The Primer Series on ICTD for Youth

Primer Series 3: ICT for Disaster Risk Management

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Primer Series on ICTD for Youth

Primer 3: ICT for Disaster Risk Management

A learning resource on ICT for development
for institutions of higher education

Lead Author:
Asian Disaster Preparedness Center

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

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PRIMER 3: ICT FOR DISASTER RISK MANAGEMENT

Disaster Risk Management (DRM) is a set of processes to lessen the impacts of disasters on society. This process involves the development of policies, strategies and capacities, among other activities, to assess, prepare for and reduce disaster risks, before a disaster strikes.

This Primer is designed to promote a framework for matching available technology with DRM processes. It provides examples of a range of information and communication technology (ICT) applications already implemented in Asia and the Pacific as well as the rest of the world. These examples will be presented as case studies on how ICTs are being used in disaster mitigation, preparedness, response and relief, as well as recovery and reconstruction.

For the purpose of this Primer, ICT is defined as information-handling tools—a varied set of goods, applications and services that are used to produce, store, process, distribute and exchange information.

ICTs have the potential to reduce the possibility of death and economic disruption by improving access to the information that can help make better choices; this is true for all individuals, organizations, localities, countries, and economic sectors, no matter what hazard is faced.

For example, volcanoes can be monitored for emissions of various materials or changes in their shapes that could indicate imminent eruptions. Rivers are measured for water volume and speed as part of flood modelling. Measurements can be relayed to far-off computing centres or published on the web in real-time hazard monitoring systems, to be analysed using software tools. This can lead to the early detection of the occurrence of hazards, as well to the improved prediction or estimation of the frequency and severity of hazards.

LEARNING OBJECTIVES

The Primer aims to:

- Introduce the basic concepts of ICT and their role and application in DRM;
- Introduce the process and components of DRM;
- Foster a better understanding of how ICTs can be applied effectively in DRM; and
- Provide case studies of ICT applications in all components of DRM.

LEARNING OUTCOMES

After reading this Primer, students will be equipped with a good understanding of different components in DRM, and exposed to the role of ICT and its wide-ranging potential application in DRM. Students will be able to utilize this as a context and potential in whatever field or profession they decide to pursue.

Specifically, this Primer provides students with:

- A framework to understand the processes and the components of DRM;
- A better understanding of the advantages as well as challenges and issues of using ICT for DRM; and
- Broad knowledge and skills to help in the effective planning, development and implementation of relevant ICT applications.

Something To Do

1. Familiarize yourself with EM-DAT, a global disaster database (http:// www.emdat.be). This will provide you with the latest disaster information and trends. Check the disaster statistics in your country, and compare it with global trends.

2. Familiarize yourself with the United Nations Office for Disaster Risk Reduction (UNISDR – http://www.unisdr.org). The UNISDR coordinates international efforts in disaster risk reduction and guides, monitors as well as reports regularly on disaster risk reduction issues. The website will give you a sense of the key issues and concerns being discussed in this area.

The UNISDR supports the development of national platforms for disaster risk reduction. These are nationally owned and led multi-stakeholder forum or committee working on disaster risk reduction. They reflect the commitment of its government to implement national and local disaster risk reduction activities while linking up to international efforts. Check if there is a national platform for disaster risk reduction in your country and find out what they are doing.

HOW TO USE THIS PRIMER

This primer introduces basic concepts, methodologies and tools for the application of information and communication technologies (ICTs) in disaster risk management.

The primer is divided into six chapters. Each section begins with a set of learning objectives and outcomes against which readers can assess their own progress. Each chapter of the primer contains practical exercises and multiple choice questions to help readers check that they have understood the discussions. The practical exercises are intended to promote an interactive learning process among students and faculty, and encourage readers to think reflectively on the issues presented.

Case studies are also provided throughout the primer. These are intended for discussion and analysis, particularly in terms of the extent to which the key concepts and principles presented in the primer work in real-world projects and programmes. Case study analysis and assignments are intrinsic to the learning process and should be taken with the seriousness they merit. In addition, the primer contains short "Youth In Action" synopses of what young people have done or can do in the field of ICT for disaster risk management. The intention of these synopses is to inspire students to go beyond classroom learning.

The primer does not only target students who plan to apply ICTs in disaster risk management. The intention is that all learners become aware of the potential of ICTs, and fully leverage this awareness even if they are not working specifically in disaster risk management or in the ICT sector. This primer can be used by students as basic material to understand the various aspects and issues in ICT for disaster risk management. The faculty can use this primer as materials for teaching. The faculty can also use this primer as materials to incorporate ICT for disaster risk management in university curricula.

Educators are invited to enhance and modify the contents provided in this primer, and/or supplement these with case studies, assignments and questions that they think will be more effective and meaningful to the students. All primers are released under the Creative Commons Attribution 3.0 License, which means that we encourage you to copy, distribute and adapt the primer provided you attribute the United Nations Asian and Pacific Training Centre for Information and Communication Technology for Development (UN-APCICT).

Educators may wish to use the template provided below for case study development. Faculties are encouraged to improve on the template or rework it as per their own needs.

Suggested template for case studies on ICT for disaster risk management (maximum 2,000 words)

Title of case study	
Stakeholders in the case study	
Location (community/city/ district/province and country)	
Project start date and duration	
Overview	A summary of the case study
Description	• Why was this project developed? • What are the objectives of the project? • What is the project context? (policy environment, economic and social conditions, etc.) • What are the strengths (e.g. resources and capacities available) and weaknesses (e.g. vulnerable conditions) of the project? • What are the external opportunities and threats that affect the project? • What are the expected results of the project? • What are the achievements and impacts? • What are the methodologies and tools used in the project? • How was the project managed? By whom? • What were the good practices, lessons learned and recommendations for future actions? • How were ICTs applied in the project?
Project management	
Questions that ask readers to reflect on the extent to which the case study applies to their situation and what they will do similarly or differently	
Source and useful references for further information	• Reports and publications related to the case study • Images or videos related to the case study • Website • Contact information (email, phone, address)

Educators are encouraged to explore the subject matter with their students, draw on their own discipline, and identify linkages to the disaster risk management processes including disaster mitigation, disaster preparedness, response and relief, as well as recovery and reconstruction.

Here are some possible ideas: Those in natural sciences can guide students in the statistical analysis of disaster trends in their region (disaster data can be obtained from EM-DAT – http://www.emdat.be). Those in social sciences can guide students in the assessment of the social impact from disasters by utilizing ICTs. Those in the arts and humanities can guide students in the promotion of dialogue and communication around disaster risk management issues using electronic media. Those in the applied fields can guide students in the development of strategies for disaster risk mitigation in different sectors.

Finally, educators and students alike are encouraged to enroll in the APCICT Virtual Academy (http://e-learning.unapcict.org) and interact with others who have started their journeys to a green and sustainable future.

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ACRONYMS

ADPC	Asian Disaster Preparedness Center
APCICT	Asian and Pacific Training Centre for Information and Communication Technology for Development
CB	Cell Broadcasting
DRCC	Disaster Response Coordination Centre
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EM-DAT	Emergency Events Database
ESCAP	Economic and Social Commission for Asia and the Pacific (United Nations)
GIS	Geographic Information System
GLOF	Glacial Lake Outburst Flood
GPS	Global Positioning System
HFA	Hyogo Framework for Action
ICT	Information and Communication Technology
ICTD	Information and Communication Technology for Development
IDNDR	International Decade for Natural Disaster Reduction
INGO	International Non-Governmental Organization
INSAT	Indian National Satellite
MHRIN	Multi Hazard Risk Information Node (Pakistan)
NGO	Non-Governmental Organization
PSTN	Public Switched Telephone Network
RBS	Radio Base Station
RSMC	Regional Specialized Meteorological Centre (India)
SUMA	Humanitarian Supplies Management System
UN	United Nations
UNDP	United Nations Development Programme
UNISDR	United Nations Office for Disaster Risk Reduction
VSAT	Very Small Aperture Terminal
WMO	World Meteorological Organization

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 Test Yourself

 Youth In Action Note

CHAPTER 1: INTRODUCTION TO DISASTER RISK MANAGEMENT

Objectives:

- Introduces the basic concepts of disasters and its impact on development, and highlights the linkage between failed development and disaster
- Discusses the relationship between hazard, vulnerability and capacity, and explains the importance of reducing vulnerability and increasing capacity in disaster risk management (DRM)
- Gives an overview of the disaster trends in Asia and the Pacific, and the role of information and communication technology (ICT) in DRM

1.1 What is 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.

In other words, when the impact of disruption goes beyond the control of human beings, that particular situation can be defined as a disaster. Disaster impacts may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being. They also include damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation.

Disaster impacts on human lives and the environment remind us of the intimate linkage between disaster and development. Disasters put development at risk and potentially lead to prolonged recovery time. The destruction and erosion of livelihoods are direct consequences of disasters. Disasters affect social investment aiming to eradicate poverty and hunger, provide access to education, drinking water, sanitation and safe housing. Disasters also jeopardize initiatives that protect the environment, and economic investments that provide employment and income.

At the same time, it has been clearly demonstrated that disaster risk accumulates historically through inappropriate development interventions. 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.

1.2 What is Disaster Risk?

Disaster risk is a combination of potential hazards, existing vulnerabilities, and capacities to cope with a disaster event. A disaster occurs when a vulnerable community is exposed to a hazard (e.g. flood, earthquake, typhoon) and is unable to cope with the impact.

Each component of disaster risk (hazard, exposure, vulnerability and capacity) is defined below:

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. Natural hazards may be hydro-meteorological (e.g. cyclone, drought, flood), geological (e.g. earthquake, tsunami, volcanic activity) or biological (e.g. outbreaks of epidemic diseases, plant or animal contagion, extensive infestations). Hazards also include human-induced technological and industrial accidents (e.g. industrial pollution, toxic waste, dam failure), and environmental degradation (e.g. deforestation, desertification, land degradation).

Hazards can be categorized based on their occurrence (slow or rapid onset). Slow onset hazards are those that build up over weeks or months such as drought, desertification and climate change effects. Rapid onset hazards include earthquake, tsunamis, volcanic eruption and flash flood.

Exposure
The presence (location) of people's livelihoods, environmental services and resources, infrastructure, and economic, social or cultural assets in places that could be adversely affected by physical events and which, thereby, are subject to potential future harm, loss or damage.

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. For example, the pressure of population growth creates unsafe conditions for certain people. Vulnerability is most often associated with poverty. Poor people are often the ones living on the river bank and flood plain areas that get flooded frequently.

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. Ideally, a country raises 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).

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, vulnerable conditions and inadequate capacity.

An example of a study on comparative resilience in the Caribbean and Central America found that Cuba usually had few deaths due to natural disasters when compared to neighbouring countries. Their resilience was related to the country's structure for disaster assistance, modes of information dissemination, and the role of both government institutions and communities in hurricane disaster preparedness.[1]

1 H. Sims and Kevin Vogelmann, "Popular mobilization and Disaster Management in Cuba", *Public Administration and Development*, vol. 22 (2002), pp. 389-400.

1.3 Disaster Risk Management

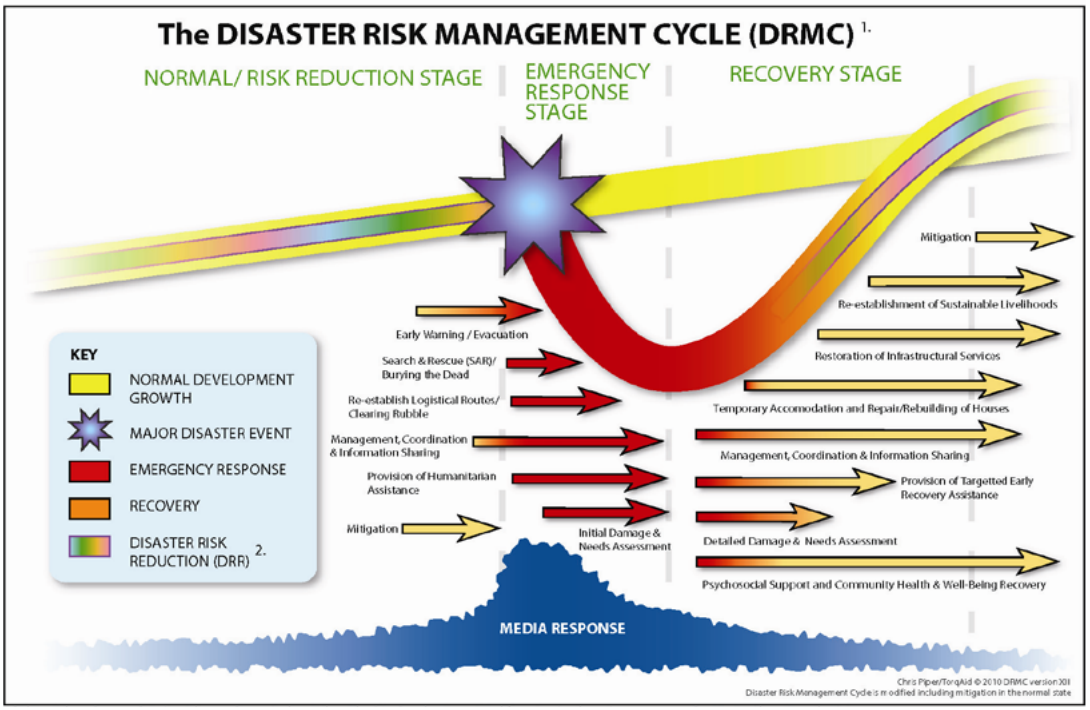
This section highlights the shift that DRM has seen in the past three decades as well as the global mandate towards reducing the risk at the regional, national and local levels.

UNISDR defines DRM as "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."[2]

In 1990, the global community on DRM joined together when the United Nations General Assembly designated the 1990s as 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, the UNISDR came into place with the aim to pursue the initiatives and cooperation agreed upon during the IDNDR.

Meanwhile, DRM witnessed a paradigm shift in its strategy and approach towards dealing with disaster risks. In the early 1980s up to the late 1990s, DRM related policy and programmes were focused primarily on post-disaster relief and response. Following the Great Hanshin earthquake (also known as the Kobe earthquake) on 17 January 1995, the global community on DRM unanimously decided to work on reducing the impact of disasters. Since then, the focus of DRM on post-disaster events has evolved into a more proactive DRM approach, elaborated in the Disaster Risk Management Cycle (see Figure 1).

Figure 1. Disaster Risk Management Cycle[3]



1. This mainly applies to a relatively quick-onset disaster (such as Cyclone, Flood, Earthquake, Tsunami, Bushfire etc), rather than a slow-onset one such as Famine (due to Drought/War)
2. For details of this see the Disaster Risk Reduction (DRR) diagram

2 "UNISDR, "Terminologies on Disaster Risk Reduction", 2009, http://www.unisdr.org/eng/terminology/terminology-2009-eng.html.

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

The DRM cycle is modelled as part of an upward development trajectory. In order for development to be sustainable, disaster risk reduction is incorporated into development activities in what is called the "normal stage". Disaster mitigation and disaster preparedness are done simultaneously in this period. 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 into a sustainable development path.

Media is modelled 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 has the role of helping provide early warning whenever possible as well as humanitarian updates of disaster events and of reporting on the post-event recovery so that the public is kept informed of the efforts by government and other stakeholders.

Bangladesh has been able to tackle human casualties from cyclones by spending modest sums on shelters, developing accurate weather forecasts, issuing warnings, and arranging for evacuations. All these actions cost less than building large-scale embankments that would potentially have been less effective.[4] This example is itself a reflection of a change in DRM policy from relief to proactive disaster risk reduction.

With the changing scenario of development and growth, the DRM cycle has seen dramatic change from event-based action to process-based preparedness and mitigation. This cycle suggests that if disaster risk reduction is included in the development and growth process, the loss and damage incurred as a result of disasters would be reduced. Disaster risk reduction is the recommended framework and approach that seeks to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development.

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.[5]

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:

(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;

4 The 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.

5 UNISDR, "Sendai Framework for Disaster Risk Reduction," http://www.unisdr.org/we/coordinate/sendai-framework.

(6) Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this Framework; and
(7) Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people.

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.

Case Study 1. Glacier lake outburst flood in Nepal

One of the effects of recent atmospheric warming in the Himalayas has been the creation of melt water lakes on the lower sections of many glaciers. In an increasing number of instances, especially well-documented in Nepal, several of these lakes have burst their natural retaining dams (usually old end moraines that were formed when the glaciers were thicker and more extensive than today). This has produced catastrophic flood surges (glacial lake outburst floods or GLOFs) that have destroyed infrastructure and taken human lives in the valleys below.

ICTs have been used extensively to manage GLOFs. Google Earth satellite images were utilized to verify the glacial lake inventory data. A combination of open source remote sensing and GIS software packages, such as Google Earth, Quantum GIS, Integrated Land and Water Information System, Postgre/PostGIS, and Python, were used to edit, manage and analyse the data for mapping.

An automated monitoring system by using remote sensing and other approaches has been set up for Imja Tsho Glacier to monitor GLOF hazards and develop an early warning system.

Source: International Centre for Integrated Mountain Development, *Glacial Lakes and Glacial Lake Outburst Floods in Nepal* (Kathmandu, 2011), http://lib.icimod.org/record/27755.

Questions To Think About

Take a look around at where you are living now:

- What are the hazards in your area?
- What are the vulnerable conditions in your area?
- What capacities does your area possess to deal with the impact of hazards?
- What is being done in your area to reduce the impact of hazards (mitigation) and prepare for disasters?
- If nothing is being done, what do you think can be done? What can you do before a disaster strikes?

Points To Remember

- Hazard does not equal to disaster. Only when the impact of hazard goes beyond the control of human beings, that particular situation can be defined as disaster.
- A community becomes at risk to disasters when their vulnerability is high and their capacity is low. The higher their vulnerability and/or the lower their capacity, the higher their risk to disasters. DRM aims to reduce vulnerability and increase capacity.
- The DRM cycle is made up of: 1. the normal/risk reduction stage where the focus is on disaster mitigation and disaster preparedness; 2. the emergency response stage; and 3. the recovery stage. Interventions at any of these stages should aim towards ensuring sustainable development.

1.4 Disasters 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, 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.[6] The past and current trends of disaster events do validate the above statement.

Table 1 shows that floods and storms are the most common types of disaster in the region. The loss of lives due to floods and storms is less than due to earthquakes, however, the number of people affected and the damage to property are still high and ranks top most in Asia and the Pacific.

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

Table 1. Top 10 disaster types and their impact in Asia and the Pacific, 1984-2013

Rank	Events	Frequency	Deaths	People affected	Damage
			(thousands)	(millions)	(millions USD)
1	Flood	1,633	139	3,058	418,265
2	Storm	1,314	391	804	235 989
3	Earthquake	531	584	143	568 009
4	Landslide	317	18	8	2 770
5	Epidemic	292	40	6	0
6	Extreme temperature	147	23	91	24 045
7	Drought	120	5	1,273	42 332
8	Volcanic activity	78	1	2	531
9	Wildfire	75	1	3	14 404
10	Mass movement (dry)	19	1	<1	9

Over the period of 1984-2015, South Asia had the greatest number of disaster events at 1,325, followed by South-East Asia at 1,237. These regions also experienced the most fatalities, with the figure for South-East Asia spiking as a result of the 2004 Indian Ocean tsunami. However, the East Asia sub region suffered most 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. The detailed data is shown in Table 2.

Table 2. Disaster events and impacts by sub-region, 1984-2015

Region	Number of events	Killed	Affected (thousands)	Damage (millions USD)
South Asia	1,325	576,043	1,828,939	149,453
South-East Asia	1,237	407,369	374,124	116,922
East Asia	1,141	188,128	3,137,704	933,687
Pacific	439	5,813	20,564	66,317
West Asia	275	23,560	17,025	37,663
GRAND TOTAL	**4,536**	**1,203,883**	**5,388,808**	**1,306,475**

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

Test Yourself (multiple answers are acceptable for some questions)

1. What is the most common type of natural disaster in the Asia Pacific region?

    a. Flood
    b. Earthquake
    c. Storm
    d. Drought

2. Which is a slow onset hazard?

    a. Flood
    b. Storm
    c. Deforestation
    d. Drought

3. Why is human and economic damage from disasters considered significant in the Pacific Island states even though the amount of damage is relatively small compared with other sub-regions in Asia?

    a. Pacific Island states have relatively smaller land mass
    b. Pacific Island states play important role in Asia
    c. Pacific Island states has relative smaller population size
    d. Pacific Island states country are more vulnerable to disasters

Youth In Action 1. Application of Ushahidi in disaster risk management

Ushahidi is an open source platform that combines existing applications such as SMS, Twitter and Google Maps to collect information from sources like text messages, blog posts, videos, phone calls, and pictures, which are then mapped in near real time. It can be used to plot everything from disasters to wars. Compared with older forms of crisis-mapping software, Ushahidi is more user-friendly and easier to build on. The end result is a crisis map that provides humanitarian actors on the ground an overview of the situation.

Ushahidi-Haiti, for example, was established two hours after the earthquake on 12 January 2010 by volunteers based at Tufts University in Massachusetts, USA. Soon after, a short code (4636) was created for incoming text messages, which spread via local and national radio stations. Witnesses could text information about what they were seeing or experiencing. If the message was actionable, for example: "there are people trapped in a building located on Border and Smith," then a volunteer would map the GPS coordinates and provide the information to rescue teams on the ground. Often, the text messages were in Creole but Ushahidi worked with about 10,000 Haitian-American volunteers across the United States, who translated every text message within 10 minutes.

To get involved with initiatives of Ushahidi, see http://www.ushahidi.com/get-involved.

Source: Jessica Ramirez, "'Ushahidi' Technology Saves Lives in Haiti and Chile", *Newsweek*, 3 March 2010, http://www.newsweek.com/blogs/techtonic-shifts/2010/03/03/ushahidi-technology-saves-lives-in-haiti-and-chile.html.

CHAPTER 2: THE NEED FOR ICTS IN DISASTER RISK MANAGEMENT

Objectives:

- Defines what are ICTs
- Details the characteristics and attributes of ICTs
- Introduces the role and the need for ICTs in DRM

2.1 Defining ICT

ICT is an umbrella term that includes any communication device, encompassing: radio, television, telephone, mobile phone, computer and network hardware and software, satellite systems and so on. The term also includes the various ICT services and applications, such as videoconferencing and distance learning. ICTs are often spoken of in a particular context, such as ICTs in education, health care or libraries. ICT involves the transfer and use of all kinds of information. An overview of the different characteristics of ICTs is shown in Figure 2.

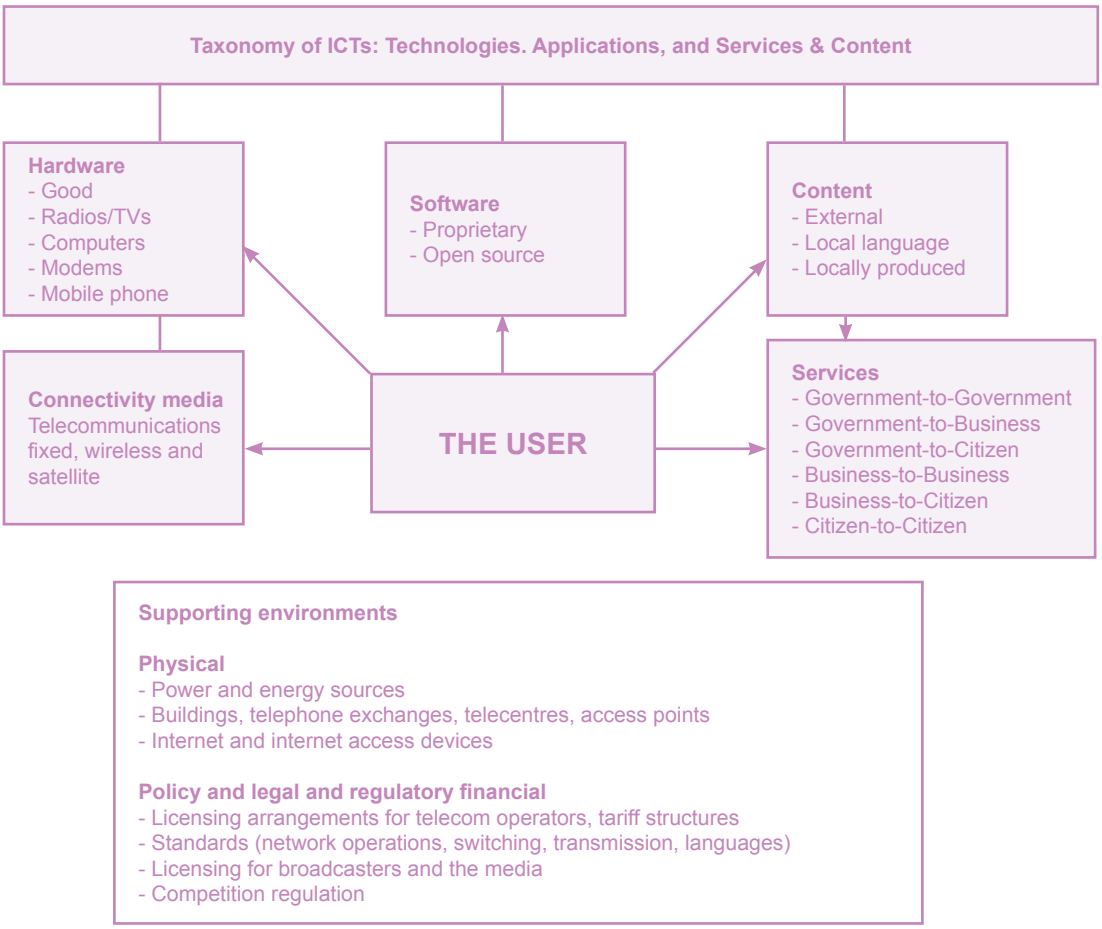
The United Nations Development Programme (UNDP) has provided a definition for ICTs in 2003:

> ICTs are basically information handling tools—a varied set of goods, applications and services that are used to produce, store, process, distribute and exchange information. They include the "old" ICTS of radio, television and telephone, and the "new" ICTs of computers, satellites and wireless technology and the Internet. These different tools are now able to work together, and combine to form our "networked world", a massive infrastructure of interconnected telephone services, standardized computer hardware, the Internet, radio and television, which reaches into every corner of the globe.[7]

ICT applications have been used to support sustainable development, in the fields of public administration, business, education and training, health, employment, environment, agriculture and science.

7 UNDP Evaluation Office, *Information Communications Technology for Development, UNDP Essentials: Synthesis of Lessons Learned* (New York, 2001), p. 2.

Figure 2. The characteristics of ICTs



Source: Usha Rani Vyasulu Reddi, *Issue 1: An Introduction to ICT for Development, Primer Series on ICTD for Youth*(Incheon, UN-APCICT/ESCAP, 2011), p. 58.

2.2 The Benefits and Limitations of ICTs

There are many conditions and factors that enable or hinder the use of ICTs. These factors range from access and availability, to issues such as literacy and ownership of ICTs. These conditions are summarized in Table 3.

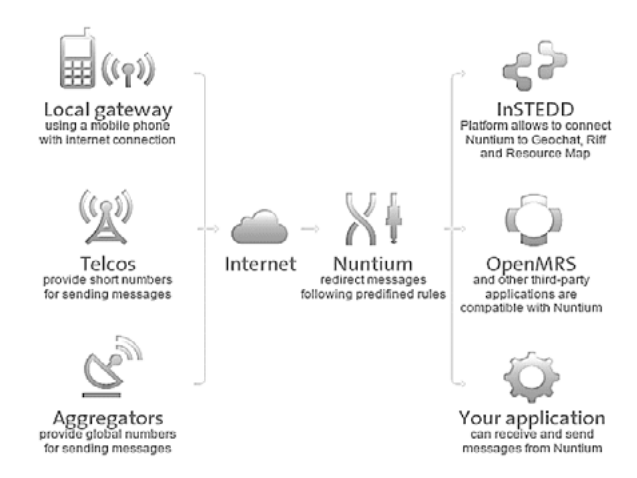
Table 3. The benefits and limitations of different ICTs

ICT	Benefits	Limitations
Print technologies	• Familiarity • Reusable • Can provide depth • Allow economies of scale • Uniform content and standards possible	• Limited by literacy • Static in time • Updating difficult • Passive, one way technology with little or no interactivity
Broadcast technologies (radio and TV)	• Familiarity • Speed of delivery • Provides vicarious experience • Allow economies of scale • Uniform content and standards possible • Rugged, ease of use	• Limited access • Static in time • Require people to be tuned in at the time of broadcast • Updating difficult • Not problem or location specific • Passive, one way technology with little or no interactivity • One size fits all content for all groups of people • High start up, production and distribution costs
Digital (computer and Internet-based technologies)	• Interactive • Low per unit cost • Allow economies of scale • Uniform content and standards possible • Can be updated easily • Problem- and location-specific • User-friendly • Unbundling of content possible • Enable people-to-people contact (social networking)	• Limited access still • High development costs • Dependent on capacity of providers • Computer literacy essential for use • Lack of local content • Impeded by physical constraints such as stable electric power and bandwidth availability
Mobile technologies	• Interactive • Low per unit cost • Allow economies of scale • Uniform content and standards possible • Can be updated easily • Problem-and location-specific • User-friendly • Unbundling of content possible • Local content possible • Computer literacy not essential for use	• Impeded by physical constraints such as signal strength • Limited by social factor inhibiting access to and ownership of instrument

Source: Usha Rani Vyasulu Reddi, *Issue 1: An Introduction to ICT for Development, Primer Series on ICTD for Youth* (Incheon, UN-APCICT/ESCAP, 2011), pp. 64-65.

Case Study 2: Nuntium software: Bridging gaps in information sharing

Nuntium is an open-source software developed by InSTEDD that allows users the ability to build effective and scalable SMS-based communication applications independent of the telecommunication infrastructure.



The system is designed to deliver and dispatch messages in scenarios common to humanitarian work. The system utilizes inexpensive hardware and software such as GSM modems and Skype via a downloadable local gateway program for small-scale use. It can also scale up to work in conjunction with SMS aggregator service providers and wireless operators, and can be integrated with email and Twitter.

At the local level, the tool has been set up as an appointment reminder system for HIV/AIDS patients in Cambodia, for example. It had served the mission-critical needs of ministries of health or during crisis situations like the 2010 Haiti earthquake.

Points To Remember

- ICTs are a basket of tools. If used effectively, they can contribute significantly to disaster risk reduction and sustainable development. But ICTs themselves cannot solve development problems.
- ICTs operate within an external environment that consists of a physical infrastructure such as power and energy sources; and a legal and regulatory framework. ICTs cannot operate effectively when the physical infrastructure is poor and when then legal and regulatory framework is weak.
- To use ICTs effectively for DRM, it is necessary to understand their benefits and limitations, and choose the appropriate technology in a DRM context.

Questions To Think About

- Which ICTs are already used in your country for DRM?
- Can you distinguish between the new and modern ICTs and the older traditional ICTs that are used for DRM in your country?
- Can you give an example of how social media could be integrated with an ICT solution for DRM?

2.3 Information Needs and Knowledge Management for Disaster Risk Management

Access to reliable, accurate and timely information at all levels of society is crucial immediately before, during, and after a disaster. Information needs to be readily collected, processed, analysed and shared in order for stakeholders to effectively respond. Without information, individuals and institutions are often forced to make crucial decisions based on sketchy, conflicting reports. The Information Management Cycle, shown in figure 3, is one way to understand this process.

Data are measurements or observations of a variable, including numbers (e.g. number of internally displaced persons), text (e.g. majority ethnic group of 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, which can be collected and analysed. Therefore, the whole information management process is not linear but cyclical.

Figure 3. Information Management Cycle

In general, it is recognized that different disaster activities have different information needs for different audiences. Activities for prevention, mitigation, preparedness planning and recovery planning include baseline data about the country and major risks, analysis and research, and

risk assessment. Activities for disaster response, rehabilitation and reconstruction need real-time information about the impact of a disaster and the resources available to combat it.

Table 4 provides a brief listing of the different information needs for the four phases of the DRM cycle.

Countries should have disaster information strategies to manage critical baseline information required in all stages of the DRM cycle. Such baseline information could be collected through risk mapping and assessment of major disaster prone areas.

Table 4. Snapshot of information needs for different DRM 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 info • 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 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 and vulnerability maps • Risk zones • Populations at risk • Access to telecommunication and electricity services • Equipment, emergency personnel and volunteers for disaster response	• Identify spatial and temporal variation in hazard severity, occurrence and likelihood and/or 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
Recovery and Reconstruction • 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
Recovery and Reconstruction • 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

ICT Needs in Disaster Mitigation

Disaster mitigation means reducing the risk of severity to human and material damage that may be caused by any 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 lessened by various strategies and actions. ICT can be employed in the formulation of mitigation strategies and their implementation. For example, ICT can be used for the disaster mitigation measures decision support, which includes hazard assessment and mapping, vulnerability assessment and so on.

ICT Needs in Disaster Preparedness

Disaster preparedness is a set of pre-disaster activities that are undertaken in anticipation of a disaster to ensure appropriate and effective actions are taken in the aftermath. Preparedness is an important part of the disaster risk reduction 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. ICT provides vital support for disaster preparedness through observation, monitoring, recording, processing, sharing, networking, communication and warning dissemination.

ICT Needs in 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

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, the information people need is simple: 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 the timeline for receiving compensation. In other words, people begin to want to know what relief, services and compensation are available to them. Therefore, expectation management through effective communication is vital during any emergency situations, 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. How can ICT help? In Banda Aceh, Indonesia, Red Cross volunteers helped reunite 3,400 tsunami survivors with their families—often using satellite phones. In Sri Lanka, many people feared the waves were a divine punishment; the Belgian Red Cross helped dispel these myths by explaining the science behind the disaster. Mobile technology and social networking tools are increasingly being used to meet information needs in disaster response as an increasing number of people have access to these tools and are using them on a daily basis

Case Study 3. Project 4636 in Haiti

Project 4636 was established in Haiti after the 2010 earthquake to meet the needs of the affected population through the use of SMS. People were able to send SMS messages about their situation and needs to the short code "4636". Through collaboration among numerous 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. Although Project 4636 collected 80,000 messages there is limited information on how effective they were at supporting the relief activities.

The Haiti case study offers an unusual example of SMS being deployed as both a one-way and a two-way communication system. Project 4636 also served as a vehicle for SMS broadcast of public health messages on a mass scale. The Thomas 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. In the case of Haiti, the strong potential of SMS-based tools for supporting, monitoring and holding accountable public health service delivery was clearly demonstrated.

Case Study 4. 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. "The value of the alerts to us was that we managed to send out the message early," said Alexander Rosete, a spokesman for the Philippines National Red Cross. "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. The Philippines has been described as the text messaging capital of the world, with an estimated one billion text messages sent daily.

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.

ICT Needs in Disaster Recovery and Reconstruction

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. ICTs used at earlier stages of disaster response can and should be leveraged to serve longer-term reconstruction and development goals. For example, once the immediate need for food and shelter is met, disaster survivors will be seeking 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. Databases can be developed to match work needs with employment and investment opportunities as these become available, for example.

This section has provided some insights into the information needs of people affected by disasters, and highlighted a few ICT tools used to address these needs. The remaining chapters of this primer look in detail at the various applications of ICT in disaster mitigation (Chapter 3), disaster preparedness (Chapter 4), disaster response (Chapter 5), and disaster recovery and reconstruction (Chapter 6).

Points To Remember

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 and learning, and for raising awareness that are all critical for developing a 'culture' of DRR, as well as building specific skills set 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

Questions To Think About

- Media channels such as the press, radio and television have always played an important and active role in disseminating information before, during and after disasters. What changes are required to increase the effectiveness of these media channels in saving lives?

- Technological innovations are happening in all sectors. How can we promote technological innovation in DRM that meet the different information needs in all stages of the DRM cycle?

Test Yourself (multiple answers are acceptable for some questions)

1. Supporting physical environments for ICTs include:

   a. Laws and regulations
   b. Power and energy, buildings and access devices
   c. Licensing procedures
   d. Open standards

2. The use of social media, such as Facebook, Twitter and Flickr in disaster response can:

   a. Better engage the public during crisis
   b. Enable a cultural shift in how the public views its role as an empowered contributor
   c. Help emergency management and crisis communication become more participatory
   d. Improve the quality and quantity of disaster response

3. Countries should have disaster information strategies to manage critical baseline information, which may be used for:

   a. Pre-disaster preparedness
   b. During-disaster emergency response
   c. Post-disaster needs for damage and loss assessment
   d. Rehabilitation and reconstruction after disaster

4. Information management is not a linear process but a cyclical one because:

   a. Information management is a learning process
   b. Information will turn into practical activities on the ground
   c. All information will be collected and analysed
   d. It is not a repeating process

5. Which of the following is not an attribute of an ICT-based system:

   a. Sensitivity to distance and slow in speed
   b. Low cost per unit
   c. Just in time information
   d. Personalization of system

Something To Do

Go through the Multi Hazard Risk Information Node (MHRIN) of Sindh Province, Pakistan available online at http://mhvra-sindh.wfp.org.pk/maps/search

The MHRIN is a platform for sharing information on the spatial distribution of prevailing natural hazards, and their risk on human, physical and economic environments in the Sindh Province. This platform is used by DRM practitioners, planners, administrators and humanitarian agencies. The contents of MHRIN are based on the data provided by the national and provincial stakeholders, with values added by the Asian Disaster Preparedness Center (ADPC).

This ICT tool has been developed for the Provincial Disaster Management Authority of Sindh Province by the National Disaster Management Authority of Pakistan with technical support from ADPC, and financial support from the United Nations World Food Programme in Pakistan.

Further Reading

Usha Rani Vyasulu Reddi, *Issue 1: An Introduction to ICT for Development, Primer Series on ICTD for Youth* (Incheon, UN-APCICT/ESCAP, 2011).

CHAPTER 3: ICT FOR DISASTER MITIGATION

"An ounce of prevention is worth a pound of cure." – Benjamin Franklin[8]

Objectives:

- Provide an overview of disaster mitigation
- Discuss how ICT can provide supporting information for disaster mitigation
- Give examples of ICT use in disaster mitigation activities

UNISDR defines mitigation as the lessening or limitation of the adverse impact of hazards.[9] The adverse impact of disaster often cannot be prevented fully, but its scale or severity can be substantially lessened by various strategies and actions. Disaster mitigation's aims may not have changed much since Benjamin Franklin's days, but it certainly can be improved by employing ICT in the formulation of mitigation strategies and their implementation.

3.1 Disaster Mitigation Measures

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 reduce the effects of disaster-causing phenomena, and should be part of development efforts.

Mitigation attempts to reduce the impact 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 them from disaster events (structural mitigation measures). It also helps business and industry avoid damages to their facilities and remain operational in the face of catastrophe (non-structural mitigation measures).

Table 5 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.

8 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.

9 "UNISDR, "Terminologies on Disaster Risk Reduction", 2009, http://www.unisdr.org/eng/terminology/terminology-2009-eng.html.

Points To Remember

- Disaster mitigation does not mean the elimination of disasters. Disaster mitigation aims to lessen or limit the adverse impact of hazard.
- Although disasters cannot be prevented fully, its scale or severity can be substantially lessened by various strategies and actions.
- Destruction caused by disasters has negative effects on social and economic development. Therefore, development efforts cannot afford to ignore the impact of hazards and should incorporate efforts to mitigate against disasters.
- Similarly, disaster mitigation efforts should consider the development context and be in synchronized with the development priorities of the country or locality.

Table 5. 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

Hazard	Mechanism of destruction	Elements most at risk	Main mitigation strategies
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 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 • Engineering of structures to withstand or accommodate potential ground movement • Flexible buried utilities • Relocation of existing settlements or infrastructure

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

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.

- 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.[10]

Mitigation measures should be viewed as the means to decrease demands for disaster response resources.

Questions To Think About

- Why do we say that mitigation is fundamental to reducing vulnerabilities?
- How is your country mitigating against disasters and creating safer communities?

Mitigation measures can be divided into two types: 1) structural mitigation and 2) non-structural mitigation. Structural mitigation measures include construction of barriers, physical modification, hazard-resistant construction, and development and implementation of building code. Non-structural mitigation measures include land-use planning/zoning, risk mapping, environmental protection regulations, insurance programmes, tax incentives, and community awareness and education programmes.

Figure 4 shows an example of different disaster mitigation measures components, which include both structural and non-structural measures.

Figure 4. Disaster mitigation system diagram

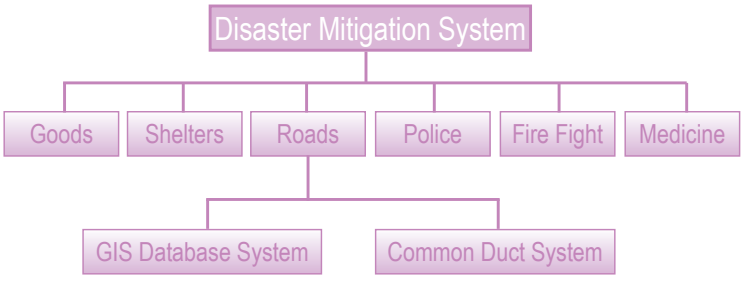


Table 6 compares death, damage and economic loss caused by earthquakes in five different countries. Analyses show that mitigation is a strong factor in reducing overall loss. Haiti and New Zealand experienced comparable earthquakes in terms of magnitude, with markedly different impacts. Haiti is characterized 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

10 Federal Emergency Management Agency, "Mitigation's Value to Society", http://www.fema.gov/government/mitigation.shtm#6.

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.[11] 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.[12]

Table 6. Comparison of damage caused by three earthquakes

Date & Place	Magnitude	Number of deaths	Estimated economic damage & loss	Losses as % of GDP
12 January 2010, Haiti	7.0	222,570	USD 8 billion	100 to 200
27 February 2010, Chile	8.8	521	USD 30 billion	10 to 15
4 September 2010, New Zealand	7.0	0	USD 4 billion	3
10 March 2011, Japan	9.0	20 896 (mostly due to drowning)[13]	USD 210 billion	4
25 April 2015, Nepal	7.8	8 633	5.2 billion[14]	33 (of 2014 GDP)

Notes and Sources: Dates in UTC; magnitudes of earthquakes and 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.

Questions To Think About

- What is the difference between structural and non-structural mitigation measures?
- How are decisions being made about whether to implement structural or non-structural disaster mitigation measures?
- Mitigation measures that have been successfully implemented over the decades in developed countries are structural or non-structural mitigation measures, or both?
- Why do different countries that have experienced comparable disaster events have different impacts?

11 Aon Benfield, *Chile: One Year On*, (Chicago, February 2011), http://www.aon.com/attachments/reinsurance/201102_chile_one_year_on_report.pdf.

12 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

13 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

14 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

3.2 ICT Applications for Disaster Mitigation

Effective mitigation measures require access to reliable, accurate and timely information. 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.

ICTs have been used to deliver DRM training and education online. One example is the World Bank Institute's distance learning programme on DRM that includes courses on mitigation topics such as "Safe and Resilient Cities", "Introduction to Disaster Risk Management" and "Disaster Risk Finance".[15]

One of the important steps towards disaster impact reduction is to 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. Computer software known as geographic information systems (GIS) is very useful for 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.

Using GIS, hazard maps and risk maps can be created and used to inform policymaking to develop land-use policies, zonation and building codes. These maps can also guide the design of structural mitigation measures through the analysis of where they 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.

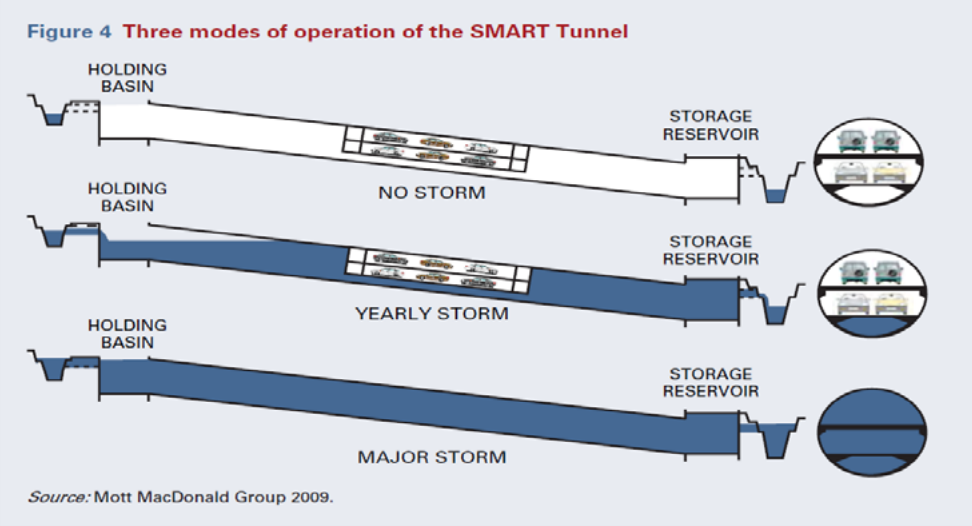
15 Information about the courses can be found at Open Learning Campus, https://olc.worldbank.org.

Case Study 5. The SMART Tunnel, Kuala Lumpur, Malaysia

Kuala Lumpur's Stormwater Management and Road Tunnel (SMART) diverts potential flood water 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.

Details about the SMART tunnel can be seen in http://www.youtube.com/watch?v=SGMN15YzsFw.

Figure 5. Three modes of operation of the SMART Tunnel



Source: The United Nations and The World Bank, *Natural Hazards and UnNatural Disasters: The Economics of Effective Prevention*, (Washington, D. C., The World Bank, 2010).

Questions To Think About

- What other examples of ICT applications for disaster mitigation can you think of?
- Find out about other examples of GIS application in disaster mitigation.

Points To Remember

- Reliable, accurate and timely information is critical for effective mitigation.
- ICTs are used in awareness raising, training and education programmes to reach out to a wider group of people and encourage continuous learning.
- ICTs, particularly the use of GIS, can help to identify and analyse potential disaster risks, which can then be used to develop appropriate mitigation strategies.

3.3 ICT to Assess Risk

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 the analysis of the physical, social, economic and environmental dimensions of vulnerability and exposure; while taking into account the coping capabilities pertinent to the risk scenarios.

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

The Comprehensive Disaster Management Programme under the Ministry of Food and Disaster Management of Bangladesh conducted an earthquake hazard and risk assessment for three major cities in Bangladesh—Dhaka, Chittagong and Sylhet. GIS was used for base map preparation, hazard mapping, vulnerability mapping, and damage and loss estimation. The Government of Bangladesh has already used the results from this risk assessment to identify evacuation routes and the locations for the evacuation shelters.

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.

Questions To Think About

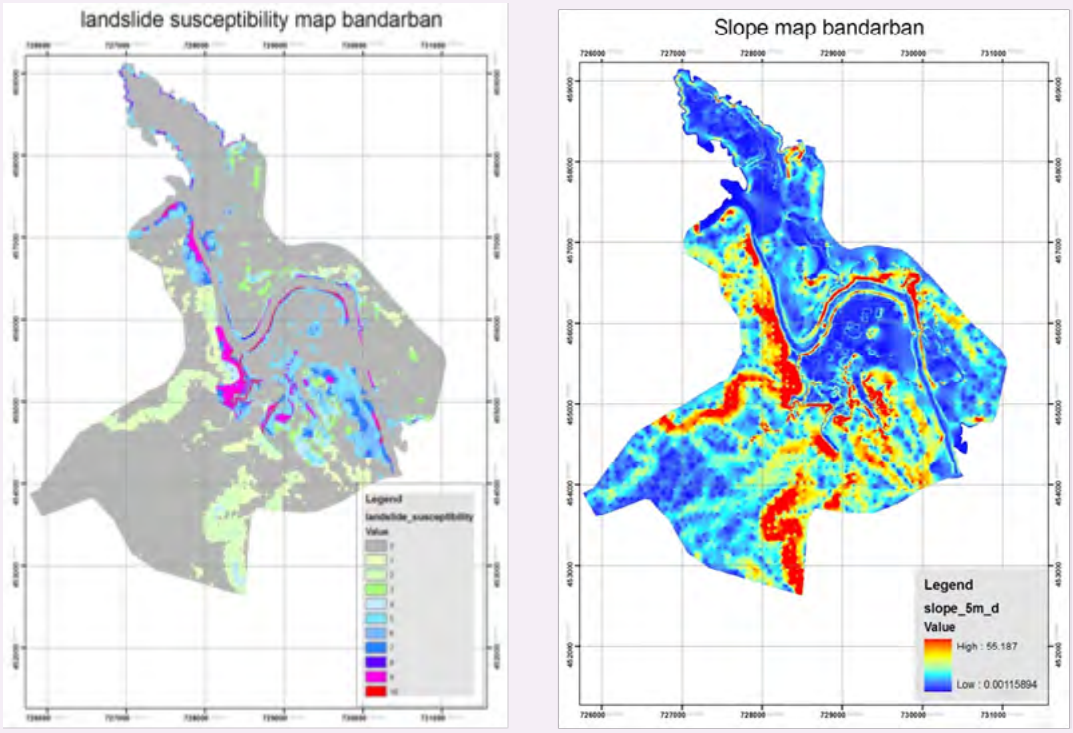
- Why do GIS-based databases make decision-making processes easier and more effective?
- What other ICT tools can work with GIS to improve the monitoring and analysis of disaster risks?

Case Study 6. The Use of GPS and GIS for Hazard and Risk Assessment

Spatial databases were developed for the landslide assessment of the towns of Rangamati, Bandarban and Khagrachari in Bangladesh. All the 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 like roads, building outlines, water body boundaries, river boundaries, etc. Fieldwork was undertaken to verify the accuracy of the coordinates of the features with the help of surveying technology such as global positioning system (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.

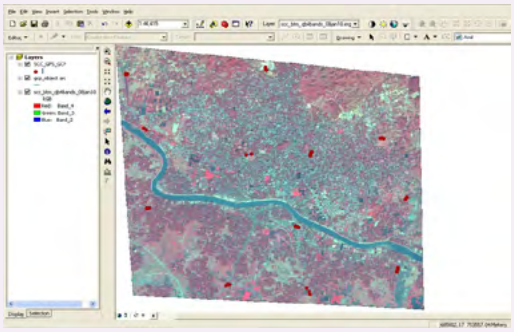
Contour maps, geomorphologic maps, and ground water table data were digitized and combined into a computerized 3-dimensional map known as a digital elevation model. The geomorphologic map, ground water table data, and borehole data were integrated by the GIS to produce the landslide susceptibility map. This susceptibility zone is matched with the critical acceleration after the peak ground acceleration map is produced.

Figure 6. Landslide susceptibility maps of Bandarban



(Source: ADPC)

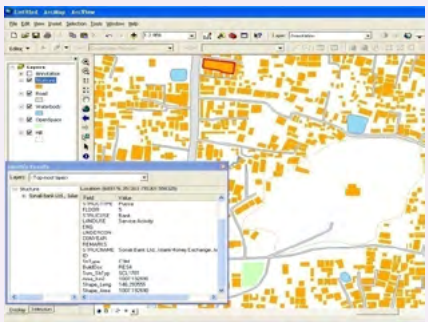
Figure 7. Some steps for base map preparation



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 fieldwork added into the attribute database of the digitized features

(Source: ADPC)

Test Yourself (multiple answers are acceptable for some questions)

1. The principal objectives of mitigation are:

   a. Save lives
   b. Reduce economic loss and disruption
   c. Earn more money
   d. Reduce vulnerabilities

2. What are the common mitigation strategies in flood hazards and volcanic eruption?

   a. Land-use control
   b. Insurance
   c. Structural mitigation
   d. Hazard zonation

3. Structural mitigation measures include:

   a. Physical modification
   b. Revision of building code
   c. Engineering techniques
   d. Risk mapping

4. Non-structural mitigation measures include:

   a. Land-use planning
   b. Community awareness
   c. Hazard-resistant construction
   d. Education programmes

Youth In Action 2. Play the Stop Disasters! Game

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 risk reduction 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.

Further Reading

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

CHAPTER 4: ICT FOR DISASTER PREPAREDNESS

"By failing to prepare, we prepare to fail." Benjamin Franklin

Objectives:

- Provide an overview of disaster preparedness
- Discuss how ICT can provide supporting information for disaster preparedness planning
- Provide examples of ICT use in disaster preparedness activities

Natural disasters are inevitable and have become a major challenge for national authorities in many countries. It is almost impossible to completely eliminate disaster risk or to fully recoup the damage caused by disaster. However, any remaining potential disaster risk can be reduced by proper preparedness and early warning strategies. Rapid advancement of ICT has created opportunities for tackling the challenges emerging from an ongoing event by improving prediction capabilities and increasing options for robust emergency communication systems, and minimizing the impact of disaster in terms of reducing the magnitude of causalities. This section describes the role of ICT and its wide-ranging potential application in disaster preparedness supported with practical experiences.

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 property.[16] 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 vulnerability/capacity assessment.

Preparedness is an important part of the DRM cycle because it is not always possible to eliminate disaster risk. However, 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 actions. 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

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

Points To Remember

- Disaster preparedness is a set of pre-disaster activities that are undertaken in anticipation of a disaster to ensure that appropriate and effective actions are taken in the aftermath.
- Extensive experience and practice in the past few decades have demonstrated that appropriate preparedness and prompt actions can effectively reduce disaster risk.

4.2 The Role of ICT 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 for people to take actions that save lives, reduce damage to property 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 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 disaster.

Many emergency communication systems use satellite phones and/or satellite radios either as back up or a 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 set up. Combining remote sensing satellites with communication satellites can be useful in ensuring that data generated by satellites reach disaster managers and planners. For example, India combines its Indian Remote Sensing satellite system—designed for land-use and ecological monitoring—with the Indian National Satellite System communication satellites. Being able to integrate satellite data with other geo-spatial datasets and ICTs is also important. To assess landslide risk, for example, it is important to integrate remote sensing data with population maps and other spatial databases. In South Africa, a system has been developed that combines satellite data with mobile phone technology to provide a cost effective alert system. The service is complimentary and anyone can sign up to receive alerts.

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 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.

4.3 Preparedness Plan

A disaster preparedness plan is a set of instructions that a DRM authority can follow to issue directions to their rescue and relief team and affected people. This speeds up the rescue and relief operations. Disaster preparedness plans are also useful for pre-disaster operations, when warnings are issued. With standard operating procedures elaborated in the disaster preparedness plan, time is saved that might otherwise have been lost in consulting with senior officers about who to send what messages to, when and how. Figures 8 and 9 show the components in a disaster preparedness plan.

Figure 8. Example of a personal disaster preparedness plan

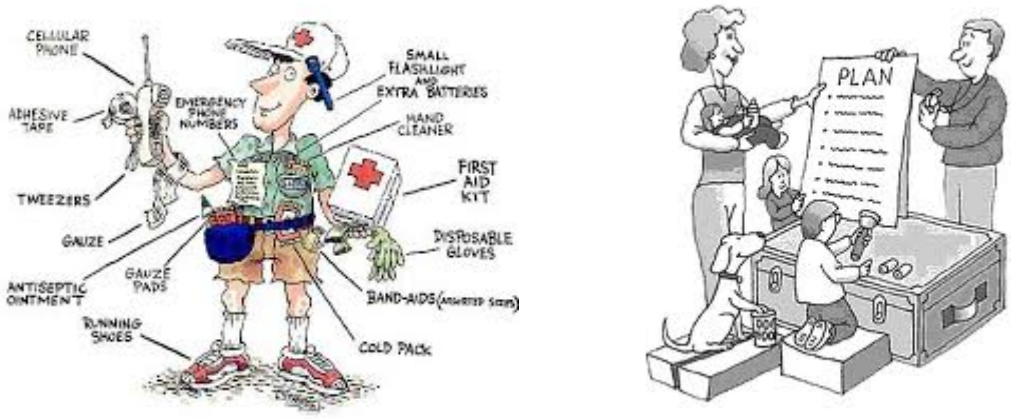


Figure 9. The basic elements of a disaster preparedness plan

Disaster preparedness planning involves predicting the risk of natural hazard and possible impact. 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.

Questions To Think About

- What is the role of ICT in disaster preparedness and disaster preparedness planning?
- What are the basic elements of a disaster preparedness plan?
- A disaster preparedness plan contains a set of instructions that a DRM authority can follow to issue directions to their rescue and relief team and affected people. What set of instructions need to be included regarding the use of ICTs during a disaster event?

Case study7. Development of an Earthquake Preparedness Plan in Bangladesh

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[17] software package.

Source: Comprehensive Disaster Management Programme, "City Level Earthquake Contingency Plan for Dhaka, Chittagong and Sylhet", Disaster Management Bureau, 2009.

4.4 Potential Application of ICT 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."[18] 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 pre-emptive and protective action to avoid harm.

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:

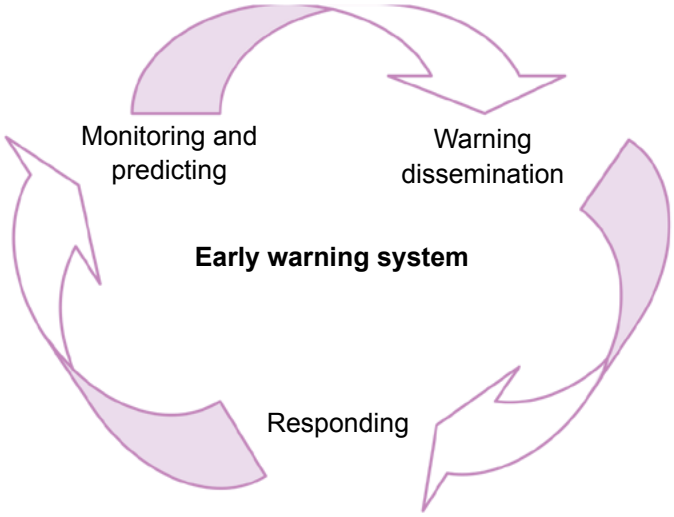
17 Hazus is a standardized methodology developed for the United States by the Federal Emergency Management Authority. Hazus uses GIS technology to estimate physical, economic, and social impacts of disasters from earthquakes, floods and hurricanes.

18 "UNISDR, "Terminologies on Disaster Risk Reduction", 2009, http://www.unisdr.org/eng/terminology/terminology-2009-eng.html.

- 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)

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

Figure 10. 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.

Points To Remember

- Early warning is one of the very important components of disaster preparedness. It can 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.
- ICT is a key element in early warning systems.
- Both traditional and modern ICTs should be applied in an early warning systems, particularly to ensure that the early warning messages reach as many people as possible.

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. Remote sensing has a wide range of application in disaster preparedness from risk modelling and vulnerability assessment, to early warning.[19]

Table 7. Remote sensing and GIS applications for disaster preparedness

Hazard	Application
Flood	Flood detection, rainfall measurement, flood mapping, early warning
Cyclone	Long-range climate modelling, 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.

Cell broadcasting (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.

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 System.

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

19 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.

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 communication media, such as, radio, television, print media, telephone, fax, telex, telegram and the police wireless network. A specially designed Cyclone Warning Dissemination System that works via the Indian National Satellite (INSAT) system, provides area-specific service even when there is a failure of conventional communication channels.

Questions To Think About

- What ICT tools (both traditional and new) are currently available that can be effectively used for disaster warning purpose?
- Think about how applications of these ICT tools can save many lives during the disaster?
- For any disaster early warning system, what is the different between "alert" and "warning"?

Case Study 8. Cyclone monitoring in the Bay of Bengal and early warning in Bangladesh

The 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 during the tropical cyclone in the Bay of Bengal and the Arabian Sea. The United Nations Economic and Social Commission for Asia and the Pacific (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.

Sources:India Meteorological Department, “Cyclone Warnings”, http://www.imd.gov.in/services/cyclone/cyclone-warning.htm; and IRIN News, “Bangladesh: Megaphones save thousands”, 23 November 2007, http://www.irinnews.org/Report.aspx?ReportId=75470.

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.

Case Study 9. Online inventory of emergency resources, India

Under the National Disaster Management Framework for the country, the Ministry of Home Affairs of India in collaboration with UNDP developed the India Disaster Resource Network (http://www.idrn.gov.in), an online inventory of emergency resources.

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. 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 about the availability of the different resources, quantity available, location, contact details, operator provision, transport options, etc. The IDRN is a live system and the inventory is updated every quarter.

Source: 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, e.g. through "SchoolNets"—a recognizable national or regional network of teachers, students and communities to 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 weather stations, earth observation systems, satellites, etc. A well-defined website is a cost-effective means of rapid, automatic and global dissemination of disaster-related information. For disaster preparedness, 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.

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, 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.

Points To Remember

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, etc, as well as people's participation in the preparedness planning process

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.

Test Yourself (multiple answers are acceptable for some questions)

1. Disaster preparedness measures includes:

   a. Preparedness plans
   b. Warning systems
   c. Mutual aid agreements
   d. Emergency simulation exercises

2. ICT provides vital support for disaster preparedness through:

   a. Observation
   b. Monitoring
   c. Processing
   d. Analysis

3. How can GIS help in preparedness planning:

   a. Communication
   b. Economic assessment
   c. Risk and vulnerability assessment
   d. Damage and loss estimation

4. Remote sensing and GIS for disaster preparedness can be used in:

   a. Weather forecasting
   b. Weather observation
   c. Early warning
   d. Hazard mapping

Something To Do

- Design an evacuation route from your university building to a safe meeting point such as a park in case of a fire hazard or earthquake. Try to use Google Earth for the route mapping.

- Does your university have a disaster preparedness plan? Is everyone aware of this plan? Is it available online? Is there an emergency preparedness checklist and emergency contact information online? If there is no such information available, form a team to put together a disaster preparedness plan and a preparedness checklist? Consider the process that you will go through to develop the plan and checklist—who will be in your team, and what will you do after you have drafted the plan and checklist? What methods and tools will you use to obtain input and feedback, and ensure that everyone is aware of the plan?

Youth in Action 3. Internship with the Sahana Software Foundation

The Sahana Software Foundation runs a number of Internship programmes (http://sahanafoundation.org/programs/internships/). The Foundation has supported national and local authorities and relief agencies in their response to numerous large-scale, sudden-onset disasters.

Further Reading

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

Satyabrata Sahu, *Guidebook on Technologies for Disaster Preparedness and Mitigation* (n.d.), http://www.technology4sme.net/docs/Guidebook%20on%20Technologies%20for%20Disaster%20Preparedness%20&%20Mitigation.pdf.

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

UNESCO, *Natural Disaster Preparedness and Education for Sustainable Development* (Bangkok, 2007), http://www2.unescobkk.org/elib/publications/103/disaster.pdf.

CHAPTER 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, Head of the Federal Emergency Management Agency, USA

Objectives:

- Give an overview of disaster response management
- Introduce the concept of a disaster response coordination centre
- Describe information management during disaster response
- Provide examples of the application of ICTs during disaster response
- Provide guidance on the use of ICTs during disaster response

5.1 Disaster Response Management

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

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/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** – The relevant Ministries/Agencies/Services/Authorities are notified whenever information is 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 to staff
- Maintenance and repair of equipment
- Conducting operational debriefs

5.2 Disaster Response Coordination Centre

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 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 overall 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 plan** - 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.

Case study 10. Rapid response system in Istanbul, Turkey

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 a damage assessment report that is disseminated as rapid response information and early warning to all key stakeholders.

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 8.

Table 8. Responsibilities of the functional groups of a DRCC

Functional group	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 8, the Information Management Group has a key supporting role for the management of information within the DRCC, as shown in table 9.

Table 9. Functions and responsibilities of the Information Management Group

Function	Responsibility
Collect information	Ensure that information is collected from all persons in the DRCC and from all relevant sources external to the DRCC
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
Distribute information	Ensure that information is distributed to all those who require it within the DRCC and in external agencies
Disseminate Public Information	Under the guidance of the Implementation Group, ensure that appropriate information is disseminated to the public
Media Liaison	Maintain regular contact with the news media, distribute media releases and arrange media conferences as required

Questions To Think About

- What is the role of the DRCC in disaster response?
- What are the functional groups in a DRCC and what are the broad responsibilities of these functional groups?
- Consider ways in which ICTs can be utilized in a DRCC?

Case Study 11. Humanitarian Supplies Management System

The Humanitarian Supplies Management System (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.

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

Communication Facilities

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

The 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, e.g. 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 DRM centres connected through underground cables as this significantly reduces the risk of loss 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 defence. 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, in some cases an operator can manage it for private customers.

These networks come in different forms. They can be wired or wireless, and they can share public networks resources, 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 the 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 locally or remotely.

- **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 it free from both a failure by 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 most widely used mobile satellite system at the time of writing is the Inmarsat system, a privatized enterprise offering service to maritime, aeronautical and land mobile customers. 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-omni-directional 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 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.

Point To Remember

The effectiveness of the DRCC is largely dependent on adequate communication. Information management relies on having a communication system, and any restriction in communication will limit the required collection, analysis and dissemination of information.

Question To Think About

What are the uses and vulnerabilities of technology options for emergency and disaster communication?

Box 1. When telecommunication infrastructure is not enough

A good telecommunication infrastructure is in place in Bangladesh consisting of satellite/ microwave, optical fibre, VSAT and mobile phones, operated by both government and private players. The telecommunication 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 telecommunication 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 that interrupted national and international telecommunication networks, and when flood water entered communication cable ducts in many districts from the 2004 floods. A more common problem is power failure during disaster events, cutting off mobile phone communication.

Source: 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.

5.3 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 affect 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

There are different types of information 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
- Information about the affected population's needs and wants

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 in 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 – short term/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:

- 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.

Case Study 12. Origen emergency management system

Origen is an emergency management system for New Zealand's Civil Defense 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

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

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 group 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. Situation Display – This is used to summarize the current situation for the various key locations affected by the disaster. This display 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 havereported 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 of major activities scheduled.
- Status Display – This display summarizes the number of deceased, injured, trapped, evacuated, homeless and unaccounted for, and their location. 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 developingthreat, hazard or known information regarding the disaster.
- The access map - This is marked with details of the routes that can be used by disasterresponse traffic, evacuation vehicles and the general public. The map may also include other coordination information concerning the event area, such as the location of temporary shelters.

Questions To Think About

- What are displays in DRCC and what is the requirement of displays in DRCC?
- What can be managed by a computerized system located in the DRCC?
- Maps are an important information resource for the DRCC, what are the main uses of maps?

Case study 13. DesInventar Disaster Information System

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 data card 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
- 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

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

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 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 connected to the Internet.

Friends and families of those affected by disasters are using social networking sites to get information and assistance. Mainstream news organizations are also utilizing it for news and information. The scope for effective relief could become greater, especially if humanitarian agencies and policymakers as well as affected populations take advantage of these technological opportunities. Social media is not only an effective tool for monitoring and engaging the public during a disaster, but has also enabled a cultural shift regarding how the public views its role as an empowered contributor. Emergency management and crisis communication have become more participatory.

With 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 translate text or analyse maps (see Youth In Action 1 on Ushahidi).

Box 2. 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” were posted.[20]

20 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.

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 includes a subscription option that allows individuals to subscribe to alerts in specific locations by SMS or e-mail.

Nevertheless, 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 who may not always be 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.

Other challenges include the way to rapidly verify the accuracy and reliability of the information collected and posted. Information must be accurate and trusted. Hence, effective crowdsourced information requires near real-time validation techniques, otherwise the advantage of speed is lost. The right balance between faster access and reliability of information must be found. Options for validation include the following:

- The submission of information is restricted to trusted individuals. This approach could be described as “bounded” crowdsourcing.

- Information goes through “auto-validation”, when multiple sources describe the same event.

Case Study 14 : The Digital Operations Center

The American Red Cross (ARC) has created a Digital Operations Center (DigiDOC) in some of their Disaster Operations Center that allows Red Cross workers to monitor social media so that they can provide better humanitarian relief. It allows them to share safety and preparedness tips during disasters as well as monitor Facebook, Twitter, YouTube and blogs.

Though the ARC is not equipped to respond to individual calls for help, the ARC staff monitor Twitter trends and if there are recurring requests for some form of assistance, they then do their best to respond. On a daily basis, over 4,000 tweets reference the ARC, and this figure goes up dramatically during a disaster. DigiDOCs are one of the strategies to manage this big data challenge. The information disseminated as a result of the knowledge gained from the various social media channels is intended to empower communities and respond to their needs in the aftermath of major disasters.

DigiDOCS rely on a combination of technologies. The center is powered by Dell’s Radian6 platform and is modeled on Dell’s social media listening command center which is used to better run the company’s customer service operations. DigiDOCS also use satellite feeds to gain real-time views of disaster-stricken areas to increase efficiency and shorten the time taken to respond. Wireless technologies enable workers to quickly set up additional computers as needed.

Test Yourself (multiple answers are acceptable for some questions)

1. 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/INGO sector:

    a. Undertake warning and alerting
    b. Combat the effects of the hazard
    c. Reduce further damage to property
    d. Provide information to the public

2. 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:

    a. Provide strategic direction
    b. Manage information
    c. Facilitate task and problem management
    d. Forward plan

3. DRCC personnel requires the following information during an emergency:

    a. Baseline information about the communities affected by the hazard
    b. Information about the impact of the emergency
    c. Information about the hazards involved in the emergency
    d. Information about the affected population's needs and wants

4. A situation report will usually contain the following key headings:

    a. Overview of immediate effects from impact of event
    b. Estimate of problem: (Size? Scope? Area? Numbers involved?)
    c. Resources: (What has been done to date?)
    d. Tasks completed since last report

Youth in Action 4. Contribute to the InaSAFE Project

InaSAFE or the Indonesia Scenario Assessment for Emergencies Project has developed a free and open source software that produces realistic natural hazard impact scenarios for better planning, preparedness and response activities. It provides a simple but rigorous way to combine data from scientists, local governments and communities to provide insights into the likely impacts of future disaster events.

InaSAFE was conceived and initially developed by the Indonesia's National Disaster Management Agency and the Australian Agency for International Development, through the Australia-Indonesia Facility for Disaster Reduction and the World Bank Global Facility for Disaster Reduction and Recovery.

Discover how you can contribute to the InaSAFE Project at http://inasafe.org/en/.

Further Reading

Karen Joyce et. al., "Incorporating Remote Sensing into Emergency Management", *The Australian Journal of Emergency Management*, vol. 25, No. 4 (October 2010), pp. 14 - 23, http://www.ema.gov.au/www/emaweb/rwpattach.nsf/VAP/%289A5D88DBA63D32A661E6369859739356%29~WEMA+Vol25No4_Joyce+&+Wright+&+Ambrosia+&+Samsonov.PDF/$file/WEMA+Vol25No4_Joyce+&+Wright+&+Ambrosia+&+Samsonov.PDF.

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

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

CHAPTER 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[21]

Objectives:

- Provide an overview of disaster recovery and reconstruction
- Discuss how ICT can provide supporting information for disaster recovery planning
- Provide 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."[22]

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."[23] 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.

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.

21 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.

22 UNISDR, *2009 UNISDR Terminology*.

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

Another task to be accomplished by the information management and coordination agency is to work closely with implementing organizations of 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.

Case Study 15. 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 tasks 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

6.2 The Use of ICTs in Disaster Recovery and Reconstruction

As in other activities of DRM, ICTs play a vital role in carrying out activities under recovery and reconstruction. This starts with forming an Information Management and Coordination Agency right 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 systems in place before a disaster will affect recovery and reconstruction. Decision makers should understand the weak points in the ICT systems and any data gaps; and clearly identify the areas of future enhancement for filling the gaps. Too often, those needs are gradually placed under 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 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. Assessment is based on collected data of damages from both paper and digital information sources such as survey questionnaires, press articles, interviews, etc. 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.[24] The assessment of damage and losses after disaster is essential for the estimation of financial needs for recovery.

This methodology was first developed in the 1970s, and recently it has been expanded to include recovery needs.

Box 3. The process of loss assessment for inundation hazards

1. Identify the purpose of loss assessment
2. Organize consultation and information co-action
3. Define the area and time frame of the assessment
4. Select the type of assessment to be made
5. Obtain information about the hazard
6. Obtain information about the people, assets and activities at risk
7. Identify the types of losses
8. Measure the extent of losses from all sources
9. Decide whether to count “actual” or “potential” losses
10. Calculate annual average damage if needed
11. Assess benefits to region of analysis
12. Present the results of the loss assessment

The process of loss assessment for inundation hazards can be applied to all kinds of hazards with minor modifications.

24 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.

Questions To Think About

- What are the main differences between systems and methods used in crisis situation and those used during normal times?
- What is the damage and loss assessment methodology developed by the United Nations Economic Commission for Latin America and the Caribbean? What is the requirement for ICT tools in this methodology?

Case Study 16. Earth observations technology to survey collapsed structures

Earth observations 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. An estimated density of 4 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.

Source: The World Bank, *Safer Homes, Stronger Communities*, p. 263.

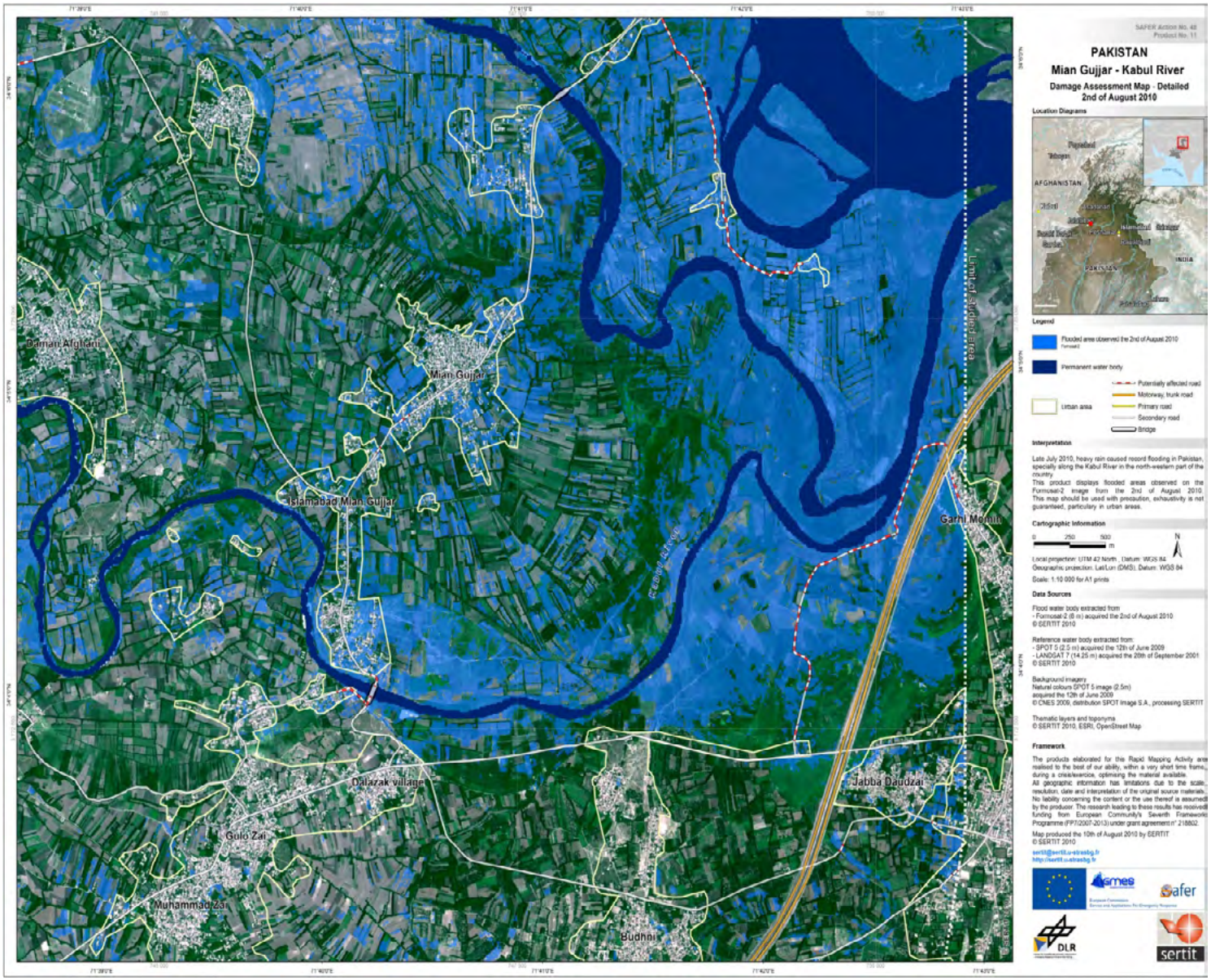
Strategy Formulation

One of the first priorities after a disaster has occurred is defining recovery and reconstruction strategies with a focus on early recovery. The next priority is planning for 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 the following:

- Social, demographic and geographic information
- Land-use and physical plans
- Utility services network information
- Housing data (occupancy, tenure, structural data)
- Infrastructure details
- National and local DRM plans
- Information on hazard, vulnerability and capacity 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.)

Figure 11. A satellite image of a section of the Mian Gujjar-Kabul River taken on 2 August 2010

This was used to rapidly identify flooded areas (in bright blue) and potentially-affected roads (shown as white and red dashed lines).



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, ICT is used to combine information from numerous sources to assist in getting timely and accurate processed information that helps in formulating relevant policies. Maps produced using GIS can visualize patterns, trends and correlations with other features. Also, information from various sources can be superimposed using GIS to identify risks and investment priorities, and to establish baselines for reconstruction.

Points To Remember

- Recovery and reconstruction efforts should always aim to “build back better”.
- To coordinate efforts for recovery and reconstruction, the establishment of an information management and coordination agency is important.
- Use standard systems and methodologies that have been approved by a recognized organization or is generally accepted and widely used in the DRM community. This allows the data collected to be exchanged between different systems, reduces data conversion costs, reduces misunderstanding of data, and promotes collaboration and re-use of data.

Questions To Think About

- What information is required for the formulation of recovery and reconstruction strategies.
- Why does the quality of ICT systems that are in place before a disaster affect recovery and reconstruction?

6.3 Implementation, Monitoring and Evaluation of Disaster Recovery and Reconstruction in a Changing Climate

During implementation, the information management agency should have a continuous dialogue with the agencies involved in relief and reconstruction and with local communities so that transparency and partnerships during the process are maintained. Once the government has approved the strategies for recovery and reconstruction, the clarification of roles and responsibilities among all the stakeholders has to be established. Resource availability should be confirmed and resources should be mobilized to implement the recovery and reconstruction measures agreed upon in the strategy.

Case Study 17. Databases to Track Beneficiary Cash Transfers After the 2004 Indian Ocean Tsunami in Banda Aceh, Indonesia

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: shelter, livelihoods recovery grants, registration for land title, and so on.

Source: The World Bank, *Safer Homes, Stronger Communities*, p. 262.

In other countries hit by the tsunami, the lack of an adequate database for food relief programmes was judged a significant weakness, particularly because it was the initial contact with most beneficiaries and could have been the foundation for the registration of all recovery programmes.[25]

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.

There are widely used pre-set systems for project monitoring. The Donor/Development Assistance Database[26] is one of the web-based tools that can be used in 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."[27]

The Challenges of Disaster Recovery and Reconstruction in a Changing Climate

The increase in the frequency and severity of weather- and climate-related disasters is a serious concern in the DRM community. There is already evidence of increases in weather extremes in some regions.

Climate change will affect disaster risks in two ways: 1. through the likely increase in weather and climate hazards, and 2. through increases in the vulnerability of communities to natural hazards, due to ecosystem degradation, reductions in water and food availability, and changes to livelihoods. Climate change will add yet another stress to those of environmental degradation and rapid unplanned urban growth, further reducing communities' abilities to cope with even the existing levels of weather hazards.

25 Lesley Adams and Retno Winahyu, Learning from cash responses to the tsunami (ODI, 2007).

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

27 Development Assistance Database – fact sheet (n.d.).

Thus, climate change and disaster risk reduction are closely linked. More extreme weather events in future are likely to increase the number and scale of disasters. This poses serious challenges for DRM. However, disaster recovery and reconstruction processes provide an opportunity to reduce weather- and climate-related disaster risks and improve communities' capacity to adapt to climate change effects.

For example, the "low regret" is the most popular concept in recent days as an effective measure to apply in disaster recovery and reconstruction. It can offer benefits in the present and the future, and also addresses improvements in livelihoods, human well-being and biodiversity conservation. Under this concept, the long-term strategy and plan that can effectively integrate structural and non-structural, human-oriented interventions will be considered in a comprehensive and holistic way for disaster recovery and reconstruction as well as to reduce disaster risk.

This means when the needs for recovery and reconstruction are identified, it should integrate disaster risk reduction associated with existing climate variability and future climate change. This will facilitate the formulation of comprehensive early recovery actions, medium-term recovery and reconstruction plans, and a long-term risk management and reduction strategy. These should be adopted and implemented to reduce the impact of future disasters, which are likely to be more intense due to climate change.

Questions To Think About

- Why do we need to consider climate change effects in the process of disaster recovery and reconstruction?
- How do we convince stakeholders to tackle future climate change effects when capacities and resources to address current challenges are limited?

Test Yourself (multiple answers are acceptable for some questions)

1. The main phases/activities under disaster recovery and reconstruction include:

   a. recovery and reconstruction strategy formulation
   b. damage and needs assessment
   c. implementation mechanism
   d. loss assessment

2. Widely used ICT tools in preparedness for disaster communications are:

   a. Broadcast radio and television
   b. Mobile phone systems
   c. Electric power
   d. Internet communications

3. Which data is critical for recovery and reconstruction planning?

    a. Information on hazard, vulnerability and capacity of the area
    b. Contact details of emergency personnel
    c. National and local DRM plans
    d. Utility services network information

4. How will climate change affect disaster risks?

    a. More weather- and climate-related disasters
    b. Less earthquakes
    c. Food insecurity
    d. Urbanization

Something To Do

Read Chapter 17 of the book on "Safer Homes, Strong Communities" on ICT in Reconstruction.

https://www.gfdrr.org/housingreconstruction

Further Reading

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.

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

Claude de Ville de Goyet, "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.

UNISDR, "Climate Change Adaptation", http://www.unisdr.org/we/advocate/climate-change

CONCLUSION

In development circles today, DRM is often treated holistically rather than as a single issue. It is an essential component of any development framework.

This Primer discusses the ways in which ICT has positively affected the various phases of DRM. It aims to serve as a useful resource for compiling and disseminating good practices in ICT for DRM, for the reference of students from different countries following a range of related courses.

In the end, the Primer hopes to support sustainable development by encouraging young people to help reduce disaster risk through working in their respective professions in a manner that is responsible and sensitive to any decisions and actions that may help keep people out of harm's way.

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 Communitybased 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

Additional UN-APCICT/ESCAP Programmes and Resources

The Academy of ICT Essentials for Government Leaders
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.

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 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 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

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