supply, electricity production, transport, banking, police, fire fighters, and ambulances, depend on telecommunications systems to function in both normal and emergency times. The role of an NETP is most evident in the support that telecommunications networks provide to society, and to public protection (police, fire fighters, medical first responders) and disaster relief organizations' needs in time of disasters or crisis. During an emergency, the ability of responding agencies to communicate is vital to the establishment of coordinated efforts to respond more effectively to disasters.

In developing an NETP, countries need to identify the minimum needs their public protection and disaster relief organizations would need in telecommunication, and identify the vulnerabilities of telecommunications networks (private and public networks). It is recommended that a comprehensive assessment of current circumstances be planned and undertaken. Key considerations of the assessment should include, but are not limited to:

Legislation Supporting Emergency Telecommunications and ICTs. The legal authority that authorizes the use of additional or exceptional powers in emergency telecommunications are generally included in national legislation that covers all aspects of an emergency plan. In general, each ministry or department in a country is responsible for implementing a specific response measure related to the sector the ministry is responsible for. The emergency telecommunication/ ICT responsibilities are generally given to the department or ministry responsible for electronic communications aspects or the national telecommunications regulatory authority in case of radio frequencies. Drawing lessons from most of the surveyed countries, an NETP serves to –

- Facilitate the provision and movement (nationally and internationally) of telecommunications equipment and services during emergencies
- Provide a framework that ensures the availability of essential telecommunications during an emergency, system overload or degradation of service
- Ensure the continuity of telecommunications services for the general public even in times of emergencies

Critical Infrastructure Protection. The responsibility to identify telecommunications critical infrastructure is either at the national or local level. For national networks, the responsibility to identify the telecommunications critical infrastructure and vulnerabilities is at the national level. For regional or local networks this responsibility is at the state, province, territory or municipal level. Critical Infrastructure Protection programmes include telecommunications network vulnerabilities, as well as computer network and information network vulnerabilities normally referred to as critical information infrastructure. The purpose of critical infrastructure protection is to establish a real-time ability for all sectors of the critical infrastructure community to share information on the current status of infrastructure elements. Ultimately, the goal is to protect critical infrastructure by eliminating known vulnerabilities (some of these vulnerabilities are mentioned in section 5). It is also important to note that the assessment exercise for identifying vulnerabilities, especially those of critical information infrastructure, is essential to preparing for natural, as well as human-made disasters (e.g., cyber attacks).

Radio Spectrum Management. Radio spectrum management plays a key role in fulfilling the government's commitment to providing emergency telecommunication resources. During most emergencies disaster response organizations and broadcasters request additional radio frequencies, by satellite earth stations and for resolving unexpected radio interference problems by. Those requests made in times of emergencies are urgent and should be resolved within a few hours. The emergency plan should therefore include all mechanisms, procedures and details of authorities responsible for providing radio frequency assignments and issuing licenses, as well as include information on all official responders during an emergency response.

Inventory of Resources. In times of emergencies, it is important to know who has what, and where these may be found. Inventory taking is important in facilitating the provision of equipment and services in response to immediate needs after disasters, or in replacing or rehabilitating equipment or networks destroyed or degraded. An inventory may be a trust relationship between the government, the private/public organizations who own the equipment, and the expertise that could facilitate the provision of equipment and services. For these equipment and services to be rapidly mobilized in emergencies, it is important to have pre-established agreements that outline procedures for deployment, as well as financial commitments of parties, especially between government authorities, organizations involved in disaster response, and national telecommunications providers' associations.

Exercises and Training. Emergency telecommunications planners should carry out their own exercises/drills and also be a participant in government exercises designed to protect the population in case of natural and human-made disasters. This also applies to other critical infrastructures such as health, electricity and transportation. Exercises should aim to: evaluate the intervention plan, or a segment of the plan; give emergency telecommunications officers and other players a better understanding of their role during an emergency; facilitate collaboration between different players, inside and outside the organization; and train emergency telecommunications officers and other emergency first responders to be able to use telecommunications or ICT equipment.

Business Continuity Plan. The Business Continuity Plan is used to create and validate a practiced logistical plan on how an organization could recover and restore, partially or completely, the interrupted critical function(s) within a predetermined time after a disaster or extended disruption. Recovery is for local incidents like building fires, regional incidents like earthquakes, or national incidents like pandemic illnesses that could jeopardize the government's core mission on emergency telecommunication. Access to the government buildings or to the Emergency Telecommunications Operation Centre may not be possible during a national disaster.

Partnership and Memoranda. Regular meetings and the creation of a national forum can help establish and nurture cooperation among government agencies and the private telecommunications industry. This optimizes the use of existing communications infrastructure and helps develop best practices in emergency telecommunications planning. Emergency preparedness leading to a memorandum of understanding is most effective when the responsibilities, resources and objectives of the government and industry are linked through joint planning. Furthermore, there is a need to develop emergency telecommunications agreements with neighbouring countries. Such agreements could address concerns and facilitate cross-border cooperation and provision of mutual assistance in the event of an emergency. The signatories could meet annually to exchange information on disaster management arrangements. The Tampere Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations provides the legal framework for handling cross-border delivery and receipt of international assistance.

Cooperation and Coordination Mechanism. Improvements to the regulatory environment for the optimal use of telecommunications for disaster response and DRM in general can only be achieved by joint efforts of all partners involved. It is the task of all national and international providers of assistance to create the necessary awareness among the national regulators. It is the task of the providers of telecommunication services and the suppliers of equipment to include provisions for the use of their goods and services in emergency telecommunications. It is the task of the national representatives taking part at conferences run by international organizations to articulate the need for all entities to render support to all initiatives that favour the development, deployment and use of emergency telecommunications. ITU forums provide such opportunities.

Glossary

This is a glossary compiled for the reference of the reader, and is presented first to create a familiarity with the terms. These definitions, developed by UNISDR are increasingly becoming the standard definitions for the field.[82]

Capacity	The combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals. Capacity may include infrastructure and physical means, institutions, societal coping abilities, as well as human knowledge, skills and collective attributes such as social relationships, leadership and management. Capacity also may be described as capability.
Disaster	A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. Disasters are often described as a result of the combination of: the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences. Disaster impacts may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation.
Disaster mitigation	The lessening or limitation of the adverse impacts of hazards and related disasters. The adverse impacts of hazards often cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions. Mitigation measures encompass engineering techniques and hazard-resistant construction (structural measures) as well as improved environmental policies and public awareness (non-structural measures). It should be noted that in climate change policy, “mitigation” is defined differently, being the term used for the reduction of greenhouse gas emissions that are the source of climate change.
Disaster risk	The potential disaster losses in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period.
Disaster risk management	The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster. Disaster risk management aims to avoid, lessen or transfer the adverse effects of hazards through activities and measures for prevention, mitigation and preparedness.
Disaster risk reduction	The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

83 UNISDR, *2009 UNISDR Terminology*.

Early warning system	The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss. This definition encompasses the range of factors necessary to achieve effective responses to warnings. A people-centred early warning system necessarily comprises four key elements: knowledge of the risks; monitoring, analysis and forecasting of the hazards; communication or dissemination of alerts and warnings; and local capabilities to respond to the warnings received. The expression "end-to-end warning system" is also used to emphasize that warning systems need to span all steps from hazard detection through to community response.
Emergency management	The organization and management of resources and responsibilities for addressing all aspects of emergencies, in particular preparedness, response and initial recovery steps.
Exposure	People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.
Hazard	A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.
Preparedness	The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.
Prevention	The outright avoidance of adverse impacts of hazards and related disasters.
Public awareness	The extent of common knowledge about disaster risks, the factors that lead to disasters, and the actions that can be taken individually and collectively to reduce exposure and vulnerability to hazards.
Recovery	The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. The recovery task of rehabilitation and reconstruction begins soon after the emergency phase has ended, and should be based on pre-existing strategies and policies that facilitate clear institutional responsibilities for recovery action and enable public participation. Recovery programmes, coupled with the heightened public awareness and engagement after a disaster, afford a valuable opportunity to develop and implement disaster risk reduction measures and to apply the "build back better" principle.
Response	The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected. Disaster response is predominantly focused on immediate and short-term needs and is sometimes called "disaster relief". The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.
Risk	The combination of the probability of an event and its negative consequences.

Risk assessment	A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend. Risk assessments (and associated risk mapping) include: a review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios. This series of activities is sometimes known as a risk analysis process.
Risk management	The systematic approach and practice of managing uncertainty to minimize potential harm and loss.
Vulnerability	The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors.

Notes for Trainers

Module 9 and other modules in the series are designed to have value for different sets of audiences and in varied and changing national conditions. The modules are also designed to be presented, in whole or in part, in different modes, on- and off-line. The module may be studied by individuals and by groups in training institutions as well as within government offices. The background of the participants as well as the duration of the training sessions will determine the extent of detail in the presentation of content.

This annex on instructional design offers you some ideas and suggestions for presenting the module content more effectively. Further guidance on training approaches and strategies is provided in a handbook on instructional design developed as a companion material for the Academy of ICT Essentials for Government Leaders module series. The handbook is available at http://www.unapcict.org/academy.

Using the Module

Each section of the module begins with a statement of learning objectives and ends with various learning activities ("Questions To Think About" or "Something To Do"). Readers may use the learning objectives and activities as a basis for assessing their progress through the module.

"Questions To Think About" has questions that are designed to enable readers to draw on their own experience to benchmark the content and to think reflectively on the issues presented. "Something To Do" has activities for which one must go online in order to use an existing resource available to the public.

Case studies are presented in each section, drawn from many countries around the world. These are intended for discussion and analysis to illustrate how ICTs may be used to improve DRM. However, you are encouraged to support these with other examples that you feel suit local conditions. You may encourage participants to cite other cases and examples from their own experience to substantiate the content of the module.

Structuring the Sessions

Depending on the audience, time available and local settings and conditions, the content of the module can be presented in different structured time capsules. What could be covered in sessions of different durations is outlined below. You are invited to modify the session structure based on your own understanding of the country and audience.

For a 90-minute session

Aim to develop a basic understanding of DRM (section 1), present the different information and communication needs of the DRM phases (section 2) using table 3 as a guide, present examples of ICT for DRM, and round off with some of the ICT issues for DRM (section 8).

For a three-hour session

Aim to develop a basic understanding of DRM, present the different information and communication needs of the DRM phases, present the four DRM phases with examples of ICT for DRM (sections 3 to 6), and round off with some of the policy issues (section 8) and discussion on at least one of the regional/international networks for DRM (section 7). If you have access to the Internet during the session, the participants may be shown any of the online DRR databases (EM-DAT and DesInventar) mentioned in the sections and look at the profiles of different countries to stimulate a discussion on how different countries would use risk information in their development planning.

For a one-day session (six hours duration)

This time frame would allow for an exploration of one or two of the ICT applications (relevant to sections 3 to 6), in addition to forming a basic understanding of DRM, presenting the different information and communication needs of the DRM phases, and discussing the policy challenges in ICT for DRM. You are encouraged to invite representatives of government agencies to supplement the examples in the module with examples of ICT applications currently in use in the country where the training is held. A workshop can also be designed to enable participants to reflect on what they have learned, using relevant discussion questions (in "Questions To Think About") to make the session interactive.

For a three-day session

This time frame should enable you to cover the entire module, including intensive discussions of relevant case studies of specific ICT applications in DRM. Include a "live" case study via a field trip to a nearby installation of an early warning system, for example. Make time also for some workshops/group sessions to allow participants to interact, through development of a local communication plan or an end-to-end early warning system, for example. The outcomes can be presented to the group. You can also consider simulating a disaster to test the communication plan developed in the workshop.

DRM is a very wide development arena, involving many disciplines and many stakeholders. Trainers who have undergone the training of trainers (TOT) for this module can take the role of a content coordinator for the Module, and in this role could reach out to other speakers from government and other stakeholders whose work covers one or two of the DRM stages. The participants' training experience can be enriched by involving several speakers. The training coordinator can also obtain additional expertise to help conduct a "computer hands-on" session where simple decision-support applications can be tried out by participants working in pairs. For example, you may get an expert to design and deliver an exercise wherein participants try Radius software, a spreadsheet-based application designed for the preliminary estimation of earthquake damage in developing countries.

About the Author

The Asian Disaster Preparedness Center (ADPC) is a leading regional resource centre working towards the realization of disaster reduction for safer communities and sustainable development in Asia and the Pacific. Its mission is: *"To reduce the impact of disasters on communities and countries in Asia and the Pacific by raising awareness, helping to establish and strengthen sustainable institutional mechanisms, enhancing knowledge and skills, and facilitating the exchange of information, experience and expertise."*

ADPC's roles in the Asia-Pacific region can be broadly categorized as the following:

• Development of capacities and promotion of learning	• Preparations and follow up of global and regional mechanisms
• Establishment of new regional mechanisms	• Dissemination of information and knowledge management
• Provision of technical and advisory services	• Support for inter-agency coherence and coordination
• Implementation of pioneering regional programmes	• Catalytic facilitator and partner of sub-regional mechanisms

ADPC was established in January 1986 after a feasibility study by the Office of the United Nations Disaster Relief Coordinator (now the United Nations Office for the Coordination of Humanitarian Affairs) and the WMO with funding from the UNDP. ADPC has in turn established new regional mechanisms such as the Regional Consultative Committee on Disaster Management in 2000, with the aim to identify the disaster-related needs and priorities of Asia-Pacific countries, develop action strategies and promote cooperative programmes on a regional and sub-regional basis, and provide strategic guidance to ADPC.

Providing intensive training on various aspects of DRM has been the foundation for ADPC's establishment and the primary focus of its activities during its first five years. The pioneering training courses became ADPC's flagship courses on Disaster Management and Community-based DRR. Additional specialized training courses on various aspects of DRM with both single and multiple hazard emphasis have remained part of our portfolio throughout the past 25 years, with the following as the core training courses:

• Climate Risk Management-Science, Institutions and Society	• End-to-End Multi-Hazard Early Warning Systems
• Community-based Disaster Risk Reduction	• Flood Disaster Risk Management
• Disaster Management Course	• Hospital Emergency Preparedness and Response
• Disaster Risk Communication	• Mainstreaming Disaster Risk Reduction in Local Governance
• Earthquake Vulnerability Reduction Course	• Public Health and Emergency Management in Asia and the Pacific
	• Use of Geographical Information Systems and Remote Sensing in Disaster Risk Management

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UN-APCICT/ESCAP

The United Nations Asian and Pacific Training Centre for Information and Communication Technology for Development (UN-APCICT/ESCAP) is a regional institute of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). UN-APCICT/ESCAP aims to strengthen the efforts of the member countries of ESCAP to use ICT in their socio-economic development through human and institutional capacity-building with the focus on the following three pillars:

1. Training. To enhance the ICT knowledge and skills of policymakers and ICT professionals, and strengthen the capacity of ICT trainers and ICT training institutions;
2. Research. To undertake analytical studies related to human resource development in ICT; and
3. Advisory. To provide advisory services on human resource development programmes to ESCAP members and associate members.

UN-APCICT/ESCAP is located at Incheon, Republic of Korea.

http://www.unapcict.org

ESCAP

ESCAP is the regional development arm of the United Nations and serves as the main economic and social development centre for the United Nations in Asia and the Pacific. Its mandate is to foster cooperation between its 53 members and nine associate members. ESCAP provides the strategic link between global and country-level programmes and issues. It supports governments of countries in the region in consolidating regional positions and advocates regional approaches to meeting the region's unique socio-economic challenges in a globalizing world. The ESCAP office is located at Bangkok, Thailand.

http://www.unescap.org

The Academy of ICT Essentials for Government Leaders (Academy)

http://www.unapcict.org/academy

The *Academy* is a comprehensive ICT for development training curriculum with currently ten modules that aims to equip policymakers with the essential knowledge and skills to fully leverage opportunities presented by ICTs to achieve national development goals and bridge the digital divide. Below are the short descriptions of the ten modules of the *Academy*.

Module 1 - The Linkage between ICT Applications and Meaningful Development

Highlights key issues and decision points, from policy to implementation, in the use of ICTs for achieving the MDGs.

Module 2 - ICT for Development Policy, Process and Governance

Focuses on ICTD policymaking and governance, and provides critical information about aspects of national policies, strategies and frameworks that promote ICTD.

Module 3 - e-Government Applications

Examines e-government concepts, principles and types of applications. It also discusses how an e-government system is built and identifies design considerations.

Module 4 - ICT Trends for Government Leaders

Provides insights into current trends in ICT and its future directions. It also looks at key technical and policy considerations when making decisions for ICTD.

Module 5 - Internet Governance

Discusses the ongoing development of international policies and procedures that govern the use and operation of the Internet.

Module 6 - Information Security and Privacy

Presents information on security issues and trends, and the process of formulating an information security strategy.

Module 7 - ICT Project Management in Theory and Practice

Introduces project management concepts that are relevant to ICTD projects, including the methods, processes and project management disciplines commonly used.

Module 8 - Options for Funding ICT for Development

Explores funding options for ICTD and e-government projects. Public-private partnerships are highlighted as a particularly useful funding option in developing countries.

Module 9 - ICT for Disaster Risk Management

Provides an overview of disaster risk management and its information needs while identifying the technology available to reduce disaster risks and respond to disasters.

Module 10 - ICT, Climate Change and Green Growth

Presents the role that ICTs play in observing and monitoring the environment, sharing information, mobilizing action, promoting environmental sustainability and abating climate change.

These modules are being customized with local case studies by national *Academy* partners to ensure that the modules are relevant and meet the needs of policymakers in different countries. The modules are also been translated into different languages. To ensure that the programme stays relevant and addresses emerging trends in the ICTD, APCICT regularly revises the modules and develops new modules.

APCICT Virtual Academy (http://e-learning.unapcict.org)

The APCICT Virtual Academy is part of the multi-channel delivery mechanism that APCICT employs in the implementation of its flagship ICTD capacity building programme, the *Academy of ICT Essentials for Government Leaders.*

The APCICT Virtual Academy allows learners to access online courses designed to enhance their knowledge in a number of key areas of ICTD including utilizing the potential of ICTs for reaching out to remote communities, increasing access to information, improving delivery of services, promoting lifelong learning, and ultimately, bridging the digital divide and achieving the MDGs.

All the APCICT Virtual Academy courses are characterized by easy-to-follow virtual lectures and quizzes, and users are rewarded with APCICT's certificate of participation upon successful completion of the courses. All *Academy* modules in English and localized versions in Bahasa and Russian are available via the Internet. In addition, plans for more content development and further localization are underway.

e-Collaborative Hub (http://www.unapcict.org/ecohub)

The e-Collaborative Hub (e-Co Hub) is APCICT's dedicated online platform for knowledge sharing on ICTD. It aims to enhance the learning and training experience by providing easy access to relevant resources, and by making available an interactive space for sharing best practices and lessons on ICTD. e-Co Hub provides:

- A resources portal and knowledge sharing network for ICTD
- Easy access to resources by module
- Opportunities to engage in online discussions and become part of the e-Co Hub's online community of practice that serves to share and expand the knowledge base of ICTD

UN-APCICT/ESCAP

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Published under programme supported by Government of Rep. of Korea