Information Communication Technology (ICT) and Crisis Management: An Imperative for Developing Countries

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Abstract

The United Nations International Strategy for Disaster Reduction (UN/ISDR) has calculated that about 5,210 disasters were recorded in the world between 1991 and 2005 and that 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 it is not possible to completely eliminate 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 detection and 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 play a major role in educating the public on the risk of a potential or impending disaster. The paper examines the role of I.C.T

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and crisis management in developing countries. The work reveals that one obvious challenge facing developing countries is the low ICT penetration level. The paper suggests that developing countries should give high priority to ICT development and adoption.

Keywords: Information and communication technology (ICT), Crisis, Crisis Management.

Introduction

The term 'crisis', can be 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. In a recent document published by the United Nations Development Programme (UNDP, 2000) in the Americas, a crisis 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'. According to another widespread definition, disasters occur when hazards strike in vulnerable areas (Anderson, 2000). 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 crisis management has been recognized as a key requirement towards achieving the Millennium Development Goals (MDGs) by the specified target of 2015.Meanwhile, information and communications technology for development had been recognized as one of the key enablers for achieving the MDGs.

Events have shown that there is no country that does not stand the threat of a disaster or crises, though they may be threatened at different

levels. Therefore, crisis management is no longer a choice; it is mandatory irrespective of where one lives. 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).

With improvement in Information & Communication Technology in the form of Internet, Geographic Information System (GIS), Remote Sensing, satellite-based communication links; it can help a great deal in planning and implementation of disaster risk reduction measures. These technologies have been playing major roles in designing early warning systems, catalyzing the process of preparedness, response and mitigation. ICT tools are also being widely used to build knowledge warehouses using internet and data warehousing techniques. These knowledge warehouses can facilitate planning & policy decisions for preparedness, response, recovery and mitigation at all levels. Similarly, GIS-based system have improved the quality of analysis of hazard vulnerability and capacity assessments, guide development planning and assist planners in the selection of mitigation measures. Communication system has also become indispensable for providing emergency communication and timely relief and response measures.

Research studies have attempted to evaluate crisis management system but the process of building consensus on what may be considered as the best practice has still been elusive (Abrahamsson, Hassel, & Tehler, 2010; Alkin & Christie, 2004; Boin, McConnell, & 'T Hart, 2008; Newburn, 2001; Seymour & Moore, 2000). As a result evaluators often end up choosing inadequate, sometimes flawed approaches which do not correspond to the unique and distinctive circumstances found in conflict situations (Church & Shouldice, 2002; Church & Rogers, 2006). Therefore, it is important to devise feasible and appropriate learning mechanisms supported by thorough evaluation methods to ensure that the ICT platform and similar initiatives continuously evolve into an effective crisis management system.

To achieve this objective, the paper proposes a generic evaluation framework to assess the impact of ICT platform and similar initiatives to achieve the goal of providing a more meaningful approach to determine the effectiveness of a crisis management system. In line with this mindset, the paper sets out to:

1. Guide the evaluators and structure the evaluation process into different components to streamline its execution.
2. Suggest steps to create sets of suitable conditions for the execution of an effective, exhaustive and useful evaluation process for a crisis management system and,
3. understand the role of ICT in the crisis management process and if possible evaluate its impact.

Conceptualization Crisis

In the literature, there is a lack of common agreement about the nature, meaning and definition of a crisis situation. The concept has so far been elusive and different authors from various domains have found the phenomenon difficult to define (Clarke, 1999; Pamell, Koseoglu, & Spillan, 2010; Pearson & Clair, 1998; Smith, 2006). According to Smith(1990:54) crisis is seen “through the eyes of the beholder or beholders” hence it has multiple definitions. In a paper titled, Crisis Management - Practice in search of Paradigm, Smith (2006:7) defines crisis as, complex events that confound the abilities of those who try to manage them. Crises present significant challenges around managerial attempts at bringing the events back under control. The damage that can be caused can be physical, financial or reputational. Therefore, a crisis maybe defined as a situation possessing the characteristics of unexpectedness and surprise; causing a disruption to routine; or escalating the flow of events which might lead to a loss of control (See Regester, 1986; Seymour & Moore, 2000). A crisis situation possesses the

muscle to decimate entire regions or cities, pose major threats to human and animal welfare or destabilize institutions (McConnell & Drennan, 2006). On account of these adverse effects it is imperative that a proper crisis management plan is put in place to either act as a preparatory process to prevent crisis or respond to crisis once it occurs (Meier & Leaning, 2009; Seymour & Moore, 2000).

Crisis Management

The domain of crisis management is still in the nascent stage of its development (Boin, McConnell, & 't Hart, 2008; Deverell, 2009; Roux-Dufort, 2007). And the task of making it more useful, effective and valuable is particularly challenging (Abrahamsson, Hassel, & Tehler, 2010; Ahmed, 2006; McConnell & Drennan, 2006). Augustine (1995:32) argues that it is extremely difficult to conceptualize a proper and an effective crisis management process as if the solution were easy, it wouldn't be [called] a crisis. Crisis Management aims to minimize the [negative] impact that crisis event might bring to institutions, society or organizations (Pamell, Koseoglu, & Spillan, 2010:108). In simple terms, crisis management maybe visualized as "a [task of] management of exceptions" (Roux-Dufort, 2007:105) or a "coincidental response to an exigency" (Ahmed, 2006:490. A crisis management system is expected to serve a multitude of functions and its nature maybe dependent on the type of crises it is managing i.e. the context within which it functions (Ahmed, 2006; Boin, McConnell, & 'T Hart, 2008; Roux-Dufort, 2007). The process of crisis management is expected to entail some, if not all, of the following stages: avoid crisis situation, prepare to manage crisis situation, recognize crisis situation, contain crisis situation, resolve crisis situation, and profit from the crisis situation (Augustine, 1995). To achieve this end, a crisis management system must ideally function

within the ambit of well defined, publicly stated set of goals such that the motivations of all the collaborating organizations and individuals are aligned. To structure the understanding of the functions of a crisis management system, Pearson & Clair (1998) proposed a three dimensional theoretical understanding by using the concept of triggering event to state that the nature of crisis management and its objectives (or goals) are a tangible or intangible barrier or occurrence that, once breached or met, causes another event to occur dependent on whether the crisis management system is functioning before, in response to, or following a triggering event. Shrivastava (1993) in one of his seminal papers on crisis management proposed a '4Cs' framework to analyze crisis along four different dimensions: causes, consequences, caution and coping. Generally, the crisis management system helps in the 'caution' and 'control' of part of the crisis. To realize the complete benefits of these crises management interventions and to generate appropriate learning and enforce accountability it is important to develop an evaluation framework. The evaluation framework will not only provide a background for reflection on the process implementation of a crisis management system but also present a useful structure for a future set of guidelines on carrying an evaluation process.

THE ROLE OF ICT IN CRISIS MANAGEMENT

The first important step towards reducing disaster impact is to correctly analyze 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.

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 centre)

Sources: UN/ISDR, 2006

All the figures reported in Table 1 are rough estimates as it is impossible

to have exact figures in such situations. However, Table I 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.

It is important to note that crisis management is indeed a system, not a singular technology, constituting the identification, detection and risk assessment of the hazard, it is 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).

ICT CHANNELS USED FOR CRISIS MANAGEMENT

The following are some of the media - both traditional and new - that can be effectively used for crisis management 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;

(i)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, suggest 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 (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). This arrangement not only ensures the timely delivery of the warning message, but also ensures the minimum duplication of efforts.

(ii)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. Code Division Multiple Access (CDMA), D-AMPS, Global System of Mobile Communication (GSM) and UMTS4 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 African 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 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 Africa, 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.

(iii)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 that 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 the 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,	Coordinating relief

	terrestrial and satellite (radio, television, etc.)	activities by disseminating information from relief planning teams to population
	Earth exploration satellite service	Assessing damage and providing information for planning activities Relief
	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

Sources: UN/ISDR, 2006

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

(iv)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, and coordinating bodies.

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 control 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, highlight 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 (Putuam, 2002).

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 (Sources: UN/ISDR, 2006).

Channel	Benefits	Challenges
Radio and television	Widespread	Takes Television 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.

Geographic Information System (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. 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 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. Visualization effect is much more effective in the latter case. 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.

POST- DISASTER MANAGEMENT

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.

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.

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 crisis 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, 2005).

ICT AND THE CHALLENGES OF CRISIS MANAGEMENT IN NIGERIA

One obvious challenge facing most of the developing countries is low ICT penetration level. According to the UNDP Human Development Report of (2005), in 2003, the tele-densities of south west, south east and northern Nigeria 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 do 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.

CONCLUSION AND RECOMMENDATIONS

It is essential that we look at crisis management from the development angle. It is no longer either a one-off or stand-alone activity. Despite the fact that crises management have not been identified as one of the

development agenda by many nation, it is apparent that proper mechanisms for disaster awareness and means of crisis management are essential to achieving developmental goals. 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 can never be achieved without giving due emphasis to effective crisis/disaster management strategies. 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 crisis 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 crisis — 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. 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 crisis management.

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 crisis management strategies, and to ensure that their own programmes reduce crisis. However, 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 crisis 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 crisis 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.

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