UNITED NATIONS
ECONOMIC
AND
SOCIAL COUNCIL

GENERAL

E/ESCAP/CDR/5
16 December 2008

ORIGINAL: ENGLISH

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

Committee on Disaster Risk Reduction

First session
25-27 March 2009
Bangkok

ENHANCING REGIONAL COOPERATION ON DISASTER RISK REDUCTION IN ASIA AND THE PACIFIC: INFORMATION, COMMUNICATIONS AND SPACE TECHNOLOGIES FOR DISASTER RISK REDUCTION

(Item 5 (c) of the provisional agenda)

Note by the secretariat

SUMMARY

Information and communications technology (ICT) is an essential component of effective disaster management systems. It facilitates, among other activities, information gathering, processing and analysis, early warning and emergency communications. In the present document, the secretariat provides an overview of evolving trends and experiences with regard to ICT and the key role it has in supporting informed decision- and policymaking in disaster risk management. Also discussed are areas in which regional cooperation, such as shared infrastructures and resources, information networks and capacity-building initiatives, can enhance the use of ICT to support national and regional efforts towards reaching the objectives of the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters.

The Committee may wish to provide guidance on the secretariat's future strategic direction in this particular area, including on possible outputs that could be reflected in the programme of work for the biennium 2010-2011.

DMR A2008-000436 TP 280109 DP 280109 DI 290109

CDR_5E.

doc

CONTENTS

Introduction

1. Disasters, in general terms, affect poor countries and poor people the most. According to the United Nations Development Programme (UNDP), 24 out of 49 least developed countries, most of which are in Asia and the Pacific, face high levels of disaster risk. Of these, six are hit by two to eight large disasters every year. Developing countries also experience higher levels of mortality.[1] Of the 10 most affected countries in 2007, in terms of number of victims, six are in Asia: Bangladesh, China, India, Pakistan, Philippines and Viet Nam.[2]

2. The catastrophic disasters that have recently affected several countries in Asia, for example the Indian Ocean tsunami in 2004 and Cyclone Nargis in 2008, caused huge human and economic losses, partly due to the lack of the monitoring and infrastructure necessary to disseminate timely disaster warnings—an all too familiar scenario. Those disasters brought to the fore the importance of ICT, including space-based tools, for supporting effective disaster reduction practices. This importance has also been acknowledged in international initiatives, such as in the Declaration of Principles and the Geneva Plan of Action of the World Summit on the Information Society;[3] the latter specifically mentions the use of ICT applications in, among other areas, the provision of humanitarian assistance for disaster relief. It is an ongoing challenge that developing countries have limited access to ICT.[4]

[1] Department for International Development, "Reducing the Risk of Disasters—Helping to Achieve Sustainable Poverty Reduction in a Vulnerable World: A DFID Policy Paper" (London, 2006) (available at www.dfid.gov.uk/pubs/files/disaster-risk-reduction-policy.pdf).

[2] ESCAP calculations based on J-M. Scheuren and others, *Annual Disaster Statistical Review: The Numbers and Trends 2007* (The Centre for Research on the Epidemiology of Disasters 2008), pp. 33 and 37. Accessed from www.emdat.be/ Documents/Publications/publications.html on 3 August 2008.

[3] A/C.2/59/3, annex, chap. I, sections A and B.

[4] World Meteorological Organization and World Summit on the Information Society, "Chairman's report on the Thematic Meeting on ICT applications in natural disaster reduction", Kobe, Japan, 21 January 2005 (available at www.itu.int/wsis/docs2/thematic/wmo/final-report.pdf).

3. ICT applications are used in two broad areas of disaster management. The first deals with raising awareness, and includes preparations and planning to reduce vulnerabilities through, among other things, an understanding of the process, modelling, monitoring, early warning systems, forecasting, hazard risk mapping, knowledge hubs and education. For example, increasingly accurate and reliable information on and prediction of weather, climate and water allow for improved decision-making, which has the potential to mitigate the negative impacts of weather and climate. The second area focuses on how best to manage these risks and disasters by utilizing available telecommunications tools, including phones and community radio, in response, rescue and mitigation activities.[5] Effective use of ICT in both areas requires the strengthening of institutional infrastructure, which could incorporate space information products and services to build strong national response mechanisms, enhance community resilience and provide guidance for effective coping and adaptation strategies.[6]

4. Greater priority must be placed on compiling and institutionalizing disaster risk information at the regional, national and subnational levels, through detailed disaster loss databases, applications of indicators and indexes, and detailed risk mapping and analysis. Particular efforts are needed to systematically incorporate such information into national programmes to reduce underlying risks and tailor preparedness for responses to potential risks.

5. There is growing evidence of the economic benefits of interventions and policy choices aimed at reducing disaster risk. Investment in early warning systems and other measures for disaster reduction, including the development of ICT applications tailored to local conditions, yields considerable benefits, particularly when compared to the potential cost of failing to invest. In terms of reducing economic losses, early warning and disaster preparedness pay for themselves many times over throughout the life of the warning system. Reducing impacts and losses has long-term benefits for the economy.

6. In the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters,[7] five priority areas for action were proposed. In the present document, the secretariat provides an overview of the fundamental role that ICT plays in addressing those priorities, including, among other things, disaster risk and early warning and preparedness for response. Details are provided on recently developed ICT applications for disaster risk reduction and management that may require coordination and cooperation among national and regional stakeholders. Experiences and evolving trends in these areas are discussed.

I. INFORMATION, COMMUNICATIONS AND SPACE TECHNOLOGY: APPLICATIONS FOR DISASTER RISK REDUCTION

A. General trends

7. In this segment of the present paper, the secretariat describes general trends related to recent developments in and applications of ICT in support of disaster risk reduction, as well as areas where ICT does or can play a key role in supporting disaster risk reduction strategy.

---

[5] Mandira Shrestha and Sushil Pandey, “Information and Communications Technologies for Disaster Risk Reduction”, presentation at the South Asia Policy Dialogue on Regional Disaster Risk Reduction, New Delhi, 21 and 22 August 2006 (available at www.janathakshan.org/sapd/pdf/NepalICIMOD.pdf).

[6] ESCAP, “Framework for regional cooperation on space technology supported disaster reduction strategies in Asia and the Pacific”, study report prepared for the Meeting of Experts on Space Applications for Disaster Management, Chiang Mai, Bangkok, 25-28 July 2005 (available at www.unescap.org/publications/detail.asp?id=1241).

[7] A/CONF.206/6 and Corr.1, chap. I, resolution 2.

8. Appropriate use of ICT tools, including space-based technology, is crucial to the effectiveness and efficiency of all stages of the disaster management cycle, from risk assessment to response and recovery. Such tools fall into a wide range of technologies, which include: (a) spatial information systems (used for, among other purposes, information integration, knowledge and decision support tools[8] for integrated analysis, modelling, early warning, mitigation and response planning); (b) remote sensing (monitoring and data gathering); (c) the Internet, websites and portals (information sharing, warehousing, knowledge hubs); (d) communication systems (television, radio, satellite and cellular mobile, broadband used to disseminate information); and (e) ICT applications (disaster management systems).[9] One initiative in Mongolia (see box) exemplifies how new technology can be incorporated into rural areas.

Box
A Last Mile Initiative in Mongolia

A new initiative to test the usage of wireless fidelity (WiFi) in an environment where telecommunications infrastructure is scarce or unavailable has produced some promising results and revealed the value of the application of ICT in early warning systems.

In 2005, a Last Mile Initiative team tested a Voice over Wireless Fidelity (VoWiFi) phone network in rural Mongolia. It focused activities at the small village level, with average populations of around 2,000 persons. The project involves deploying innovative technologies and leveraging existing and upcoming private sector investments.

An initial assessment suggested a pilot project based on wireless technology as the best means of connecting rural Mongolia in an effective and affordable way. The new technology (VoWiFi) is a mobile-phone version of the computer-based Voice over Internet Protocol. VoIP is making headlines across the world, with a few companies leading a revolution in the telecommunications industry by offering voice communications via wireless Internet as opposed to traditional copper wire or digital mobile networks. The WiFi phone is interoperable with those networks as well.

The initiative demonstrated the usefulness and affordability of a wireless rural phone network. Future applications for a sustainable network include the following services:

- Emergency communications
- Distance learning
- Telemedicine (human and veterinary)
- Tourism communications
- Early warning network for drought and fire hazards.

Source: "Last Mile Initiative Mongolia—Connecting Rural Communities", *DOT-Comments e-Newsletter*, March 2007 (available at www.dot-com-alliance.org/newsletter/article/article.php?article_id=147).

[8] Decision support tools are computer-based information systems that facilitate decision-making.

[9] For a comprehensive discussion of the use of ICT as a tool to support the different phases of disaster management, see C. Wattegama, *ICT for Disaster Management* (the United Nations Development Programme-Asia-Pacific Development Information Programme and the Asian and Pacific Training Centre for Information and Communication Technology for Development, 2007) available at www.unapcict.org/ecohub/resources/ict-for-disaster-management.

9. Facilitated by the rapid evolution of ICT, in particular computer technology, access to suitable communications tools and the rapid growth in bandwidth, global Web-based access to geospatial information and relevant applications is fast becoming a reality across suitable technology infrastructures.[10] Because the Web is an almost universal platform for distributed computing that integrates diverse information systems, it has been possible to overcome the decades-old technical challenges of interoperability. The Web has also facilitated the processing of data, thus adding value to the information used in various applications of ICT, including disaster management.

10. As a result, many countries have access to advanced computer and telecommunication network technologies, which allow them to capture a large amount of pre-disaster information at the time it is needed. Scientific and technological systems for disaster management based on those rapidly developing technologies can provide a high-tech platform to integrate the processing of such information.

1. Spatial information systems

11. Space-based ICT applications are playing a specific role in providing information, information services and decision support tools for disaster management. Activities such as continuous information acquisition over a broad geographic area, as well as the distribution of information services and applications to remote and less serviced areas, particularly benefit from this technology. The rapid development of space-based ICT and the integration of remote sensing, Geographic Information Systems (GIS), and satellite position systems, collectively known as 3S technology, have created a solid foundation for effective disaster monitoring and information and knowledge management. In short, spatial information systems are revolutionizing the ways to analyse hazards, risks and vulnerability, and prepare for disasters.

12. For example, GIS technology, using spatial data, enables different kinds of information to be combined as map overlays. This can include information on, among other things, transport routes, power lines, hazard zones, seismicity lines and the location of emergency services and facilities. The main users of the technology have been scientists and the emergency management services of national and local governments in developed countries. Field test results are still scarce, although there are examples of successful GIS use by non-governmental organizations (NGOs) for risk management. One of the best known examples is Save the Children's RiskMap package, which has been used for many years to monitor trends in food security. The Philippine National Red Cross has also used GIS[11] in a community-level disaster preparedness programme. While GIS shows great potential, interested organizations need to consider the cost, their skill-base and their information requirements.

13. Spatial positioning systems (SPS) can be used to determine one's position wirelessly via satellites in real time and in three dimensions anywhere on Earth. The Global Positioning System of the United States of America and the Global Navigation Satellite System of the Russian Federation are the two most popular and successful SPSs. The Galileo system of the European Union and the Beidou Navigation System of China are being developed. In terms of dynamic mapping, the Office for the Coordination of Humanitarian Affairs, the Office of the United Nations High Commissioner for Refugees and United Nations Humanitarian Information Centres

[10] Ibid, p. 69.

[11] John Twigg, *Disaster Risk Reduction: mitigation and preparedness in development and emergency programming*, Good Practice Review series (London, Overseas Development Institute, 2004), p. 47 (available at www.odihpn.org/documents/gpr9/part1.pdf).

are actively using SPS technology and Google Earth[12] to map and share dynamic, georeferenced information to improve situational awareness and humanitarian coordination. Google Earth has been used by many organizations in a number of recent emergencies, including the disaster caused by Cyclone Nargis, which devastated Myanmar in May 2008.

2. Other technologies

14. Communications technologies, such as multiband radio frequencies[13] and satellite and mobile phones, are now integrated into daily operations in emergency management. Increasingly, such technologies are being applied to support risk assessment, early warning and response, and are being used to design programmes that address specific problems of disaster risk reduction.

15. Large and complex infrastructures, such as electricity and mobile phone networks, should be able to cope with massive service failures following disasters. If the emergency management and control systems of a network are decentralized, the ICT, and therefore the network, remains operable in areas that have not been damaged. In recent years, national and regional organizations have increasingly recognized the potential of decentralized services, such as distributed and mobile technologies. Adoption of these new ICT technologies would highly benefit countries, helping them to reach their development targets and better serve communities that are prone to disasters.

3. Future tools

16. Currently, several promising technologies are being developed and/or tested for use in various stages of disasters, including: (a) an interface to display fully georeferenced text messages from the field on Google Earth in real time; (b) a camera with built-in SPS and wireless capability that can send images straight to a laptop via satellite; (c) equipment that enables online communication via satellite; (d) mobile-to-notebook, and vice versa, communication; (e) an inflatable satellite communications device for short-term emergency outbreaks; (f) simultaneous instant messaging translation (www.im-translate.com) in 17 languages; and (g) satellite tracking systems that map a person's location every few minutes and thus can be used during search and rescue operations following disasters.

4. Initiatives

17. In recent years, disaster management has been on the agenda of a number of major international and intergovernmental meetings and conferences. In this connection, several global initiatives have been created to address related issues. For example, the Global Spatial Data Infrastructure Association encourages the collection, processing, archiving, integration and sharing of geospatial data and information using common standards and interoperable systems and techniques, and posts the data on the Web. An extensive list of other global initiatives is available at the Association website (www.gsdi.org/SDILinks.asp).

18. At the regional scale, the following initiatives supply information and products and service the disaster management communities: the Antarctic Spatial Data Infrastructure, ANZLIC-The Spatial Information Council, Arctic GIS, the

[12] Mention of firm names and commercial products does not imply the endorsement of the United Nations.

[13] A multiband radio frequency allows a single radio device to operate on all public safety radio bands. Thus, emergency responders (such as police officers, firefighters and emergency medical service personnel) can communicate with partner agencies regardless of which radio band they are on.

International Centre for Integrated Mountain Development, and the Permanent Committee on GIS Infrastructure for Asia and the Pacific.

19. Infrastructure for Spatial Information in Europe (http://inspire.jrc.ec/europa.cu) is a European Commission initiative that aims to make available relevant, harmonized and quality geographic information for the purpose of formulation, implementation, monitoring and evaluation of community policymaking.[14] Closely associated is the Global Monitoring for Environment and Security initiative, jointly led by the European Commission and the European Space Agency, which has been established to produce and disseminate timely and reliable information in support of policy sectors concerning the environment and security. Other associated projects include the Open Architecture and Spatial Data Infrastructure for Risk Management, the Wide Information Network for Risk Management and the Optimising Access to SPOT Infrastructure for Science, which deal with disaster, risk and crisis management in Europe and establish good practices in various parts of the world. They all use common information architecture principles and have missions convergent with a number of United Nations agencies.[15]

20. Following the strategic advice of a steering committee of 12 international organizations and donor agencies, including, among others, the World Bank, the Munich Re Foundation, the International Federation of Red Cross and Red Crescent Societies and the International Strategy for Disaster Reduction, the UNDP Global Risk Identification Programme (www.gripweb.org) provides information on disaster risks and losses and facilitates the incorporation of that information into risk management decision-making. The programme focuses on capacity development, risk assessment, enhanced loss information and global risk updates.

21. While member States are making significant efforts to improve the ICT infrastructure in Asia and the Pacific to meet the needs of disaster management authorities and a rapidly growing ICT sector, least developed and developing countries are still lagging behind. Member States are also working on acquiring new and improved warning systems and better ICT infrastructure to provide a safer environment and better protection against disasters. Since the focus of disaster policies and strategies has shifted from reaction to prevention, the importance of ICT technology that facilitates effective early warning has become even clearer.

B. Disaster risk and early warning

22. Identification of potential risk and the frequency and occurrences of hazards, through the establishment of successful early warning systems, is essential to the disaster management activities carried out by authorities. Today, almost all countries have a monitoring and early warning system for the main weather- and climate-related hazards. Some countries suffer less from disasters due to better knowledge about disaster management and the use of ICT tools for early warning. As noted above, the lack of information infrastructure for early warning played a part in the high human and economic losses caused by recent disasters in Asia. However, a few countries, such as Bangladesh, are relatively well prepared for annual disasters.

23. An early warning system, depending on the availability of the necessary infrastructure, may use more than one communication medium in parallel. These can be either traditional media, such as public radio and television, fixed telephones, amateur and community radios and sirens, or modern media, such as short message

[14] Group on Earth Observations, “Report of the Subgroup on Architecture”, GEO4DOC 4.1(2), (2004).

[15] Barry Henricksen, “United Nations Spatial Data Infrastructure”, draft discussion paper (United Nations Geographic Information Working Group, 2006).

service, cell broadcast messaging[16] and satellite radio.[17] Services such as e-mail or instant messaging can also be used, but they require Internet access. Online media play an important role, as demonstrated by AlertNet (www.alertnet.org), a good example of an ICT/media initiative that contributes towards early disaster warning and management. That news network aims to keep relief professionals and the general public up to date on humanitarian crises around the globe; its website attracts more than 10 million users per year. Whatever channel is used, the goal is to pass the warning to the people in danger as quickly and accurately as possible.

24. A comprehensive information base is critical to developing, implementing, evaluating and recording plans and programmes to address current and future risks. For example, the India Disaster Resource Network (www.idn.gov.in), initiated by the Ministry of Home Affairs of India in collaboration with UNDP, is a nationwide electronic inventory of resources for disaster management, including, among other areas, early warning. The information, from both the district and State levels, is collected and transmitted so that disaster managers can mobilize quickly. Authorized Government officials, district level nodal persons, corporate bodies and units of the public sector can access this online information system, which is updated every three months.[18]

25. ICT provides most of the tools necessary to develop reliable early warning systems and thereby ensure timely and understandable alert dissemination to those at risk. Interlinked information from various sources is collected, used early in risk assessment and disaster modelling, and analysed quickly for early warning. In order to send an alert from the central authority that monitors and issues the warning to the target communities, one or more communication channels are used.

26. The goal of delivering reliable and effective early warning to populations in potential disaster areas has never been a more integral consideration in the day-to-day management of hazards. Public use of hardware and technology, potentially including computers, radios, televisions and mobile phones, makes it possible for disaster managers to deliver messages simply, quickly and directly. For example, notification technologies allow an administrator (disaster/emergency manager) to deliver within seconds a clear and concise message and instructions to all connected people across a region.

C. Preparedness for response

27. At times of disaster, impacts and losses can be substantially reduced if authorities, individuals and communities in hazard-prone areas are well prepared and ready to act and are equipped with the knowledge and capacities for effective disaster