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ICT for Disaster Management

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Asia-Pacific Development Information Programme
e-Primers for the Information Economy, Society and Polity

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LIST OF ACRONYMS

ADPC	Asian Disaster Preparedness Center
ADRC	Asian Disaster Reduction Centre
ADRRN	Asian Disaster Reduction and Response Network
APCICT	Asian and Pacific Training Centre for Information and Communication Technology for Development
APDIP	Asia-Pacific Development Information Programme
ASEAN	Association of Southeast Asian Nations
CAP	Common Alerting Protocol
DAD	Development Assistance Database
FACTS	Food and Commodity Tracking System
FOSS	Free and Open Source Software
GDIN	Global Disaster Information Network
GIS	Geographic Information System
HF	High Frequency
ICT	Information and Communications Technology
ICT4D	Information and Communications Technology for Development
IDRN	India Disaster Resource Network
ITU	International Telecommunication Union
MANDISA	Monitoring, Mapping and Analysis of Disaster Incidents in South Africa
MDG	Millennium Development Goal
NDWC	National Disaster Warning Center
NGO	Non-Governmental Organization
OASIS	Organization for the Advancement of Structured Information Standards
PACTEC	Partners in Technology International
PDA	Personal Digital Assistant
PDC	Pacific Disaster Center
SMS	Short Message Service
TEWS	Tsunami Early Warning System
TSF	Télécoms Sans Frontières
UHF	Ultra High Frequency
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UN/ISDR	United Nations International Strategy for Disaster Reduction
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNOSAT	United Nations Institute for Training and Research Operational Satellite Applications Programme
US	United States
USAID	United States Agency for International Development
VHF	Very High Frequency

FOREWORD

The United Nations International Strategy for Disaster Reduction (UN/ISDR) has calculated that of the 5,210 disasters recorded in the world between 1991 and 2005, 2,029 (approximately 40 percent) have occurred in the Asia-Pacific region. Several other reports have stated that in the last three years alone, the region has been prone to more natural disasters than in the last three decades. Earthquakes across Indonesia and other countries in the region have now become annual occurrences for the last three years, particularly in areas along the Sumatra fault, the origin of the earthquake that spawned the 2004 tsunami. The year 2006 was also notable in that the Pacific typhoon season ran year-round, causing considerable physical damage and loss of life in many Asian countries, including China, the Democratic People's Republic of Korea, the Philippines, the Republic of Korea and Viet Nam.

The consequences of natural and man-made disasters and the vulnerabilities to which populations are exposed can be mitigated if they are targeted proactively. Though one must always remember that it is not always possible to completely eliminate a risk, extensive experience and practice in the past few decades have demonstrated that the damage caused by any disaster can be minimized largely by careful planning, mitigation and prompt action.

In this context, information and communications technology (ICT) can potentially play a pivotal role in disaster prevention, mitigation and management. Remote sensing for early warning is made possible by various available technologies, including telecommunication satellites, radar, telemetry and meteorology. ICT encompasses both traditional media (radio, television) as well as new media (cell broadcasting, Internet, satellite radio), all of which can play a major role in educating the public on the risks of a potential or impending disaster. Before disasters strike, ICTs are used as a conduit for disseminating information on an impending danger, thereby making it possible to take the necessary precautions to mitigate the impact of these disasters. In order for this to be possible, it is critical that there be consistency in the application of ICT and the dissemination of warning messages to at-risk areas. Such warning dissemination must be widespread and should educate the public on the potential risks to the local area. No matter how expensive or sophisticated, a warning system can never be totally effective without an education component.

Furthermore, ICT plays a critical role in facilitating the reconstruction process and in coordinating the return of those displaced by disasters to their original homes and communities. Disaster management activities, in the immediate aftermath of a disaster, can be made more effective by the use of appropriate ICT tools. These include tools for resource management and tracking, communication under emergency situations (e.g. use of Internet communications), collecting essential items for the victims, and national and international fundraising.

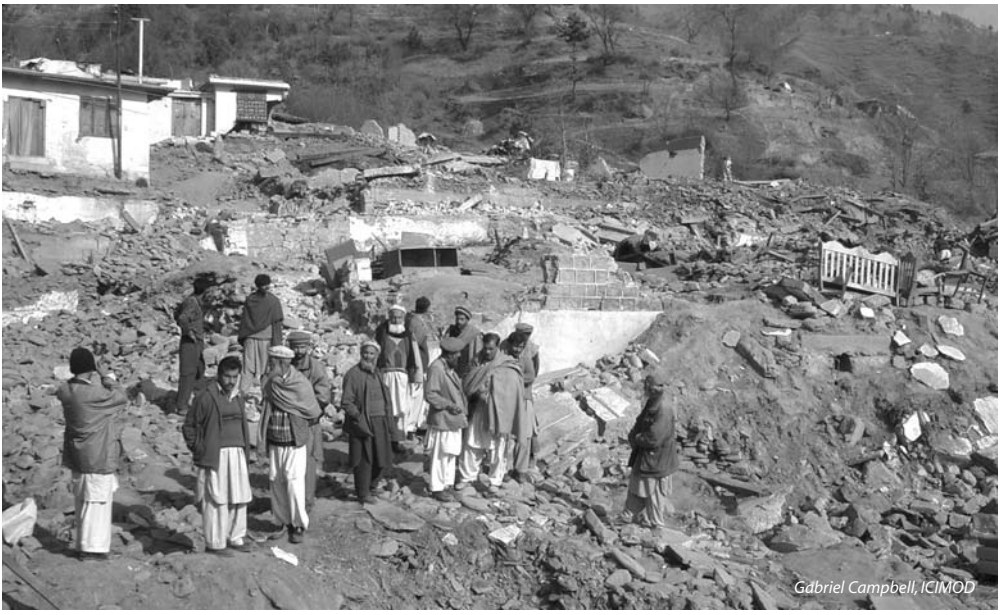
Since the December 2004 Indian Ocean tsunami, the Asian Disaster Preparedness Center (ADPC) together with the International Telecommunication Union (ITU) have taken initiatives to study the current situation of emergency communications in the Asia-Pacific countries and to give recommendation on national emergency telecommunication and national early warning system setups. Assessments were conducted in Bangladesh, Maldives and Sri Lanka on these emergency communication systems. To enhance early warning systems, ADPC, under the Indian Ocean Early-Warning System programme, also introduced the Tsunami Alert Rapid Notification System Programme with emphasis on robust ICT systems to disseminate information and warnings from the national to the community level.

In line with this, I am pleased to introduce this e-Primer brought to you by the United Nations Development Programme's Asia-Pacific Development Information Programme (UNDP-APDIP) and the Asian and Pacific Training Centre for Information and Communication Technology for Development (APCICT). I am confident that this e-Primer will play an effective role in enhancing and propagating awareness of various ICT tools and will serve as a guide to policy makers, disaster management practitioners and media personnel on how best to use ICT tools to successfully counter the threat of disaster.

Prof. Krasae Chanawongse
Chairman
ADPC Board of Trustees

INTRODUCTION

The term 'disaster', meaning 'bad star' in Latin, is defined as an impact of a natural or man-made hazard that causes human suffering or creates human needs that the victims cannot alleviate without assistance. The word's root is from astrology and implies that when the stars are in a bad position, a bad event is about to happen. In a recent document published by the United Nations Development Programme (UNDP) in the Americas, a disaster is defined as 'a social crisis situation occurring when a physical phenomenon of natural, socio-natural or anthropogenic origin negatively impacts vulnerable populations ... causing intense, serious and widespread disruption of the normal functioning of the affected social unit'.[1] According to another widespread definition, disasters occur when hazards strike in vulnerable areas.[2]



Transforming crisis to opportunity: Pakistan prepares to rebuild from the ruins

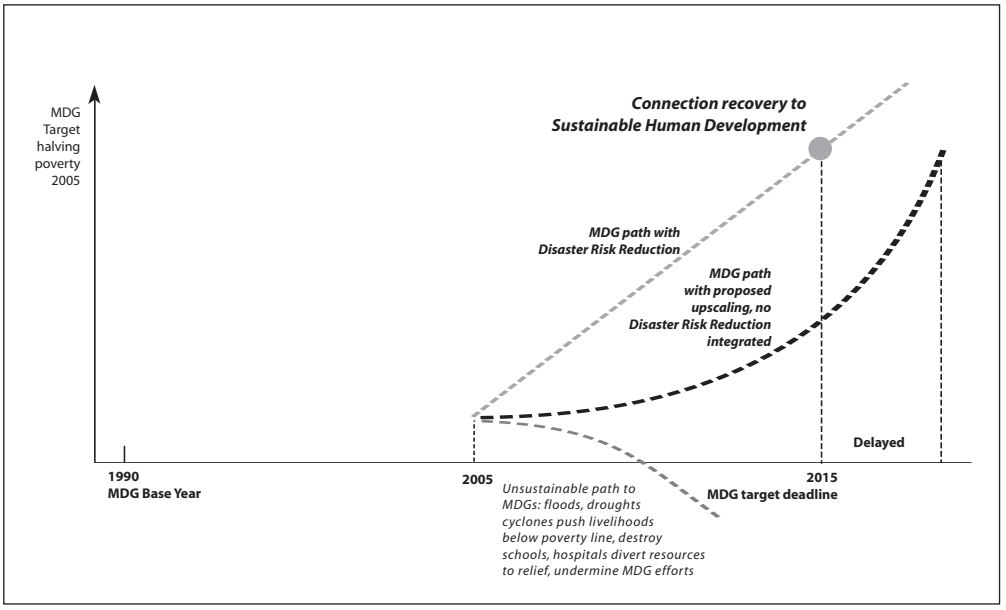
In development circles today, disaster management is often treated holistically rather than as a single issue. It is an essential component of any development framework. Proper disaster management has been recognized as a key requirement towards achieving the Millennium Development Goals (MDGs) by the specified target of 2015, as illustrated in Figure 1. Meanwhile, information and communications technology for development (ICT4D)[3] has been recognized as one of the key enablers for achieving the MDGs.

[1] Complete definition of disaster by UN/ISDR: A social crisis situation occurring when a physical phenomenon of natural, socionatural or anthropogenic origin negatively impacts vulnerable populations and their livelihoods, production systems infrastructure and historical heritage, causing intense, serious and widespread disruption of the normal functioning of the affected social unit. The impacts and effects cannot be overcome with the resources autonomously available to the affected society. Impacts are expressed in different forms such as the loss of life, health problems, the destruction, loss or rendering useless of the totality or part of private or collective goods and severe impacts on the environment. These negative impacts require an immediate response from the authorities and from the population in order to attend the affected and to re-establish acceptable thresholds of wellbeing and life opportunities. (Source: Living with Risk: A global review of disaster reduction initiatives, UN/ISDR).

[2] A hazard may not necessarily result in a disaster. For example, an undersea earthquake might not result in the loss of any lives or damage to property, and a typhoon is not a disaster until heavy rain and wind cause damage or disruption to inhabited areas (to human life, infrastructure, production, etc.).

[3] ICT4D is an initiative aimed at bridging the digital divide (the disparity between technological 'have' and 'have not', geographic locations or demographic groups) and aiding economic development by ensuring equitable access to up-to-date communication technologies. ICT includes any communications device – encompassing radio, television, mobile phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning.

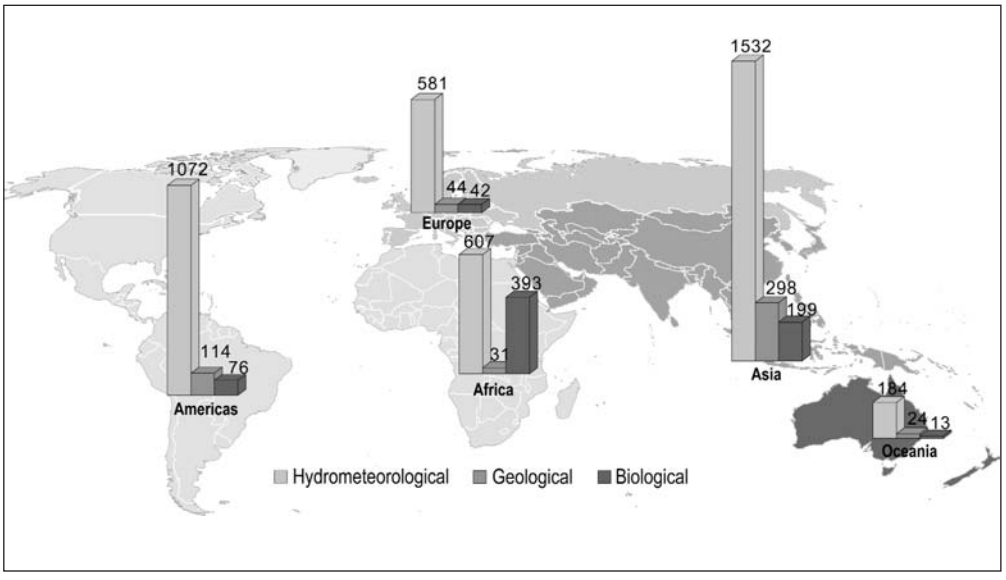
Figure 1: Contribution of Disaster Management Efforts to MDG Achievement



Source: UN/ISDR.

Recent events have shown that there is no country that does not stand the threat of a disaster, though they may be threatened at different levels. Therefore, disaster preparedness is no longer a choice; it is mandatory irrespective of where one lives. As shown in Figure 2, the Asia-Pacific region is one of the most risk-prone areas for disasters, based on disaster occurrences since 1995.

Figure 2: Number of Disasters by Origin: Regional Distribution, 1995–2004

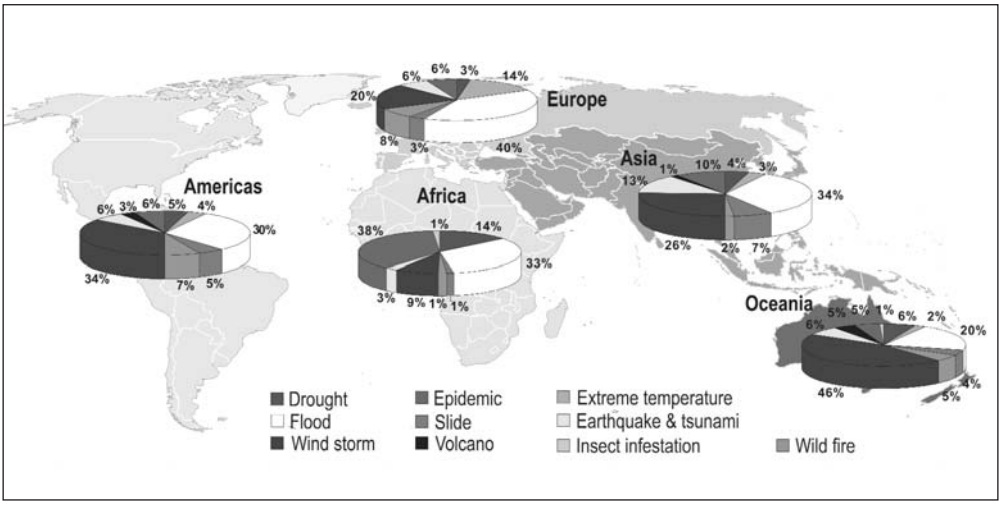


Source (base map): UNEP/DEWA/GRID-Europe. November 2004.
http://www.unisdr.org/disaster-statistics/occurrence-type-disas.htm

Monsoon floods in Kathmandu Valley

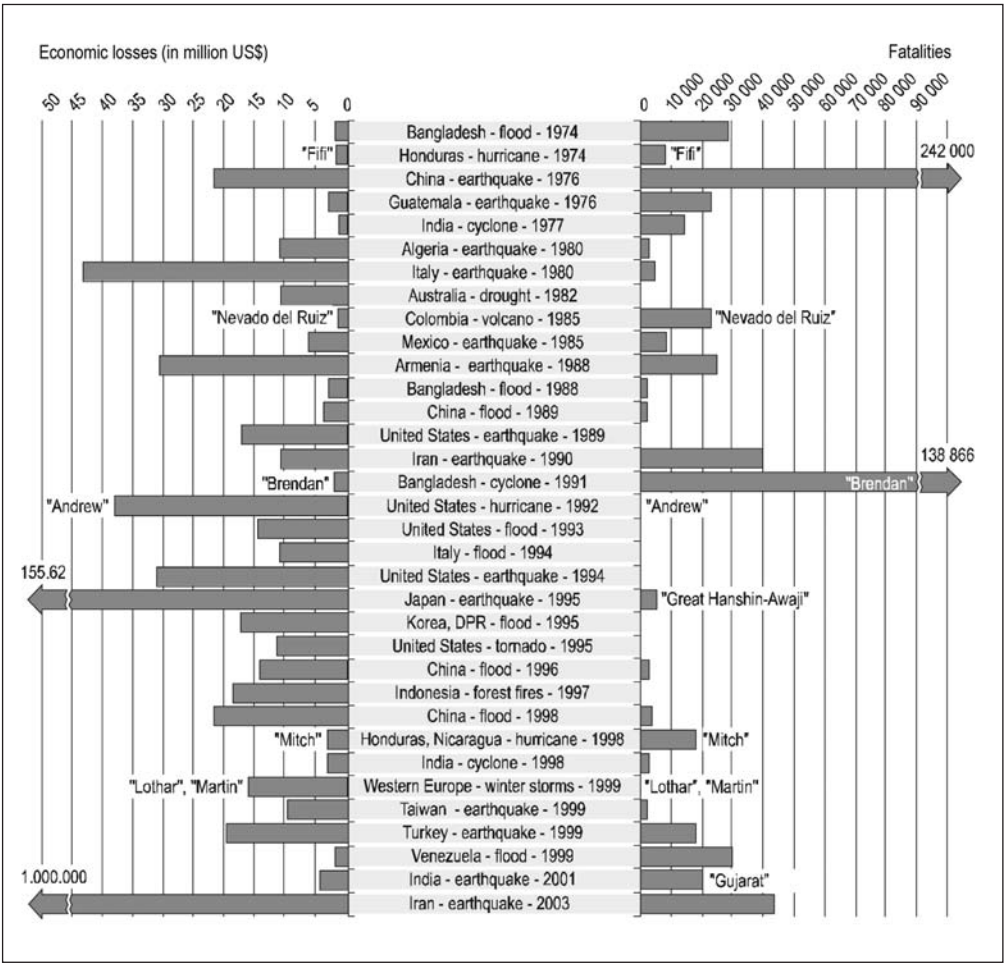
Risk types vary and increase depending on a country's geographic location. For instance, countries like China, Indonesia, Iran and Pakistan are prone to earthquakes. Small island states in the Pacific region and countries like the Maldives are prone to various types of threats from the sea. Bangladesh and parts of China and India experience floods each year. Figure 3 shows how different types of disasters are distributed across regions, while Figure 4 highlights some of the worst disasters mankind has faced over the past 30 years.

Figure 3: Regional Distribution of Disasters: By Triggering Hazards, 1995–2004



Source: (base map): UNEP/DEWA/GRID-Europe, November 2004.
http://www.unisdr.org/disaster-statistics/occurrence-type-disas.htm

Figure 4: Large-Impact Disasters over the Last 30 Years



Source: EM-DAT: The OFDA/CRED International Disaster Database – http://www.em-dat.net – Université Catholique de Louvain – Brussels-Belgium, 2004.
** Includes disasters with at least 2,000 people killed or US$10 billion of economic losses (2002 US$ value).*

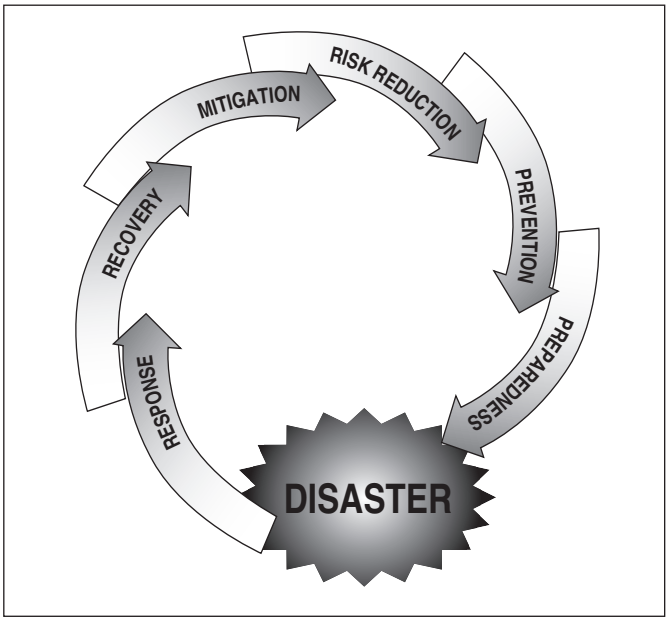
Some countries have also encountered man-made hazards recently (e.g. river pollution in China). Environmental pollution taking place today could be the origin of many man-made disasters in the coming years. In addition, with the increased mobility of people, there is always the danger of a serious outbreak of a fatal disease (e.g. avian flu, mad cow disease and SARS). This too may lead to disastrous situations.

DISASTER MANAGEMENT

There are no standardized rules defining the different phases of the disaster management cycle. Different agencies use different cycles depending upon their objectives. However, while approaches vary, it is agreed that disaster management activities should be carried out in a cycle. Figure 5 illustrates the phases of the disaster management cycle, which are described as follows:

- **Mitigation:** any activity that reduces either the chance of a hazard taking place or a hazard turning into disaster.
- **Risk reduction:** anticipatory measures and actions that seek to avoid future risks as a result of a disaster.
- **Prevention:** avoiding a disaster even at the eleventh hour.
- **Preparedness:** plans or preparations made to save lives or property, and help the response and rescue service operations. This phase covers implementation/operation, early warning systems and capacity building so the population will react appropriately when an early warning is issued.
- **Response:** includes actions taken to save lives and prevent property damage, and to preserve the environment during emergencies or disasters. The response phase is the implementation of action plans.
- **Recovery:** includes actions that assist a community to return to a sense of normalcy after a disaster.

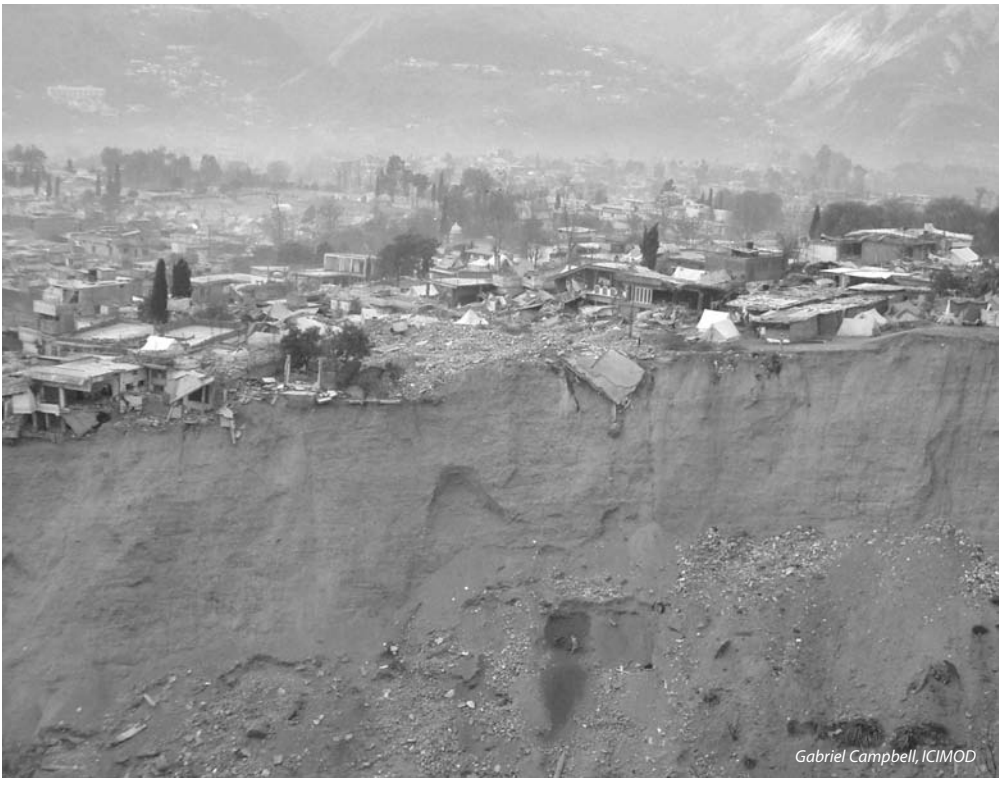
Figure 5: The Disaster Management Cycle



These six phases usually overlap. ICT is used in all the phases, but the usage is more apparent in some phases than in others.

ICT FOR DISASTER PREVENTION, MITIGATION AND PREPAREDNESS

The first important steps towards reducing disaster impact are to correctly analyse the potential risk and identify measures that can prevent, mitigate or prepare for emergencies. ICT can play a significant role in highlighting risk areas, vulnerabilities and potentially affected populations by producing geographically referenced analysis through, for example, a geographic information system (GIS). The importance of timely disaster warning in mitigating negative impacts can never be underestimated. For example, although damage to property cannot be avoided, developed countries have been able to reduce loss of life due to disasters much more effectively than their counterparts in the developing world (see Table 1). A key reason for this is the implementation of effective disaster warning systems and evacuation procedures used by the developed countries, and the absence of such measures in the developing world.



A major landslip after the earthquake in Muzaffarabad, Pakistan

Table 1: Comparison of Damage Caused by Three Recent Disasters

Incident	Considered area	Number of deaths	Estimated financial loss
Indian Ocean tsunami (December 2004)	Sri Lanka	30,920 or 38,195 (two different official estimates)	US$1 billion damage and US$1.8 billion recovery costs
Northern Pakistan earthquake (October 2005)	Pakistan	87,350 (official) Over 100,000 (unofficial)	US$5 billion
Hurricane Katrina (August 2005)	New Orleans, USA	1,604 accounted for (both direct and indirect) 2,000 missing	US$25 billion-US$100 billion US$75 billion (according to the US National Hurricane Center)

Sources: BBC: http://news.bbc.co.uk; Central Bank of Sri Lanka: http://www.cbsl.lk; http://www.pakquake.com; US National Hurricane Center: http://www.nhc.noaa.gov

All the figures reported in Table 1 are rough estimates as it is impossible to have exact figures in such situations. However, Table 1 clearly shows that in the case of Hurricane Katrina, although the economic loss and damage to property were much higher, the number of deaths was remarkably less than that resulting from the Indian Ocean tsunami in Sri Lanka and the Pakistan earthquake. This is largely because in Sri Lanka and Pakistan, the victims were mainly communities living below the poverty line – a factor that significantly contributed to their vulnerability – and because effective disaster warning systems were not in place. In New Orleans, official warnings were dispatched in advance and many in the affected areas were evacuated in time. In addition, the disaster management process was much better than what it had been in Sri Lanka and Pakistan, despite the heavy criticism it received.

A warning can be defined as the communication of information about a hazard or threat to a population at risk, in order for them to take appropriate actions to mitigate any potentially negative impacts on themselves, those in their care and their property (Samarajiva et al., 2005).

The occurrence of a hazard does not necessarily result in a disaster. While hazards cannot be avoided, their negative impacts can be mitigated. The goal of early public warning is to ensure to the greatest extent possible that the hazard does not become a disaster. Such warnings must be unambiguous, communicate the risks succinctly and provide necessary guidance.

The success of a warning can be measured by the actions that it causes people to take, such as evacuation or avoiding at-risk areas. In a disaster situation, there is no doubt that timely warnings allow people to take actions that save lives, reduce damage to property and minimize human suffering. To facilitate an effective warning system, there is a major need for better coordination among the early warning providers as well as those handling logistics and raising awareness about disaster preparedness and management.

While disaster warnings are meant to be a public good, they are often most effectively delivered through privately-owned communication networks and devices. There are many new communication technologies that allow warning providers not only to reach the people at risk but also to personalize their warning message to a particular situation. Opportunities are available right now to significantly reduce loss of life and potential economic hardship if disaster warning systems can be improved.

It is important to note that disaster warning is indeed a system, not a singular technology, constituting the identification, detection and risk assessment of the hazard, the accurate identification of the vulnerability of a population at risk, and finally, the communication of

information about the threat to the vulnerable population in sufficient time and clarity so that they can take action to avert negative consequences. This final component underscores the importance of education and creating awareness in the population so that they may respond with the appropriate actions (Samarajiva et al., 2005).

Key Players in Disaster Warning

The United Nations International Strategy for Disaster Reduction (UN/ISDR) identifies several key parties that play major roles in the disaster management process, especially in disaster warning (UN/ISDR, 2006).

Communities, particularly those most vulnerable, are vital to people-centred early warning systems. Their input into system design and their ability to respond ultimately determine the extent of risk associated with natural hazards. Communities should be aware of hazards and potential negative impacts to which they are exposed and be able to take specific actions to minimize the threat of loss or damage. As such, the geographic location of a community is an essential determinant in the selection of disasters on which the system should focus their community education. For example, coastal communities need to be educated and prepared for the possibility of a tsunami, while a mountain community can be educated to respond to an early warning system for landslides.

Local governments should have considerable knowledge of the hazards to which their communities are exposed. They must be actively involved in the design and maintenance of early warning systems, and understand information received to be able to advise, instruct or engage the local population in a manner that increases their safety and reduces the potential loss of resources on which the community depends.

National governments are responsible for policies and frameworks that facilitate early warning, in addition to the technical systems necessary for the preparation and issuance of timely and effective hazard warnings for their respective countries. They should ensure that warnings and related responses are directed towards the most vulnerable populations through the design of holistic disaster response and early warning frameworks that address the specific needs of the related micro- and macro-level actors. The provision of support to local communities and local governments to develop operational capabilities is an essential function to translate early warning knowledge into risk reduction practices.

Regional institutions and organizations should provide specialized knowledge and advice in support of national efforts to develop or sustain the operational capabilities of countries that share a common geographical environment. Regional organizations are crucial to linking international capabilities to the particular needs of individual countries and in facilitating effective early warning practices among adjacent countries.

International bodies should provide support for national early warning activities and foster the exchange of data and knowledge between individual countries. Support may include the provision of advisory information, technical assistance, and policy and organizational support necessary to ensure the development and operational capabilities of national authorities or agencies responsible for early warning practice.

Non-governmental organizations (NGOs) play a critical role in raising awareness among individuals and organizations involved in early warning and in the implementation of early warning systems, particularly at the community level. In addition, they play an important advocacy role to help ensure that early warning stays on the agenda of government policy makers.

The private sector has a diverse role to play in early warning, including developing early warning capabilities in their own organizations. The private sector is also essential as they are usually better equipped to implement ICT-based solutions. The private sector has a large untapped potential to help provide skilled services in the form of technical manpower, know-how, or donations of goods or services (in-kind and cash), especially for the communication, dissemination and response elements of early warning.

The media plays an important role in improving the disaster consciousness of the general population and in disseminating early warnings. The media can be the critical link between the agency providing the warning and the general public.

The scientific community has a critical role in providing specialized scientific and technical input to assist governments and communities in developing early warning systems. Their expertise is critical to analysing the risks communities face from natural hazards, supporting the design of scientific and systematic monitoring and warning services, fostering data exchange, translating scientific or technical information into comprehensible messages, and disseminating understandable warnings to those at risk.

Channels Used for Disaster Warning

The following are some of the media – both traditional and new – that can be effectively used for disaster warning purposes. Some may be more effective than the rest, depending on the nature of the disaster, the regions affected, the socio-economic status of the affected communities and their political architecture. However, it is not a question of one medium against another. All are means to a common goal of passing along disaster warnings as quickly and as accurately as possible. Any one or combination of the following media can be used for that purpose.

Radio and Television

Considered the most traditional electronic media used for disaster warning, radio and television have a valid use. The effectiveness of these two media is high because even in developing countries and rural environments where the tele-density is relatively low, they can be used to spread a warning quickly to a broad population. The only possible drawback of these two media is that their effectiveness is significantly reduced at night, when they are normally switched off.

A study on media, perception and disaster-related behaviour in Bangladesh revealed that early, easily understandable and language-appropriate warning dissemination through radio can reduce the potential death toll of catastrophic cyclone and tidal bore. The study, conducted by the Forum for Development, Journalism and Communication Studies, recommended that relevant authorities develop innovative warning signal systems and take 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. Mohammad Sahid Ullah, the Chittagong University professor who led the study, suggests that part of the process is increasing public confidence in broadcast media since self-evacuation and the poor quality of shelters are the major causes of death (Sahid Ullah, 2003).

After the Indian Ocean tsunami of 2004, many radio manufacturers considered introducing new digital radio alert systems that react even if the set is switched off. In order to trigger this alarm, a special flag integrated into the received signal from a terrestrial transmitter or a satellite would be used and the set would automatically tune to the emergency broadcast channel. The only disadvantage of this system is that to introduce a new generation of receivers in analogue environment generally takes 5 to 10 years. With digital receivers, this would be somewhat easier (Dunnette, 2006).

Box 1: UNDP Supports Radio Programme to Reduce Tsunami Trauma

The devastating tsunami that hit Indonesia and other countries in December 2004 left behind a trail of death and destruction. Thousands died and livelihoods were destroyed. Besides the physical havoc, the tsunami also inflicted deep psychological scars on the survivors. Having suddenly lost close relatives, houses and work tools, those who did not perish were profoundly traumatized. In order to address this pressing problem, UNDP is supporting a radio programme to reduce the trauma in Meulaboh, in the province of Aceh, Indonesia.

The one-hour show is broadcast weekly on Saturdays at Dalka FM, the oldest and most popular station in the district. The main target audience is internally displaced persons who are still living in temporary camps. The project is implemented in partnership with Samaritan Purse and a local NGO, Yayasan Mulia Hati. "The radio programme is part of our strategy to assist 13,000 displaced people. We have 30 counsellors who work closely with the community, so the programme is grass-roots based," says Frida Kawulusan, the counselling programme manager.

The topics covered in the radio programme stem from interaction with the community. A counsellor and a psychologist expert go to the studio and provide hints and advice on how to cope with various forms of stress. The programme has addressed issues such as how to control emotions, family relations, worries about employment and income, housing conditions, as well as establishing a community support network.

Asnawati, a 45-year-old woman who is still living in the temporary barracks, does not miss a show: "The most interesting topic I heard in the show is how to control our emotions. Now I understand why people like me get angry and what I can do about it." Holding her mobile phone, she adds: "If I have a pressing problem, I send an SMS and ask for advice."

Grass-roots connections and interactivity have turned the trauma radio show into one of the highest audience ratings programmes in the region. Bound by disaster and resilience, tsunami survivors find new ways to move forward and rebuild their lives.

Source: http://www.undp.or.id/tsunami/view.asp?Cat=st&FileID=20060711-1

Telephone (Fixed and Mobile)

Telephones can play an important role in warning communities about the impending danger of a disaster. There were many examples of how simple phone warnings saved many lives in South Asian countries during the 2004 tsunami.

Perhaps the most famous was an incident that occurred in one small coastal village of Nallavadu in Pondicherry, India. A timely telephone call – warning about the impending tsunami – was said to have saved the village's entire population of 3,600 inhabitants, as well as those of three neighbouring villages.

Villagers of Nallavadu were involved in the M.S. Swaminathan Research Foundation's Information Village Research Project. Vijayakumar, a former project volunteer, was working in Singapore and heard a tsunami alert issued there. He immediately phoned the research centre in Nallavadu, which issued an alert. His quick thinking, followed by swift and coordinated action, led to the evacuation of the four villages before the tsunami hit the coast (Subramanian, 2005).

In some countries, mechanisms called 'telephone trees' are used to warn communities of impending dangers. An individual represents a 'node' in a telephone tree. When that individual receives a warning message (either through phone or by other means), s/he is supposed to make a pre-determined number of phone calls (usually four or five) to others in a pre-prepared

list. This arrangement not only ensures the timely delivery of the warning message, but also ensures the minimum duplication of efforts.

However, there are two drawbacks to using telephones for disaster warning. Telephone penetration in many areas is still not satisfactory – particularly in rural and coastal areas most at risk. Even with the exponential increase in the number of phones that has occurred in recent years, there are still many regions in the Asia-Pacific region, where a telephone is considered a luxury. The other drawback is the congestion of phone lines that usually occurs immediately before and during a disaster, resulting in many phone calls in that vital period that cannot be completed.

Short Message Service

Short message service (SMS) is a service available on most digital mobile phones that permits the sending of short messages (also known as 'text messages', 'SMSes', 'texts' or 'txts') between mobile phones, other handheld devices and even landline telephones.

During the 2005 Hurricane Katrina disaster in the US, many residents of affected coastal areas were unable to make contact with relatives and friends using traditional landline phones. However, they could communicate with each other via SMS more easily when the network was functional. This is because SMS works on a different band and can be sent or received even when phone lines are congested. SMS also has another advantage over voice calls in that one message can be sent to a group simultaneously.

Cell Broadcasting

Most of today's wireless systems support a feature called cell broadcasting. A public warning message in text can be sent to the screens of all mobile devices with such capability in any group of cells of any size, ranging from one single cell (about 8 kilometres across) to the whole country if necessary. CDMA, D-AMPS, GSM and UMTS[4] phones have this capability.

There are four important points to recall about the use of cell broadcasting for emergency purposes:

- There is no additional cost to implement cell broadcasting. It is already resident in most network infrastructure and in the phones, so there is no need to build any towers, lay any cable, write any software or replace handsets.

- It is not affected by traffic load; therefore it will be of use during a disaster, when load spikes tend to crash networks, as the London bombings in 2005 showed. Also, cell broadcasting does not cause any significant load of its own, so it would not add to congestion.

- Cell broadcasting is geo-scalable, so a message can reach hundreds of millions of people across continents within a minute.

- It is geo-specific, so that government disaster managers can avoid panic and road jamming by telling each neighbourhood specifically if they should evacuate or stay put.

The only possible disadvantage to cell broadcasting is that not every user may be able to read a text message when they receive it. In many Asia-Pacific countries, a sizeable population of the phone users cannot read and understand a message sent in English. Thus, it is essential to send warning messages in local languages. However, these messages would still be inaccessible to those who cannot read, even in their own language.

[4] CDMA, D-AMPS, GSM and UMTS are popular mobile phone system standards used around the world. CDMA, D-AMPS and GSM are considered second-generation technologies, while UMTS is a newer third-generation system designed to replace GSM.

The Dutch Government plans to start using cell broadcasting for emergency warnings. The infrastructure is already in operation with the operators KPN, Telfort and Vodafone. It is believed to be the first multi-operator warning system in the world, based on cell broadcasting with government use (Clothier, 2005).

Satellite Radio

A satellite radio or subscription radio is a digital radio that receives signals broadcast by communications satellite, which covers a much wider geographical range than terrestrial radio signals.

Satellite radio functions anywhere there is line of sight between the antenna and the satellite, given there are no major obstructions such as tunnels or buildings. Satellite radio audiences can follow a single channel regardless of location within a given range.

Satellite radio can play a key role during both disaster warning and disaster recovery phases. Its key advantage is the ability to work even outside of areas not covered by normal radio channels. Satellite radios can also be of help when the transmission towers of the normal radio station are damaged in a disaster.

Table 2: Radio Communication Media Used in Disaster Warning and Management

Disaster phases	Major radio communication services involved	Major tasks of radio communication services
Prediction and detection	Meteorological services (meteorological aids and meteorological-satellite service) Earth exploration satellite service	Predicting weather and climate Detecting and tracking earthquakes, forest fires, hurricanes, oil leaks, tsunamis, typhoons, etc. Providing warning information
Alerting	Amateur radio services	Receiving and distributing alert messages
	Broadcasting services, terrestrial and satellite (radio, television, etc.)	Disseminating alert messages and advice to large sections of the public
	Fixed services, terrestrial and satellite	Delivering alert messages and instructions to telecommunication centres for further dissemination to public
	Mobile services (terrestrial, satellite, maritime, etc.)	Distributing alert messages and advice to individuals
Relief	Amateur radio services	Assisting in organizing relief operations in affected areas (especially when other services are still not operational)
	Broadcasting services, terrestrial and satellite (radio, television, etc.)	Coordinating relief activities by disseminating information from relief planning teams to population
	Earth exploration satellite service	Assessing damage and providing information for planning relief activities
	Fixed services, terrestrial and satellite	Exchanging information between different teams/groups for planning and coordination of relief activities
	Mobile services (terrestrial, satellite, maritime, etc.)	Exchanging information between individuals and/or groups of people involved in relief activities

Source: ITU.
http://www.itu.int/ITU-R/index.asp?category=information&link=emergency&lang=en

The International Telecommunication Union (ITU) has identified various radio communication media that can be used in disaster-related situations (see Table 2).

Internet/Email

The role Internet, email and instant messages can play in disaster warning entirely depends on their penetration within a community and usage by professionals such as first responders, coordinating bodies, etc. While these media can play a prominent role in a developed country, where nearly half of all homes and almost all offices have Internet connections, this is not the case in the developing world. In many developing countries, less than 5 percent of the population uses the Internet and even those who are users do not use it on a regular basis. In such a situation, it is difficult to expect Internet and email to play any critical role.

In spite of that drawback, many disaster-related activities are already underway within the Internet community. For example, a new proposal for using the Internet to quickly warn large numbers of people of impending emergencies is currently being drafted by the Internet Engineering Task Force.

At a 1997 international conference on 'Harnessing the Internet for Disasters and Epidemics', participants raised issues affecting their ability to use the Internet for improving crisis management. Concerns included the high cost of technology, a lack of content in local languages, and governmental controls on information exchange. "The most significant obstacle impeding widespread Internet usage was the widening gap between those with unlimited access and those, whose access to information and new technologies was restricted by economic, linguistic, cultural or administrative constraints", highlights the Pan American Health Organization's report on the conference. Without direct communication between decision makers and without a free flow of reliable information among all involved, effective contingency planning and emergency response are at risk (Putnam, 2002).

Box 2: Common Alerting Protocol (CAP)

In many countries, common carriers such as radio, television and telephone networks have used individual public alert technologies for hazards or threats such as weather events or civil defence. From the societal perspective of public warning investments, it makes no sense to create separate public warning systems for each particular threat. Efficient use of funds as well as effectiveness of public warning both argue for using standards and combining the public warning requirement for all-media coverage with the requirement for an all-hazards approach.

A standards-based, all-media, all-hazards public warning strategy not only makes sense for governments to alert the public, it makes sense for information technology providers and communication carriers as well. As these providers migrate to digital technologies, services are being offered that integrate radio and television with cellular and satellite telephone and with a variety of Internet-based and other network services. A service that supports all-hazard alerts and warnings is no longer so much a matter of designing specialized communications technology as it is a matter of simply agreeing on common standards for the content and handling of such alerts.

The Common Alerting Protocol (CAP) is an open, non-proprietary standard digital data interchange format that can be used to collect all types of hazard warnings and reports locally, regionally and nationally, for input into a wide range of information management and warning dissemination systems. CAP standardizes the content of alerts and notifications across all hazards, including law enforcement and public safety, as well as natural hazards such as earthquakes, fires, severe weather, tsunamis, etc. Systems using CAP have shown that a single authoritative and secure alert message can quickly launch Internet messages, news feeds, television text captions, highway sign messages, and synthesized voiceover automated telephone calls or radio broadcasts.

This project acts on several recommendations of the 'Effective Disaster Warnings' report issued in November 2000 by the Working Group on Natural Disaster Information Systems, Subcommittee on Natural Disaster Reduction. It also draws on various earlier professional discussions such as the recurring 'Common Alerting Protocol' thread in the Networks in Emergency Management email forum during the 1990s.

These are some of the key benefits of CAP over individual systems:

- Automatic multi-channel dissemination of warning messages will extend the reach of warning messages and enhance the effectiveness of those messages by providing timely corroboration of warnings from several sources.

- Such a system will simplify the work of alerting officials by giving them a write-it-once method for issuing warnings over multiple dissemination systems without duplicate effort.

- The CAP will enhance government's 'situational awareness' at the state, regional and national levels by providing a continual real-time database of all warnings, even local ones. (This information about local warnings, unavailable to state and local officials at present, could be crucial to the timely evaluation of certain threats, such as, biological terrorist attacks, which are most readily identified by detecting patterns in local responses.)

- Special-needs populations including the deaf and hearing-impaired, the blind and visually-impaired, and non-English speakers will be better served by consistent delivery of warnings and public safety information through all available channels.

- By decoupling the diverse elements of the national warning infrastructure, CAP will allow technology developers and sponsors to expand, upgrade or even replace existing facilities without disrupting entire systems. A mechanism for warning system 'interoperability' will free system providers to innovate and improve their services without facing barriers due to technological 'legacies'.

The CAP 1.0 specification was approved by the Organization for the Advancement of Structured Information Standards (OASIS) in April 2004. The OASIS is a non-profit international consortium that drives the development, convergence and adoption of e-business standards. Members themselves set the OASIS technical agenda, using a lightweight, open process expressly designed to promote industry consensus and unite disparate efforts. OASIS produces worldwide standards for security, web services, conformance, business transactions, supply chain, public sector, and interoperability within and between marketplaces.

Based on experience with CAP 1.0, the OASIS Emergency Management Technical Committee adopted an updated CAP 1.1 specification in October 2005.

Sources:
http://www.oasis-open.org/committees/download.php/5830/CAP_Factsheet
http://www.incident.com/cookbook/index.php/Welcome_to_the_CAP_Cookbook
http://en.wikipedia.org/wiki/Common_Alerting_Protocol

Amateur and Community Radio

For almost a century, amateur radio (also known as 'ham radio') operators have assisted their communities and countries during disasters by providing reliable communications to disaster relief organizations at a moment's notice – especially when traditional communications infrastructure breaks down. In such a situation, amateur radio operators transmit emergency messages on voice mode about the well-being of survivors and information on casualties to friends and relatives. As was evident during the Indian Ocean tsunami that destroyed electricity and communications infrastructure in the Andaman and Nicobar Islands, amateur radio operators were the critical link between the islands and the Indian mainland and helped in the coordination of rescue and relief operations.

Besides disseminating voice-based messages, some amateur radio operators can also transmit in digital modes that include technologies such as radio teletype, tele-printing over radio, packet radio transmission and the recent Phase Shift Keying, 31 Baud – a type of modulation.

Amateur radio broadcasters are authorized to communicate on high frequency (HF), very high frequency (VHF), ultra high frequency (UHF) or all three bands of the radio spectrum. They require a license from the licensing authority to ensure that only competent operators use their skills. However, depending on the country, obtaining a license can be a long process.

Messages can be disseminated using one or more of the available bands. HF waves travel long distances, while VHF and UHF waves travel very short distances as these are line-of-sight propagation. However, repeaters increase the communications range and temporary repeaters can be set up in an emergency so that messages can reach the nearest town or city (Acharya, 2005).

There are no well-known case studies where community radio has been successfully used for disaster warning purposes. The main reason can be because this is not a widespread media channel in many countries. Even where there are community radio systems, they operate within limited areas. Nevertheless, community radio is a medium that can be very effectively used for disaster warning purposes. The effectiveness of this medium is being tested through a disaster warning system implemented by Sarvodaya, the most widespread NGO in Sri Lanka (Daily News, 2006).

Sirens

Though not necessarily an ICT-based solution, sirens can be used in tandem with other ICT media for final, localized delivery.

The strengths of each medium and the challenges in using them are summarized in Table 3.

Table 3: Comparison of Different Communication Channels Used in Disaster Warning

Channel	Benefits	Challenges
Radio and Television	Widespread	Takes time to get the warnings Limited use at night
Telephone (fixed and mobile)	Messages delivered quickly	Problems of authenticity Does not reach non-users Congestion
SMS	Quick Messages can be sent to groups	Congestion Does not reach non-users Local language problems
Cell broadcasting	No congestion Can address a group simultaneously	Does not reach non-users Local language problems
Satellite radio	High reachability	Cannot be used to educate masses Only good for specific points
Internet/Email	Interactive Multiple sources can be checked for accuracy of information	Not widespread
Amateur/Community radio	Excellent for rural, poor and remote communities	Not widespread People lose interest if used only in case of disaster
Sirens	Can be used even at night Good in rural areas	Maintenance of the system Cannot disseminate a detailed message

GIS and Remote Sensing in Disaster Management[5]

GIS can be loosely defined as a system of hardware and software used for storage, retrieval, mapping and analysis of geographic data. Spatial features are stored in a coordinate system (latitude, longitude, state, plane, etc.) that references a particular place on the earth. Descriptive attributes in tabular form are associated with spatial features. Spatial data and associated attributes in the same coordinate system can then be layered together for mapping and analysis. GIS can be used for scientific investigations, resource management and development planning.

Remote sensing is the measurement or acquisition of information about an object or phenomenon by a recording device that is not in physical or intimate contact with the object. In practice, remote sensing is the remote utilization (as from aircraft, spacecraft, satellite or ship) of any device for gathering information about the environment. Thus, an aircraft taking photographs, earth observation and weather satellites, monitoring of a foetus in the womb via ultrasound, and space probes are all examples of remote sensing. In modern usage, the term generally refers to techniques involving the use of instruments aboard aircraft and spacecraft.

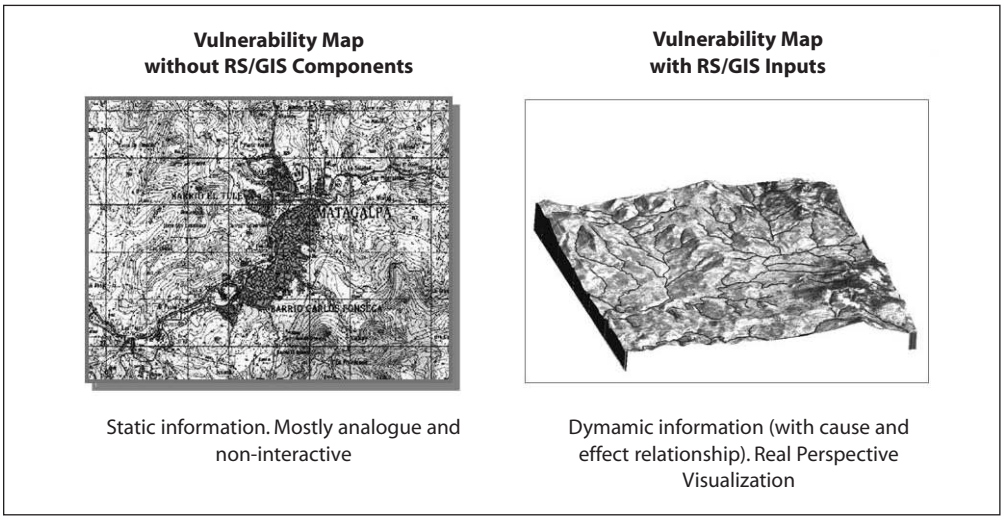
As disaster management work usually involves a large number of different agencies working in different areas, the need for detailed geographical information in order to make critical decisions is high. By utilizing a GIS, agencies involved in the response can share

[5] Information on GIS taken from:
Jayaraman,V. 2006.'Framework for Regional Cooperation on Space Technology Supported Disaster Reduction Strategies in Asia and the Pacific'. Presentation at the ESCAP Meeting of Eminent Experts, 3-4 August 2006, Bangkok, Thailand;
Johnson, Russ. 2000.'GIS Technology for Disasters and Emergency Management', Environmental Systems Research Institute, Inc. white paper. http://www.esri.com/library/whitepapers/pdfs/disastermgmt.pdf;
Northwest GIS Services, Inc. http://www.nwgis.com;
Raheja,Naresh, Ruby Ojha and Sunil R Mallik.Role of internet-based GIS in effective natural disaster management. http://www.gisdevelopment.net/technology/gis/techgi0030.htm; and
Space Technology, GIS and Disaster Management in Afghanistan, Afghanistan Information Management Service Project. http://www.aims.org.af/services/sectoral/d_m/space_tech_and_d_m/space_tech_and_d_m.html

information through databases on computer-generated maps in one location. Without this capability, disaster management workers have to access a number of department managers, their unique maps and their unique data. Most disasters do not allow time to gather these resources. GIS thus provides a mechanism to centralize and visually display critical information during an emergency.

There is an obvious advantage to using a map with remote sensing or GIS inputs instead of a static geographical map. A static map is mostly analogous and is not interactive. On the other hand, a vulnerability map with GIS input provides dynamic information with cause and effect relationship. As shown in Figure 6, the visualization effect is much more effective in the latter case.

Figure 6: Difference Between an Ordinary (2D) Map and a Map with GIS Input



Source: UNOSAT, 2004.

GIS-based space technology solutions have become an integral part of disaster management activities in many developed and some developing countries. The United Nations Office for Outer Space Affairs has been implementing a Space Technology and Disaster Management Programme to support developing countries in incorporating space-based solutions in disaster management activities.

The use of GIS in different phases can be illustrated as follows:

Planning

Locating and identifying potential problems is a core requirement in disaster management. GIS can be used effectively to achieve this objective. Using a GIS, it is possible to pinpoint hazard trends and start to evaluate the consequences of potential emergencies or disasters. When hazards are viewed with other map data, such as buildings, residential areas, rivers and waterways, streets, pipelines, power lines, storage facilities, forests, etc., disaster management officials can formulate mitigation, preparedness, response and possible recovery needs.

Information derived from remote sensing and satellite imagery plays an important role in disaster management and crisis prevention. Their effective application depends not solely on technical specifications, but is influenced by factors such as data collection, processing and distribution, capacity building, institutional development and information sharing. Earth observation satellites could be used to view the same area over long periods of time and, as a result, make it possible to monitor environmental change, human impact and natural processes. This would facilitate scientists and planners in creating models that would simulate trends observed in the past, present and also assist with projections for the future.

Mitigation

After potential emergency situations are identified, mitigation needs can be addressed. This process involves analysing the developments in the immediate aftermath of a disaster, evaluating the damage and determining what facilities are required to be reinforced for construction or relocation purposes. Mitigation may also include implementing legislation that prevents building structures in areas prone to earthquake, flood or tsunami. Other mitigation approaches may target fire-safe roofing materials in wildfire hazard areas. Utilizing existing databases linked to geographic features in GIS makes the task of monitoring these possible.

Preparedness

During the preparedness and response phases, GIS can accurately support better response planning in areas such as determining evacuation routes or locating vulnerable infrastructure and vital lifelines, etc. It also supports logistical planning to be able to provide relief supplies by displaying previously available information on roads, bridges, airports, railway and port conditions and limitations. Apart from this, activities such as evacuee camp planning can also be done using GIS.

GIS can also provide answers to some of the questions important to disaster management officers, such as the exact location of the fire stations if a five-minute response time is expected or the number and locations of paramedic units required in a specific emergency. Based on the information provided by GIS, it is also possible to estimate what quantity of food supplies, bed space, clothes and medicine will be required at each shelter based on the number of expected evacuees.

In addition, GIS can display real-time monitoring for emergency early warning. Remote weather stations can provide current weather indexes based on location and surrounding areas. Wind direction, temperature and relative humidity can be displayed by the reporting weather station. Wind information is vital in predicting the movement of a chemical cloud release or anticipating the direction of wildfire spread upon early report. Earth movements (earthquake), reservoir level at dam sights, radiation monitors, etc. can all be monitored and displayed by location in GIS. If necessary, this type of information and geographic display can be delivered over the Internet to the public.

Case Study: The Tsunami Early Warning System (TEWS) for South-East Asia

The Indian Ocean tsunami of December 2004 took many Asian countries by surprise. There was virtually no warning until thousands of people suddenly found themselves in the middle of giant killer waves.

In the aftermath of the tsunami, several international meetings have been held among countries in the Indian Ocean rim to concertedly address threats from similar disasters. It was agreed that arrangements for a Tsunami Early Warning System (TEWS) in the Indian Ocean and South-East Asia should build on existing institutions, strengthen national capacities, integrate early warning with preparedness, mitigation and response (end-to-end), and must furthermore be integrated into existing warning systems to promote a multi-hazard approach.

The partner countries in this effort were Cambodia, China, Lao PDR, Myanmar, Philippines, Singapore, Thailand and Viet Nam.

The Asian Disaster Preparedness Center (ADPC) is a non-profit organization supporting the advancement of safer communities and sustainable development through implementing programmes and projects that reduce the impact of disasters upon countries and communities in Asia and the Pacific, by:

- Developing and enhancing sustainable institutional disaster risk management capacities, frameworks and mechanisms, and supporting the development and implementation of government policies;
- Facilitating the dissemination and exchange of disaster risk management expertise, experience and information; and
- Raising awareness and enhancing disaster risk management knowledge and skills.

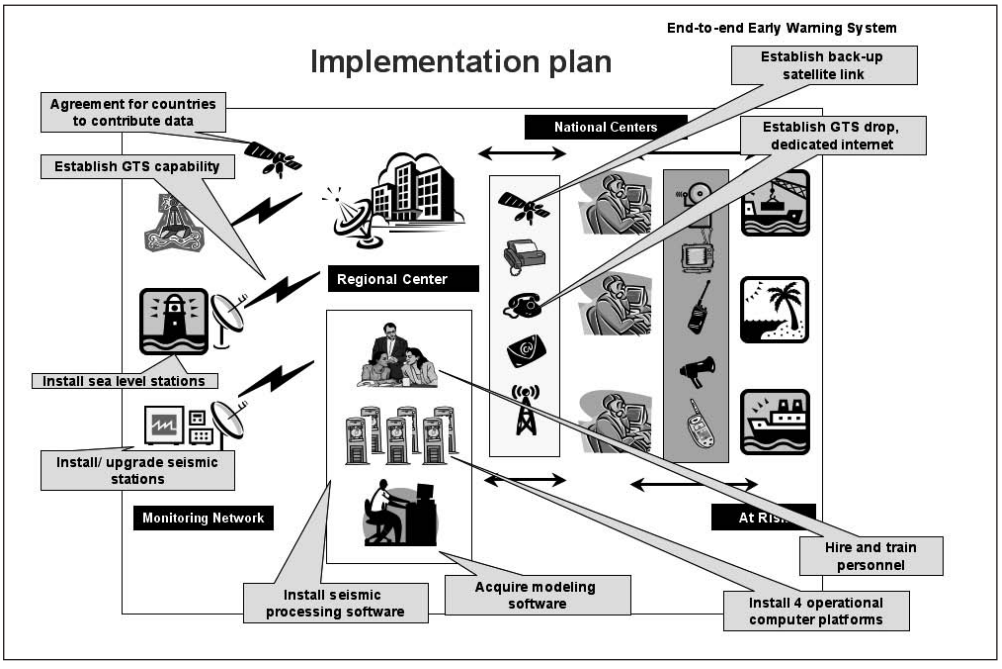
In March 2005, ADPC, in partnership with the Royal Thai Government and in collaboration with the United Nations Economic and Social Commission for Asia and the Pacific, organized a Regional Meeting of the above countries to assess the feasibility of implementing a Multi-Hazard Early Warning System in South-East Asia.

In April 2005, Bangladesh and Sri Lanka indicated interest in receiving similar support to enhance their national early warning capacity and capabilities. Consequently, ADPC has been working with these governments and in the Maldives to enhance emergency communication systems through an ITU-funded project. ADPC furthermore completed an assessment of Sri Lanka's early warning systems through a separate UNDP-funded project.

The donor agencies for the implementation of TEWS are UNDP, The Danish National Development Agency and the United States Agency for International Development (USAID).

This warning system is designed to be end-to-end, encompassing both technological components and the training of both affected and at-risk communities in preparedness and response measures. Each component is important and should be given equal development focus. The non-technical components of hazard mapping and risk assessment, risk reduction and preparedness activities, and efficient warning dissemination reaching vulnerable local coastal communities are the most challenging to develop in a comprehensive early warning system, as these involve societal dimensions.

Figure 7: Implementation Plan of the Tsunami Early Warning System



Source: ADPC.

Some of the existing early warning systems in the region address recurrent hazards such as cyclones/typhoons, floods and drought. Investing in hazard monitoring and forecasting for a rare event such as a tsunami is costly in terms of capital and the required investment of human resources.

Hence, in the face of low tsunami frequency, but the prevalence of high-risk coastal zones (due to population growth and development), resources to undertake hazard monitoring and forecasting are pooled in a regional monitoring system and forecasting centre in order to provide an economically sustainable system.

The technical components are comprised of a network of seismographic stations, sea-level gauges and deep-sea pressure sensors, a data-processing and tsunami forecasting centre, and communication links to regional tsunami warning centres. These are in turn linked to national disaster management and warning systems.

The network will utilize relevant facilities already available in the countries (assessed by the Inter-Governmental Oceanographic Commission and in national workshops arranged by ADPC) and consider the establishment of new ones.

The network of accelerographs, to be located in islands close to the coastlines of Indonesia and the Nicobar and Andaman Islands, will provide rapid estimation of the tsunamagenic potential of an earthquake. Deep-ocean pressure sensors detect the early passage of a tsunami before it reaches shallow waters and the coast. Sea-level gauges, to be strategically located close to tsunami sources and in areas that would provide sufficient lead-time for response, are essential in determining the passage of a tsunami wave following an earthquake, to monitor its progress, estimate the severity of the hazard along the coast, and provide a basis for declaring the end of a hazard.

The sea-level gauge stations are designed for long-term sea-level monitoring, but are capable of monitoring tsunami and storm surges. High-frequency sea-level data will be transmitted via the European Organisation for the Exploitation of Meteorological Satellites Meteosat-5 and the Japanese Meteorological Agency's Geostationary Meteorological Satellites, and are connected to the Global Sea-Level Observation System Core Network.

Risk assessments and training will be conducted with the relevant national authority. Utilizing satellite imagery, GIS and further applicable technologies, ADPC will support bathymetric surveys and national training workshops on risk mapping, conduct a pilot risk-mapping survey (to be replicated in other vulnerable locations by the national authorities), and support regional workshops on numerical prediction models facilitated by the acquisition of the modelling tools.

Community preparedness activities are the most critical component of this system. The technological capacity of a system is obsolete without a prepared or fully aware public. Despite the dissemination of a warning, communities that lack sufficient preparedness and training in effective responses to both the warning and the event remain acutely vulnerable.

Box 3: The Role of Media in Disaster Warning: Reuters AlertNet

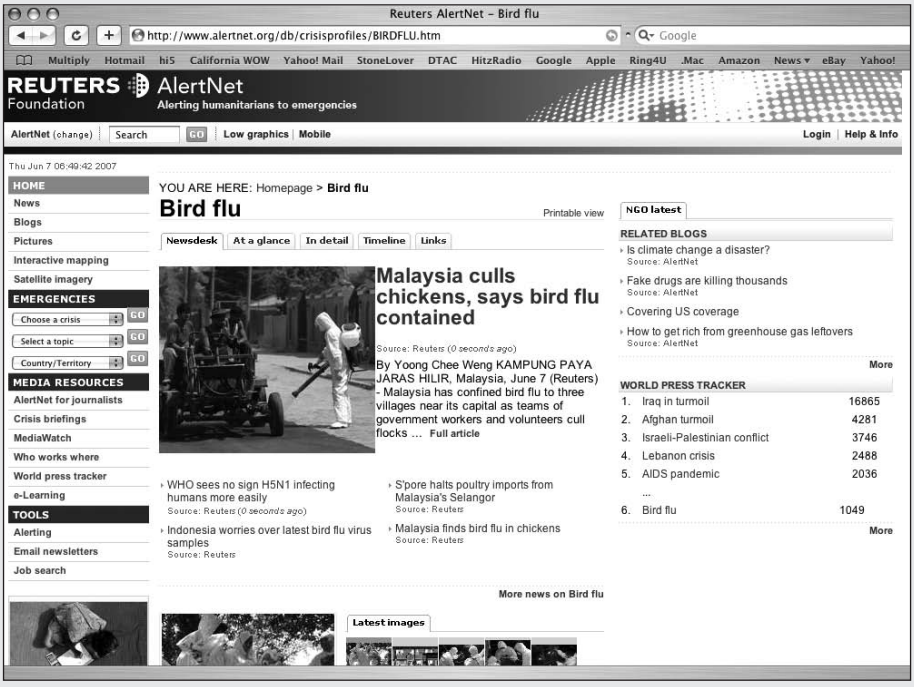
Reuters AlertNet is a good example of an ICT/media initiative that contributes towards early disaster warning and management at an international level. AlertNet was set up in 1997 by Reuters Foundation – an educational and humanitarian trust – to direct Reuters' core skills of speed, accuracy and freedom from bias to the service of the humanitarian community. It is a humanitarian news network based on a popular website that aims to keep relief professionals and the wider public up-to-date on humanitarian crises around the globe (AlertNet, 2006).

AlertNet has been in operation for more than a decade now. It was born in the aftermath of the Rwanda crisis of 1994, when the Reuters Foundation became interested in media reports of poor coordination between emergency relief charities on the ground. It surveyed charities to determine what could be done to remedy this. The conclusion was that there was a need for a service that would:

- Deliver operation-critical information to relief charities worldwide;
- Encourage relief charities to exchange information; and
- Raise awareness of humanitarian emergencies among the general public.

These overlapping objectives are summarized in the Reuters AlertNet tagline 'Alerting humanitarians to emergencies'.

Figure 8: AlertNet Website



AlertNet categorizes emergencies into four types, namely: health-related, sudden onset, food-related and conflict. In practice, emergencies do not fit neatly into such categories, frequently overlapping in a complex manner in which it is difficult to separate cause and effect. AlertNet's presentation of emergency material aims to make clear these areas of overlap.

Reuters is the main source of information for AlertNet, but it is not the only source. AlertNet finds information from many other sources as well. They do this with a surprisingly limited full-time staff.

AlertNet tracks all emergencies for which it is possible to find reliable information. In particular, one will find coverage of emergencies that, for a variety of reasons, receive only sporadic coverage elsewhere in the media – so-called 'forgotten' or 'hidden' emergencies. For example, the north-eastern Indian state of Assam has experienced several massive floods, with thousands of people displaced and made homeless, but proper warning and evacuation procedures mean that the death toll has usually been low or non-existent. Being a regular seasonal event rather than a sudden new disaster makes it even less likely to make headlines beyond the local media.

AlertNet attracts more than three million users a year, has a network of 400 contributing humanitarian organizations, and its weekly email digest is received by more than 17,000 readers (Gidley, 2005).

ICT FOR DISASTER RESPONSE

The most difficult period of a disaster is the immediate aftermath. This period calls for prompt action within an exceptionally short period of time. In the aftermath of any disaster, a significant number of individuals will be injured and/or displaced. Many of them may still be living with the trauma they have encountered, including loss of loved ones. Affected individuals may also be without food or other essential items. They might be waiting in temporary shelters, with no idea what to do next. Some might need immediate medical attention, while the disaster aftermath environment also creates ideal breeding grounds for possible epidemics.

Charged with leading the response, authorities may find themselves with limited resources and without any comprehensive plans to use them or to find more. They often need the help of a third party, which can include donors, both institutions and individuals. These institutions may have assistance to offer, but know no means in which they can provide it as they may not have any link with those who are working in the field.

The following case studies illustrate how ICT can be used effectively to address such problems in the immediate post-disaster period.

Case Study 1: Sahana Disaster Management System in the Aftermath of the Indian Ocean Tsunami in 2004 and Pakistani Earthquake in 2005

Sahana, a free and open source software (FOSS)-based system developed by Lanka Software Foundation, is a suite of web-based applications that provides solutions to the problems arising in a post-disaster situation. The following examples show how Sahana assisted disaster victims during the Indian Ocean tsunami in 2004 and the Pakistani earthquake the following year.

Result of heavy jolt by the earthquake in Pakistan

Example 1: Tracing Missing Persons

After a disaster, there are often a large number of individuals missing. It is common to find families scattered and children separated from their parents. Outside relatives and friends, especially those living overseas, naturally want to know the latest information about the condition of their loved ones. The psychological strain on children can be severe and it is essential that they be reunited with their families as soon as possible.

One objective of Sahana is to assist victims in connecting with their families and friends as soon as possible. Sahana's Missing Person Registry is an electronic version of a bulletin board of missing and found people. It can capture information not only on the people missing, but also about those who seek details about the missing, thus increasing their chance of reuniting. Even if the victims or families do not have access to this information themselves, it is quite easy for any authorized NGO or civil society group to connect to the central portal and provide that service in the areas they are working.

Example 2: Coordinating Donor Groups

In the immediate aftermath of the 2004 tsunami in Sri Lanka, there was a massive outpouring of support from international NGOs, local NGOs and community groups. There were at least 300 NGOs working on the same goals, though they used different approaches. In an environment where resources are in short supply, it is essential that response efforts should not be duplicated. Otherwise, such duplication can result in issues such as congested supply routes, competition between organizations, double vaccinations and saturation of support provided to some areas while other affected areas are neglected. Consequently, goodwill can be lost.

This coordination task is too much for an authorized emergency controller to handle manually. An ICT solution can thus be the ideal solution. For instance, an electronic organization registry can help immensely. It can effectively track who is doing what, where, when and, more importantly, whether there are areas in which services are not adequate. This awareness can enable volunteers and organizations to distribute themselves evenly across affected regions.

Sahana has developed such an organization registry. It keeps track of all the relief organizations and civil society groups working in the disaster region. It captures information on both the places where they are active and the range of services they are providing in each area to ensure that there is no overlap.

Example 3: Recording the Locations of Temporary Camps and Shelters

In a disaster situation, there are usually no pre-planned locations for camps and shelters. A temporary shelter or camp can be anywhere and can range in size from a large government-maintained camp to an individual house. Due to these differences, it is necessary to record the locations and populations of all camps. This is paramount to distributing aid effectively and ensuring that no affected areas are inadvertently ignored. A sub-application of the Sahana system keeps track of the location of all the camps in the region. It also records basic data on the facilities they might have and the number of people in them. If necessary it can provide a GIS view to plot the location of the camps in the affected area (De Silva, undated).

Case Study 2: Use of Internet in the Aftermath of the 1999 Earthquake in Turkey

On 17 August 1999, a major earthquake caught people off guard in Izmit, Turkey, resulting in 15,000 deaths. A second earthquake occurred on 12 November of the same year in Duzce, claiming 1,000 lives. In addition to these casualties, almost twice as many people were displaced as a result of both events. A total of 120,000 houses were damaged beyond repair while 50,000 houses were partially damaged.

During the Izmit earthquake, telecommunications infrastructure was so extensively damaged that it was impossible to access emergency services. The use of public phones was almost impossible, while mobile phone networks were operating with reduced bandwidth. In addition, many of the microwave repeaters mounted on apartment buildings had been damaged during the quake. In this situation, Internet was the only possible medium that could connect the affected areas to the outside world. Several Internet applications were used in the post-disaster response, mainly in two key areas: coordination of aid disbursement and finding information about missing people.

Due to system disruption, donors often found themselves acting as the distributors of aid as well, thus, the Internet proved a valuable resource. NGOs played a central role in the provision of discussion lists for the coordination of donations so that donors could find the most in need, identify what they were in need of, and in some cases, determine how to get there. Internet was also used to provide information regarding the whereabouts of missing family members. For example, many organizations formed 'message lines', which acted as a database of people found, their condition or the degree of damage to the region in which relatives lived (Zincir-Heywood & Heywood, 2000).

The importance of information security and privacy can never be underestimated in ICT-based humanitarian systems. In these cases, data privacy is not just a matter of encryption, it can also be a matter of life and death. If data falls into the wrong hands, it can result in rape and sexual harassment, child and female trafficking, child soldier recruits, prostitution and even ethnic cleansing. This is especially the case when a disaster occurs in an ethno-politically volatile region, where the technology and frameworks conceptualized and implemented need to be deeply cognizant of ground realities and tensions between ethnic groups, factions and non-state actors.

Case Study 3: UNOSAT's Role in Disaster Response During the 2004 Indian Ocean Tsunami[6]

The United Nations Institute for Training and Research Operational Satellite Applications Programme (UNOSAT) provides the international community and developing countries with enhanced access to satellite imagery and GIS services. These tools are used mainly in humanitarian relief, disaster prevention and post-crisis reconstruction. UNOSAT also acquires satellite images from all commercial providers.

UNOSAT provides services on:

- Image processing;
- Map production;
- Methodological guidance;
- Technical assistance; and
- Training.

The UNOSAT core team consists of UN fieldworkers as well as satellite imagery experts, geographers, database programmers and Internet communication specialists. This unique combination gives UNOSAT the ability to understand the needs of the users and to provide them with suitable, tailored solutions.

UNOSAT has been active during many recent disasters. When the Indian Ocean tsunami struck on 26 December 2004, UNOSAT provided an immediate overview of the situation prior to triggering the International Charter Space and Major Disasters the day after. UNOSAT immediately created regional maps of potential impact and more focused maps of the areas reported to be heavily affected in the first days after the disaster. The first UNOSAT map was on-line and distributed to field users on 29 December 2004.

[6] Information from UNOSAT website: http://unosat.web.cern.ch/unosat

Satellite image analyses and map production provided UN colleagues and the international humanitarian community with regional and local damage assessment maps using a wide range of satellite sensors. The Imagery Bank was on-line as of 14 January 2005 with a large amount of free satellite data obtained through the Charter and the US Government. Currently, over 670 raw satellite images and over 200,000 tsunami maps are available on its website at http://unosat.web.cern.ch/unosat.

Box 4: Sarvodaya.org in the Aftermath of the Indian Ocean Tsunami in 2004

The Internet, a form of media that did not play any role as a warning system in Sri Lanka, was surprisingly one of the media used most effectively in the immediate aftermath of the tsunami. It was used in two key approaches. First, Internet was widely used for dissemination of tsunami-related news both in broadcast and unicast modes. Second, Internet was used as an indispensable fund-raising tool. This was made possible due to the interactive nature of the Internet and its ability to not only raise awareness, but also to act as a payment mechanism.

The following case study illustrates how effectively the new digital media can be used for fund-raising and disaster recovery activities.

Sarvodaya is a Sri Lankan non-profit organization developed around a set of coherent philosophical tenets drawn from Buddhism and Gandhian thought. It has been operational for almost half a century. Built on the visionary leadership of Dr. A. T. Ariyaratne, today Sarvodaya is Sri Lanka's largest and most broadly embedded people's organization, with a network covering 15,000 villages, 34 district offices, over 100,000 youth, and the country's largest micro-credit organization, with a cumulative loan portfolio of over US$10 million.

With its past experience in responding to similar disasters, Sarvodaya is seen as one of the most qualified organizations to handle recovery measures in a disaster situation. However, the tsunami impact was of such a large scale that even Sarvodaya could not launch a well-planned programme. Immediately after the tsunami, Sarvodaya deployed its entire available staff at its Headquarters and as many as possible in the field to deal with the devastation caused by the tsunami, ignoring nearly all of its day-to-day regular activities both in the field and at the Headquarters. For about a week, normal Sarvodaya work came to a virtual standstill. Many volunteers as well as private sector organizations and other agencies assisted in this effort.

Sarvodaya utilized Internet for dissemination of information as well as fund-raising. In fact, a young group of bloggers at Sarvodaya Headquarters in Sri Lanka and its international centres in the US and the UK worked around the clock to channel information received from Sarvodaya district coordinators on the ground in affected areas to the Internet. They also registered and built a new web portal specifically for the event. This portal, http://www.sarvodaya.org, became a tsunami information gateway to the world, with hundreds of popular websites like Google, Apple, Nortel and U2 linking the site with millions around the globe. Sir Arthur C. Clarke, a distinguished resident of Sri Lanka, made a special reference to the Sarvodaya website in his appeal to the world for help. Sarvodaya was in prime focus in almost all international media coverage of the tsunami response in Sri Lanka, including ABC, BBC, CNN, NBC, etc. Sarvodaya's commitment, volunteer contribution, relief collection and distribution plan was discussed with much praise.

Source: http://www.sarvodaya.org

Box 5: Blogs and Tsunami Response

Web logs or 'blogs', frequently updated on-line journals, have proven to be of particular use in disseminating information in time of disaster. The role of bloggers in the immediate aftermath of tsunami is worth a special mention. The important role bloggers can play in disaster situations has been widely discussed, and this was the first time it was practically experienced in most of the countries, including India, Thailand and Sri Lanka. According to a study released in early January 2005 by the Pew Internet and American Life Project, more than eight million Americans have started blogs, and 27 percent of Internet users surveyed said they read blogs – a 58 percent jump since February 2004 – and 12 percent of Internet users have posted comments to blogs (Convio, undated). The effectiveness of blogs as an alternative communications medium was observed even in Sri Lanka, a country that can hardly be termed as 'wired'.

ICT FOR DISASTER RECOVERY

Disaster reconstruction has to start as soon as the initial disaster cleanup has taken place. This is a very complex endeavour, requiring a huge array of skill sets and a thorough knowledge of an ever-increasing variety of techniques and equipment. A range of software tools are being used for these purposes. Thus, while the role of ICT in the long-term disaster recovery process is not as apparent as it is in disaster warning, there is no doubt that ICT is being used widely to expedite these activities.

Specific Disaster Management Software

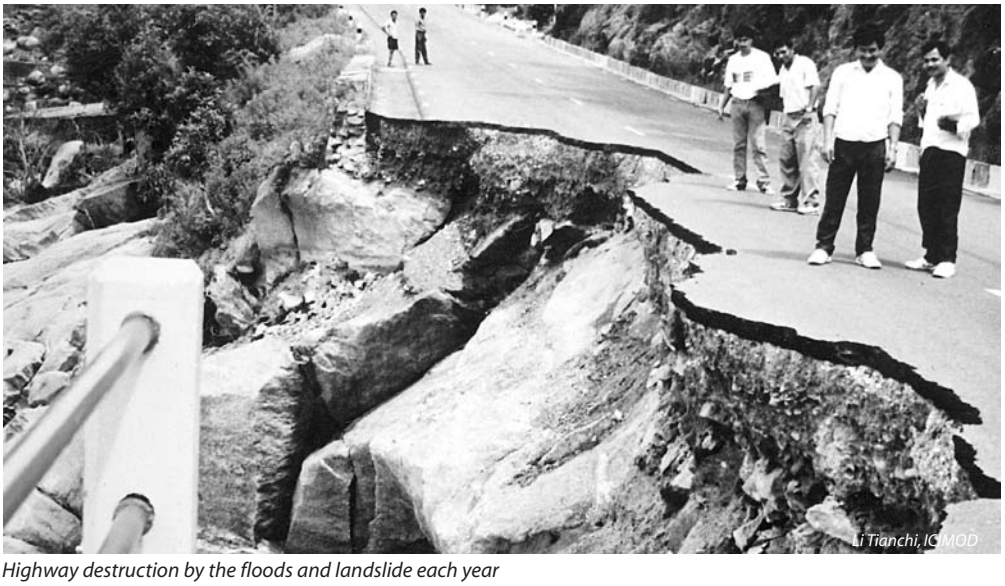
Different types of software tools are being used to gather, store and analyse data related to disasters, not only in post-disaster conditions, but also as a long-term measure to mitigate the risk of the disasters. One such approach is known as DesInventar.

DesInventar is a methodical way to gather and store information about characteristics and effects of different types of disasters, particularly the ones not visible from global or national scales. This allows for the observation and analysis of accumulated data regarding these 'invisible' disasters at a global or national scale.

The DesInventar system can also be used to simulate disasters and study their impact. For example, it is possible to trigger an earthquake in the virtual environment and analyse its impact on a geographical area ranging from a municipality to a group of countries. The system forecasts information on the possible loss of human lives, impact on the economy and damage to infrastructure, etc.

DesInventar is also a tool that facilitates the analysis of disaster-related information for applications in planning, risk mitigation and disaster recovery purposes. It can be used not just by government agencies, but by NGOs as well in their disaster management work.

The following are some case studies where DesInventar and similar software are being used in the disaster preparedness process.



Highway destruction by the floods and landslide each year

Case Study 1: Latin America

This was the first time DesInventar was used in disaster preparedness activities. The project was initiated by the Network for Social Studies on Disaster Prevention in Latin America in 1994. National-level DesInventar disaster databases, with up to 30 years of data, have been developed to date in 17 countries in North and South America.

Localized disasters with very limited direct impact (e.g. the destruction of a single house, or a household affected by the loss of their harvest as a result of a frost) are also covered. However, the focus was on major disasters that can affect a large number of people. The databases have been developed by national governments, international organizations, universities, scientific organizations and NGOs. Data is obtained from the media and government agencies, and existing databases. Once collected, data is verified nationally for consistency. Shared definitions are used for some key hazards, while for others, local specificity is more important. The challenge of uniformity between the databases remains, limiting the capacity for international comparisons.

Case Study 2: Orissa, India

In 2002, UNDP set up a database including an inventory of disaster events with a natural trigger for the state of Orissa in India. The aim of the project was to develop a tool to help decision makers prioritize expenditure in an objective manner. The Orissa project is to act as a pilot for the next stage, including replication in an additional four Indian states and integration into a national government of India integrated disaster resource network.

The methodology was modified from the experience of the Latin America initiative. News media and government sources of information were used to build up the disaster events database. A historical database going back to 1970 has been collated and is being updated on a weekly basis.

Case Study 3: South Africa

The programme for Monitoring, Mapping and Analysis of Disaster Incidents in South Africa (MANDISA) is a core activity for the Disaster Mitigation for Sustainable Livelihoods Programme of the University of Cape Town. MANDISA was initiated as a pilot study in the Cape Town metropolitan area in the Western Province of South Africa from 1990 to 1999. The methodology was inspired by DesInventar but has been adapted for the South African context.

MANDISA focuses on hazards relevant to South Africa, including large urban 'non-drainage' floods, wildfires and extreme wind events, as well as highly frequent 'small' and 'medium' fires. Socio-economic and environmental risk factors that affect disaster impact are included where possible, allowing the potential for tracking developmental conditions that prefigure disaster. While newspapers formed one source of information for tracking disaster events, the South African experience indicated that these provided limited insight into the highly recurrent relatively small events that occur in informal settlements. Such newspaper coverage reflected only 649 of the 12,300 total incidents tracked through a thorough review of 12 different data sources, including incident reports from Fire Services, Social Services, the South African Red Cross Society and disaster management agencies.

Other Software

Many other software applications, though they are not specifically meant for disaster management purposes, are being used by disaster management practitioners. The following are some examples.

Groove, http://www.groove.net

Groove was initially developed by a small technology start-up established by Ray Ozzie, creator of Lotus Notes and former CEO of Iris Associates. Groove has recently been acquired by Microsoft.

On its most basic level, Groove is a desktop software designed to facilitate collaboration and communication among small groups. A key concept of the Groove paradigm is the shared workspace. A Groove user creates a workspace and then invites other people into it. Each person who responds to an invitation becomes a member of that workspace and is sent a copy of the workspace that is installed on his/her hard drive. All data is encrypted both on disk and over the network, with each workspace having a unique set of cryptographic keys. This local copy avoids the physical distance between the user and his/her data. In other words, a workspace is a private virtual location where members interact and collaborate. Once a workspace is established, Groove keeps all the copies synchronized via the Internet or the corporate network. When any one member makes a change to the space, that change is sent to all copies for update. If that member is offline at the time the change is made, the change is queued and synchronized to other workspace members when that member comes back on-line. Using the shared workspace, one or more members (peers) now have a context for collaboration.

Groove is being used widely by disaster management practitioners. It has been used in Iraq, the Indian Ocean tsunami response and in other emergencies.

Voxiva, http://www.voxiva.net

Voxiva is another technology start-up with a specific philanthropic intent. It originally provided only reporting services, especially in the health sector, to governments in developing countries. Now, it targets NGOs as well as UN agencies. Voxiva offers an integrated monitoring and reporting function through an on-line platform. Another application meant to provide programme management in the field is currently being developed.

Voxiva's Pyramid Platform is designed to bring technology to the so-called 'bottom of the pyramid', such as rural and poor communities. By leveraging phones, mobile phones, personal digital assistants (PDAs), faxes and radios as well as the Internet, applications built and deployed on Voxiva's multi-channel Pyramid Platform have much broader reach. Solutions built on the Pyramid Platform allow organizations to collect information from and communicate with distributed networks of people in a timely and systematic way. Voxiva also provides the tools to organize maps and analyse the data collected and make the right decisions. Voxiva systems are deployed to track diseases, monitor patients, report crime, and respond to disasters across Latin America, Africa, Asia and the US.

Voxiva is currently being used by organizations such as the US Department of Defense, USAID, the Rwanda Ministry of Health, the Ministry of Health of Tamil Nadu (India), the International Rescue Committee and the Ministry of Health of Peru.

FACTS

The Food and Commodity Tracking System (FACTS) is an easy-to-use Internet-based application that is capable of managing multiple relief operations simultaneously. Mercy Corps, a humanitarian aid organization, based in Portland, USA has worked with Microsoft to develop this tracking system that can help humanitarian aid agencies deliver supplies in disaster situations.

According to Microsoft, FACTS represents the first significant step towards creating a standard framework for improving humanitarian assistance on a global level. During crisis, coordinating and distributing the millions of metric tonnes of food and other commodities from donors is a challenge to even the most seasoned relief agencies. FACTS is an effort to address these challenges. The FACTS design team, which also includes the American Red Cross, Catholic Relief Services, Food Aid Management, Food for the Hungry International, Project Concern International and Save the Children, has worked to standardize logistics operations and to streamline reporting. This allows material aid programme managers to focus on the actual delivery of needed supplies while maintaining high standards of commodity tracking.

Mercy Corps has already implemented FACTS pilot programmes in Indonesia and Kyrgyzstan. Three additional agencies are using FACTS in their Bolivia and Guatemala operations, and one agency soon plans to extend the solution to Ethiopia.

Apart from these specific software applications, there are many international and regional organizations that use ICT effectively in the disaster management process. For example, the International Federation of Red Cross and Red Crescent Societies has set up a secure extranet, FedNet, https://fednet.ifrc.org, to share multilingual information among its staff, national societies, field delegations, etc. Additionally, FedNet serves as an interactive forum for on-line collaboration.

Disaster Information Networks

National and regional networks are useful for effective information sharing and coordination. Here are two examples.

UNDP's Tsunami Resources and Results Tracking System

The High Level Coordination Meeting hosted by the Asian Development Bank in March 2005 emphasized the need for more effective tracing of tsunami aid resources and project results. UNDP presented a package of capacity development support for aid coordination, including staff, training and a customized Development Assistance Database (DAD), to help align aid inflows with priority needs. The Government of Indonesia, Maldives, Sri Lanka and Thailand have, with UNDP support, established nationally-owned aid information management systems. A regional information portal and DAD system has been developed as a resource for coordination at the regional level. This brings together results and resource allocation data from each country and makes it available in one place at http://tsunamitracking.org.

By accessing DAD, users can find out real-time information on who is doing what and where. The portal also provides access to various maps, reports, charts, documents and other information giving donors, implementers, governments and the general public better insight into funding flows and projects' progress. A Private Sector DAD has also been developed to record private sector flows, particularly those from transnational firms that may not have reported their assistance to the individual government-owned systems in the tsunami-affected countries.

India Disaster Resource Network

The India Disaster Resource Network (IDRN) is a web-enabled and GIS-based national database of resources essential for effective emergency response. The project, initiated by the Ministry of Home Affairs and UNDP, collects and stores information such as individual and organizational expertise, and details of equipment and supplies required during emergencies, available at government departments, military units, NGOs and private companies in different districts. Accessible from http://www.idrn.gov.in, this inventory is being used by disaster managers at the national, state and district levels to make informed decisions and mobilize resources quickly during emergencies.

GIS in Disaster Recovery

In addition to its usage during the prevention, mitigation, preparedness and response phases of disaster management, GIS can also play a role in disaster recovery, in both the immediate and long-term phases.

Immediate Aftermath

In the aftermath of any disaster, it is essential to restore vital services and systems. This may include providing temporary food, water and shelter to those who have lost homes in the disaster. Medical services are needed for those who are injured. GIS can play several roles in this process. It can identify the damage and begin to establish priorities for action (triage). GIS can also ensure uniformity in the distribution of supplies (medicine, food, water, clothing, etc.) to emergency distribution centres. They can be assigned in proper amounts based on the extent and type of damage in each area.

Earth observation satellites could also be used in emergency situations where on-the-ground resources are often not available. Satellites can provide data rapidly when there are earthquakes, landslides, floods and other natural disasters that often prevent assessment by ground or aerial services. They also provide accurate global coverage and operability no matter what the weather or conditions are on the ground. They can also be used for a large number of activities during their lifetime.

Long Term

Long-term recovery is to restore all services to normal or better than they were prior to the disaster. It involves replacement of homes, water systems, streets, hospitals, bridges, schools, etc. and returning life to normal. This can take several years. GIS tools can be used to track the progress of these activities. It is also possible to prioritize restoration investments with the help of GIS. A GIS can ease the burden of accounting for recovery activities.

CONCLUSION

It is essential that we look at disaster management from the development angle. It is no longer either a one-off or stand-alone activity. Despite the fact that disaster preparedness has not been identified as one of the MDGs, it is apparent that proper mechanisms for disaster awareness and means of disaster recovery are essential to achieving the MDGs. In particular, the MDG targets such as integrating the principles of sustainable development into country policies and programmes, and reversing the loss of environmental resources[7] can never be achieved without giving due emphasis to effective disaster management strategies.

Damaged house by the landslide in mountainous area

The key priorities for the future, as illustrated by the UN/ISDR report 'Living with Risk'(2004), can be extremely useful to help understand the prospects of ICT in disaster risk reduction.

First, as the report points out, there is a need for disaster and risk reduction to be an essential part of the broader concerns of sustainable development, and hence the need to make sure that risk assessments and vulnerability reduction measures are taken into account in different fields, such as environmental management, poverty reduction and financial management.

Second, it is essential to note that current development practices do not necessarily reduce community vulnerability to disasters – indeed, ill-advised and misdirected development practices may actually increase disaster risks. A considerable challenge remains in raising awareness of this concern and to influence and enhance existing development projects, poverty reduction strategies and other programmes to systematically reduce disaster risk.

[7] First target under MDG 7: Ensuring environmental sustainability.

Third, political commitment by public and private policy makers and local community leaders, based on an understanding of risks and disaster reduction concepts, is fundamental to achieving change.

Finally, even though national and local authorities bear the main responsibility for the safety of their people, it is the international community's duty to advocate policies and actions in developing countries that pursue informed and well-designed disaster risk reduction strategies, and to ensure that their own programmes reduce disaster risks.

The challenge is to determine the role of ICT in addressing these priorities. ICT is only a tool and it should not be treated as a panacea for all issues arising in disaster management. As is the case with any other tool, the effectiveness of ICT in reducing disaster risk depends on how it is used. The use of ICT for disaster management should not be a choice between this medium/technology against that medium/technology. The very reason for the existence of so many channels is that none of them is suitable for every situation. One medium that might fit best under a certain set of circumstances might be of little use under another. Thus, what is required is not a competition between different media and technologies, but instead, using the best combination depending upon the circumstances.

One obvious challenge facing the Asia-Pacific region is the low ICT penetration level in most of the region's developing countries. According to the UNDP Human Development Report of 2005, in 2003, the tele-densities of Cambodia, Nepal and Bangladesh were 38, 18 and 15 per 1,000 people, respectively. The situation is the same for radio and television. The irony is that while a small selection of households might have all of these media, the majority does not have any of them. With such low penetration levels, it is extremely difficult to establish any effective ICT-based disaster warning system. For such communities, it is essential to think of other means (such as community radio or public address systems). Unless the levels of telephone, radio and television penetration can be reasonably increased, it is difficult to guarantee that such a community can be free from disaster risks, irrespective of the efficiency of the disaster monitoring systems.

Another significant challenge to be recognized is the reluctance of some national governments to implement ICT-friendly policies. Many governments do not see investment in ICT or even building up ICT-enabling infrastructure as priorities. The result invariably will be that ICT and technology in general take a backseat to presumed priorities such as ensuring good governance practices, providing healthcare facilities and addressing gender barriers. The examples provided in this e-Primer make it obvious that as far as disaster management is concerned, there is no reason why ICT should take such a secondary role.

ICTs, in this context, are not just commercial tools that are being used for the sole purpose of increasing profits in a business; they play a much larger role in protecting the well-being of the general population. It should therefore be the responsibility of all concerned stakeholders, from governments to donor organizations, to give the right priority to ICT development and adoption. Only that will ultimately guarantee disaster risk reduction for all.

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ANNEX: GLOBAL AND REGIONAL ORGANIZATIONS WORKING IN DISASTER MANAGEMENT

Asian Disaster Preparedness Center, Bangkok

ADPC is a non-profit organization supporting the advancement of safer communities and sustainable development through implementing programmes and projects that reduce the impact of disasters upon countries and communities in Asia and the Pacific.

ADPC was established in 1986 at the recommendation of the UN Disaster Relief Organization – now known as the UN Office for the Coordination of Humanitarian Affairs (UNOCHA) – as an outreach activity of the Asian Institute of Technology in Bangkok, Thailand, with the aim of strengthening the national disaster risk management systems in the region. In 1999, ADPC became an independent entity governed and guided by a Board of Trustees (21 members representing 15 countries).

ADPC develops and implements disaster risk management programmes and projects by providing technical and professional services in formulating national disaster management policies, capacity building of disaster management institutions, programme design for comprehensive disaster risk management, post-disaster assessment, public health and emergency management, land-use planning, disaster-resistant construction, and the planning of immediate relief response and subsequent rehabilitation activities.

Contact details:

Asian Disaster Preparedness Center
58 Moo 9, Km. 42, Paholyothin Highway
Klong Luang, Pathumthani 12120, Thailand
Tel: +66 2 516 5900 to 5910
Fax: +66 2 524 5350 or +66 2 524 5360
Email: adpc@adpc.net
Website: http://www.adpc.net

Asian Disaster Reduction and Response Network

In February 2002, the Asian Disaster Reduction Centre (ADRC) Kobe and UNOCHA, in Kobe, with the assistance of the ASEAN Foundation, brought together more than 30 NGOs from across Asia to discuss the need for a network of NGOs for disaster reduction and response in Asia.

As a result, the Asian Disaster Reduction and Response Network (ADRRN) was formed. This loose body of NGOs was consolidated in December 2003, and in June 2004, the structure, content and direction of the ADRRN was clearly formulated and implemented.

The objectives of ADRRN are to:

- Develop an interactive network of NGOs committed to achieving excellence in the field of disaster reduction and response;
- Raise the relevant concerns of NGOs in the Asia-Pacific region to the larger community of NGOs globally, through various international forums and platforms;
- Promote best practices and standards in disaster reduction and response; and
- Provide a mechanism for sharing reliable information and facilitating capacity building among network members and other stakeholders.

Contact details:

Asian Disaster Reduction and Response Network
Secretariat
No 45B Jalan Mamanda 9, Ampang Point
68000 Ampang, Selangor, Malaysia
Tel: +60 3 4256 9999, +60 3 4256 5724
Fax: +60 3 4251 8435
Email: feedback@adrrn.net
Website: http://www.adrrn.net

Asian Disaster Reduction Centre, Kobe Japan

The United Nations has been promoting the International Decade for Natural Disaster Reduction throughout the 1990s to reduce damage from natural disasters worldwide through international cooperative initiatives. On the basis of the lessons from the Great Hanshin-Awaji Earthquake, the need to promote multinational disaster reduction cooperation in the Asian region was stressed at the ministerial-level Asian Natural Disaster Reduction Conference held in Kobe City in December 1995, attended by delegates from 28 countries in Asia and other regions. Subsequently, ADRC was established in Kobe, Hyogo Prefecture, to facilitate exchange of disaster reduction experts from each country and concerned bodies, accumulate and provide disaster reduction information, and carry out research in multinational disaster reduction cooperation as the focus of this initiative.

The symbol of the ADRC, which portrays a man embracing the Earth with his arms extended to reach all corners of the world, represents its commitment to creating a worldwide cooperative information network. The symbol expresses ADRC's goal of a fully developed unification of information networks and human power.

Contact details:

Asian Disaster Reduction Centre
Hitomiraikan 5F, 1-5-2, Wakinohama-kaigan-dori
Chuo-ku, Kobe City
Hyogo Prefecture, 651-0073 Japan
Tel: +81 78 262 5540
Fax: +81 78 262 5546
Email: rep@adrc.or.jp
Website: http://www.adrc.or.jp

Australian Tsunami Warning System

The Australian Tsunami Warning System provides tsunami warning services for Australia based on seismic information from the Pacific Tsunami Warning Centre, Japanese Meteorological Agency and Geoscience Australia on earthquakes. Other potential triggers for tsunami are volcanic eruptions, underwater landslides and meteorites.

Currently there is a four-year project (2005–2008) to upgrade this service by enhancing the seismic monitoring network and sea-level monitoring network, in addition to the modelling of seismic events, tsunami propagation and coastal inundation. This is a cooperative project between the Bureau of Meteorology, Geoscience Australia and Emergency Management Australia.

Contact details:

Emergency Management Australia
PO Box 1020 Dickson
Australian Capital Territory 2602
Australia
Tel: +61 (0) 2 6256 4600
Fax: +61 (0) 2 6256 4653
Website: http://www.ema.gov.au/agd/ema/emainternet.nsf/Page/Tsunami_Warning

Duryog Nivaran (South Asian Network for Disaster Risk Reduction)

In 1995, the Duryog Nivaran network was established to fill a void in cross-border dialogue and experience sharing among organizations, governmental or otherwise, working in the world's most disaster-prone region, South Asia. It promotes an alternate perspective towards disasters, be they natural or man-made. This perspective points out that people affected by disasters are more than mere victims, but rather partners in their future development and well-being. The network's activities are information sharing, building a concerned media, research and grass-roots community action. It is already involved in disaster management research work in Bangladesh, India, Nepal, Pakistan and Sri Lanka.

The key objectives of Duryog Nivaran are:

- Provide an opportunity for national and regional organizations in South Asia to strengthen their capacity and carry out effective disaster mitigation and development activities by sharing information, learning from each other's experiences and providing support for each organization's activities;
- Make the case for an alternative perspective by analysing existing interventions and demonstrating, through research and action, other approaches that challenge the existing paradigm; and
- Carry out specific activities to influence decision makers in government, donor agencies and NGOs.

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Website: http://www.duryognivaran.org

Global Disaster Information Network

The Global Disaster Information Network (GDIN) is a voluntary, independent, self-sustaining non-profit association with an interest in facilitating the provision of disaster warning and management-related information to its various stakeholders such as governments, international organizations, industry, academia, donor organizations and NGOs. It is committed to assist disaster managers in finding the information they need, particularly when other means have failed, develop unique information-sharing procedures that augment the existing system, promote the development of new disaster information technologies and foster professional development.

GDIN originated in the US in 1997, based on experiences with the G7 and the UN. However, the international community quickly decided at the first GDIN Conference in Washington that it would be an international project that operates in partnership with all sectors and it is not owned by any one entity. Now, it operates as an informal international body with members from all sectors.

GDIN has facilitated the development of fresh GIS products based on remote sensing for Viet Nam, Mozambique and Turkey. It has also developed textual reports on infectious diseases in Afghanistan and a well-regarded paper on anthrax.

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International Charter for 'Space and Major Disasters'

Satellite imagery is very expensive and not affordable by most developing nations without their own space programmes. In the event of a natural or man-made disaster, space technology data should be readily available for developing nations that do not have or cannot afford their own space programmes.

Following the UNISPACE III conference held in Vienna, Austria in July 1999, the European and French space agencies initiated the idea of an International Charter for 'Space and Major Disasters'. The Canadian Space Agency, National Oceanic and Atmospheric Administration, Indian Space Research Organization, Argentine Space Agency, Japan Aerospace Exploration Agency and the United States Geological Survey have also joined the Charter at later stages.

The International Charter aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through Authorized Users. Each member agency has committed resources to support the provisions of the Charter and thus is helping to mitigate the effects of disasters on human life and property.

Contact details:

Website: http://www.disasterscharter.org

Pacific Disaster Center

The mission of the Pacific Disaster Center (PDC), established after Hurricane Iniki caused heavy destruction to the Hawaiian island of Kauai, is to provide applied information research and analysis support for the development of more effective policies, institutions, programmes and information products for the disaster management and humanitarian assistance communities of the Asia-Pacific region and beyond.

Central to achieving these objectives is providing unique and valuable geospatial and disaster-related information through a web-based data system for international, regional, national and local information access and dissemination. Through the use of the PDC web-based information system, disaster managers can develop both situational awareness and appropriate responses before, during and after disaster events. These responses range from the assessment of hazards and risk to managing risk through mitigation, preparedness, response, recovery and reconstruction.

In one of its projects, the PDC has entered into a contract with the National Disaster Warning Center (NDWC) in Thailand to provide technical assistance to NDWC in order to enhance its disaster management capabilities, systems and practices. Under this contract, PDC and its partners – Lockheed Martin Information Technology, Sun Microsystems and Environmental Systems Research Institute – will provide NDWC with technical solutions, systems integration and human resources training to achieve its strategic objective of establishing a scalable and world-class disaster management and emergency communications facility.

The project, funded through a grant by the US Trade and Development Agency, will help build Thailand's capacity as part of the US government's broader support for an Indian Ocean tsunami warning system.

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Partners in Technology

The objective of Partners in Technology International (PACTEC) is to support any nation's effort to build communications capacity in case of an emergency. It provides assistance to establish or improve two-way communications where reliable telephone service is unavailable. PACTEC purchases, installs, and maintains HF/VHF radio networks and satellite communications connectivity. PACTEC installs and administers computer networks for email, web-based communications and applications. PACTEC also provides training for local technicians who can then operate and maintain PACTEC communication systems.

PACTEC has already undertaken work in Afghanistan, Indonesia, Kazakhstan, Lao PDR, Mauritania, Morocco and Senegal. PACTEC is in the process of spinning off a new non-profit organization to be called the Disaster Relief and Strategic Telecommunication Infrastructure Company, http://www.drasticom.net.

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ReliefWeb

ReliefWeb is an on-line gateway to information (documents and maps) on humanitarian emergencies and disasters. It provides timely, reliable and relevant information as events unfold, while emphasizing the coverage of 'forgotten emergencies' at the same time. ReliefWeb was launched in October 1996 and is administered by UNOCHA.

The ReliefWeb portal has seen steady growth in usage. In 2002, ReliefWeb received 1.5 million hits per week, and in 2004, the site received approximately 1 million hits a day. Shortly after the Indian Ocean tsunami disaster of December 2004, it received 3 million hits a day on average. Over 70,000 users subscribe to ReliefWeb's email services. It operates from three time zones to ensure that its news items are updated around the clock and posts about 150 maps and documents daily from over 2,000 sources. These are then categorized and stored in a searchable database containing a large number of such items dating back to 1981.

Contact details:

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Website: http://www.reliefweb.int

Télécoms Sans Frontières

Télécoms Sans Frontières (TSF) is an NGO specializing in emergency telecommunications. TSF deploys lightweight equipment that can provide voice, Internet, fax, and video connections via its satellite, Wi-Fi, and Global System for Mobile communications equipment. The services are available to everyone, including UN personnel, NGOs, other responders, local government agencies and citizens. The TSF teams will remain in an area for about a month, until more permanent satellite and other communications are established. TSF, however, often stays in regions much longer as part of other humanitarian work it does including training on satellite communications equipment and the strengthening of early warning systems using ICT.

Website: http://www.tsfi.org/tsfispip/index.php

UN International Strategy for Disaster Reduction

UN/ISDR is the focal point in the UN System to promote links and synergies between, and the coordination of, disaster reduction activities in the socio-economic, humanitarian and development fields, as well as to support policy integration. It serves as an international information clearinghouse on disaster reduction, developing awareness campaigns and producing articles, journals, and other publications and promotional materials related to disaster reduction. The UN/ISDR headquarters is based at the Palais des Nations in Geneva. It conducts outreach programmes through its regional units in Kenya, Panama, Tajikistan and Thailand.

Recognizing that natural hazards can threaten anyone, UN/ISDR builds on partnerships and takes a global approach to disaster reduction, seeking to involve individuals and communities towards achieving the goals of reducing the loss of lives, the socio-economic setbacks and the environmental damages caused by natural disasters.

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ABOUT THE AUTHOR

Chanuka Wattegama, an electronics engineer, graduated from the National Institute of Technology, Karnataka, India and holds an MBA from the University of Colombo. He counts more than 13 years' experience at the specialist and senior management levels. His specialization is ICT and its applications for development. He is also one of the key ICT for Development researchers in Sri Lanka, with several international-level publications to his credit.

Chanuka works for UNDP-APDIP, which aims to promote ICT for sustainable human development. He is a member of the Technical Committee of APCICT. He has also worked as a consultant for the Information and Communication Technology Agency and the apex body for ICT-related activities in Sri Lanka, leading one of its largest projects.

As a researcher, Chanuka has co-authored the Sri Lankan chapters for the books 'Media in Asia', 'Internet in Asia', 'Cyber Communities in Asia' and 'Digital Review of Asia Pacific'.

APDIP

The Asia-Pacific Development Information Programme (APDIP) is an initiative of the United Nations Development Programme (UNDP) that aims to promote the development and application of information and communication technologies for sustainable human development in the Asia-Pacific region. APDIP aims to meet its goals by focusing on three inter-related core areas: (i) policy development and dialogue; (ii) access; and (iii) content development and knowledge management.

APDIP collaborates with national governments, regional, international and multi-lateral development organizations, UN agencies, educational and research organizations, civil society groups, and the private sector in integrating ICTs in the development process. It does so by employing a dynamic mix of strategies – awareness raising, capacity building, technical assistance and advice, research and development, knowledge sharing and partnership building.

http://www.apdip.net

APCICT

The Asian and Pacific Training Centre for Information and Communication Technology for Development (APCICT) was established by the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) in 2006 to strengthen the efforts of the member countries of the UNESCAP to use ICT in their socio-economic development through building the human and institutional capacity for ICT. APCICT is located in Incheon, Republic of Korea.

APCICT aims to build capacity of policy makers, project managers and trainers, and conduct research on human resource development in the field of ICT that will support the training programme. The ultimate goal of the centre is to reduce the digital divide in the region. In addition, APCICT provides programmes for the training of trainers and exchange of trainers and experts; advisory services on ICT-related human resources development to UNESCAP members and associate members; and analytical studies related to human resources development in ICT, including identifying training needs and sharing good practice in human resources development programmes and training methods.

http://www.unapcict.org

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