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Paper No. 11
Information and Communication Technologies in Disaster Prevention and Mitigation

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Information and Communication Technologies (ICTs) in Disaster Prevention and Mitigation

Introduction

Disasters, both natural and man-made, continue to ravage the world with increasing frequency and severity. Recent earthquakes in Turkey and Taiwan have caused great loss to human lives and property and have put the respective countries back by several years of social and economic development. Some disasters can at best be prevented while the devastating impact of others can be reduced. Communications of all sorts, especially application of telecommunications and associated information technologies in remote sensing, radar, broadcasting and other media, meteorology as well as communications for disaster logistics management, early warning systems and public education, all have a pivotal role in reducing loss of life and property arising from disasters. Information and communication technologies (ICTs) and media are essential to link scientists, disaster mitigation officials, and the public; educate the public about disaster preparedness; track approaching hazards and alert authorities and those likely to get affected; assess damage; collect information, supplies, and other resources; coordinate rescue and relief activities; and motivate public, political, and institutional responses.

As per World Disaster Report of 1999, during the period of 1973 to 1997 on an average 89,546 were killed every year in disasters and of this 44,262 (49%) were from Africa and 36,914 (43%) from Asia (Table 1).

Table 1: Annual average number of people reported killed by region and period (1973-97)

<table>
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<tr>
<th>Period</th>
<th>Africa</th>
<th>Americas</th>
<th>Asia</th>
<th>Europe</th>
<th>Oceania</th>
<th>Total</th>
</tr>
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<tr>
<td>1973 to 1977</td>
<td>84,413</td>
<td>8,519</td>
<td>68,454</td>
<td>2,318</td>
<td>107</td>
<td>163,811</td>
</tr>
<tr>
<td>1978 to 1982</td>
<td>1,436</td>
<td>3,172</td>
<td>16,529</td>
<td>1,406</td>
<td>35</td>
<td>22,579</td>
</tr>
<tr>
<td>1983 to 1987</td>
<td>115,269</td>
<td>10,853</td>
<td>17,073</td>
<td>2,302</td>
<td>183</td>
<td>145,686</td>
</tr>
<tr>
<td>1993 to 1997</td>
<td>7,919</td>
<td>3,065</td>
<td>19,078</td>
<td>1,996</td>
<td>149</td>
<td>32,206</td>
</tr>
<tr>
<td>1973 to 1997</td>
<td>44,262</td>
<td>6,171</td>
<td>36,914</td>
<td>2,075</td>
<td>124</td>
<td>89,546</td>
</tr>
</tbody>
</table>

The rapidly developing ICTs provide us the opportunities to make use of them to reduce disasters and their damage. The participants of “An International Meeting on Harnessing the Internet for Disasters and Epidemics”\(^1\) recognized while concluding the meeting that “... establishing a *global culture of prevention* implies adopting a *global culture of information* by which actors at local, national, regional, sub-regional, and international levels are encouraged and enabled to exchange information, ideas and experiences, communicate freely across institutional and geographical borders, and consult with individual experts or collective databases to improve the performance of their duties and functions in the context of disaster reduction.”

The ICTs offer wide range of options to be exploited for disaster reduction. Broadly, the utilization of ICTs in disaster reduction can be categorized as:-

- sharing data and information for providing information on and prediction of natural hazards using satellites, remote sensing devices, and computer
- coordination among the government, affected populations, relief agencies, disaster response officials
- communication and coordination for effective, dependable operation and interaction of private, governmental, and international disaster prevention and relief organizations
- sharing and exchange of information among policy makers, scientists, engineers, disaster response officials, and the media to develop knowledge of natural hazards and reduce their impacts
- public awareness and education through print and electronic media to educate them about natural hazards and disaster prevention.

The media plays a vital role in educating the public about disasters, warning of hazards, gathering and transmitting information about affected areas, alerting government officials, relief organizations, and the public to facilitate discussions about disaster preparedness and response. Timely, accurate and sensitive communications in natural hazards are demonstrated, cost-effective means of saving lives, reducing property damage and increased public understanding.

The following sections look at the early stages of development of communication technology and focuses on the Internet technology:

Early Developments

The history of broadcasting is barely 100 years old and it began with Guglielmo Marconi in 1895. However, there were several attempts before Marconi to “broadcast”. By the 1880s, it was possible to send both code and sound through wires, using electricity. Telegraph and telephone are examples of this technology. Experiments involving wireless transmission for sending information included magnetic induction, conduction and electrostatic coupling. Such wireless transmissions were extremely limited in terms of the coverage of area, usually less than 5 km.

A major “breakthrough” in wireless transmission came with the new technological developments harnessing ultrasonic electromagnetic radiation which proved to be more useful for distance signaling than all other methods prevalent at that time. With the introduction of “radio frequencies” came the concept of broadcasting that usually refers to transmission of information over an area intended for a group of people.

During 1895, Marconi developed what is generally recognized as the first practical "generator" of radio waves in Italy in 1895 and later demonstrated transmission over several miles in 1897.

Parallel to the experiments and developments of audio broadcasting, attempts were being made to transmit the picture. In 1924, John Logie Baird became successful in broadcasting a picture with a resolution of 30 lines. In 1935, the German government began its national public television service, followed by UK in 1936 and USA in 1939. Year 1953 marked the first color television broadcast.

The ICTs have come a long way in this century. The following section makes an attempt to present emergence of the Internet and its increasing applications and resulting changes to disaster management practices. The sheer growth of computers and increasing reach of the Internet has already had significant impacts on collection, analysis, documentation and dissemination of information and development of both formal and informal networks across the globe.

Emergence of the Web

Beginning from a small network in 1969 set up by Advanced Research Projects Agency (ARPA) in US, the Internet has grown rapidly encompassing the entire globe in just a period of last 30 years.

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The 1990s saw emergence of Hyper-Text Transfer Protocol (HTTP), which allowed linking of information on servers. This new system of servers and clients came to be known as World Wide Web and allowed users to access information from any computer on the network merely by clicking on hyper-text links. The rapid growth of servers and free distribution of clients led to the number of users on the Web multiply every month. The capabilities of Web clients to integrate text, graphics, audio and video led to the increased popularity of the Web and many universities and private companies started running their own servers. The rapid growth of the network and continuously developing software (both shareware and freeware) allowed organizations to run their own Web servers. Reports, newsletters and publications started being available on the Web.

The outcome of these technological developments is clear to anyone connected to the Internet. Most of the institutions started developing their Web sites to provide information about their activities. Electronic mails became the most popular mode of communication and everyone was finding electronic mails as the easiest way of communication. New interest groups were formed who started on-line discussions and sharing information through various electronic discussions groups supported by the new technologies. Situation reports were being sent to these discussion groups. Lists such as EARTHQUAKE-L and VOLCANO-L for different interest groups were serving the disaster specialists. Another list called NETS (Networks in Emergency Management) generated good participation with several hundred subscribers.

There were few international initiatives in the early stages. Among them was GEOWARN <http://wwwghcc.msfc.nasa.gov/GEOWARN/isu.report/table.of.contents.html>, a global disaster warning system, initiated by NASA of USA. Another project, Global Emergency Management Information Network Initiative (GEMINI) <http://hoshi.cic.sfu.ca/~anderson/G7.html> was endorsed by G7 countries in 1996.

**The recent developments during 1990s**

After the initial rapid development in the early 1990s, the technological developments have reached a level of maturity now. More Web sites are now organized to disseminate information on all types of disasters at international, regional and national levels. Video and audio conferencing software allow flow of multimedia information in real time. New concepts for delivery of courses in distance education and training have emerged. The “push” technology brings latest news to individual desktop machines. Real time video

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data is being transmitted from Web sites. For disasters, this include warnings, flash news, real time video broadcasts.

The multimedia steaming is still constrained by bandwidth in many countries. On the other hand, simple electronic mails have wider coverage at global level as accessing electronic emails does not require sophisticated desktop machines. The IDNDR have been organizing electronic conferences on disaster mitigation since 1996. These electronic conferences have generated participation from all over the world. The latest conference held during 14-25 June 1999 is archived at <http://www.quipu.net.T999>.

The information availability, both qualitatively and quantitatively, on the Web has improved considerably in the recent years. Web sites such as Federal Emergency Management Agency (FEMA) <http://www.fema.gov>, Emergency Preparedness Information Exchange (EPIX) <http://hoshi.cic.sfu.ca/epix> and the Natural Hazards Center in Colorado <http://www.colorado.edu/hazards> have become portal sites containing useful information and links to may other sites. Reliefweb <http://www.reliefweb.int> contains situation updates on all types of disaster from all parts of the globe, in addition to a number of on-line documents.

The Internet has been used in many ways during disasters, for example dissemination of information about Kobe earthquake. To facilitate communication and provide information about world disasters, Disaster Message Service <http://www.viexpo.com> which has been used extensively during disasters.

**Future trends**

Going by the rapid growth the ICTs have registered during this decade, it is too difficult to make detailed estimates in the longer term. In near future, up to maximum 5 years from now, one sees synergies of emerging technologies. Integrated personal computing devices are more likely to be ubiquitous and affordable.

The constraints of bandwidth may no longer be there. Higher bandwidth will allow flow of multimedia content. The overall performance of individual computing devices will increase tremendously.

The technological developments will allow easy access to information and real-time data from every nook and corner of this globe. Increased availability and access to information will require specialized search agents/crawlers. Due to increased computing capacities, data processing, analysis and dissemination of information would help reducing the impacts of disasters.
The complex networks would remain vulnerable to security risks and would pose recurring challenges to the network managers and possibility of “electronic disasters” can not be ruled out.

On educational front, the traditional methods of teaching, training and learning will undergo significant changes and will provide equal access to learning opportunities.

Need for harnessing the potential of ICTs in disaster prevention and mitigation

There is a need for improved flow of information including satellite based communication and broadcasting as it can assist in prediction, monitoring and early warning to prevent some of the consequences and reduce the impact of disasters once they have occurred. The following indicate possible needed action areas by all the actors (disaster mitigation organizations, relief and response agencies, scientific community, media, etc.) involved in disaster reduction:

- Establish free flow and exchange of information among individuals and institutions with regard to disaster reduction as an integral element of sustainable human development

- Place a high priority on reducing the widening informational gap between different sections of society by increasing Internet access and training for a greater number of users

- Increase efforts to establish Internet network linking all actors in the public sector, NGOs and the private sector to promote a direct dialogue and a free exchange of information on matters related to disaster prevention, mitigation, preparedness and response

- Share through the Internet, publications, studies, emergency plans and post disaster reports, with a view to increasing public awareness

- Contribute to the development of content in local language(s)

Media and disaster reduction

- Develop working relationships among scientific, disaster mitigation organizations and the media to understand each other’s role before, during and after the disasters
• Disaster mitigation organizations to provide reliable information to the media, as early possible, in a concise and readily understandable format.

• Media and disaster mitigation organizations to take advantage of opportunities to work together, to provide relevant training for reporters to enhance their understanding of disaster preparedness, mitigation, relief efforts and the timeliness, quality, and accuracy of reporting about natural hazards.

The ICTs have played, and will continue to play major role in reducing the devastating effects of disasters by improving hazard identification and risk assessment, disaster preparedness, monitoring, early warning and post-disaster relief operations. The ICTs have tremendous potential for being the most useful tool to be used by all involved in disaster reduction. With the rapid expansion of the Internet in Asia and expected increase in the number of users, the full potential is yet to be exploited. It is hoped that the joint efforts of all those involved in disaster reduction will reduce the devastating effects of disasters in the years to come!
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DAY TWO

14 October 1999