2 Alerts
Early warning and communication needs

Information has huge value in emergencies, but in times of crisis, objective, accurate, and freely available information is often in short supply. Governments, regulators, and international agencies therefore have a key role in ensuring that people have as much reliable information—often described as a 'public good'—as early as possible during emergencies or conflicts. It is also critical that the right regulations and standards are in place for communications to be deployed quickly when needed, especially across national borders. This section looks at the most advanced aspect of emergency information provision, early warning systems, while later sections address new applications in other areas of information need, using emerging technologies.

Early warning systems in natural disasters

Efforts to improve early warning communications in emergencies started as far back as the 1940s. But recent progress on early warning systems owes much to the profound impact of the 26 December 2004 tsunami in the Indian Ocean, one of the deadliest natural disasters to date. (See box on page 10)

In response to the tsunami's impact, the 2005 report of the International Red Cross and Red Crescent, *World Disasters Report 2005: Focus on information in disasters*, featured examples of good practice in using communications effectively, and pointed out the need for better early warning systems and the need for an international regulatory framework.[16] Since then, progress has been rapid, as summarized in the timeline below.

Why was the impact of this particular disaster so devastating? Part of the explanation is that tsunamis are rare in the region, and neither early warning nor suitable disaster-preparedness arrangements were in place. In regions where such events are more frequent, there were already appropriate early warning arrangements. The longest-established example is the Hawaii-based Pacific Tsunami Warning Center, which has covered the Pacific Ocean since 1949. But in 2004 the Indian Ocean was not covered.

So the Indian Ocean, like the Pacific, now has an early warning system. In general, weather-related hazards are the best covered worldwide compared to other natural disasters, thanks in large part to the World Meteorological Organization system. Innovation continues in this field. The box describes one example, cell broadcasting. One such example is cell broadcasting, highlighted in the following box. This initiative, launched in June 2009, is a partnership between the UN Development Programme (UNDP), Grameenphone and state-owned Teletalk.[17] Yet early warning systems for other kinds of events are limited.

2003	2004	2005	2005	2006
Second International Conference on Early Warning, Bonn	December: Indian Ocean tsunami	January: Kobe World Conference on Disaster Reduction, formal launch of International Early Warning Programme; publication of *Hyogo Framework for Action 2005-2015*	August Indian Ocean Tsunami Warning System agreed (implemented in 2006) as an initial step toward an International Early Warning Programme	Third International Conference on Early Warning, Bonn. Launch of UN *Global Survey of Early Warning Systems*

Credit: UN/Evan Schneider

Credit: UN/Evan Schneider

The Indian Ocean Tsunami

The 26 December 2004 Indian Ocean tsunami was one of the deadliest natural disasters in recorded history. More than 250,000 people are thought to have died, while the cost of the physical damage has been estimated as at least $7 billion.[18] The epicenter of the sub-ocean earthquake was west of Sumatra, and the resulting wave of up to 98 feet affected India, the Maldives, Sri Lanka, and Thailand as well as Indonesia.

The mobile phone played a key role in the aftermath of the tsunami.[19] The tsunami struck on a Sunday, when mobile network traffic was significantly below weekday peaks and could be rerouted, so networks continued to operate where the infrastructure was not destroyed. Some damaged infrastructure was restored the day after the disaster by the deployment of new masts. *Mobiles also, for the first time, became a fundraising tool.* In the United Kingdom alone, a united campaign by all major mobile operators saw more than 725,000 people raise £1.1m by donating £1.50 each to the Disasters Emergency Committee's fundraising appeal in January and February 2005.[20]

Preparedness, which includes education about potential disasters, is a vital part of the information landscape. One remarkable story shows that technology is only part of the story about how information can mitigate disasters. A 10-year old British schoolgirl, Tilly Smith, had recently studied tsunamis at school. When she saw the sea suddenly recede, the water start to bubble and the boats on the horizon bob up and down violently, she alerted her parents who urged others on the beach to seek high ground. About 100 people on Maikhao beach in Phuket, Thailand escaped death by minutes.[21]

Furthermore, it has become clear that *the technological and scientific focus of past initiatives overlooked the importance of who gets the information and how it is used.* The recent tsunami in the South Pacific that affected Samoa, Tonga, and American Samoa showed the limitations of the Pacific Tsunami Warning system especially when there is little time to respond; reports suggest many people did not know what to do.[22] This echoes a study into the lessons of the tsunami by LIRNEasia, a think tank based in Sri Lanka, who found that the catastrophic impact of the 2004 tsunami resulted from the "absence of institutional mechanisms for the provision of warnings to vulnerable populations including… mobilization of ICTs."[23]

A UNDP report, *Where's My House?*, surveyed members of the population in Aceh, Indonesia affected by the 2004 tsunami.[24] The report was notable for marking a turning point in the humanitarian community's perception of the need for effective communication. Only 15% of respondents said they had received enough practical information about assistance. They wanted simple information about housing, above all. But despite the obvious presence of many agencies, they could not get it. The report said: "There has not been enough of a systematic effort by those working in tsunami relief to keep communities abreast of what is available to them."

Subsequent work has identified the areas of response needing improvement. The United Nation's Global Survey of Early Warning Systems, launched at the Third International Conference on Early Warning in 2006, concluded that there were numerous gaps and shortcomings in terms of

effectively reaching and serving the needs of those at risk.[25] "A major challenge is to integrate the knowledge and insight of relevant social and economic communities into the predominantly technically based existing systems."

Even when warnings are issued, they fail to reach all who need to take action, including local authorities, community-based organizations, and the public at large. Often warnings issued are not properly understood or may not be taken seriously. If people receive the information, they might not trust it or know how to use it.

The most recent *World Disasters Report* from the International Federation of Red Cross and Red Crescent Societies (IFRC) emphasized people-centeredness.[26] It hailed the establishment and improvement of early warning systems as a key factor driving a decline in injuries, loss of livelihoods, and deaths from disasters over the past 30 years. For example, serious flooding of the River Limpopo killed an estimated 700 people in Mozambique in February 2000—when the birth of baby Rosita in a tree caught the world's attention—but only 30 in 2007 and nobody in 2008. The report concluded that there has been significant progress in adopting better early warning technologies since 2005, but much remains to be done on connecting the technology to its users.

As IFRC's Secretary General, Bekele Geleta, wrote in his foreword: "The development of a more people-centered approach is clearly essential to ensure that the warnings captured by satellites, computer modelling and other technologies reach at-risk communities and are then acted upon."

The regulatory framework for early warning systems

The regulatory situation for disaster early warning exhibits significant progress prompted by the Indian Ocean tsunami, but more work is required. The ratification in January 2005 of the Tampere Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations was a major policy milestone.[27] The treaty, first proposed in 1998, calls on signatories to facilitate the provision of prompt telecommunication assistance. It covers both the installation and operation of reliable, flexible telecommunication services.

The ratification removes earlier regulatory roadblocks to moving telecommunications personnel and equipment into and within disaster-affected areas. Previously, there were many obstacles to the rapid deployment of the necessary equipment without prior consent of the local authorities. The convention calls on countries to waive barriers such as licensing requirements for the use of needed frequencies,

Early warning systems in South Asia

The December 2004 tsunami prompted several subsequent developments around the Indian Ocean. For instance, the Sri Lankan government established a Disaster Management Centre (DMC) in January 2005 to monitor potential natural disasters, funded by the UN Development Programme. Following a tsunami warning, an alert is sent via short message service (SMS) message to village chiefs, government agents, the military, police officers and media. These agencies, in turn, contact citizens in their district to inform them of the alert, using SMS as well as television and radio networks. On 19 September 2007, Sri Lankans received a 20-word text alert following a magnitude 7.9 earthquake off the southern coast of Sumatra: "Tsunami warning for Sri Lanka north, east and south coast. People asked to move away from coast – Disaster Management Center." No injuries or casualties were reported and citizens returned home over the course of the next three days. However, mobile networks became jammed after the alert was issued due to the high volume of voice calls. The Sri Lankan telecommunications authority now insists that subscribers may only use SMS messaging during national emergencies, so as not to overburden the networks.[28]

Another tsunami early warning system has been developed by the GeoForschungsZentrum Potsdam (GFZ, Germany's National Lab for Geosciences), SeisComP3, launched in May 2007. Its functionality was demonstrated on 12 September 2007, when it determined within four minutes the magnitude (8.0) and the location of the Bengkulu quake in the southern part of Sumatra. Based on that information, the Geophysical Survey in Jakarta released its first ever tsunami warning.[29]

The Indian Ocean Tsunami Warning System came into operation in 2006. It is a partnership between the United Nations Educational, Scientific and Cultural Organization's (UNESCO) Intergovernmental Oceanographic Commission (IOC), which coordinated the planning and implementation, and the global satellite communications operator INMARSAT. It comprises an extensive network of seismic instruments, sea level gauges, and deep ocean pressure sensors that can register and measure an offshore earthquake and any resulting tsunami. The information, for the moment, is transmitted to the tsunami warning center in the Pacific and the Japanese Meteorological Agency, which then issues information bulletins to designated authorities.


Credit: Télécoms Sans Frontières

restrictions on importing equipment, and limits on the movement of personnel teams.

However, some barriers remain, including incomplete standardization or interoperability of different user devices, network equipment, and emergency communications systems. One example of a technological obstacle to effective operation is the fact that VOIP (voice over internet protocol) users—people using internet telephony on their laptop—often cannot provide geographical coordinates of people calling the emergency services (in contrast to mobile phone technology).

Recent experiences of disasters and conflicts have highlighted some key remaining gaps in the technical and regulatory framework:

- the need for further standardization of communications in emergency situations—such as a global standard for cell broadcast technologies, for example;
- the need to develop standards applicable to existing and future systems for delivery of early warnings or alerts;
- the need for interoperability between public networks and networks dedicated to emergency communications; and
- a need for priority access by emergency services personnel to communications.

The International Telecommunication Union's fourth World Telecommunication Development Conference in 2006 called on governments to ensure that the enabling environment for the use of communications in emergencies extends to rapidly growing new technologies. It pointed out that the growth of broadband and the convergence of telecommunications, computing, and multimedia applications have opened up new potential for disaster relief and response, environmental protection, and post-war or post-disaster reconstruction.[30] The *2009 Global Assessment Report on Disaster Risk Reduction* reviews individual countries' progress toward fulfillment of the Hyogo Framework for Action.[31]

Therefore, it has become clear that more work is needed so that information and communication tools can inform, protect, and empower people affected by emergencies of different kinds. The technology itself is vital but can only be effective in the right framework—which needs to evolve as new technological tools are becoming available at a rapid pace.

> **"The technology itself is vital but can only be effective in the right framework—which needs to evolve as new technological tools are becoming available at an amazing pace."**

Conflict warning and prevention

Disaster early warning and response systems have gained the most attention, and the regulatory changes described above have been a reaction to the recent experience of natural disasters. Yet the field of *conflict* early warning and response has also achieved some important milestones, albeit lagging

that of disaster warning. The principles of 'early detection, early response' apply as much to conflict early warning and prevention as to disasters. Conflict early warning systems, however, seek to monitor the triggers, processes, and outcomes of armed conflict.

The purpose of conflict warning systems traditionally has been to catalyze and inform diplomatic or top-down operational responses. The former may take the form of preventive diplomacy while the latter may include the deployment of peacekeeping forces. These are just two of several potential institutional responses that are typically adopted—often too late—after early signs of escalating violence. The Organization for Economic Cooperation and Development (OECD) noted in a major 2009 report on the future of conflict early warning systems that "an external, interventionist, and state-centric approach in early warning fuels disjointed and top-down responses in situations that require integrated and multilevel action. Evidently, a state-centric focus in conflict management does not reflect an understanding of the role played by civil society organizations in situations [for example] where the state has failed."[32]

This recognition has started to shift the debate on conflict early warning to people-centered approaches—also referred to as third- or fourth-generation early warning systems—in a parallel to the earlier debate on disaster early warning.[33] In this context also, people-centered approaches can empower local at-risk communities. While external, top-down efforts emphasize the need to predict accurately the escalation of armed conflict, emerging conflict early warning systems emphasize local contingency planning.

Moreover, while technology has long played a prominent role in disaster early warning systems, this is not equally true of conflict early warning systems. As the 2009 OECD report notes, "most inter-governmental and non-governmental systems … have not gone beyond the use of email and websites for dissemination, and communication technology for data collection."[34] None of the major intergovernmental and nongovernmental conflict early warning systems have made use of mobile technology, for example.

On the other hand, new people-centered conflict early warning initiatives have been early adopters of technology. For example, Ushahidi, described later in this report, is an online platform where people can post individual reports that are then aggregated and presented in useful ways. Another important recent development is the United Nation's Global Impact and Vulnerability Alert System (GIVAS). Launched in September 2009, the GIVAS website is expected to make maximum use of new media and digital technologies for information collection and crisis alerts.

Cell Broadcasting for Early Warning

With growing mobile phone access, SMS messages hold great appeal as a means of conveying information to people at risk of an emergency. But SMS messaging has some important limitations. For example, only pre-registered numbers can be texted. In addition, SMS alerts can only be sent out one-by-one in a queue and so can be delayed. Furthermore, people cannot easily tell whether SMS alerts come from trusted sources.

SMS cell broadcasting is an appealing alternative. It is a one-to-many (or one-to-area) mode of communication unlike SMS, which is one-to-one. It allows authorities to broadcast messages to anyone in a given geographical area without needing any pre-registered numbers or infringing on privacy. Messages can be tailored for different geographical areas and use dedicated communication channels thus eliminating congestion.

There is also no way for an outsider to generate a cell broadcast message, so false emergency alerts are considered unlikely.[35] While mobile phones have to be switched on to receive the alerts, cell broadcasting allows for repeat messages to be broadcast periodically. Simultaneous multi-language broadcasting is also possible.

In Bangladesh, the UNDP is supporting the development of instant disaster alerts via SMS cell broadcasting. The initiative is being piloted in the flood-prone district of Shirajganj and the cyclone-prone district Cox's Bazar. According to the UNDP, "The messages will flash automatically on the screen of mobile phone sets, instead of going to message boxes. This way, a user does not even need to push a button."[36] The program will be expanded across the country through the UNDP-sponsored Comprehensive Disaster Management Program.

Innovations like Twitter and the increasingly widespread availability of mobile phones, along with recent interest in the use of high-resolution satellite imagery (described later in this report), present some important opportunities for conflict early warning initiatives.

However, these developments pose some challenges that do not typically arise in the context of natural disasters.


Credit: Eskinder Debbibe

> **“Misinformation and propaganda are often rife during conflicts and political crises, so integrating multiple technologies and individual inputs runs the risk of amplifying misleading information.”**

Misinformation and propaganda are often rife during conflicts and political crises, so integrating multiple technologies and individual inputs runs the risk of amplifying misleading information.

In addition, some regimes, such as the Sudanese government, or the Iranian authorities after the 2009 election, may seek to monitor text messages and trace them back to the original sender. *There is a need for technologies that ensure anonymous or secure communication*, a relatively new issue in the conflict early warning field. Such needs are typically less pronounced in disaster settings.

The OECD report warns, “The humanitarian community is no better positioned today to prevent another Rwandan genocide than we were in 1994.” Conflict early warning lags 15 years behind disaster early warning, it concludes. There is significant potential for the development of effective people-centered conflict early warning systems, but these also carry the risk of abuse by parties to the conflict. In sum, the use of technology in conflict settings requires a different set of solutions to overcome existing challenges, and lags some years behind the evolution of natural disaster early warning systems. The field of conflict early warning is witnessing a shift away from state-centric, top-down approaches to more decentralized, people-centered initiatives. This shift is further accentuated by the availability of digital technology and new media, which is more decentralized and distributed than traditional technologies. The challenge is to leverage these new technologies to empower individuals affected by conflicts.

Conclusions

The impact of disasters and conflicts on lives and livelihoods can be greatly reduced by giving affected communities advance warning. The Indian Ocean tsunami was a turning point in exposing the devastating effect of weaknesses in early warning systems.

Much progress has been made in addressing those weaknesses. It is clear, though, that there is some way to go before warnings reach all those who should take action.

Milestones in conflict prevention and conflict early warning systems

The unanticipated Yom Kippur war in 1973 and the Falklands war in 1982 provoked the first debates over the lack of conflict early warning systems.

1981: UN Special Rapporteur, Prince Sadruddin Aga Khan, delivers his report *Massive Exodus and Human Rights* to the UN and calls for an early warning system for refugee movements.

1987: United Nations sets up the Office for the Research and Collection of Information (ORCI) to establish an early warning system and provide early warnings and recommendations to the UN Secretary General.

1992: UN Report *An Agenda for Peace* (the Brahimi Report) is presented to the UN Secretary General, emphasizing the need to "identify at the earliest possible stage situations that could produce conflict and to try through diplomacy to remove the sources of danger before violence erupts."

1993: UN Department for Humanitarian Affairs (DHA) establishes the Humanitarian Early Warning System (HEWS) to identify crises with humanitarian implications.

1994: April through June, Rwandan genocide.

1994: May, Carnegie Corporation of New York establishes the Carnegie Commission on Preventing Deadly Conflict.

1997: Forum on Early Warning and Early Response (FEWER) establishes a network of 35 organizations worldwide and catalyzes the creation of early warning systems in the Caucus, Great Lakes Region of Africa, and West Africa.

1997: Final Report of Carnegie Commission on Preventing Deadly Conflict states "The circumstances that give rise to violent conflict can usually be foreseen."

2001: UN Secretary General's report *Prevention of Armed Conflict* stresses the need for conflict analysis in conflict-prone countries and the importance of preventive diplomacy to ease tensions before they result in conflict.

2003: InterGovernmental Authority on Development (IGAD) launches Conflict Early Warning and Response Mechanism (CEWARN).

2005: Economic Community of West African States (ECOWAS) launches ECOWAS Early Warning System (ECOWARN).

2008: African Union's Communications Early Warning System launched.

More progress needs to be made on the provision of accurate and consistent information for the people exposed to risk. People-centered systems are even farther behind in the context of conflict early warnings.

Recent experiences have highlighted some *key remaining gaps in the technical and regulatory framework.* These include the need for further standardization, greater interoperability between public networks and networks dedicated to emergency communications, and priority access by emergency services personnel to communications.

Coordination of information also remains an issue. Early warning information needs to be collected and deployed. Often this will be done by official agencies, but their responsibilities may be overlapping and uncoordinated.

Situations of conflict pose additional challenges. *In an emerging conflict, individuals who are affected will often be important sources of information themselves,* and the new technologies offer tremendous potential for the information people provide to be aggregated and made available to others. *However, the risk of misinformation can be acute in a conflict, making authentication a vital challenge.* At the same time, it is important to ensure that communications technologies can offer their users a sufficient degree of anonymity and protection.

There is a fundamental tradeoff between the authoritativeness of information and its timeliness. Humanitarian information systems have traditionally favored authoritativeness and so have lagged events. New real-time approaches are changing this, but the issue of validation remains a challenge. This important point is addressed in the following section.

Credit: Save the Children