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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.

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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.

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[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 management. ICT applications can play an effective and tactical role in bridging early warning with early response.[19]

28. For example, ICT supports the provision of assistance during or immediately after a disaster to protect life and meet the basic subsistence needs of those people affected. During an emergency, the ability of responding agencies and field teams to

[16] Cell broadcast messaging is a feature supported by some wireless systems that allows a public warning text message to be sent to all mobile devices that have such a capability.

[17] Satellite radio plays a key role during both the disaster warning and disaster recovery phases, since it works even outside of areas not covered by normal radio channels.

[18] India, "ICT for disaster risk reduction: the Indian experience" (New Delhi, National Disaster Management Division, Ministry of Home Affairs). Accessed from www.ndmindia.nic.in/wcdr_official_documents.htm on 13 August 2008.

[19] Patrick P. Meier, "Bridging multiple divides in early warning and response: upgrading the role of information communication technology", PhD dissertation, The Fletcher School at Tufts University, 2008 (available at www.allacademic.com//meta/p_mla_apa_research_citation/2/5/4/2/7/pages254277/p254277-1.php).

communicate is vital to the establishment of a coordinated effort to mitigate the impact and aftermath of disasters. All those teams must be able to communicate, potentially across borders, to ensure the efficiency of their coordinated actions.

29. Usually, the first ICT tools deployed after a disaster are satellite mobile systems, as they are immediately useable and are scalable from small to larger networks. However, such systems have some drawbacks. First, the cost of usage is high and, generally, could not be sustained even for the medium term. Second, their handling capacity for simultaneous calls is limited, although new satellite phones capable of terrestrial GSM wireless service are now available.

30. Geospatial information facilitates the assessment of damage and the planning of relief activities, and the use of ICT applications, such as disaster management systems, enables better coordination between all the relief actors. ICT-based disaster management systems address the common coordination needs that arise during a disaster, from finding missing people to managing aid and volunteers. For example, the Sahana Disaster Management System, a Web-based collaboration tool, is the result of a project that was initiated by volunteers in the Sri Lankan free and open source software development community after the Indian Ocean tsunami in December 2004. The system was officially used by the Government of Sri Lanka and released as free and open source software. Sahana has been deployed to help manage, among other disasters, the earthquake in Northern Pakistan (2005), the Southern Leyte landslide in the Philippines (2006) and the earthquake in Yogyakarta, Indonesia (2006) (see www.sahara.IK/node/12).

31. For disaster logistics, ICT, including space-based technology, provides for decentralized coordination of flows of materials, inventory management, route planning for vehicles, redistribution of materials and participation of volunteers. Nevertheless, existing regulations can delay critical access to these technologies in a disaster area by imposing barriers that restrict the import and rapid deployment of emergency telecommunications equipment, the use of the radio-frequency spectrum by humanitarian teams, or the transit of necessary personnel and telecommunication resources for disaster mitigation and relief.

D. Coordination mechanisms

32. A survey of nodal disaster management agencies in 22 countries of the region, carried out to determine which activities are funded by national Governments or international agencies, has revealed the following order of priority: (a) hazard zonation and risk assessment; (b) early warning; (c) emergency communications; (d) impact mapping; and (e) damage assessment (see ST/ESCAP/2318). All these activities are highly information- and technology-dependent; therefore, information centres and stakeholders must provide each other with information support to strengthen these activities, as summarized in table 1.

Table 1. Information needs in support of decision- and policymaking

Policies	*Information needs*
National evaluations of vulnerability and risks, and medium- and long-term mitigation and prevention plans	• Hazard assessment mapping • Vulnerability assessment • Risk assessment • Large-scale spatial maps on demographic distribution, infrastructure, lifelines and

	critical facilities, logistics and transportation routes, and human and material response resources
Access to worldwide, regional, national and local warning systems	• Enabling information infrastructure: hydro-meteorological networks, early warning systems, emergency communications backbone, and rapid mapping with near-real-time turn-around

Source: ST/ESCAP/2318, table 2.

33. Policy decisions should be based on (a) sound assessments of data and information provided by multiple sources and (b) standardized methodologies. Such data will support a number of key elements of any disaster reduction policy, in particular the effective applications of early warning systems. Disaster management authorities in developing countries may have insufficient technical capacity to integrate ICT tools into their daily work. It is the responsibility of national ICT stakeholders to improve the accessibility and affordability of ICT products and services in order to support disaster risk reduction.

34. Each hazard has particular characteristics and therefore each requires a different early warning system with appropriate information and timeframes and its own specific technical and coordination mechanisms. The collection and management of such information should be considered one of the prerequisites of disaster risk management. In a disaster situation, authorities need several kinds of up-to-date information to make decisions quickly and take the necessary action. Poor or non-interoperable information exchanges between key players can be disastrous. A platform that integrates data and manages workflow between risk management agencies and their service providers is essential. Management of and access to historical information also contributes a great deal to risk modelling and disaster predictions.

35. Integrated national ICT strategies ensure the effectiveness of disaster risk reduction, by ensuring that the right institutional structures are in place. Because of its cross-cutting nature, disaster risk reduction calls for collaboration by a wide range of stakeholders. Efforts should include a focus on building human, technical and institutional capacities. At the Government level, cross-departmental coordination must be ensured; at the society level, better links between Government, NGOs, the private sector and academia are required. There is a need to raise awareness at all levels. In Bangladesh, for example, these needs are well recognized, which has resulted in institutional reform and better coordination between key line ministries, strengthened capacity at district and central levels and better understanding of the longer-term implications of disaster risk.

36. The legislative/legal framework and mechanisms should be established by the Government, and national institutional networks with clear responsibilities should be developed. Understanding the natural hazards and related vulnerabilities, for early warning purposes, requires a combination of actors from several areas, such as science and research (including social sciences and cultural aspects), land-use planning, environmental studies, finance, development, education, health, energy, communications, transportation, labour and social security as well as national defence. For disaster management to be effective, concerted actions, coordinated by a higher authority, must be taken by specific types of institutions to address the many dimensions of data gathering and processing for informed decision-making.

37. Links to existing regional and international mechanisms should be further strengthened, and their service fields should be expanded. Efforts should also be made to explore the possibility of establishing regional and subregional technical supporting capacities and facilities to help build the resilience of nations and communities. In these processes, national Governments are encouraged to work closely with relevant international organizations, as well as development, technical assistance and funding agencies, and to avail themselves of the experience and opportunities presented by other existing mechanisms to support their national efforts.[20]

II. REGIONAL COOPERATION IN THE USE OF ICT FOR DISASTER RISK REDUCTION

38. At several major international conferences and summits, such as the World Summit on Sustainable Development, the World Summit on the Information Society, the World Conference on Disaster Reduction and the annual United Nations Climate Change Conference, international and regional cooperation to support national efforts in disaster management and risk reduction has been discussed. Recognizing that disaster risk reduction is a cross-cutting issue of great complexity, which requires understanding, knowledge, commitment and action, ESCAP adopted resolution 64/2 of 30 April 2008 on regional cooperation in the implementation of the Hyogo Framework for Action. In the resolution, the Commission requests the Executive Secretary to, among other things, strengthen the role and capacity of ESCAP in the area of disaster risk reduction and take effective measures to facilitate, in cooperation with relevant United Nations entities, the implementation of the Hyogo Framework for Action in the region.

39. ICT tools and applications for disaster management are becoming more accessible and affordable to developing members of ESCAP, including countries with special needs. However, there is a need to assist developing countries in accessing and effectively managing such applications at the grass-roots level and upwards (see E/ESCAP/CMG(3/II)/4).

40. ESCAP has been promoting the integration of disaster management into national development planning, the operational use of space-based technology in disaster management, and regional cooperative mechanisms for disaster management. The Commission is of the view that the regional cooperative mechanisms would facilitate equitable sharing of available information and other resources among all countries in the region. A study[21] prepared by the secretariat provides a model framework, suggests modalities for regional cooperative mechanisms to address drought, flood and related disasters, and proposes actions towards institutionalizing the mechanisms. One of the key prerequisites for such mechanisms is the strengthening of national-level risk assessment capabilities.

41. Disaster risk reduction is a complex issue and requires an understanding of the disaster cycle, knowledge accumulation, commitment to action and regional cooperation. Since its establishment, ESCAP has been committed to assisting members in Asia and the Pacific to prepare for, and respond to, hazards and disasters. ESCAP has also been promoting the formation of regional cooperation mechanisms in disaster management, including disaster communications. The lessons learned from

[20] See the Beijing Action for Disaster Risk Reduction in Asia, adopted by the First Asian Ministerial Conference on disaster Risk Reduction (Beijing, 2005), available at www.gov.cn/misc/2005-09/30/content_73398.htm.

[21] 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).

those experiences could be used for promoting regional cooperative mechanisms in ICT for disaster risk reduction.

42. In the Beijing Action for Disaster Risk Reduction in Asia, national Governments were encouraged to use and strengthen existing regional cooperation mechanisms, such as ESCAP, to ensure that available resources are used in the most productive way, follow up on the recommendations of the Action, and facilitate the review of the implementation of the Hyogo Framework for Action. The latter called upon regional organizations to promote, among other things, the development of regional programmes for hazard and vulnerability monitoring and assessment, early warnings to disasters, the sharing of information and capacity development, to support national and regional efforts to achieve the objectives of the Framework.

A. Sharing infrastructures and resources

43. The increasing integration and mutual dependency of information and communication technologies is accelerating the provision of information services at a lower cost and with broader penetration. As many smaller economies still cannot afford to have their own full-fledged disaster management information systems, there is a need to explore affordable ways to share the infrastructure and information resources at the regional or subregional levels. To respond efficiently to natural disasters that span borders, international cooperation has become an indispensable means of providing affordable access to resources for effective disaster management.

44. In 2002, WMO launched the development of a coordinated global information infrastructure for the collection and sharing of weather, water and climate information for all WMO and related international programmes: the WMO Information System (WIS). WIS implementation builds upon the most successful components of the Global Telecommunication System, in an evolutionary process. It includes the development of a comprehensive global electronic (online) catalogue, comprising the necessary metadata information, of all related data, and is intended to serve the whole user community, including operation and research. WIS is based on the use of international ICT industry standards, as well as modern data communication services, including the Internet. WIS is to be a major component of the Global Earth Observation System of Systems.[22]

1. Regional emergency communication systems

45. The absence of effective communications infrastructure is a major obstacle for many least developed countries, landlocked developing countries and Pacific island developing countries. This deficiency prevents timely access to telecommunications and information products and services, which is a serious impediment to preparedness for and rapid response to major disasters (see E/ESCAP/CICT/2).

46. Recent experience shows that, when disasters strike, telecommunications can save lives. ICT applications for disaster reduction play key roles in providing early warning of environmental hazards, thereby helping to preserve economic continuity, social structure and cultural dynamics. Recent tragedies have drawn attention to the life-saving role of common technologies, such as mobile telephony-based text

[22] 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).

messaging.[23] The importance of those technologies was evident in the Cyclone Nargis disaster in 2008.

47. Although communications technology has a role in all the phases of disaster management, most applications have traditionally been in the response and recovery phases. The convergence of technologies leads to greater possibilities for integrating different communications systems. Therefore, the interoperability of various systems, including the Internet, mobile phones, fax, e-mail, radio and television, is becoming increasingly functional. As a result, the possibilities for their use in the mitigation and preparedness phases are also increasing.

48. Disaster risk communication helps ensure that at-risk communities become more aware of the threats they face and the protective actions they can take. In emergency response and management, it is extremely important to have operational communication links between decision makers at various levels and operational response teams on the site. Unfortunately, the regular telecommunications infrastructure of public wired and wireless telephones is usually disrupted by the disaster. It is essential to set up reliable information and communications networks employing both terrestrial and satellite-based communications technologies with redundancies to establish a base network for the national emergency communication plan.

49. Communications satellites have been particularly instrumental in facilitating the necessary last-mile connectivity and extending the reach of ICT services to remote and isolated regions.[24] Because of their ability to provide rapid broadband communication deployment, satellites can form the backbone of a communications system during an emergency. Satellite broadband communication has been recognized as one of the most useful means of supporting disaster response. Satellite communication-based services, providing large bandwidth connectivity, could be rapidly and easily redeployed to other locations when and where needed. IP-based platforms support voice, data and video communications requirements, and a network of relevant nodes within a disaster management system would ensure the flow of information in a timely manner.

50. Satellite-based emergency communication has demonstrated immense potential in emergency management. The satellite communication sector, having moved into the private domain, can be harnessed only through public-private partnerships. The Tampere Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations,[25] which came into effect on 8 January 2005, is expected to enhance the penetration of satellite-based emergency communication. Removing regulatory barriers and strengthening transborder cooperation between countries, actions facilitated by the Convention, is an enabling step in this direction.[26]

51. Countries need to be prepared and establish standby mobile communication systems, including plans for rapid restoration of communication facilities and services, to provide communication support to disaster response actions and temporary services to the people affected. Standby emergency communications arrangements, which would involve not only the telecommunications authorities and service providers but also the disaster management authorities and stakeholders, should be an integral part of national disaster reduction strategy.

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[23] "Essence of early warning systems", *i4d Magazine*, 18-22 January 2005 (available at www.i4donline.net/feb05/disaster_full.asp).

[24] According to a count conducted by the secretariat in June 2008, the Asia-Pacific region is being served by 302 communication satellites.

[25] United Nations, *Treaty Series*, vol. 1586, No. 27688.

[26] For more information, see E/ESCAP/CDR/3.

2. Regional mechanisms to provide space-based information

52. Many recent ICT initiatives, mainly promoted by space agencies at the global and regional levels, support cross-border sharing of information from Earth observation satellites to facilitate disaster management in the region. However, some countries lack the capacity required to access and process the information and integrate such tools with national disaster management practices. Furthermore, space-capable countries tend to lack committed policies for the long-term provision of such services. Countries in the region have thus realized the necessity of developing harmonized regional cooperative mechanisms to ensure easy and affordable access to such services and to facilitate the effective use of information in national disaster risk reduction practices. In this respect, the secretariat has been working to prepare for such cooperation and intends to complete this task with interested members.

53. The United Nations Platform for Space-based Information for Disaster Management and Emergency Response[27] is an initiative aimed at, among other things, ensuring that all countries have access to and develop the capacity to use all types of space-based information to support the full disaster management cycle. The initiative aims at developing a gateway to space-based information for disaster management support, connecting the disaster management and space communities and facilitating capacity-building and institutional strengthening, in particular for developing countries. Under the initiative, the United Nations Office for Outer Space Affairs, in cooperation with ESCAP and the Pacific Islands Applied Geoscience Commission, held a regional workshop in Fiji in September 2008. The workshop recommended that a survey be conducted among Pacific members to assess national disaster management and information requirements. Among the other major outcomes of this workshop, the Pacific Disaster Net (www.pacificdisaster.net), a Web-based portal that will help link disaster management specialists and resources throughout the Pacific subregion, was launched.

54. Within the region, the Sentinel Asia project, initiated in 2005 by the Asia-Pacific Regional Space Agency Forum, aims at integrating space information and value-added products and services from Earth observation satellites, Internet-based means of dissemination and communication satellite capability into a regional support system for disaster reduction by 2010. The Web-based platform established under this initiative would be used to develop a harmonized regional cooperative mechanism for ICT applications for disaster management in the Asia-Pacific region. Currently, India and Japan are providing existing satellite resources. Some countries in the region are contributing with their ground-based infrastructure and processing facilities, and have expressed an interest in providing support with their future Earth observation satellites. Capacity-building for technical users of emergency-response agencies on the utilization of satellite images for disaster management is undertaken primarily in coordination with the Asian Institute of Technology and ESCAP.[28]

55. ESCAP is working closely with the Japan Aerospace Exploration Agency to promote access to Sentinel Asia resource and services. At the Regional Symposium on a Regional Disaster Management Support System-Satellite Information Access Mechanism, held in March 2008, participants discussed and identified necessary actions to establish an effective and efficient mechanism for the distribution and operational utilisation of space data in disaster management, including the possibility of establishing a network of national focal points in each country to coordinate issues related to regional disaster management support systems and designating a contact point for requesting access to Sentinel Asia services.

[27] See General Assembly resolution 61/110 of 14 December 2006.
[28] See the Sentinel Asia Website at http://dmss.tksc.jaxa.jp/sebtinel/contents/SA-main.html.

56. WMO is developing profiles of International Organization for Standardization series 19100 standards for the implementation of the WMO Information System.[29] The use of profiles will facilitate interoperability and connectivity, including the exchange of information between individual national meteorological and hydrological services and between each service and its users.[30] The use of standards helps to ensure cost-effective implementation of information systems, and greatly facilitates sustainable implementation in developing countries.

57. International cooperation has been recognized as one of the important strategies for providing access to Earth observation products for civil defence and disaster management agencies in support of emergency management. The International Charter: Space and Major Disasters (www.disasterscharter.org), implemented in October 2000 to ensure immediate access to Earth observation data from participating space agencies to authorized organizations, is a major step in this direction. The main features include an operational mechanism which delivers Earth observation products to civil protection agencies, emergency and rescue services and to signatories during emergency situations. The United Nations has been a cooperating body under the Charter since 1 July 2003. A number of specialized United Nations agencies can request activations of the Charter. Since its institution, the Charter has been activated hundreds of times; more than half of those activations have been for United Nations bodies.

58. The Operational Satellite Applications Programme of the United Nations Institute for Training and Research (http://unosat.web.cern.ch/unosat), implemented by a United Nations-led open consortium of value-adding private companies and specialized public resource centres, such as the European Organization for Nuclear Research, is another example of such coordination. It was initiated with additional support from the European Space Agency, the Centre national d'études spatiales (the French national space agency), and the Governments of France and Norway. Most United Nations activations of the charter are initiated through this programme.

59. Efforts to build the Global Earth Observation System of Systems, an initiative by the intergovernmental Group on Earth Observations, represent an important step in improving the coordination of Earth observations.

60. As noted in chapter I, Global Monitoring for Environment and Security in Europe is a regional example of a mechanism that produces and disseminates such information.

61. The frameworks discussed above have helped to promote Earth observation products that aid in disaster reduction. However, most such products have been used during the response phase of a disaster, without the participation of stakeholders and without capacity-building mechanisms at the user's end. In both the pre- and post-disaster phases, combining Earth observation products with socio-economic and other information adds substantial knowledge and provides structured solutions to the demands of users at the international, national and local levels.[31]

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[29] The use of profiles aims to address the problem of describing datasets and defining their contents in a way that is widely understood. Profiles will allow users to find where data are held and provide the information they need to request and retrieve those data. By imposing a common method of describing the data, profiles make it possible for people from different backgrounds to find data of interest to them (S.J. Foreman, "WMO core profile of the ISO 19115 Meta data Standard" (World Meteorological Organization)).

[30] 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).

[31] 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).

B. Regional disaster information networks

62. Governments at all levels, as well as populations exposed to disasters, must be able to access the information necessary to deal effectively with plans, programmes and response actions related to disaster risk reduction. When a region is hit by a major catastrophic event, Governments urgently need access to current space- and land-based information. In order to engage in a prompt response, major stakeholders should have access to regional and global good practices and expertise in organizing and coordinating complicated, large-scale emergency response actions, as well as to advice from experts. By accessing experiences of communities that have dealt with disaster impacts, and by using knowledge, innovation and education to improve the culture of safety and resilience, communities could strengthen their disaster preparedness for effective response.

63. National and regional disaster networks are invaluable sources of information. As long as they complement each other, they are practical for effective information sharing and coordination. Some mechanisms already exist. For example, through a UNDP initiative, the Governments of Indonesia, Maldives, Sri Lanka and Thailand have established nationally owned systems for aid information management in order to trace tsunami aid resources and relevant project results more effectively. Under the same initiative, a regional information portal has been developed as a resource for coordination at the regional level. It brings together results and resource-allocation information from each country and makes them available at the website http://tsunamitracking.org.[32]

64. A comprehensive database of disaster-management-related inventories and an organized information dissemination system are essential for mobilizing resources to respond immediately during a disaster. To date, a lack of adequate, up-to-date information on disasters has hampered quick and measured response, resulting in delays which were critical. An online inventory of emergency resources could be developed through South-South cooperation. Valuable non-confidential information, in addition to being managed at national data centres, could be replicated, in subregional or regional centres that are facilitated through bilateral or regional agreements among partnering countries. Such centres could also add value to the data.

65. The secretariat has offered to promote the network of networks on knowledge sharing and analysis for disaster management (see E/ESCAP/CDR/3). The mechanism would be multi-sectoral, to orchestrate coordination and cooperation among the different national and regional networks and the disaster management authorities that have responsibility for specific hazards and its operations. In this context, the secretariat undertook a survey of major national, regional and international initiatives and networks for disaster risk reduction, response, recovery and management which have been assisting members of ESCAP. The list also includes the key international and regional mechanisms which provide a framework to assist the member countries in determining courses of action, policies and regulations.

C. Capacity-building

66. Institutional capacity is necessary for addressing gaps in access, adoption and value in the utilization of ICT products and services in least developed and developing countries. All the steps necessary for making ICT services operational in support of disaster risk reduction depend on possessing and maintaining capacity, converting data into useful information and services, establishing infrastructure, training stakeholders to use services effectively, and integrating national endeavours with international systems. Developing countries, especially countries with special needs, still need support in these areas.

[32] For further information, see E/ESCAP/CDR/3.

67. The impacts of disasters can be substantially reduced if people are informed of the risk, know how to behave in an emergency, and receive early warning. A national and regional culture of disaster prevention and resilience can be attained through human and institutional capacity-building on disaster risk reduction. Sharing of disaster information, indigenous knowledge, research results, good practices and lessons learned regarding hazards and vulnerabilities is the key to improving capacities.

68. In general, disaster management authorities in most developing countries lack technical capacities, in particular ICT and space technologies for analysing and interpreting information. Capacity-building in the use of information and communication technical tools for disaster risk reduction encompasses not only education and training (building technical skills) for the personnel, but also organizational and institutional strengthening. ESCAP utilizes the well established network of its Regional Space Applications Programme, in cooperation with other relevant organizations, to build the capacities of countries at individual, policy, institutional and technical levels, thereby integrating the use of ICT into disaster risk reduction management.

69. ESCAP and other regional and international agencies, Governments and the private sector all have important and complementary roles to play in ICT capacity-building for disaster risk reduction. The special capacity-building needs of least developed countries, landlocked developing countries and small island developing States, which are particularly vulnerable to natural disasters, should be addressed in relevant platforms and forums by the international community at large.[33]

III. ISSUES FOR CONSIDERATION

70. In the context of the critical role of ICT in the area of disaster risk reduction, the Committee may wish to advise the secretariat on priority areas of work with regard to the following:

(a) Promotion of regional cooperative mechanisms for sharing information, communication and space-based resources, including emergency communications, at the regional and subregional levels to support better disaster preparedness and response by all members;

(b) Development of a methodology for evaluating the level of disaster preparedness and national ICT infrastructure, identifying good practices and producing guidelines for member States on how to increase the resilience of this critical infrastructure;

(c) Research and analysis of the effectiveness and impacts of ICT applications for disaster risk reduction with a view to possibly including such tools and applications in ICT policies;

(d) Cooperation with the national platforms for disaster risk reduction to facilitate the dialogue between disaster management authorities and ICT authorities at the national and regional levels and thereby increase the use of relevant technologies for disaster risk reduction.

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

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[33] "Essence of early warning systems", *i4d Magazine*, 18-22 January 2005 (available at www.i4donline.net/feb05/disaster_full.asp).