KNOWLEDGE NOTE 3-2

CLUSTER 3: Emergency Response

Emergency Communication

GFDRR
Global Facility for Disaster Reduction and Recovery

THE WORLD BANK

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Emergency Communication

The Great East Japan Earthquake (GEJE) caused immense damage and congestion in telephone infrastructure, including 1.9 million fixed-line services and 29,000 mobile phone base stations. Government radio communication infrastructure was also seriously damaged. Voice messages were widely used to confirm whether family members and relatives were safe, and satellite phones played a crucial role in emergency communication during the response stage. Social media was extensively used for search and rescue, as well as for fundraising. Social media and community radio reach two distinct age groups: social media for the younger generation and community radio for the older generation.

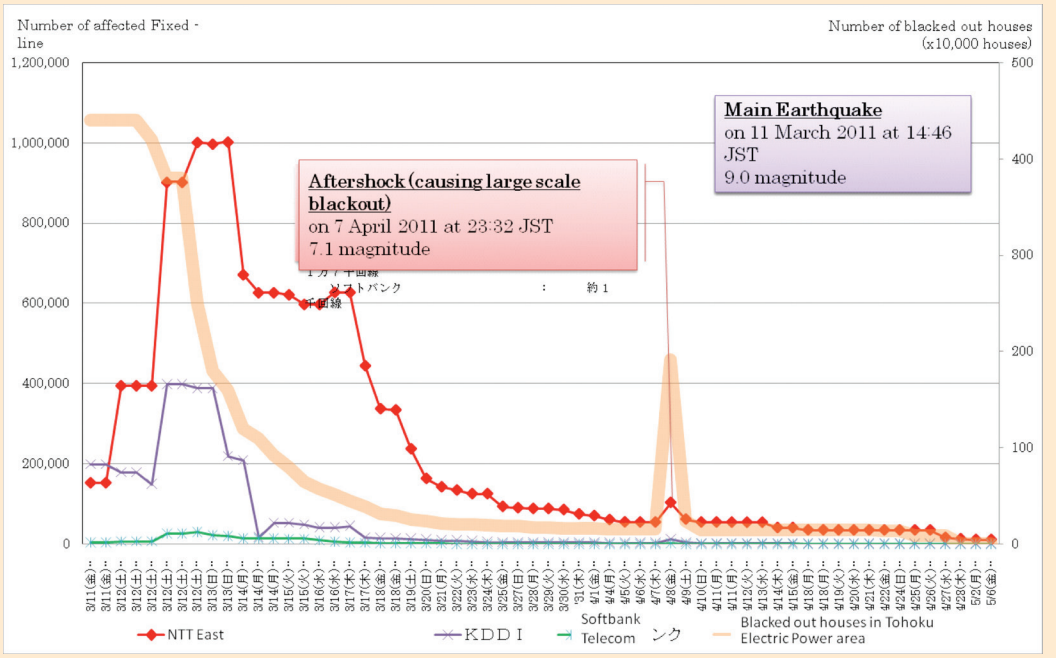
FINDINGS

Communication infrastructure is indispensable in securing government functions and protecting lives and property during disasters. Communication systems are used to disseminate warnings to the public, to enable search and rescue organizations to communicate among themselves, and to confirm the safety of family members and relatives. Social media was extensively used for search and rescue, as well as fundraising. Community radios can provide local information such as times and locations where emergency water and food supplies or relief goods will be delivered.

TELEPHONE

Damage and subsequent restoration of fixed-line, mobile, and broadband services. The Great East Japan Earthquake (GEJE) caused immense damage to both fixed-line and mobile phone infrastructure, including flooding of exchange facilities, damage to underground cables and conduits, destruction of telephone poles and overhead cables, destruction and loss of mobile phone base stations, and draining of backup batteries during the long power outages. In the Tohoku and Kanto regions, an estimated 1.9 million fixed-line services from NTT East Japan, KDDI and SoftBank Telecom were rendered inoperable,

FIGURE 1: **Number of affected fixed lines**



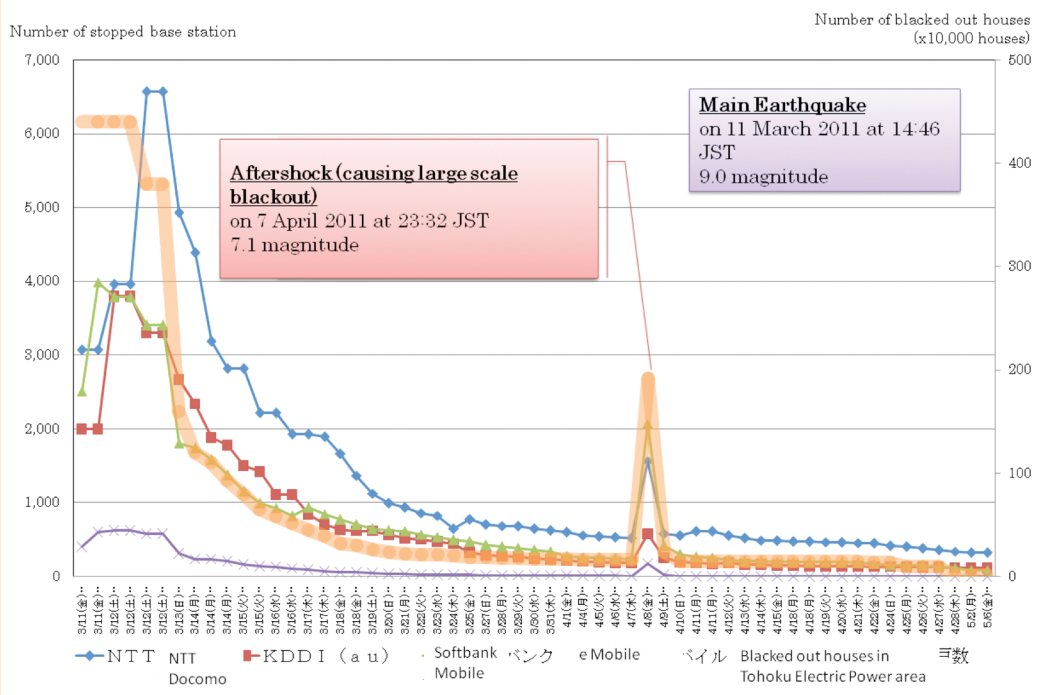
including subscriber lines, ISDN and FTTH, while 29,000 mobile phone and PHS base stations also stopped functioning.

Telecommunications carriers initially deployed mobile power supply vehicles and mobile base stations to those areas with no commercial power supplies, and set about re-building damaged facilities as quickly as possible. The rapid response effort saw full service restored to almost all affected areas, with some exceptions, by the end of April 2011 (Figures 1, 2, and 3).

Voice messaging and other services. The sharp increase in voice call traffic immediately after the earthquake caused significant congestion. Carriers restricted fixed-line traffic by as much as 80-90 percent and mobile services by as much as 70-95 percent in order to allow emergency calls and other critical communications to go through. Mobile phone packet communication services such as email were generally not restricted.* Even when carriers did impose restrictions, they were generally no more than about 30 percent and were only temporary. Thus, packet communications provided considerably easier access than voice services.

* A data stream is divided into packets, or units, that are separately routed to a destination where the original message is then reconstituted.

FIGURE 2: **Number of affected mobile base stations**



Telecommunications carriers set up emergency messaging services so that people could check on the safety and whereabouts of their families, relatives, and other relevant people (figure 4). These services were used some 14 million times following the GEJE. Because of these emergency messaging services, traffic congestion was cleared up on the same day the earthquake struck, in contrast to the Hanshin-Awaji Earthquake in 1995 when congestion continued for five days.

Some mobile phone carriers introduced an emergency messaging service whereby the terminal device converted voice recordings into voice files that could then be sent via packet transmission. Other mobile phone carriers are planning to follow suit.

DISASTER MANAGEMENT RADIO COMMUNICATIONS

The disaster management radio communications networks of national and local governments are generally considered to be more robust and resilient than public fixed networks. In the GEJE, however, many towns and villages, particularly those located along the Pacific coastline, suffered various levels of damage to their radio communications systems, including both community announcement systems with loud speakers and mobile systems

FIGURE 3: **Damage of NTT East and NTT Docomo**

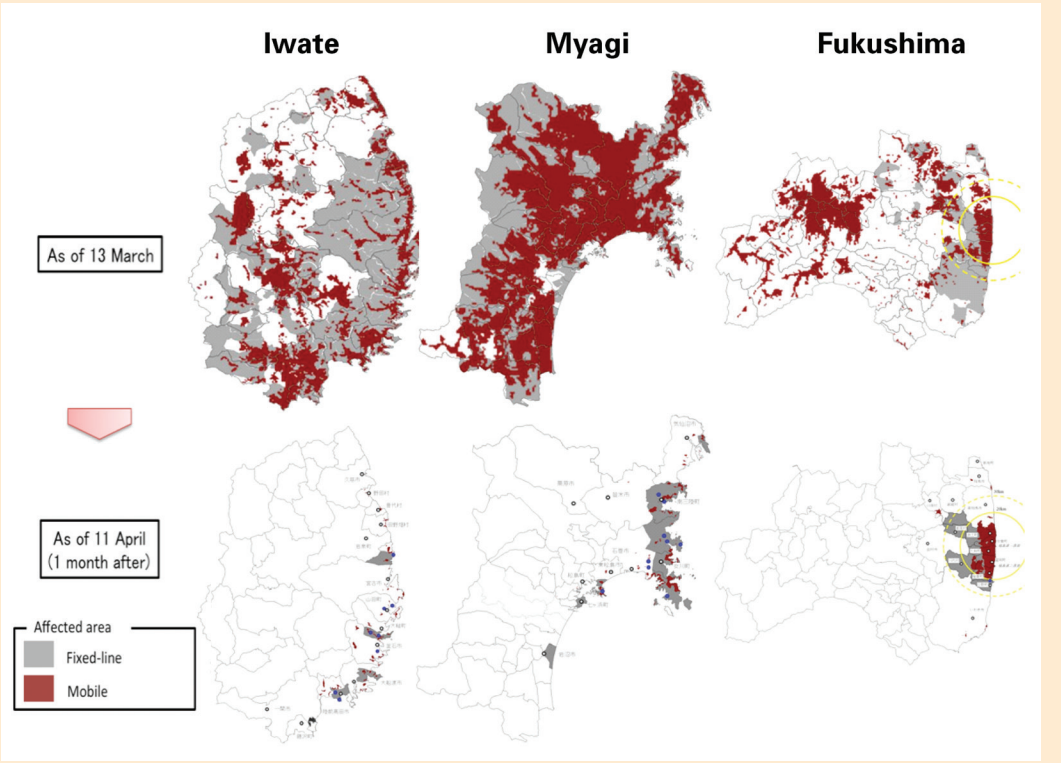
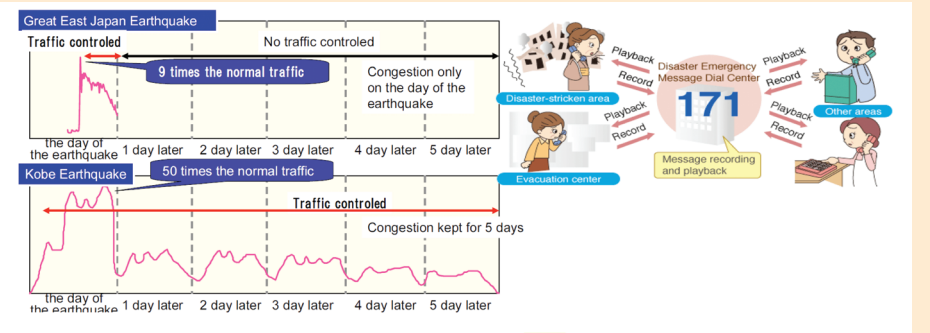


FIGURE 4: **Disaster emergency message traffic and comparison with Kobe Earthquake**



on emergency vehicles. The main causes were damage to or loss of radio transmission equipment from the earthquake and tsunami as well as loss of electric power during sustained blackouts.

In the aftermath of a megadisaster like the GEJE, a key issue is how to deliver relevant information such as public warnings and evacuation instructions across wider areas in a timely and reliable manner. Local governments are looking at advancing and multiplying ways to deliver emergency information to residents, and improving their disaster resilience.

SATELLITE COMMUNICATIONS

Compared to terrestrial communication infrastructures, satellite phones and satellite communication systems were less vulnerable. These systems had the advantage of being available for quick deployment in any region including regions with no land-based communication infrastructure, as well as in marine areas. Satellite phones, in particular, played a vital role in emergency communication among local governments and rescue organizations.

Satellite mobile phones. This system provided voice and internet communication capabilities for disaster management organizations, evacuation shelters, and staff working on infrastructure rehabilitation, among others. This was also the case for local governments and communities isolated by typhoons and heavy snowfall. In preparing for disasters, batteries and equipment should be stored for rapid deployment.

VSAT (Very Small Aperture Terminals). VSAT provides voice and internet communication capability by enabling accesses from multiple mobile terminals via wireless LAN technology. They were also used to provide connection through portable and truck-mounted mobile phone base stations for rapid restoration of communication infrastructure, and to provide a temporary communication network for disaster relief organizations.

Portable and truck-mounted satellite earth stations. These were used by disaster relief organizations and media entities to transmit video images from disaster sites. The Heli-Sat system, which enables video transmission through satellite, will be introduced in the future.

Marine earth stations. This provided communication for rescue and recovery activities by seagoing vessels in cases where land routes were disrupted.

RESPONSES IN DISASTER INFORMATION BROADCASTING

After the earthquake occurred, broadcasting companies including NHK (Japan's public broadcasting corporation) and local operators interrupted regular programming to provide disaster-related information. For example, NHK delivered emergency earthquake warnings, followed by news reports on a continuing basis starting 2 minutes after the earthquake occurred. These were carried on the company's 8 channels including its general programming channel, the educational channel, and its radio channels. The general programming channel continued to provide news reports and programs related to the earthquake and tsunami for 12 days up until March 22; and the total time devoted to disaster-related news and reports was about 254 hours. People were able to watch many of those programs on

their mobile phones in areas where the electricity supply had failed. The programs were delivered by one-segment broadcasting.†

As many as 120 television relay stations stopped functioning because of the loss of commercial electricity during the initial period of the disaster, and as many as 4 radio relay stations shut down. Master stations continued broadcasting by generating their own power. All the stations within the area had been restored by the end of May 2011 except for one radio station within the evacuation zone around Fukushima Daiichi nuclear power station. This station was restored by March 2012. After the March 11 events, the Ministry of Internal Affairs and Communications (MIC) requested the NHK, the National Association of Commercial Broadcasters (NAB) in Japan, and the radio stations in the affected areas to increase broadcasting disaster information; and on April 1, 2011 MIC requested that NHK and NAB be able to provide accurate and detailed information as quickly as possible to the public.

SOCIAL MEDIA

Social media are a set of applications and services that use the Internet to connect people. They combine dynamic, collaborative Internet-based tools, social networks, computers and, increasingly, mobile devices. Social media consist of social networks such as Twitter and Facebook that connect users, as well as websites and computer applications that enable users to collaborate and create content, such as the Wikipedia and YouTube websites.

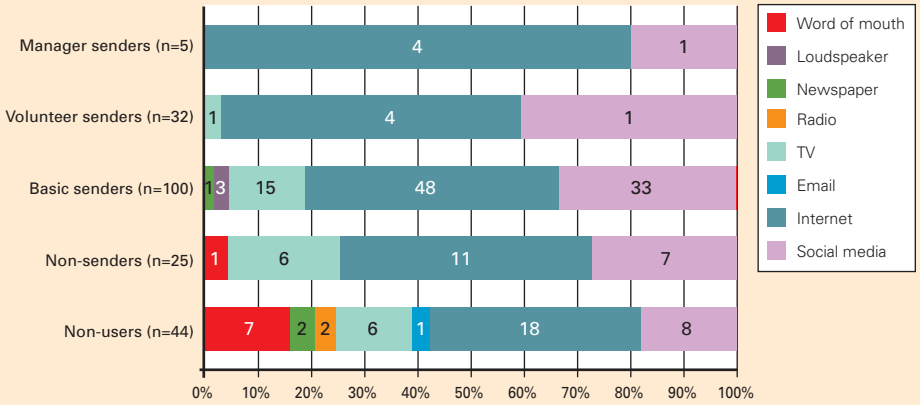
Social media were used extensively during the GEJE for various purposes, such as search, rescue, and fundraising. Table 1 summarizes how they were used to meet different types

TABLE 1: **Dominant information types and how they were used**

	Twitter	*Facebook*	*Mixi*	*SMS*	*Email*	*Wikis*	*Webpages or blogs*	*Smartphone applications*	*Maps*
General disaster information		✔	✔	✔	✔	✔	✔	✔	✔
Safety conformation	✔	✔	✔	✔	✔			✔	
Fundraising	✔	✔	✔	✔			✔		
Infrastructure status notification/ regional facility status	✔		✔			✔			✔
Housing provision		✔							✔
Goods provision	✔						✔		✔
Moral support	✔	✔	✔	✔			✔		
Resource saving	✔	✔	✔				✔		
Volunteer recruitment		✔	✔		✔		✔		✔
Special needs support	✔	✔							

† A mobile terrestrial digital audio video and data broadcasting service in Japan. People can watch TV programs on mobile phone.

FIGURE 5: **Perceived most viable source of information by message sender group in the Tohoku disaster**



of information-sharing needs during the disaster. A questionnaire survey was carried out to learn about the uses of social media by 250 different types of responders: information senders, volunteers, managers of media groups, and so forth (figure 4).

Social media and the Internet were found to be highly reliable regardless of the users' role, location, or the extent to which they were affected by the disaster. Users found social media to be extremely beneficial in general to an overwhelming degree. For directly affected individuals and people in the affected areas, the strongest reasons for using social media were convenience and their mass dissemination capacity. The Google Person Finder let people enter an inquiry about a missing person or provide information for interested parties. In total over 600,000 person names were registered.

All users experienced problems with the trustworthiness of information to a high degree. Users feel, to a particularly high degree, that the information shared through social media needs to be more accurate and reliable, especially information about infrastructure. Support for government use of social media in disasters is extremely high and was highest among directly affected individuals, individuals in disaster-stricken areas, and those involved in disseminating information to groups.

The higher the level of participation in sharing information through social media, the more likely an individual is to receive and share large amounts of information, and believe that the information comes from credible sources.

EMERGENCY FM RADIO

Emergency FM radio also played a crucial role in providing information to local residents. In the Tohoku area, 25 emergency broadcasting stations specializing in disaster information were set up. Immediately after the disaster, the communication systems developed by

BOX 1: **Ringo (Apple) Radio of Yamamoto Town, Miyagi Prefecture**

FM Radio was used as a temporary emergency station in Yamamoto. It is located inside the Yamamoto town hall and was set up with the help of FM Nagaoka of Nagaoka city, Niigata prefecture. Ringo FM started broadcasting on March 21, and is on the air from 7:00 am to 7:00 pm. At first, it only announced information such as bathing times and food rationing information for those living in the town. Later the content became less about daily life than about supporting and comforting the residents. According to the coordinator, "We will never be able to completely eliminate the sadness of the victims, but we would like to provide them with encouragement from the bottom of our heart."

local governments did not work because of power failures and a lack of emergency backup power supply. MIC distributed 10,000 portable radio receivers to evacuation shelters, and requested equipment manufacturers such as Panasonic and Sony, to distribute over 40,000 portable radio receivers.

FM radio provided locally customized information, such as information about aftershocks, or the availability of local services and activities related to people's everyday needs. This kind of information was beneficial immediately after the disaster, while different information was required as reconstruction progressed. Some entertainment programs were presented 6 to 9 months after the disaster (box 1).

Several problems were identified. Ensuring sufficient human resources is a key issue. Immediately after the disaster, a significant number of volunteers provided the radio stations with different kinds of help, but over time the number decreased. A sustainable funding source is needed to continue radio broadcasting either in the form of emergency radio or community radio. FM radio users in Natori city are keen on having local residents continue to participate in broadcasting activities, and on gradually changing over to community FM with funding from communities and subsidies from local governments.

LESSONS

- To reduce telephone network congestion, packet communications and emergency message services should be expanded. MIC is raising public awareness about using these services in times of disaster.
- The GEJE reminded us that resilient and redundant communication systems should be established. Backup systems are needed and batteries and generators with enough fuel should be acquired and stored in higher locations to avoid flooding.
- Social media and FM radio have played a crucial role in providing information to local communities; they reached two distinct age groups: while the former was used more by the younger generation, the latter is used mainly by the older generation.
- The way in which social media and FM radio are used changes over time–from sharing information about the safety of family and friends, to disseminating information about relief goods and services, and gradually to livelihood-related information.
- To enhance the use and effectiveness of social media in emergencies, city and local governments should use them for regular communications related to city news and events. In Japan, the Prime Minister's Office launched a new twitter site after the disaster.
- For FM radio, sustainability is a key issue. Off-air activities, in which communities participate in producing radio programs, should be strengthened, so that communities will be invested in supporting the continuation of FM radio.

RECOMMENDATIONS FOR DEVELOPING COUNTRIES

When disasters strike, communications infrastructure should be used to disseminate warnings to the public, to enable communication among search and rescue organizations, and to confirm the safety of family members and relatives. Immediately after the disaster, however, communications systems often break down because of power failures, damage to infrastructure, and congestion.

Improve the reliability of communication networks. The following actions are required:

- **Reducing damage** by developing backup systems, such as batteries, generators, and backup trunk lines.
- **Mitigating congestion** by increasing the capacity of facilities such as switching equipment.
- **Restoring service** by deploying emergency facilities, such as portable switching equipment and portable satellite stations.

Utilize social media. The increasingly higher levels of mobile phone penetration in developing countries can allow for the effective use of social media during disasters, provided they are also used during normal times. Social media can also provide information to communities outside the disaster-stricken area, and facilitate the acquisition and appropriate allocation of aid and assistance. Starting with the Haiti Earthquake of 2010, the use of social media during disasters has significantly increased in other countries. There is a strong potential for cultivating the use of social media among different groups and for developing a social media-based platform designed for emergency situations.

Improve accessibility. Local accessibility is a key issue in many developing countries. Using mobile networks and social media can help in collecting and disseminating local information before and during disasters.

Enhance reliability of social media. The trustworthiness of information is extremely important for social media. Local government or relevant national government agencies should consider using social media in their public relations activities during normal times. When disasters occur, those social media channels can be used to share disaster-related information with the public.

Utilize radio to share information in communities. FM radio is commonly used in developing countries to share information in communities. Community radio is a rather low-cost and effective means of reaching small groups that are usually not served by the national and international media. Radios can provide information such as times and locations for provision of emergency water and food supplies or distribution of relief goods in the immediate aftermath of a disaster, and then gradually shift to providing different information for daily living or to help lift the spirits of people in the local communities. Radio is also appreciated by the elderly who may not have access to internet-based information.

Enlist community participation to ensure sustainability. For FM radio to be effective, there needs to be a balance between on-air and off-air activities. Community participation is the key to the long-term survival of FM radio, and therefore, off-air community activities, such as workshops, are very important. These activities can also be linked to local schools and educational system for greater sustainability.

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