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APDIP e-Notes present an analytical overview of specific issues related to information and communication technologies for sustainable human development in the Asia-Pacific region. APDIP e-Notes are developed by the United Nations Development Programme's Asia-Pacific Development Information Programme (UNDP-APDIP) based at the UNDP Regional Centre in Bangkok, Thailand. For more information, visit <http://www.apdip.net> or contact info@apdip.net

Summary

Looking at disaster events of the last few years it is evident that by no means natural or man-made disasters can be fully prevented. Only the loss caused by these events can be prevented.

Information and Communications Technology (ICT) can be used to minimize this impact in many ways. ICT is used in almost all phases of the disaster management process. In the disaster mitigation and preparedness process, ICT is widely used to create early warning systems. An early warning system may use more than one ICT media in parallel and these can be either traditional (radio, television, telephone) or modern (SMS, cell broadcasting, Internet). As demonstrated by AlertNet, on-line media play an important role.

In the immediate aftermath of a disaster, special software packages built for the purpose can be used for activities such as registering missing persons, administering on-line requests and keeping track of relief organizations or camps of displaced persons. In addition, geographic information systems (GIS) and remote sensing software are being effectively used in all phases of disaster management.

It is essential that ICT is given its due place in disaster management but it should also not be taken as panacea for all ills. ICT, like any other tool, can deliver its best when the other necessary ingredients are in place.

Why Disaster Management?

Disaster management (also called disaster risk management) is the discipline that involves preparing, warning, supporting and rebuilding societies when natural or man-made disasters occur. It is the continuous process by which all individuals, groups and communities manage hazards in an effort to avoid or minimize the impact of disasters resulting from hazards. Effective disaster management relies on thorough integration of emergency plans at all levels of government and non-government involvement. Activities at each level (individual, group, community) affect the other levels.

Events over the last two years have shown that there is no country that does not stand the threat of a disaster. Countries like China, Indonesia, Iran and Pakistan are prone to earthquakes. Small Islands States in the Pacific region and countries like Maldives are prone to various types of threats from the sea. Bangladesh and parts of China and India experience floods each year. Therefore, disaster preparedness is no longer a choice; it is mandatory irrespective of where one lives.

Disaster Management and the MDGs

It is somewhat surprising that no Millennium Development Goal¹ (MDG) directly addresses the issues related to disaster management. Perhaps it is because it is so obvious that building a safer world is a prerequisite for the achievement of all the eight MDGs. Poverty eradication, freedom from hunger, primary education, freedom from disasters, and building a sustainable world etc. are all key aspects of the disaster management process. It has been shown that any nation should have effective disaster reduction and recovery processes in place to achieve the MDGs by the expected deadline of year 2015.

¹ The Millennium Development Goals (MDGs) are eight goals to be achieved by 2015 that respond to the world's main development challenges. The MDGs are drawn from the actions and targets contained in the Millennium Declaration that was adopted by 189 nations and signed by 147 heads of state and governments during the UN Millennium Summit in September 2000.

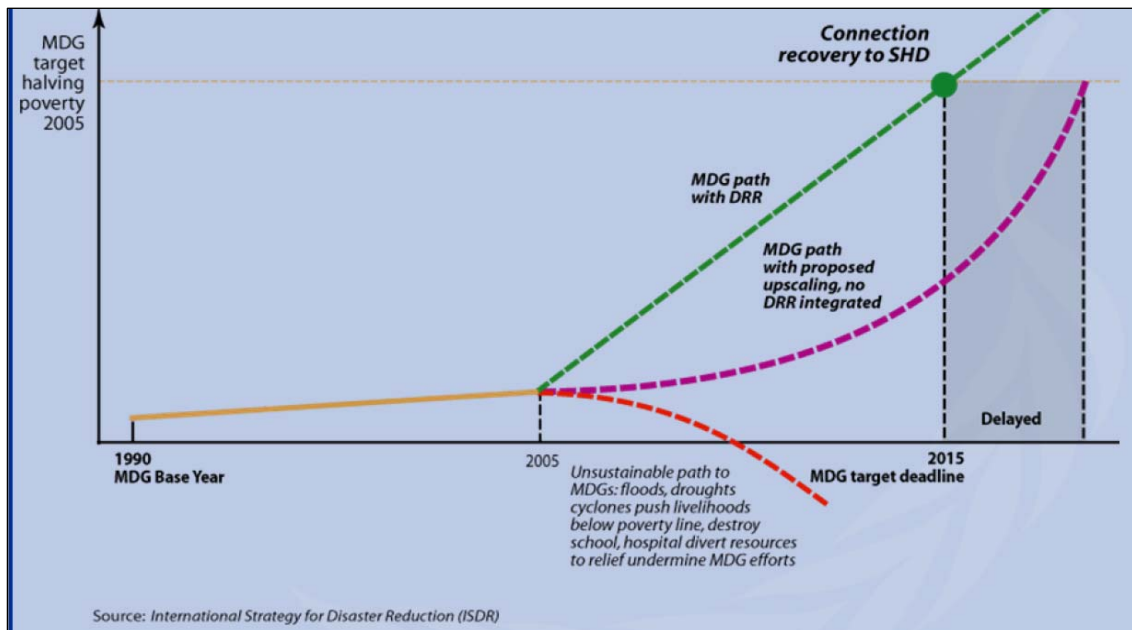


Figure 1: Illustration of how proper Disaster Reduction and Recovery processes can assist in achieving the MDGs by 2015

Where ICT Fits In?

The disaster management cycle involves four key phases.²



Figure 2: Disaster Management Cycle

- **Mitigation** - includes any activities that prevent a disaster, reduce the chance of a disaster happening, or reduce the damaging effects of unavoidable disasters.
- **Preparedness** - includes plans or preparations made to save lives or property, and to help the response and rescue service operations.
- **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.

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

ICT for Disaster Mitigation and Preparedness

The importance of timely disaster warning can never be underestimated. When the tsunami in 2004 hit several countries in the Asian region, it caused a loss of hundreds of thousands of human lives, because there was no timely disaster warning. The history repeated in Northern Pakistan in the Kashmiri earthquake nearly a year later. On the other hand, the US was relatively well prepared and could evacuate the population of New Orleans, and thus, minimized the number of deaths as a result of the hurricane Katrina in 2005, which was no less damaging than the Asian tsunami or Kashmiri earthquake.

An early warning system involves several players and has many links. At one end there is the central authority that monitors and issues the warning. At the other end are the communities to whom the warning message is intended. In between, one or more channels are linking these two ends. This is where ICT plays the most crucial role. However, in this case it is not a question of one medium against another. The requirement is to pass the warning as quick and as accurate as possible.

Any one - or a combination - of the following ICT and media tools can be used for that purpose.

² Some disaster management cycles use six phases (as shown in Figure 2), but here the simplest model has been considered.

Radio and television: Considered the most traditional electronic media used for disaster warning, radio and television still 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.

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.

Short Message Service (SMS): 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 the 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, which have such a capability in any group of cells of any size, ranging from one single cell (about 8 kilometres across) to the whole country if necessary. GSM, D-AMPS, UMTS and CDMA³ phones have this capability.

Satellite Radio: Satellite radio can play a key role during both the 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 radio can also be of help when the transmission towers of the normal radio channels are damaged in a disaster.

Internet and Email: The role Internet and email can play in disaster warning depends entirely on their penetration within a community. These media can play a prominent role in a developed country where nearly half of all homes and almost all offices have Internet connections. In many developing countries, however, less than five 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

disaster warning. However, both Internet and email can play an important role in the other phases of disaster management.

Amateur Radio and Community Radio: For almost a century, amateur 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 the communication infrastructure breaks down. In such a situation, amateur radio operators transmit emergency traffic on voice mode about the well-being of survivors as well as information on casualties to friends and relatives.

Role of On-line Media in Disaster Management

Reuters' AlertNet (see Figure 3 - next page) is a good example of an ICT/media initiative that contributes towards early disaster warning and management, at an international level. "AlertNet started in 1997 by Reuters Foundation - an educational and humanitarian trust - to place Reuters' core skills of speed, accuracy and freedom from bias at 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, 2007)

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. Reuters Foundation surveyed charities to determine what could be done to remedy this. AlertNet now attracts more than three million users a year, it has a network of four hundred contributing humanitarian organizations and its weekly email digest is received by more than 17,000 readers.

For more details please visit <http://www.alertnet.org>

ICT for Disaster Response and Recovery

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 might still be living with the trauma they have encountered, including loss of loved ones. Affected individuals might also be without food or other essential items. They might be waiting in temporary shelters, with no idea of what to do next. Some might need immediate medical attention, while the disaster aftermath environment also creates ideal breeding grounds for possible epidemics.

ICT can play a key role in such an environment in managing the available resources.

A good example of this is Sahana, a free and open source software (FOSS)-based disaster management system that grew out of the events during the 2004 Asian tsunami disaster. This system was developed in

³ GSM: Global System for Mobile Communications
D-AMPS: Digital Advanced Mobile Phone System
UMTS: Universal Mobile Telecommunications System
CDMA: Code Division Multiple Access

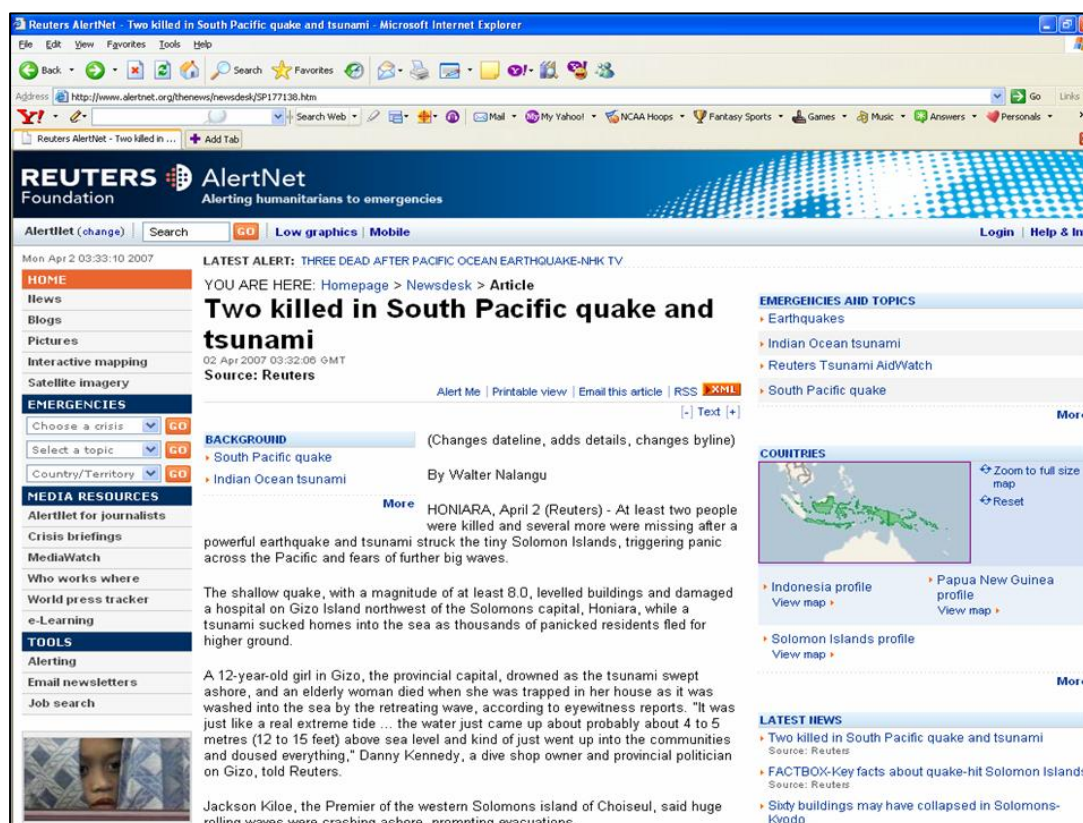


Figure 3: Alertnet web portal

Sri Lanka - one of the countries hardest hit by the tsunami - by a team of ICT volunteers to help track families and coordinate work among relief organizations during and after the tsunami disaster. Subsequently, Sahana has been deployed to manage the earthquake disaster in Northern Pakistan (2005), the Guinsaugon landslide in the Philippines (2006) and the earthquake in Yogyakarta, Indonesia (2006).

Sahana provides four main solutions:

- **Sahana Missing Person Registry:** This is an on-line bulletin board of missing and found people. Information about the person seeking another person is also captured, which increases the chances of people finding each other.
- **Sahana Organization Registry:** This registry keeps track of all the relief organizations and civil society groups working in the disaster region. It captures not only the places where they are active, but also information on the range of services they are providing in each area.
- **Sahana Camps Registry:** This registry keeps track of the location of all the camps in the region and provides basic data on the facilities they may have and the number of people in them. It also provides a GIS view to plot the location of the camps in the affected area.
- **Sahana Request Management System:** This is a central on-line repository where all relief organizations, relief workers, government agents and camps can effectively match requests of aid

and supplies to pledges of support. It looks like an on-line aid trading system tracking request to fulfillment.

GIS and Remote Sensing in Disaster Management

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.

GIS and remote sensing are examples of ICT tools being widely used in almost all the phases of disaster management activities.

In the planning process GIS can be used to identify and pinpoint risk prone geographical areas, as a GIS-based 3D map provides much more information compared to an ordinary 2D map. Earth observation satellites can 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. In the mitigation phase, GIS are helpful in monitoring.

GIS play several roles in the recovery phase too. It can identify the damage, assess it 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 amount and type of damage in each area.

Conclusion

It is essential that we look at disaster management from the development angle. Disaster management 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.

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

Another big challenge is the reluctance of some national governments to implement ICT-friendly policies. There are many governments that do not see investments in ICT or even building infrastructure as priorities. The result invariably will be that ICT and technology in general take a back seat to presumed priorities such as ensuring good governance practices, providing healthcare facilities and addressing gender barriers come under the spotlight. The examples highlighted in this *APDIP e-Note* make it obvious that as far as disaster management is concerned, there is no reason why ICT should take a secondary role.

~ Chanuka Wategama, UNDP-APDIP

Disaster Management Organizations and Networks

Asian Disaster Preparedness Center. <http://www.adpc.net>

Asian Disaster Reduction and Response Network. <http://www.adrrn.net>

Asian Disaster Reduction Centre. <http://www.adrc.or.jp>

Duryog Nivaran (South Asian Network for Disaster Risk Reduction). <http://www.duryognivaran.org>

Global Disaster Information Network. <http://www.gdin.org>

International Charter "Space and Major Disasters". <http://www.disasterscharter.org>

Pacific Disaster Center. <http://www.pdc.org>

Partners in Technology. <http://www.pactec.org>

Relief Web. <http://www.reliefweb.int>

UN International Strategy for Disaster Reduction (UN/ISDR). <http://www.unisdr.org>

Additional Reading

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