Disasters and Communication Technology: Perspectives from Asia

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I. Introduction

The role of communication technology has been recognized as integral to disaster management for a long time. Although application of communication technology has a role in all the four distinct phases of disaster management namely, mitigation, preparedness, response and recovery, most of the application has traditionally been in response and recovery phases. The new communication and information technologies that have emerged over the last two decades lend themselves to greater possibilities of integration of different communication systems. The interoperability of various communication systems including internet, mobile phones, fax, e-mail, radio and television is increasingly becoming functional. As a result, the possibilities for application of communication technologies in mitigation and prevention of disasters are also increasing. There are both social and technical aspects to the application of communication technologies in disaster management. The effective application of these technologies for disaster management depends greatly upon their appropriateness for the social and economic context in which they are applied. In this paper we describe the emerging role of communication technologies in mitigation, preparedness, response and recovery phases of disaster management and highlight the emerging challenges in making the application of these technologies effective.

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II. Application of Communication Technologies in Disaster Mitigation

The advancements in earth observation systems and telemetry associated with the relay of information from sensing technologies (such as stream gauging stations) have tremendously enhanced the potential for application of communication technologies in disaster mitigation. For areas vulnerable to flooding, remotely sensed images can be used to generate digital terrain models for the simulation of potentially disastrous conditions and the identification of vulnerable areas. During and after event, mapping of sequential inundation phases is possible, including the duration, depth of inundation, affected areas and direction of current. It has been demonstrated that using satellite data for flood mapping becomes economically advantageous with respect to ground survey for areas larger than a couple of ten square kilometers.

Similar applications are possible for mitigating the impacts of earthquakes, volcanic eruptions, landslides, forest fires and drought. In the Asian region, particularly in the Indonesian archipelago, remote sensing is being widely used to monitor and detect the areas vulnerable to forest fires in almost real time. The hot spots generated by remotely sensed images coupled with real time meteorological observations give a drought index which can help narrow down areas vulnerable to forest fires and where fire prevention and suppression resources need to be mobilized. However, the experience of 1997-98 forest and land fires in Indonesia indicates that effectiveness of these systems depends to a great extent on the institutional arrangements put in place on the ground to receive these early warnings and take necessary action to prevent and mitigate the impacts of these fires.

Advancements in telemetry associated with ocean and atmosphere observation systems has also contributed to upgrading in climate prediction. The El Nino 1997-98 was predicted with several months lead time. However, in the absence of local and national capacities to downscale these forecasts to local level and make them usable for specific action, these forecasts could not be used to mitigate the negative impacts of El Nino and enhance the potential benefits.

While it is clear that recent advancements have increased the potential for application of communication technologies in disaster mitigation, most of it has remained in the scientific and technical realm. There are discussions underway in the scientific community in the Lower Mekong sub-region in Southeast Asia as well as in Ganga-Meghna-Brhamaputra basin in South Asia to share real-time hydro-meteorological data to strengthen flood mitigation systems. However, in order to ensure maximum societal benefit, this scientific dialogue will have to extend to other disciplines and take into consideration the societal and institutional aspects of application. This will also call for greater integration of advanced technologies with more conventional (sometimes even indigenous) technologies.

III. Application of Communication Technologies in Preparedness

Communication technologies can help establish preparedness networks that link emergency operation centers, emergency broadcasting systems and front-line emergency responders or communities. This network can be used to educate communities about disaster preparedness, track approaching hazards, alert authorities and warn people who are likely to be affected.

Here we present an example from Bangladesh to illustrate both technical as well as social aspects of a communication system for preparedness.

The Cyclone Preparedness Program (CPP) in Bangladesh, managed jointly by the Government of Bangladesh and Bangladesh Red Crescent Society, is one of the most successful cyclone preparedness programs in the world. The CPP operates an extensive network of radio communications facilities in the coastal area, linked to its communication center at its headquarters in Dhaka. The network consists of a combination of HF and VHF radios which covers the high-risk cyclone zone areas. The telecommunication network of the CPP is composed of the following three elements:

- High Frequency (HF) transceiver radios with a main base station located at the Dhaka headquarter to transmit information related to the cyclone. From the field station local information related to the progress and effects of the cyclone is sent to Dhaka-headquarters.

- A field station system of Very High Frequency (VHF) transceivers to receive and transmit messages from HF Field Station to Sub-Stations located at Union (group of villages) level.

- Transistor radios used at village level to receive meteorological information and cyclone warning signal bulletins transmitted by Radio Bangladesh special weather bulletin on regular basis during the time of cyclones or depressions.

The effectiveness of this extensive telecommunication network depends largely on a well-trained, large volunteer base at different levels. These volunteers are well-trained and are equipped with appropriate warning equipment such as megaphones, sirens, public address equipment, signal lights and signal flags. The volunteers are also provided with appropriate gear such as rain coat, gum boots, hard hats, life jackets and torch lights.

The entire program has a significant training and public awareness component. On recruitment, the volunteers are given preliminary training by the CPP officers. A three-day basic training is then given to the volunteers, batch by batch, on different aspects such as dissemination, evacuation, sheltering, rescue, first aid and relief operation. The training of volunteers is complemented by an extensive public awareness program that includes cyclone drills and demonstration, staging of dramas/ folk songs, distribution of posters, leaflets and booklets, film/ video shows and radio and TV programs.

The CPP is an excellent example of how the use of communication technology in disasters can be made effective by preparing an appropriate social and cultural context in which these technologies are applied. A well-planned warning system with equal

emphasis on both social and technical components, ensures that in case of an emergency, one-point failure in the system does not lead to a complete break down.

IV. Application of Communication Technologies in Response and Recovery

Effective communication linkage between emergency operations center, broadcasting systems, and front-line responders and affected communities is critical in the aftermath of a disaster. The communication linkage is necessary for: assessing damage and need; collecting information on supplies and other resources; coordinating rescue and relief activities; accounting for missing people; and motivating public, political, and institutional responses. It is important that communication infrastructure in a disaster-prone area is resilient. In the aftermath of Gujarat earthquake in January 2001, the communication infrastructure suffered serious damage. However, an efficient communications unit was able to quickly assess the communication needs and restore basic communication infrastructure within a short period of time.

In the aftermath of Gujarat earthquake a number of private web sites also sprung up that provided highly localized damage and needs information. The government website was no longer the only information provider to the outside world willing to pour help. This example shows that the new communications technologies are going to transform the nature of disaster communication networks from being a conventional "command and control" type to a highly decentralized and perhaps multi-node network. In the long run, in those areas where new web-based technologies have percolated, this has a potential to redefine the role of the governments in disaster management. In a way, this is in consonance with the increasing recognition of the importance of community-based disaster management.

V. Challenges Ahead

Promoting an understanding of basic principles of effective early warning systems

The effective application of emerging communication technologies can be realized only if they form part of a sound early warning system based on well-established basic principles. For example, lack of emphasis on downstream end has led to less than optimal performance of flood forecasting and warning in Bangladesh. While the quality of flood forecasts and warnings is very good, its application on the ground is relatively poor.[‡] This is because most people potentially affected by the floods either do not have access to the forecasts or do not understand the forecasts. Now, the flood forecasting and warning center in Bangladesh is undertaking an end to end review of its dissemination in three pilot locations. This example clearly indicates that effective application of new technologies rests on their well thought out strategic application in sound early warning systems.

Cross-sectoral integration of application of communication technologies

Over the last few years, the application of communication technologies has been marred with sectoral isolation. For example, in a number of Asian countries, the communication and information systems used to predict the behavior of water resources do not look into its possible application in agriculture or public health. While the disaster management community in Asia is recognizing the cross-sectoral nature of the problems of disasters, this recognition has not led to sharing of communication resources across different sectors to track emerging crises and manage their impacts. The region is replete with examples where different departments and agencies have developed there own GIS for looking into their sectoral interests.

[‡] Based on discussions with officials of Flood Forecasting and Warning Center in Bangladesh

Disparities in communication infrastructure

In the Asian region, there is significant disparity in communication infrastructure across countries and across different kinds of users groups. While among the scientific and technical community there is a lot of enthusiasm to make use of emerging communications technologies to share real-time information as well as local knowledge and experiences, the decision makers most responsible for managing disasters have to rely on rather conventional means of communication. Low band-width, poor computing infrastructure pose serious constraints. On a national and regional level this calls for conscious integration of emerging and conventional communication technologies.

Exploiting local innovation

While disparities in communication infrastructure do exist, there is a lot of local innovation in the Asian region which needs to be harnessed and integrated with new technologies. The use local cable television for internet access and use of phone booths for internet kiosks in India, wireless internet access in Lao are some of the examples of local innovation that can be exploited for communications in disasters.

Towards a multi-node communication network for disaster management

Traditionally, the application of communication technology in disasters has been inspired by parallels in military operations, which follow a well-defined command-and control structure. However, growing emphasis on devolution of disaster management to community level and greater recognition of effectiveness of community-based disaster management would require that the disaster management community looks into innovative approaches for the application of emerging communication technologies in disaster management.

Overcoming the language barrier

While new communications technologies have made the sharing of knowledge and information much faster and reliable, in the Asian region language is going to be a major barrier in the effective application of these technologies. Translation software do not yet address the needs of Asian communities. In the coming years, overcoming the language barrier would be a major challenge and would require a combination of high-tech as well as more down to earth human-based systems.

VI. Conclusion

The last decade has seen the emergence of new communication and information technologies. On one hand this opens doors for innovative application of communication technologies in different phases of disaster management, on the other this poses new challenges for disaster management community. The effective application of new communication technologies would require that these new technologies are integrated with the more conventional technologies. The disaster management community will also have deal with the disparity that exists between different regions and communities in terms of communications infrastructure. The information technology revolution has also led to local innovation in communications infrastructure. The disaster management community will have to capitalize on these innovations and where possible integrate them with new technologies. In the coming years, the new communications and information technologies can potentially redefine the conventional disaster management systems. There is a movement underway, away from strict "command and control" model to a more devolved system of disaster management.

REFERENCES

Stephenson, Robin, and Peter S. Anderson. "Disasters and the Information Technology Revolution." Disasters 21-4 (1997): 305-334.

Gow, Gordon A. New Approaches to Disaster Communications: Towards a Global Communications Lifeline Infrastructure. Unpublished graduate thesis. University of Calgary, 1997. (downloaded from website: http://www.sfu.ca/~gagow/capcom/thesis.htm on 14 May 2001).

Bangladesh Red Crescent Society. Cyclone Preparedness Programme at a Glance. CPP Brochure. Edited by Abdul Wahid Miah. Dhaka, 2001.