Sustainability and Using Information Technologies in Disaster Managament

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Abstract

Sustainable development is a concept that meets the needs of present without compromising the ability of future generations to meet their own needs. In recent years world population suffered by numerous natural and manmade disasters so that they strived to

protect their own existence prior to the future. However, most of the disasters were caused by un-sustainable attitudes of politicians, decision makers and communities.

In this paper, the concept of disaster management and using information technologies in disasters will be discussed in the sustainability context. The study focuses on the use of information technologies in disaster situation. Information technologies are used in before and after of disaster.

In this paper role and place of communication and communication technologies in crisis and disaster situations is considered. This issue, crisis, disaster communication, coordination of disaster situation examined using national and international literature and experience of disaster occurred. In the study developments on the use of communication technologies in disaster management, success of disaster information systems in disasters, advantages and disadvantages of using communication technologies are examined.

Keywords: Sustainability, Crisis Management, Disaster Management, Communication Technology, Public Administration.

1. COMMUNICATION TECHNOLOGIES FOR DISASTER MANAGEMENT

Developments occurring in the field of communication technologies have elleminated the constraints of time and distance. These technologies can help to disaster managers to solve complex problems usin socio-technical system approach. (Çelik and Çorbacıoğlu, 2010: 140).

The main communication technologies used in disaster management computer technologies that can be used in different types of disasters and different processes of disaster management These technologies are used for flow of information, emergency contact, mitigation, intervention and allows the realization of information of fast and high quality way.

Since the 1990s, these technologies have become an important part of disaster and emergency operations (Fink, 1986; Heath, 1998: 275). The main activities of these technologies and their use in disaster management are listed below (Marincioni, 2007: 460;

the Ministry of Public Works and Housing, 2004: 77-79; Stephenson and Anderson, 1997: 320; Mathew, 2005: 55);

a) Early warning systems and simulation models: provides information about the possible effects of the disaster, disaster risk, and the number of potential people affected by disaster and these systems aimed at risk reduction, bringing people to move as quickly as possible. Simulation models are used as instruments for disaster preparedness: public health measures, planning, decision making etc. To create early warning system, seismometers, sub-sea tsunami detectors are used for this purpose. Thanks to early warning systems tsunami, hurricane, flood, landslide hazards can be identified and it is possible to allow time to take action (Samarajiva, 2005: 735).

b) Web-based disaster databases: computer software and hardware system that transfers data which properties of the disaster affected area and vulnerable community. Thus, it is possible o identify risk areas, and strategies for fighting the risks of the community-owned.

c) Satellite communications: Particularly search and rescue operations, these systems refers to the utilization of global positioning systems, images and aerial photographs to determine map coordinates of points that identified urgent target to be achieved, Disaster areas and support the need for warning signals to quickly handle the situation in order to obtain the use of satellite telecommunications systems will replace the mobile space-based communications infrastructure systems, telephone systems, allowing the introduction of commissioning.

d) Remote sensing systems: Using optical and radar satellite systems these techniques are used to prepare land use plans and disaster prone areas, to determine risk areas and infrastructure.

e) Geographic information systems and spatial planning (ground positioning systems): Using radar and GPS space technology, especially on potential areas, it is provide benefit to be prepared for earthquakes, observation and monitoringof risky areas; the simulation used in the fields in disasters, making the situation analysis, risk assessment, spatial modeling, disaster mapping.

f) Decision support systems: makes it possible to develop decision support systems and expert systems for using internet, information infrastructure in disaster-related areas. Internet, expert systems and decision support systems provide for rapid decision-making, options assessment, and disaster management and analyze.

g) Mail, web sites, internet: these technologies are used to meet needs in disaster areas, education and information about disasters andrelated activities.In the process of disaster internet, TV and video-conferencing systems provides the possibility to experts discuss disaster in e-mail, chat rooms and other media (Marincioni, 2007: 472).These technologies, videos, graphics, links to connect users to do the voting, statements of opinion, do the experts predict, allowing discussion of the possibilities to use the channels, which allows local reporters to login to introduce disaster areas and be contacted in this process, to involve stakeholders in co-operation done. Frequent updating web pages on disaster/crisis to provide information about the possible effects, scope of disaster (Coombs, 2007; Seeger, Sellnow and Ulmer, 1998: 248). Especially sudden events such as natural disasters, fast and frequently updated information is quite important. 1996 Kobe Earthquake, Oklahoma City bombing

Internet was the most important communication tool. Using internet electronic networks, maps, photos, digital damage, have been able to reach disaster victimsand their relatives. Forest fires in California, Google maps used by those who wish to obtain information about shelters.In Hurricane Katrina Craiglistler was used as an area offering a variety of forms of assistance.After the September 11 attacks, company web pages, personal blogs used to provide assistance and information (Semaan et al., 2010: 1-10).The spread of the internet, from an emergency disaster warning, breaking news, fast-changing data, real-time video feeds, given the opportunity to reach the literature on natural disasters and emergency situations.

In recent years using of social media in the process of disaster has increased. Social media and blogs have become an important source of information and they have power to influence experts and opinion leaders (Edwards et al, 2010: 1-4; Krakovsky, 2010: 1-6; Starbird et al, 2010: 1-5; Latonero et al, 2010: 1-10).After the Banda Aceh Tsunami Twitter used by people to help disaster victims, and drew attention to the speed transformation of news according to the traditional news channels.The interactive nature of Twitte, obtain information to public administrators about disasters, collect, and analyze statistical information about the community affected by disaster, after disaster to keep, serves as a tool to determine the survival rates (Zhu et al., 2011: 431).

Additionally, computerized imaging, intelligent vehicles, disaster archives, digital libraries on disasters, meteorological satellite systems, radios, cell phones, fax, tv, emergency telephone lines, sms, rss, telecommunications, communication networks are used extensively in the disaster.

In next years, these technologies are used in the field of disaster management is likely to add new ones, and the diversification of existing ones. Coming years it is expected that the

diversification of specialized micro-processors and sensors, multimedia, remote monitoring and data collection instruments. In this context, it is probably in the future, the use of disaster and emergency management such as extensive networks with broad bands of the Internet, network commerce, smart grid search software, high-capacity data storage systems, smart cards, mobile, wireless personal digital assistants, high-performance computers, high-resolution satellite imagingTechnologies will spread (Sephenson and Anderson, 1997: 320).

2. EXAMPLES OF USING COMMUNICATION TECHNOLOGIES FOR DISASTER MANAGEMENT

Communication technologies in disaster following the earthquake used in Mexico City in 1985 for the first time, called an ATS-3 (The Advanced Technology-3) system, in order to ensure communication, international aid. Used in the process of rebuilding of Armenia Earthquake of 1988, the U.S. space the bridge is accepted the largest comprehensive telemedicine disaster assistance project. Similar tele-medicine projects between the U.S. and Russia used in medical consulting and medical education in the process of disaster response, and then these Technologies began to be used extensively in communication technologies, especially medical procedures (Reddy et al., 2009: 263; Mathew, 2005: 2005, Meissner et al., 2002). Advanced communication technologies in the U.S. in the Gulf War (1991) mobile health units, the U.S. assistance to Somalia (1993) also used a remote clinical communication system (Garshnek and Burkle, 1999: 215).

Increasing the number of systems to ensure coordination used in the communication technologies in disaster management, including international organizations, especially to coordinate disaster response operations. The main purpose of these systems which called Emergency Management Information System (EMIS) in disaster management make life easier for employees, the organization of existing information and resources to more effectively not only geographically but functionally different channels and means of cooperation offer. Some of these are given below (Onorati et al., 2010; Dorasam and Raman, 2011: 3; Currion, 2007: 62):

a)The UN is one of the most important organizations in the international disaster response operations. Using disaster information systems the UN coordinate different types of disaster and humanitarian relief operations

aa) UN-OCHA: serve on the internet, intended to provide synchronization, mapping, flexible design. Some projects coordinated by OCHA such as IRIN (Humanitarian News and Analysis), CAP (The Consolidated Appeals Process), CERF (Central Emergency Response

Fund, The), FTS, RedHum (América Latina y el Caribe Red de Información Humanitarian money), OCHA3W (Who does What Where / Contact Management Directory), IASC (The Inter-Agency Standing Committee). Using these these projects web pages, it is possible to organize, download documents or information about disasters (Bui et al, 2000: 436).

ab), UN Relief Web: provide mapping, online library, professional resources, web-based service, designed for different types of disaster application forms, assessments, maps, press releases, field research, the reports.

ac) LARED-UNDP-GMP: provide disaster information cards, database support, GIS, provides google maps.

ad) FEMIS (Federal Emergency Management Information System): provide google mapping, reader blogs, disaster modeling, provides.

b) Within the European Commission;

ba) ECHO (European Community Humanitarian Office): serves within the framework of the Emergency Public Information Centers and Communication and Information System (the Common Emergency Communication and Information System-CECIS).

bb) European Commission prepared a report that better protection of European citizens in order to improve disaster, the aim of this project establish an early warning system within the framework of the Indian Ocean in 2007. The Commission's objective to create real-time monitoring, providing real-time data and multi-faceted approach to disaster-warning mechanisms and to increased analytical capacities of participating countries.

bc) Meteoalarm: founded by the European meteorological service, as a collection of Internet-based multi-lingual European alert platform for weather warnings.

bd) The Global Disaster Alerts and Coordination System (GDACS): a fully automated manner with the participation of the EU and the UN, works with the data obtained from natural disasters 24/7 according to the warning system.

be) the Commission are also prepared early warning systems for specific groups of disaster. The European Commission, the European Flood Alert System (EFAs) has funded the

establishment. EFAs, 3-10 days prior to the damaging floods alert monitoring and information center. AK forest fires, forest fire information system was set up, with this system, and 6 days prior to the daily weather forecasts are made of fire hazard maps, maps of fire locations on a daily basis, 7 days in advance by means of satellite images also provided estimates of damage and risk areas on a daily basis, are published in the hot spots. The European Mediterranean Seismological Center in the Mediterranean region with a partnership with the determination of earthquake risks and Tunisia cooperated on adding three new sensor. Earthquakes in North Africa with the presence and location of the sensors to determine more clearly the nature of the increased chance. AK, as well as with inter-governmental Oceanographic Commission K. Tsunami early warning system has been cooperating in the Atlantic and the Mediterranean. European Commission, the effects of disasters and mitigation works on the development of technologies associated with the subject. Commission management research, information society, with a joint research center is engaged in disaster prediction and disaster management. Institute for environment and sustainability, especially within the joint research center, the commission is working tightly with the civil protection service.

c) SAHANA: Established after the Indian Ocean tsunami (2004), the system provides open source software, training, aid distribution, status, mapping and response management. The Free and Open Source Software (FOSS) is a system open to sharing information, transparent and acting suitable for the general principles of humanitarian organizations.

d) FEMA: FEMA is a organization that serves information about places for temporary shelters, medical special needs, materials, distribution points for aid materials, GIS, mapping etc.

e) DERMİS-Dynamic Disaster Response Management Information System

f) SARVOYADA: operated during the tsunami.

g) IMASH-Information Management System: Designed for hurricanes.

h) Digital Typhoon: Provides information about typhoons.

i) PeopleFinder and ShelterFinder: Google search engine service which is heavily used in disasters. This system heavily utilized positioning and applications, helping those who struggle quake in Japan and Haiti,

i) NIMS: National Incident Management Systems has been operating in the United States.

j) DesInventar System: The system supported by UNDP and used in Africa and Latin America; works as a database to serve information about post-disaster damage, historical disaster data collection tool

k) SIGAME: The sysytem was established after the mass fires in Galicia (2007).

h) HAVARIA: The system works as a Disaster Information Services Alert Map, Global Display of Terrorism and suspicious events

i) CRED-The Centre for Research of the Epidemiology of Disasters: The system was founded in Belgium (1973) as a international organization. System used by many international organizations, such as UN's EM-DAT (Emergency Disaster-Emergency Disaster Database Data Base), EM-BİB (Documentation Centre, bibliographic databases) (Hamzaçebi, et al., 2007: 179).

i) Emergency Disaster Database (EM-DAT): The Research Centre of the Epidemiology of Disasters (OFDA / CRED) is an organization which covering the largest database about natural disasters. CRED prepares an annual statistical data tables and analysis. It can be searched by date, user country, disaster type, and system serves statistical database about list of general disaster. There are also some maps based on the EM-DAT database. These maps show the geographic summary about effects of disasters and catastrophes between 1974 and 2003.

j) The Asian Disaster Reduction Center-ADRC: In order to reduce the effects of disasters and to share information about disaster in the Asian region it was establish in 1998, Japan.

22 states are member of ADCR today. System provide disaster related information about country / region, date, disaster type, loss of life and property, disaster related links (reports, articles), geographical data information, emergency response information (Hamzaçebi, et al., 2007: 179).

k) Emergency Management Australia (EMA): Emergency Management Australia (EMA): disaster databases in EMA's website serves information about historic disasters in Australia. All hazards are identified by type, date, district, region, the total number of dead, injured, number of affected population and the number of homeless (Hamzaçebi, et al., 2007: 179).

l) Canadian Disaster Database (CDD): It was established in 1990, it provides information about wars and conflicts in ten years period except for natural and technological disasters (Hamzaçebi, et al., and 2007: 179).

Besides these sites, there are web sites that provide information in different areas of disaster management, disasters, response operations, video, teleconferencing, early warning systems, disaster awareness on radio, television, cable television, amateur radio, wireless communication systems, and some organizations such as EU, WHO, FAO, IFRC, the Natural

Hazards Center and the Pan-American Health Organization, DEC (Mathew, 2005: 56). Some institutions, such as The U.S. National Hurricane Center, the Caribbean Hurricane Page, the National Meteorological Center, serves as a mechanism on the web, to warn people, inform the path of disaster, provide information on damage . Epix, Colorado Natural Disaster Center, DHA, and many other website, electronic magazines and related material, such as the Journal of Humanitarian Assistance have become possible information sources. After the G7 summit in 1996, under the name of Global Emergency Management Information Network Project (GEMINI) was created by a global network (Stephenson and Anderson, 1997: 325).

3. USE OF COMMUNICATION TECHNOLOGIES FOR DISASTER MANAGEMENT SYSTEM IN TURKEY

Public organizations that responsible for disaster management in Turkey are organized in national and local governments. Disaster and Emergency Management Authority (AFAD), founded in 2009, is the basis of the system. Departments of Disaster and Emergency Authority are Disaster and Emergency High Council, Disaster and Emergency Coordination Committee, Earthquake Advisory Board.

AFAD web page provide information about disaster, concepts associated with disaster, types of disasters, disasters occurring throughout the world, Turkey's National Disaster archive, disaster maps of cities in Turkey and their risk status according to different disasters, measures to be taken in the face of disasters, risk management, civil defense and first aid. Using maps, tables and sateliteimages, Office of Earthquke which department of AFAD, provides information about earthquake that occur since 1900, in last 24 hours and last 30 days.

The aim of National Disaster Archive System of Turkey is , using information technologies, to share information with other related public organizations, about disaster experiences of our country, disaster management system, disaster respond and recovery activities (Hamzaçebi et al., 2007:181).

Regional and local seismic networks are established and operated by the universities in Turkey. In addition, the TUBITAK Marmara Research Center Earth and Marine Sciences Research Institute works to build and operate regional and temporary seismic networks.

Bogazici University Kandilli Observatory and Earthquake Research Institute is a main organization that monitoring earthquakes on a national scale and producing information for emergency response agencies at the national and international scale. Bogazici University

Kandilli Observatory and Earthquake Research Institute works as a 'National Seismic Network', it gives information about earthquakes to inform responsible public authorities. Institute has got 102 seismic stations across the country. It collects, evaluates data and then transfers information to related institutions. (Ministry of Public Works and Housing, 2004: 71-72).

As a part of The General Directorate of Disaster Affairs, TURKNET (Turkey National Telemetric Seismic Network), was founded in 1989. The purpose of TURNET is to try to determine causes of earthquakes and TURKNET studies on hazard mitigation of earthquakes. TURNET has got a network which spread across the country. The network has got 31 stations. 12 of them are located on the North Anatolian Fault Zone (NAFZ). TURKNET information center provides newsletters and catalogs, seismicity maps, long-term data, a fast and automatic earthquake alert, information via the Internet, a reliable estimation of the earthquake (Alkan, and Kaplan, 2005: 164-165).

"Active Fault Map of Turkey" is published in 1992 by the General Directorate of Mineral Research and Exploration (MTA). It is a reference source and shows the map of active faults of the whole country. From the date of its publication, this map is a main data resource for ongoing efforts about earthquake in our country. The Ministry of Public Works and Settlement prepared and released "Earthquake Zoning Map" in 1996.

Especially after the 1999-Marmara Earthquake, initiatives for the establishment and operation of disaster information systems, national scale disaster information technologies have been increased in Turkey. In this context joint studies with international organizations as the World Bank, EU, JICA, have been increased. Universities, municipalities prepared projects, implementation plans and reports for addressing issue on a regional, national scale. However, the majority of them have been an attempt or preparation. Process has been continuing. Some of these studies are follows: (Ministry of Public Works and Settlement, 2004: 71):

i) "Turkey Geographic Information Bank" the preparatory work was completed in 1995 by the SPO, the system aims to provide production and use survey data.

ii) "Management Information System" Project; has prepared by the Prime Ministery, the system aims a healthy flow of data between public bodies, to ensure using computer network that sought to establish a Standard.

iii) "National Geographic Information Systems Strategies in Turkey Project" has prepared by Ministry of National Defence.

iv) "Geographical data production and usage survey" has prepared in 2004 by the General Diroctorate of Land Registry and Cadastre.

v) "Turkey Disaster Preparedness Response and Coordination System Concept 'Report" has prepared by Turkish General Staff.

vi) Documents which showing the required needs of disaster prepared by AFAD

Turkish Disaster Information System (TDIS) has prepared by the Ministry of Interior and Istanbul Technical University in 2001. Four projects have been implemented in In this context: i) National Emergency Management, Training and Exercise Program, ii) Dvelopment Projects of National Emergency Management Model, iii) Restructuring of the National Fire Brigades, iv) National Remote Sensing System (UAS) and Geographic Information System (GIS)-Based Data Base and Disaster Management Creating Standards-Oriented Decision Support System (Turkey Disaster Information System - TABİS) . The purpose of TABİS is, using modern satellite technology and information systems, in order to establish the standard model, especially in emergency planning, implementation, and in case of any disaster, disaster management and damage that can be used to estimate, central and function as a decision support system in Turkey. The purpose of TABİS has been creating inventory on disasters, gather information about disasters and transfer them in a information system (Nurlu, 2009).

In addition, Turkish Red Crescent has got a system that estimate damage of disaster. In this way, the Red Crescent, can quickly know the size and needs of disaster. And it can respond to disaster most appropriate intervention. Provincial Disaster and Emergency Management at provincial level, especially in provinces that located in high risk areas, appear to be more active in AFAD Office.

Bogazici University Kandilli Observatory and Earthquake Research Institute, in the context of Istanbul Disaster Preparedness Education Project (İAHEP) has been developed the Geographic Information Sharing System (GISSI). Based on information sharing, using digital maps, GISSI has been provided current data accessibility. In this way, the system aims to help neighborhood organization to the development of earthquake preparedness and post-earthquake emergency response plans. Since 2000, Istanbul Governorship Disater Management Center has been set up to provide coordination and cooperation between the relevant institutions and organizations. Disaster Management Center has been legally responsible for carrying out the preparations for disaster management in İstanbul. Center has been collect, update, analyze and synthesize all kinds of information about disasters.

Another project in İstanbul is the Istanbul Disaster Information System. The aims of the system to do disaster planning, implementation, managament, estimate damages, by using satellite technology and information systems; to provide information for the other provincies,

to act as a pilot decision support system project. Additionally, Disaster Coordination Center in Istanbul Metropoliten Municipality has been providing real-time monitoring about disaster and archive disaster records.Other example of national disaster databases in Turkey is the Middle East Technical University Department of Environmental EngineeringTechnological Accidents Information System.

At local level, especially in the high risky provincies, disaster information technology-based works are a lot. For example, the RADIUS Project coordinate by İzmir Metropoliten Municipality aim to evaluate sismic situation and to determine the possible damages that may occur during an earthquake İzmir. Crisis Management Center of the Governorship of Izmir has been initiated to Emergency Management and Geographic Information System. The Disaster Management Information System (İZAYBİS) established and İzmir Development Agency (İZKA) provided financial support to the "Enhancing the Effectiveness of Disaster Management Framework of the Provincial Emergency Response Plan".Creating a disaster management information system within the scope of this project, studies are performing in Izmir. Crisis Management Center of the Governorship of Izmir sharing information with various institutions and organizations. The center serves information to the other organizations using geographic information systems and digital maps in different formats (Mersin and Şahin, 2009: 45).In Afyonkarahisar Emergency Management and Data Processing Center (ADUYBİM) are available. The center, operates within the scope of GIS. In Kastamonu (Hamzaçebi et al, 2004: 1) and Rize (Balci, 2007) there have been attempts to establish meteorological early warning systems in the disaster information system.

4.CONCLUSIONS AND RECOMMENDATIONS

Because of the disasters, importance of the use of communication tools increased. However, for various reasons, particularly economic constraints, the adaptation of communication technologies in disaster management is not easy. Taking into account these constraints, some suggestions can be developed for adaptation of successful communication technologies in disaster management process.

Using communication technologies, aid agencies who’s responsible for disaster should tie together within the framework of global, national and local scales. While communication technologies are aligned with the local disaster plans at a later stage, this information should be collected on a national scale, and ultimately global disaster information should be shared between relevant countries and organizations. For example, particularly local hospitals should equipped terminals; they should used capable of wireless lines and should be connected to the disaster area. For example, in a disaster situation that

may affect multiple countries such as tsunami, unlike establish early warning systems in each country; establish a common system is more cheap and useful. Indeed, such a model after the 2004 tsunami took place in India and Taiwan (Samarajiva, 2005: 735).

Disaster management should adapt technical infrastructure, people and agencies that involved in the process. In this context, to be prepared for disasters, especially the open-source, easily accessible software and training tools are needed in each stage of intervention (Currion, 2007: 62). Designing the disaster technology infrastructure the possible technical difficulties, social dimensions should be consider. So, framework of disaster management process should be designed as a socio-technical systems approach (Reddy et al, 2009: 267).

An ideal disaster management system should be involved public agencies, citizens, voluntary organizations, private sector. At this point especially in disaster databases and other technologies in disaster design, establish, implementation, financing partnerships with the private sector is very important.

Disaster communication systems should planned alternativly (Lien et al., 2009: 1-10). In an effective disaster management, roles and visions of a local disaster teams must comply with professional standards, appropriate technologies should be used, teams must be open to interaction and knowledge transfer.

After the Marmara Earthquake some important legal and institutional regulations has been done disaster management system in Turkey. But it is hard to say desired level. Some of the strategic objectives of National Earthquake Disaster and Emergency Management Strategy and Action Plan (UDSEP) (2012-2023) which prepared by the AFAD, are to develop disaster information infrastructure and to design new research and develop methods; to establish earthquake data bank; to develop seismic observation networks; to develop forecasting and early warning system etc. (AFAD, 2010: 8-18).

To improve disaster communication technologies in Turkey, some recommendations are as follows:

-National disaster management authority should determine tasks and responsibilities clearly, and should share rolles and responsibilites with government organizanizations, universities, private sectors etc.

-Whichorganization produces and which information must be determined; to standardize the data produced by different organizations, the data flow, rules of data flow should be determined between institutions; the data collected and should be coordinated in one hand.

-Disaster management policies should be prioritized in national policies,

-E-government infrastructure should be completed and disaster management systems should be integrated in.

-A national network system which country-wide disaster monitoring, recording, evaluation, archiving shold set up,

-Institutions responsible for disaster management should be recruited expert-qualified personnel

-Information access, exchange infrastructure should set up in national level.

-National disaster coordination and data center on a space based established.

-Training in disaster management, disaster technologies should be supported

-International cooperation in the use of satellite communications and other systems in disaster management should be increased

-National disaster information system standards, terminology and definitions should be identified.

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