New Technologies in Emergencies and Conflicts

The Role of Information and Social Networks

UNITED NATIONS FOUNDATION

Vodafone Foundation

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About the UN Foundation and The Vodafone Foundation Partnership

The United Nations Foundation & Vodafone Foundation Technology Partnership is a leading public-private alliance using technology programs to strengthen the UN's humanitarian efforts worldwide. Created in October 2005 with a £10 million commitment from The Vodafone Foundation matched by £5 million from the UN Foundation.

The Technology Partnership has three core areas of focus: (1) to strengthen communications in humanitarian emergencies though capacity building and support for disaster response missions that connect disaster relief workers and affected families; (2) to support the development of mobile health (mHealth) programs that tackle critical public health challenges and improve public health systems, decision-making and, ultimately, patient outcomes; and (3) to promote research and innovation using technology as a tool for international development. The UN Foundation and The Vodafone Foundation are among the founding partners of the mHealth Alliance. More information about the Technology Partnership can be found at: www.unfoundation.org/vodafone.

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Foreword

In times of crisis, a phone line can be a lifeline. As natural disasters and civil conflicts increase worldwide, so too do innovative ideas about how to communicate in disasters.

New technologies and innovative uses of existing technologies are improving crisis preparedness, response, and prevention. Yet barriers to bringing these ideas to scale remain, and humanitarian aid groups and others must weigh the potential risks and rewards of using new communications technology tools.

Much like the creation of CNN and the 24-hour news cycle forever changed how the news is reported, the mobile phone has revolutionized how, when, and where we communicate with one another. With the growth of broadband and the convergence of telecommunications, computing, and multimedia, this revolution will only intensify.

The UN Foundation and The Vodafone Foundation commissioned this report to profile innovation on the frontlines of communications in emergencies, and to point to new opportunities for governments, civil society, and individuals alike to benefit in times of crisis from our increasingly connected world. Through the work of groups supported by the United Nations Foundation and Vodafone Foundation Technology Partnership, we have seen coordinated and efficient information sharing save countless lives. This report profiles some of this work.

We hope you enjoy this report, the fifth in our Access to Communications publication series. And we look forward to receiving your comments and ideas at www.unfoundation.org/emergencies-report.

Ted Turner, Chairman

Vittorio Colao, CEO

Sincerely,

Vittorio Colao, CEO
Vodafone

Ted Turner, Chairman
United Nations Foundation

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Credit: Diego Fernandez

Executive Summary

Natural disasters and violent conflicts have always been part of human existence. But the number of humanitarian crises has been rising in recent years. Moreover, disasters strike most frequently, and with the most devastating impact, in the least developed countries. These countries also have the weakest communications infrastructures, which poses a particular challenge to governments, aid agencies, and the affected population at every stage of a crisis, from the run-up to a disaster through to long-term reconstruction.

There have been dramatic advances in communications technology: in the number of new technologies, the mobility and range of functions available, and the spread of these technologies. Growth has been particularly strong in the penetration of mobile phones and more recently the uptake of social networking websites including Facebook and Twitter. One important change is a shift from one-to-many forms of communication, such as television and radio, to many-to-many forms of communication, such as social networking and crowdsourcing websites, that is changing the way in which information is delivered and exchanged.

Communications advances present an opportunity for humanitarian organizations to harness modern technology to communicate more effectively with communities affected by disasters and to allow members of those communities to communicate with each other and with the outside world. People in affected communities can recover faster if they can access and use information. A look at the use of communications technology during disasters in recent years shows that while it has played a positive role, its full potential has not yet been realized.

Moreover, governments, humanitarian agencies, and local communities face challenges and risks associated with modern technological innovation. These include:

- Information flows must be two-way to be effective—from the external world to the affected community, but also from those affected to the agencies seeking to help them in useful ways.
- Information will not be used unless it is trusted. The utility of any technologies will depend on the social context. People are a vital part of the communication system.
- Information will be helpful only if it is accurate. There are risks in unregulated information flows, especially when these are spread rapidly online, and these risks need to be managed. Authentication is a key challenge.

This tension between the potential benefit to humanitarian efforts from harnessing these technologies and the risks that they pose is a key theme of this report. The report examines how authorities and humanitarian and aid organizations can best balance the opportunities and challenges of exploiting different technologies at the key stages on the timeline of crisis—early warning and preparedness, immediate humanitarian relief, and reconstruction and long-term development.

Credit: AP Photo/Ben Curtis

1 Introduction

On 13 June 2009, thousands of Iranians poured into the streets to protest what they believed to be a flawed national election. Emerald green banners, the color of opposition candidate Mir-Hossein Mousavi, lined roads clogged with people who held what became one of the most important tools for the grassroots movement: the mobile phone. With the Iranian regime restricting internet access and banning journalists' access to key demonstrations, communications via text messaging and social networks like Facebook and Twitter became a crucial tool for information sharing between the protesters and the outside world, and even a source for the news media. So critical was this source of information that the U.S. State Department asked Twitter to delay a scheduled network upgrade that would have shut down the site for some hours on June 15 and 16.[1]

Yet both hoaxers and Iranian officials also are said to have used these same communications networks to post false information. Without a trusted process of vetting, misinformation gained currency simply by being constantly repeated or re-Tweeted. One such instance was the claim that the election monitoring committee had declared the result invalid. Another was the initial circulation of a photograph said to be of a young woman killed in one of the Tehran demonstrations; the well-known picture was of another woman with the same first name, Neda.[2]

The phenomenon dubbed 'Twitter in Tehran' demonstrates both the opportunities and the challenges new communications technologies present for information sharing during emergencies. Objective and accurate information is essential for organized communities—it is often referred to as a 'public good' for this reason. But particularly in times of crisis, vital information is often in short supply. New technologies and new uses of existing technology present an important opportunity for improving how people can prepare for, respond to, and recover from major disasters. At the same time, they present new risks and challenges. For assistance to be effective and communities to gain in resilience, the right balance between faster access to and reliability of information must be found.

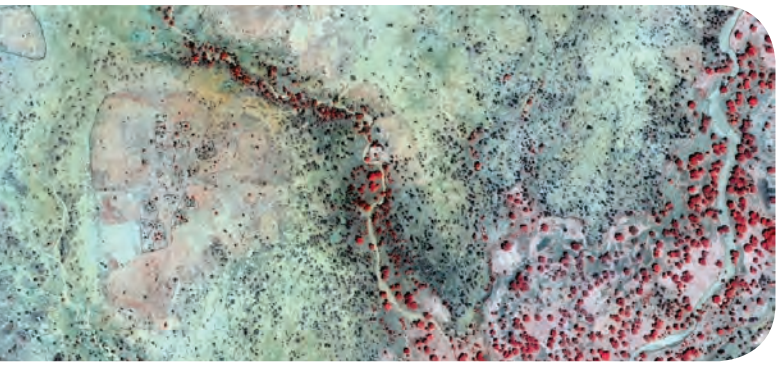
This report looks at the progress that has been made to date in setting policies that assist populations affected by disasters and conflicts, and considers some examples of both government-organized and grassroots uses of technologies that may help pave the way forward.

But first, some context.

Why consider the role of communications in emergencies?

There are two compelling reasons. First, there has been an increase in the prevalence of certain kinds of emergencies, whether natural disasters—including those resulting from climate change—or disasters resulting from human conflict.

> **"New technologies and new uses of existing technology present an important opportunity for improving how people can prepare for, respond to, and recover from major disasters."**



Credit: UNITAR/UNOSAT

And although the number of conflicts between countries has fallen markedly since the Cold War, there is a rising level of civil conflict, particularly in sub-Saharan Africa and the Middle East and North Africa.[3]

Second, the information and communications revolution of the past 20 years is continuing, meaning there is growing potential for people affected by emergencies to benefit from the flow of information. *If communities depend on information for their survival in times of crisis, then communication technologies are their lifelines.* More information is being gathered. More people have access to communications. The scope for effective relief is greater, especially if humanitarian agencies and policy makers as well as affected populations take advantage of the technological opportunities.

Growing number and intensity of emergencies

The number of disasters, both natural and technological, has been rising in recent years. According to the International Disaster Database, there has been a steady increase in the frequency of natural disasters during the past 35 years, with almost as many occurring during the past 5 years as in the whole of the previous decade. On average, there were 428 disasters per year between 1994 and 1998, but the annual average jumped to 707 between 1999 and 2003. This increasing trend in the total number of disasters is mirrored in most categories, including hurricanes, floods, and earthquakes.

Countries of low human development (as defined by the United Nations) have suffered the biggest increase in the occurrence of natural disasters, partly due to changes in weather systems affecting tropical latitudes. Moreover, people in the poorest countries are the worst affected by natural hazards, due to factors such as poor quality housing, inadequate levels of infrastructure, and weak emergency services.

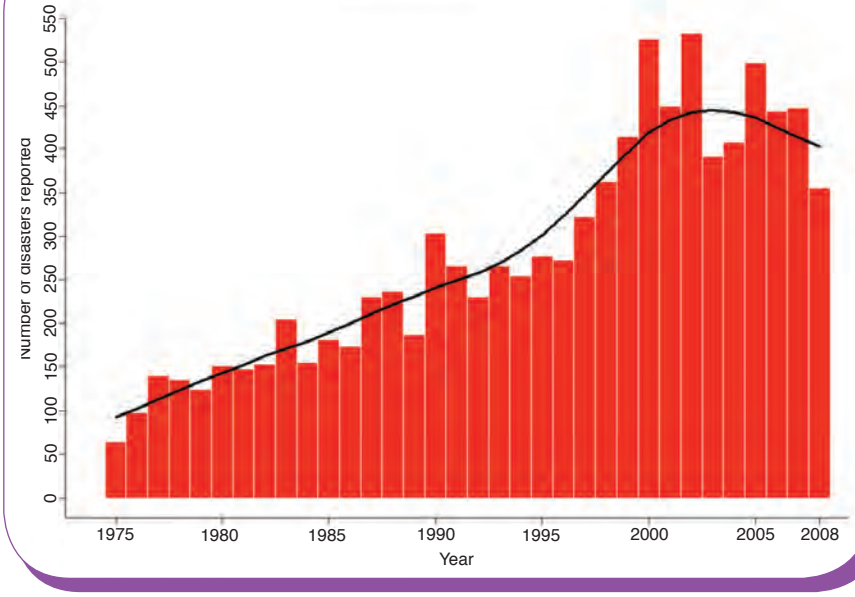
This report also looks at the use of communications in crises such as civil conflict and terrorism. Like natural disasters, terrorist incidents have increased in recent years. Figures from the Terrorism Knowledge Base show that in the years 1998 to 2000, the number of terrorist incidents averaged about 1,100 per year. In the four years from 2001 to 2005, they averaged around 2,300 a year, reaching 3,000 in 2005 (the latest available data).[4] The location of attacks has varied from year to year, with the cities targeted including London, Madrid, Mumbai, Jakarta, and Istanbul.

While the number of armed conflicts increased steadily throughout the Cold War, beginning in the early 1990s, conflict between nations began to decline. Clashes within states now account for 95% of all conflict-related casualties, and most of these civil conflicts occur in the world's poorest countries, according to the 2005 Human Security Report.

Growing access to new communications technologies

The potential for the use of communications before, during, and after natural disasters or conflict has been enhanced thanks to the advent of new technologies such as mobile phones and the internet.

Natural disasters reported from 1975 to 2008



Source: EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.net – Université Catholique de Louvain – Brussels – Belgium

Landmark events in the role of information in emergencies

Some events have carried striking lessons about the impact of information and in each case have had a profound effect on the subsequent development and use of communications technologies.

The Kobe earthquake, 1995

The earthquake that hit the Japanese port of Kobe on 17 January 1995 was one of the first major disasters of the modern communications age. Official emergency communications were overwhelmed, but two computer networks set up free online bulletin boards. During its first week, one of these had 5,000 messages posted and was accessed 650,000 times by 140,000 people. *Decentralized and online communication and information initiatives were more effective than official efforts.*

Indian Ocean Tsunami, 2004

The 26 December 2004 Indian Ocean tsunami was one of the deadliest natural disasters in recorded history. There was no early warning system covering the Indian Ocean at that time and, as described in the next section, *the disaster gave great impetus to early warning efforts.* The confused aftermath led humanitarian agencies to start paying greater attention to information needs. The impact of the tsunami was *a lesson in the costs of inadequate information flows.*

Credit: Meridith Byrne

Hurricane Katrina, 2005

When the Category 3 hurricane hit New Orleans on 29 August 2005, there was no lack of early warning. The shortfalls came in the slow response of the authorities and lack of support for the community. *Preparedness, which is broader than early warnings and includes education about potential disasters, is a vital part of the information landscape.* Absent effective official relief, *the online media proved a new way for those affected by the crisis to connect with sources of help.* According to one study, for many this was the first time they used a computer.[5] *For many people, informal knowledge from trusted social contacts was the most important source of information.*[6]

Protests after 2009 Iranian elections

Social networks can amplify the spread of information enormously, as demonstrated by their use in Iran. Certainly, where mobiles and computers are widely used, people have the scope to supply information. *However, they have equal power to amplify inaccurate or deliberately misleading information.* Other illustrations of these issues arose with the November 2008 terrorist attacks in Mumbai and the post-election violence early in 2008 in Kenya.

Credit: UN/Evan Schneider

Mobile Phones

The growth in the use of *mobile phones* has been one of the most remarkable features of the last decade. At the end of 2008, the number of subscriptions topped 4 billion, reaching 61 for every 100 people, according to the International Telecommunications Union (ITU)[7]. Mobile penetration is not even across the globe. In the developed world, there is about one mobile subscription per person, but the equivalent figure for the developing world as a whole is 39%, with large variations between countries and between urban and rural areas.[8] But the mobile divide is narrowing: for instance, Africa has the highest growth rate in new mobile subscriptions, with a compound annual rate of 47% from 2003 to 2008, according to the ITU.

Internet

The total global *internet* audience (people aged 15 and above with access to home or work computers) passed one billion in December 2008.[9] China has the largest online audience in the world, with 180 million internet users, representing nearly 18% of the worldwide total, followed by the United States (16.2%), Japan (6.0%), Germany (3.7%), and the United Kingdom (3.6%). But while almost three-quarters of the North American population have access to the internet, in most poor and middle income countries just 1 in 50 people or fewer have internet access. Internet access is expected to continue to expand. For developing countries, this is likely to be via *mobile internet*.[10] The advent of mobile internet in these countries is recent but already shows signs of extremely rapid growth. Given the absence of a fixed line infrastructure, it is mobile internet that offers the scope for wider access for people in the developing world.[11]

Social Networks

On the back of the recent spread of broadband internet access, the popularity of *social networking sites* such as Facebook, Orkut, and Twitter has exploded. These are websites that allow users to communicate with other people as they choose, either sending messages (of fewer than 140 characters in the case of Twitter) or sharing photos.[12] The most popular social networking site globally is Facebook, which saw a 153% surge in unique visitors to 132.1 million from June 2007 to June 2008 and another 157% to reach 208 million visitors by June 2009.[13] Although its largest base is in North America (70 million in mid-2009), Facebook's growth there was relatively modest. In every other region, Facebook's audience more than quadrupled in 2008. Even so, social networking is still small-scale in developing countries. In India (where Orkut is the most popular site), 19.4 million people were using these sites in December 2008, an annual rise of 51% but a tiny fraction of its more than 1 billion people.[14]

Twitter

Twitter, whose users are concentrated in the developed world, is also experiencing extraordinary growth. The number of visitors to Twitter.com increased by 67% in the month of April 2009 alone, from 19.1 million to 32 million. Rich nations predominate on Twitter. One report by independent analysts Sysomos that analyzed 115 million accounts found that almost two-thirds (62.2%) of users were based in the United States. The highest ranked developing country was Brazil at 2.0%, followed by India (0.87%), the Philippines (0.64%), and China (0.49%).[15]

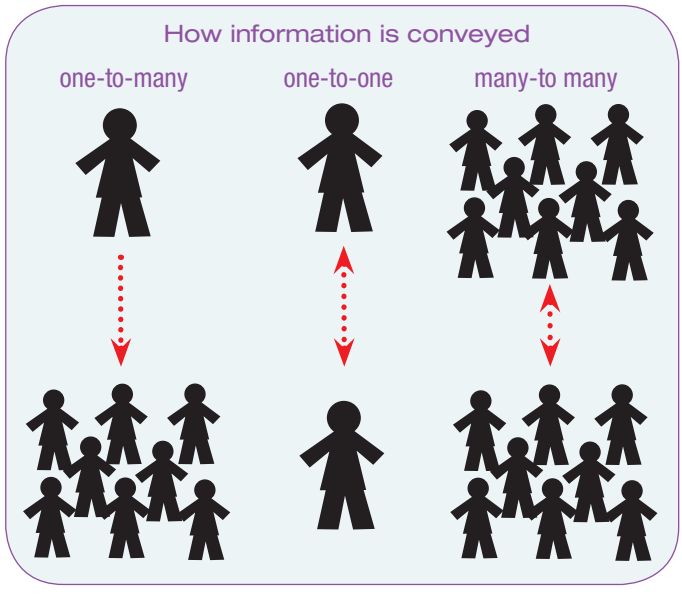
Themes of the report: what is the role of information in a crisis?

In this report, we give many examples of how different *technologies* are being used in different *contexts*, to illustrate the potential benefits and challenges. We offer some general lessons about the effective use of information in emergencies, and about the management of new risks. Two main themes that emerge are the importance of the *accuracy* of information and of the social context (either face-to-face or online) in which it is used.

This report examines the opportunities and challenges of using technology to promote information sharing in disasters, whether natural or manmade. The report is divided into four sections that look at the use of different technologies at the key stages on the crisis timeline: early warning, wider information preparedness, humanitarian relief and reconstruction, and long-term development.

The report also makes distinctions in terms of the *format* of the communications. While the underlying communications technology may be radio, mobile, or internet, it is useful to how the information is conveyed, whether:

- one-to-many (broadcast—radio, television, web, mobile applications (apps) and services, short message service (SMS) broadcast);
- one-to-one (mobile voice and SMS); or
- many-to-many, such as social networks (online or mobile internet, mapping, and crowdsourcing).



In evaluating the use of communications technologies in disaster relief, the report also considers the different *audiences* or users of information, whether a global or local mass audience; the aid and policy community, including their emergency relief efforts; or the affected population.

Reading this report

The below diagram provides a map of the major themes explored in this report, and identifies the communications formats, tools and applications, actors and examples identified in each section.

	Summary	Communications Formats	Tools & Applications	Actors	Examples
Section 1. Introduction	Growing access to technology and continuing innovation offer the potential for more effective response in emergencies, but also create new risks to be managed.			Facebook; Twitter	Kobe Earthquake, Japan, 1995; Indian Ocean tsunami, Dec 2004; Hurricane Katrina, New Orleans, 2005; Protests following disputed Iranian elections, June 2009
Section 2. Alerts: Early Warning	People need as much reliable information as possible to prepare for onset. Regulations and standards are vital but effective early warning systems must have people at their center.	Timely one-way communication to as many people as possible, as quickly as possible.	Meteorological warning systems; SMS messages; Cell broadcast	GIVAS	Indian Ocean tsunami Dec 2004, a turning point in understanding the importance of information; Ongoing pilot of cell broadcasts in flood-prone areas of Bangladesh
Section 3. Preparedness: Rebuilding Communities' Resilience	Preparedness depends on long-term education and planning in order to ensure people affected by an emergency or conflict can respond appropriately.	Interoperable and resilient communications infrastructure for emergencies; Public awareness and education; Two-way exchange of information	Broadcast media; Geospatial technologies; Crowdsourcing	EU Joint Research Centre's European Media Monitor & MOSAIC; GIVAS; Internews & BBC World Service Trust; Save the Children; Ushahidi & Swift River; World Food Programme's EPIC	Post-election violence in Kenya in early 2008; Cyclone Nargis in Burma in May 2008; Gaza conflict in Dec 2008-Jan 2009; Mozambique elections in October 2009; Ongoing conflict in DRC & Afghanistan
Section 4. Response: Coordination in Emergencies	The overwhelming need at the height of an emergency is rapid and high-quality information, delivered to those affected, and co-ordinated effectively between relief organizations. Information flows need to be two-way and validated for reliability.	Person-to-person contact for swift delivery of information; Emergency response communications for humanitarian workers and for affected families	Emergency telecoms/ satellite; Social networks; Satellite imagery; Unmanned Aerial Vehicles (UAV)	EU Joint Research Centre; GDACS; InSTEDD; Télécoms Sans Frontières; UNOSAT & AAAS for satellite images, UAVs; World Food Programme's ITHACA	Mumbai terror attacks in November 2008; Conflict in Sri Lanka 2009; Post-election protests in Iran, 2009; Niger community communications centers, ongoing
Section 5. Reconstruction: Post-Crisis Services and Development	Rebuilding after an emergency or conflict depends on the quality of the existing infrastructure. New technologies and applications mean information flows offer great potential for longer-term reconstruction.	Information exchange and co-ordination; Dispersed 2-way communications for as many people as possible; Access to communications tools	Mapping; SMS tools; Mobile transactions; Online job matching	EU Joint Research Centre; Kiwanja & FrontlineSMS; M-PESA and M-Paisa; Souktel & LabourNet; UNDP's TRMA	Assistance in Kenya during post-election violence, 2008; Monitoring during March-June 2008 election campaigns in Zimbabwe; Post-conflict monitoring in Sudan; Money transactions in Afghanistan; Job creation in Gaza and Bangalore

Credit: UN/Evan Schneider

Key milestones in development of disaster early warning systems

1949

Hawaii-based Pacific Tsunami Warning Center established, following the 1946 Aleutian Island earthquake and tsunami

1989

December: United Nations declared 1990s International Decade for Natural Disaster Reduction

1994

World Conference on Natural Disaster Reduction, Yokohama, adopted *Yokohama Strategy and Plan of Action for a Safer World*

1995

January: Kobe earthquake

1998

Potsdam International Conference on Early Warning Systems

2000

UN International Strategy for Disaster Reduction launched

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

3 Preparedness
Building communities' resilience

The introduction highlighted the distinctions between different stages with respect to the onset of a disaster or conflict. Being prepared beforehand is one of these distinct stages. Early warning, the subject of the previous section, is a narrow aspect of the information needs for preparing communities. In this section, we look at the technologies and types of communication that can create preparedness and resilience in a broader sense in the event of an emergency. This requires long-term planning, investment, and education. Less progress has been made on this front than on the narrower aspect of preparedness represented by early warning systems, but new technological developments offer new potential for improving preparedness within populations at risk.

The purpose of people-centered early warning is to enable local communities to get out of harm's way or to otherwise cope as effectively as possible.[37] Meeting the information needs of communities before the onset of emergencies—perhaps long before—is an important way to build community preparedness and resilience.

Markku Niskala, Secretary General of the International Federation of Red Cross and Red Crescent Societies (IFRC) said, "Information bestows power," and at-risk communities need "information as much as water, food and medicine, or shelter," before (and during) disasters.[38] Hence, disaster is first of all seen as a crisis in communicating within a community—that is, as a difficulty for someone to get informed and to inform others.[39] The torrent of information generated before and during crises can be hard to access and understand.

At the same time, the increasingly widespread use of mobile and online technologies present new potential information lifelines in times of crisis.

From the perspective of local communities, new platforms like Ushahidi, described later in this section, have the potential to improve awareness as an emergency unfolds by *crowdsourcing* crisis information. Crowdsourcing—a name derived from 'outsourcing'—is a term coined by *Wired* journalist Jeff Howe to describe when tasks are opened up to anyone as a way to "tap the talent of the crowd."[40] Anyone with access can contribute his or her solutions. Crowdsourcing platforms can use information sent via mobile phone, email, or the web to create dynamic online maps.

However, this innovation raises some important concerns regarding the reliability of the information presented. *The tension between wider sharing of information and confidence in its reliability is heightened by new technologies.* This theme recurs throughout this report. Information needs to be prepared and disseminated. To be useful, it must be accurate and trusted

> **"If effective, preparedness equips the population to be as self sufficient as possible and makes external relief more effective. Importantly, it can also pre-empt emergencies."**

and it must be understood and used by the community.

As noted above, the December 2004 Indian Ocean tsunami was the trigger for a re-evaluation of the role of information, and stimulated the first steps toward the more effective use of information in emergencies. The 2009 *World Disasters Report* from the IFRC has built on the earlier progress by emphasizing the importance for effective early warning systems of the 'last mile,' which means preparing people in communities at risk. Communities must own the risk assessment process and early actions in disaster response if the impacts are to be minimized. According to the report, "Early warning is not only the production of technically accurate warnings but also a system that requires an understanding of risk and a link between producers and consumers of warning information."[41]

> **"Those who are in the business of providing information must expect to have much greater engagement than in the past with people affected by a disaster or conflict, and to be doing so in a context of the wider availability of other information sources."**

This section gives examples of different ways of covering that last mile in order to be prepared. The first is the existing broadcast media, especially radio, which is available almost everywhere and is a powerful tool for dissemination.

Public education and the role of the media

Broadcasting is useful both in public education and disaster preparedness and in disseminating advice in the aftermath of a crisis. Lisa Robinson of the BBC World Service Trust was the co-author with Imogen Wall of a recent study on the role of information in humanitarian response.[42] She says that many organizations in the field struggle to communicate with affected populations because this requires specific skills they have not traditionally needed.

The World Service Trust report argues that the priorities to get information provision recognized by humanitarian agencies as a standard part of both preparedness and aid delivery should be:

- preparing off-the-shelf material agreed between humanitarian and aid agencies (what to do in an earthquake, basic sanitation advice, for example);
- training humanitarian agencies in communication skills, including receiving and using feedback from communities; and
- including a wind-up radio in aid packages.

Mark Frohardt of Internews advocates capacity building among the local media so that journalists who understand the local situation can disseminate information effectively. "The message needs to tell a story, to engage emotions, in order to affect people's behavior," he says. This is clearly a long-term activity that needs to predate any emergency.

Money spent on formal public information campaigns is less effective because these are so much less engaging, he argues. Humanitarian organizations need to provide good, consistent, and accurate information, with local capacity to disseminate it.

"The humanitarian community had previously come to look at information as something it shared within itself," Mark Frohardt says. *But information can now be much more widely shared.* The scope for direct contact with people affected by conflict or disaster has been revolutionized: for example, many have mobile phones and many have contact with diaspora communities overseas.

Just as in other contexts, the increasing access to new technologies is changing audiences' expectations of the broadcast media. Those who are in the business of providing information must expect to have much greater engagement than in the past with people affected by a disaster or conflict, and to be doing so in a context of the wider availability of other information sources, which may be more trusted even though informal.

While the broadcast media are unparalleled in their potential for disseminating information along the last mile in ways that connect powerfully with their audiences, and while people will seek information from many sources, there is an increased need for authoritative official information. We turn next to recent developments, both institutional and technological, in official alert and preparedness systems.

Global alert and preparedness systems

There is a need to aggregate reliable and timely information to enhance preparedness. A number of important recent initiatives focus on this. Three very different initiatives are described here. The UN's Global Impact and Vulnerability

People-centered communications practice at Save the Children

The perspective on communication in the humanitarian community has shifted significantly in the past year or two. Save the Children has actively focused during this time on making information one of the key aid deliverables. Jon Bugge of Save the Children says, "The communication has to be two-way. You can't just turn up and deliver anything."

He thinks changes in the technology of communications have increased awareness of information needs, but the methods used can be very simple—posters on a notice board will often be enough, or simple printed leaflets with advice.

Credit: Save the Children

Information needs should be built into the initial assessment in an emergency, he says, because it will help the people affected start to be the architects of their own recovery. Agencies need to coordinate the advice they hand out so people are not receiving conflicting information. And they need to include feedback mechanisms, which are invaluable for making programs more effective.

One early innovative information mechanism used by Save the Children was the children's feedback committees they set up in Zimbabwe in 2003. These gave children, selected through a careful process, a role in monitoring and reporting on food distribution. The children were trained, and the committees helped target food distribution better and uncovered other issues affecting children.

In a more recent example, Save the Children developed with the World Service Trust a five- minute daily bulletin in Burmese that was broadcast on the BBC Burmese service after Cyclone Nargis. The scripts covered basic health and sanitation advice and aimed also to provide some psychological comfort.

The agency also set up Information Centres at every distribution point, giving advice but also answering questions and handling feedback and complaints. Save the Children Myanmar is piloting a feedback management process specifically for children, through Child Friendly Spaces and Early Childhood Development Centres.

According to Jon Bugge, there is some resistance in the humanitarian community to the recent emphasis on the importance of information and communication—mainly because it is complicated and there isn't enough time to deal with the community in this way in an emergency.

However, he thinks the transition to two-way communication as an integral part of humanitarian efforts is reaching critical mass. There is now an inter-agency working group looking at the issues involved, particularly the coordination of advice.

The agenda is nevertheless challenging. Issues to be considered include:

- The development of appropriate communications skills in humanitarian agencies
- Establishing effective feedback mechanisms
- Ensuring messages from different agencies are not contradictory
- Ensuring the accuracy of information and keeping it up-to-date
- Local capacity building

Alert System (GIVAS) website was launched in September 2009 and will make maximum use of new media and digital technologies for information collection and crisis alerts.[43]

The Joint Research Centre (JRC) of the European Commission has developed the European Media Monitor (EMM), a news clustering and collection tool for global monitoring and analysis. Finally, The World Food Programme's (WFP) Emergency Preparedness Integration Center (EPIC) aims to create a platform integrating operational information from a variety of sources into one tool available to all humanitarian workers.

Global Impact and Vulnerability Alert System (GIVAS)

Over the past decade, the international community has put in place a number of sector- specific global early warning mechanisms. However, there are few mechanisms that are able to report across sectors on the immediate impacts that global shocks have on the lives of the poorest and most vulnerable populations. There is an information gap between the point when a global crisis impacts vulnerable populations and when solid quantitative information reaches decision-makers.

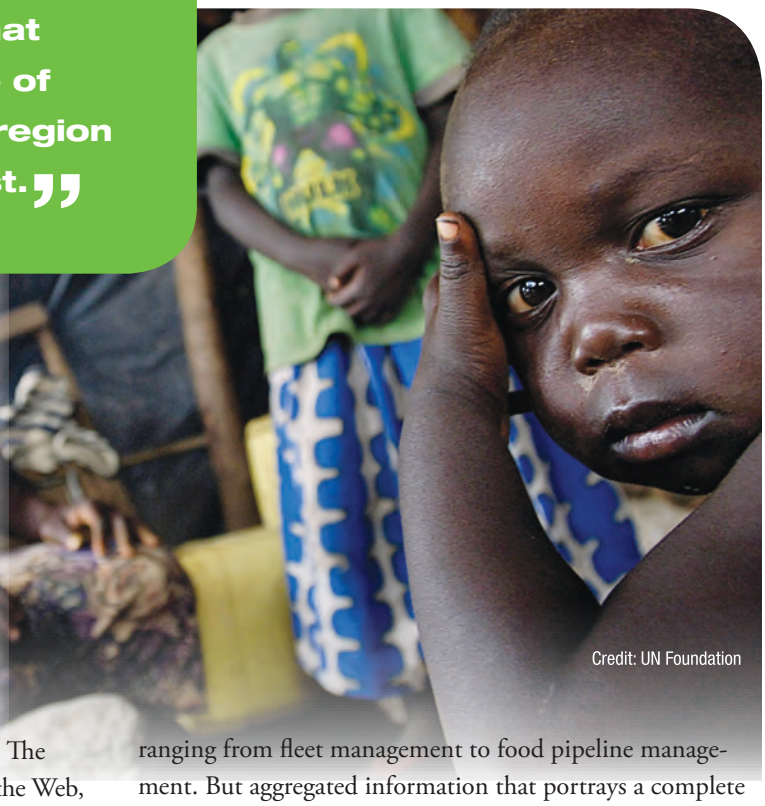
Recognizing this gap, the UN Secretary-General has called on the UN System — drawing on the expertise of outside partners — to establish a global impact and vulnerability alert system that provides decision makers with real-time information and analysis to ensure that responses to global crises take appropriate account of the needs of the most vulnerable populations.

The GIVAS is currently in its design phase with a first prototype planned for June 2010. It will build on the wealth of existing early warning systems and data bases, and fill real time data gaps where necessary. The added-value of the Alert will be the compilation of quick time data from a variety of reliable sources covering multiple dimensions of vulnerability that will help the international community understand new emerging vulnerabilities and the interaction between different threats and crises. The Alert System will be triggered when a crisis becomes global in scope and there are first subtle signs it will affect the most vulnerable and least well-prepared populations.

While guided by an ambitious vision, the GIVAS will be implemented in a phased approach. It hopes to leverage the expertise of many UN and non-UN organizations — ranging from vulnerability analysis to technology and design — to ensure that the needs of the most vulnerable are an integral part of the international community's crisis response.[45]

Credit: UN Foundation/Nothing But Nets

> **"...aggregated information that portrays a complete picture of humanitarian activities in a region or country does not yet exist."**



Credit: UN Foundation

European Media Monitor (EMM)

The second example is a monitoring system created by the European Commission's Joint Research Centre (JRC). The JRC is a research and development center that caters to the needs of the European Union's policy makers, such as on issues of international security. Its European Media Monitor (EMM) automatically 'reads' news articles using statistics and language technology. The platform specifically monitors non-static content on the Web, such as news sites, discussion forums, and publications. EMM searches more than 4,000 websites from 1,600 key news portals around the world plus 20 commercial news feeds. It is able to collect over 80,000 news articles per day in more than 40 different languages and classifies them according to hundreds of subjects and countries. EMM can extract information about locations, persons, and organizations covered in the media. Users can receive customized alerts by email and SMS. The system thus detects events in near real-time, in support of internal European policy making.

Toward the end of 2009, EMM was renamed OPTIMA (Open Source Text Information Mining and Analysis) to reflect the growing applications of the platform. The JRC recently partnered with the African Union to develop, deploy, and operate the Continental Early Warning System (CEWS). In 2010, OPTIMA will integrate a blog-monitoring feature and a sentiment detection system to follow public opinion.

Emergency Preparedness Information Centre (EPIC)

In contrast to the monitoring function provided by GIVAS and EMM, the WFP's Emergency Preparedness Information Centre (EPIC) is developing an operational management tool for aggregating region- and country-specific information on a range of activities. Different agencies use a variety of operational management tools for distinct purposes, ranging from fleet management to food pipeline management. But aggregated information that portrays a complete picture of humanitarian activities in a region or country does not yet exist. Managers currently make decisions based on unstructured and fast-evolving information. There is thus an obvious need for a tool that can aggregate existing information into a single place that will present decision makers with a simple and efficient way to access all operational emergency information.

During EPIC's three years of development, its main activities will include the development and piloting of remote data collection and links to primary logistic systems, the addition of unstructured data, the establishment of field pilots, the integration of data from other organizations, and the expansion of geographic coverage. Finally, a Competency Centre will be built that handles applications, develops interfaces, integrates data, and supports the system globally.[46]

The EPIC project seeks to develop a toolbox that will aggregate information from a variety of sources into a unified visual tool. Humanitarian workers will be able to input data to, access, and query this tool from their operational area through computers, mobile devices, and satellite phones. In addition, the team is working on developing radio networks that can be integrated as another source of information. In cooperation with Motorola, WFP has tested a new generation of digital radio technology (Mototrbo) that in addition to providing secure voice communications can also carry data. Work is now underway to equip a standard mobile device with a compatible radio so that EPIC services can be


Credit: Télécoms Sans Frontières

transmitted over this network.

WFP is also exploring the potential use of World Vision's Last Mile Mobile Solution (LMMS). This initiative combines mobile computing technologies with improved humanitarian business practices to "promote greater efficiencies and heighten accountability in food aid programming at the last mile of our humanitarian work."[47] LMMS is an interactive and automated platform that uses real-time photo verification to document humanitarian response.

Finally, the WFP runs twice-yearly training programs on the use of information and communications technologies (ICTs) in disaster preparedness and response that are open to the global community of humanitarian aid workers. The ICT Emergency Preparedness and Response Management Training, funded by The Vodafone Foundation and the UN Foundation, is designed to standardize the use of communications technologies in disasters.

Using geospatial technologies to support preparedness

At the height of the Cold War, U.S. President Dwight Eisenhower called for the creation of a UN aerial surveillance service to detect preparations for attack.[48] In 1960, he pledged that the United States would "do everything in its power to contribute to the rapid organization and successful operation of such international surveillance."[49] While no such center for conflict early warning was established then, today's geospatial technologies have considerable potential to support preparedness and early warning activities in a number of contexts.

Geospatial technologies include "a range of modern tools, such as satellite images, geographic information systems (GIS), and global positioning systems (GPS) that allow for mapping and analysis of multiple layers of geo-referenced data."[50] The data can be analyzed to identify crisis patterns and to show evidence of military preparations. Satellite imagery can provide evidence to corroborate field reports of escalating conflicts and disasters, as was recently done in Sri Lanka (see Section 4).

The EU's JRC mentioned previously has a Geo-Spatial Information Analysis for Global Security and Stability Program that includes a number of projects relevant to preparedness and early warning.[51] For example, one new tool can automatically identify built-up urban areas using high- or very high-resolution satellite data. This is particularly important for measuring vulnerability and risk for disaster

preparedness because field-based data are often not available. The analysis can even be produced rapidly at the global and regional level to provide real-time data, which means that hot spots can be quickly identified and responded to in a timelier manner. Section 4 provides some examples.

In contrast to the top-down and external perspective of these applications are new tools that source information from the people affected by a crisis.

Crowdsourcing crisis information

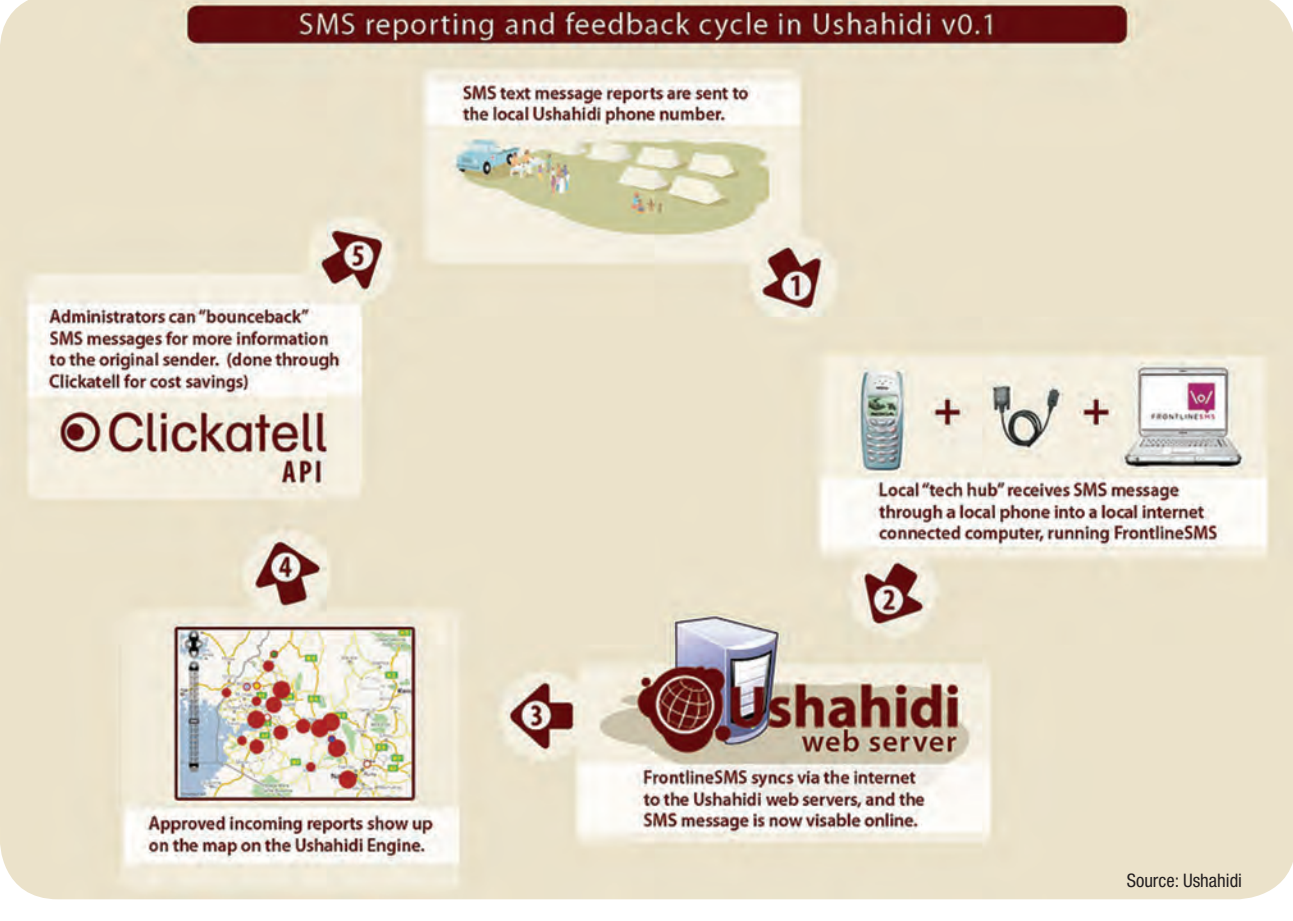
Humanitarian information management systems typically follow a strict information collection and reporting protocol. However, if only designated officials have permission to report information, this reduces the amount available, in contrast to an open system in which everyone can share information. While data validation is important, information is perishable and risks becoming obsolete. Thus information collection and sharing represents a significant development.

Ushahidi, meaning 'witness' in Swahili, is a free and open source platform that combines SMS, Twitter, and Google Maps to crowdsource crisis information. Ushahidi was developed by Kenyan bloggers in response to the violence after the December 2007 elections. Anyone with a mobile phone could text a dedicated number to report human rights abuses, or incidents could be reported and mapped on the website directly. Ushahidi has since been used in Afghanistan, Colombia, the Democratic Republic of the Congo (DRC), Gaza, India, and Lebanon, and will be used in Mozambique.

Traditional humanitarian information management systems are typically closed and controlled. Ushahidi is open and decentralized. Opening the reporting of crisis information to anyone with access to technology presents exciting opportunities and important challenges.

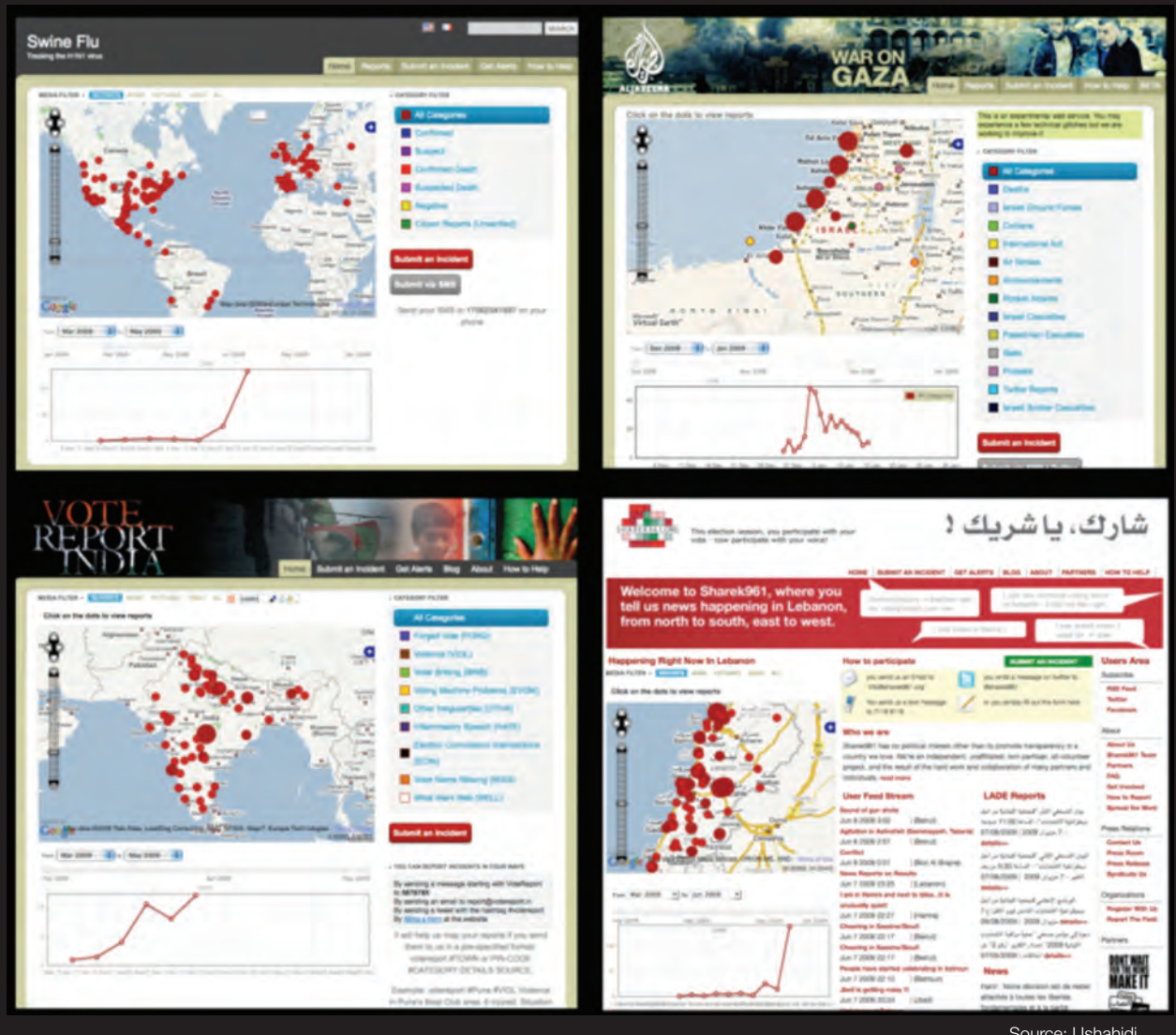
Compared with traditional humanitarian information management systems, Ushahidi also 'closes the feedback loop,' such that information collected can be communicated directly to those who most need to use it. Communities have little use for early warnings that do not reach them. Ushahidi includes a subscription option that allows individuals to subscribe to alerts in specific locations. These can be communicated by email and SMS. In other words, Ushahidi's innovative approach allows for 'crowdfeeding' as well as crowdsourcing crisis information.[52]

That said, crowdsourcing also presents some serious challenges. The most important is how to verify rapidly the information collected and posted. Some of the incidents re-



Source: Ushahidi

Deployment of the Ushahidi platform around the world



Source: Ushahidi

ported might have been wrong or even deliberately misleading. Hence effective crowdsourced information requires near real-time validation techniques, otherwise the advantage of speed is lost.

There are a number of options for validation. Users of the Ushahidi platform could be informed whether the alerts they have subscribed to receive have been verified. The submission of information to Ushahidi could be restricted to trusted individuals. Al-Jazeera used Ushahidi to cover Israel's attack on Gaza; only its own journalists contributed to the near real-time reporting. This approach could be described as 'bounded' crowdsourcing.

Ushahidi also allows pictures to be geo-referenced and reported in almost real-time directly from phone cameras. Pictures are relatively harder to fabricate than simple text messages. Moreover, if several different pictures of the same incident were submitted, the multiple sources offer some validation. If text messages describing the same event depicted on the photographs were also reported on Ushahidi, there would be even more 'auto-validation.' In other words, the more information that can be collected across different media, the easier it is to verify. Ushahidi is now launching a new project called Swift River, which will use this logic to filter the torrent of information generated online during any crisis.

Conclusions

As noted at the start of this report, *if information means survival for communities in crisis, then communication technologies are their lifelines.*

The idea of preparedness extends beyond simply having

effective early warning systems. *Meeting the information needs of communities before the onset of emergencies is an important way to build preparedness and resilience.*

Communications technology will help humanitarian agencies create preparedness and resilience in the event of an emergency. However, the collection and use of information does not just depend on technological innovation. The technologies need to be widely adopted and used properly, thus making people-centered approaches more effective.

More progress is needed on the provision of accurate and consistent information to vulnerable communities. Traditional media are an effective means of reaching large numbers of people in ways that will get important messages across. *Nongovernmental organizations (NGOs) and humanitarian agencies could make more effective use of both traditional and new media to reach the communities they aim to serve.*

Preparedness also requires the international humanitarian community to be able to act on the information and analysis enabled by these emerging systems. Innovations in information systems serving the international humanitarian community hold out the promise of improved opportunities to empower vulnerable communities. *Preparedness also requires the international humanitarian community to be able to act themselves on the information and analysis enabled by these emerging systems.*

There is a trade-off between the authoritativeness of information and its timeliness. Humanitarian information systems have traditionally been authoritative but lagging urgent developments. New real-time approaches are changing this, offering the potential for using multiple reports in different formats to cross check. *But the issue of validation remains a significant challenge.*

Information and misinformation in Kenya

One example of the scope for the spread of misinformation is provided by the December 2007 elections in Kenya. The official results of the election gave the lead to incumbent President Mwai Kibaki, despite initial results that suggested opposition candidate Raila Odinga was well ahead. The outcome was disputed and six weeks of violence followed, with more than 1,000 deaths and perhaps half a million Kenyans displaced from their homes.

One of the outcomes was the extensive use of mobile phones, for SMS messaging, and online tools both to organize peaceful protest, and unrest, and to report on events. The text describes the development of Ushahidi for collating reports of violence. Media outlets also asked for SMS or email updates; the BBC received about 4,000 text messages from Kenyans.

A number of groups mobilized to send text messages aiming to prevent violence, including an emergency response scheme provide by Oxfam GB.[53] There were also some 'chain' text messages encouraging ethnic hatred. Safaricom sent messages to its subscribers urging them to be calm and warning of possible prosecution if they sent SMS messages that might cause public unrest.[54]

There is clearly the need for a broad public debate about the potential to use new technologies for malicious purposes, including the applicability of existing media law to new media. Screening of text message and social network content in some countries seems increasingly likely, which is a double-edged trend depending on the intent of the authorities.

However, this is not a problem confined to new technologies; traditional media can play the same role. The best-known precedent was set by Radio Milles Collines, a popular radio station that encouraged hatred during the 1994 Rwandan genocide. Criticism of some local language radio stations occurred in Kenya in early 2008. Furthermore, as one study of Kenya noted, "Since SMS, unlike radio, is a multi-directional tool, there is also hope that voices of moderation can make themselves heard." [55]

Credit: Nick Rain

4 Response
Coordination in emergencies

The overwhelming need during an emergency and in its immediate aftermath is coordinated and high-quality information. From the perspective of external organizations such as humanitarian and aid agencies this is a two-way information flow: on the one hand, delivering information and services to people affected by a disaster in an effective and coordinated manner; and on the other, collecting information from affected areas in order to coordinate supplies and assistance in order to improve fundraising efforts and flows, and to document impacts for future reference.

From the perspective of the affected people, coordination is an exchange of information among themselves and related groups such as diaspora communities. This is a fine-grained and decentralized exchange of information, taking advantage of the scope offered by new technologies, especially mobile devices.

In practice, what means of communication and information sources can people turn to in the confused and desperate situations of an emergency? This section gives some examples highlighting recent developments in technology and the ways it is used. It begins with the vital emergency response role played by Télécoms sans Frontières (TSF), one of the organizations designated as First Responder in the UN Emergency Telecoms Cluster.[56] TSF serves both the communications needs of affected populations and those of the humanitarian workers.

We then turn to developments in the use of social media during crises by affected populations. The 2004 Indian Ocean tsunami was the catalyst for the role of user-generated content (UGC) in the coverage of emergencies, as it was for so many developments we are considering in this report. Other milestones in the growth of UGC were terrorist attacks—on the London and Madrid transport systems, for example, and the Mumbai terrorist attacks in November 2008—and political events such as Kenya's disputed elections in 2008 and Iran's in June 2009. The section ends by looking at the evolving use of innovative technologies within the global policy community.

Emergency response from Télécoms Sans Frontières

The central role of communications in crises is well illustrated by the importance of Télécoms sans Frontières (TSF) to international emergency response efforts.

The organization, founded by Jean-François Cazenave and Monique Lanne-Petit in 1998, in response to their experiences as aid workers in the war-torn Balkans, has only 40 staff members and a €2 million annual budget. Yet its emergency communications support is part of almost every humanitarian response effort after a natural disaster or conflict.

This vital role is recognized in TSF's status with regard to UN and other official agencies. In 2006, it became the first nongovernmental partner of the Office for the Coordination of Humanitarian Affairs (OCHA) and the United Nations Children's Fund (UNICEF). TSF's teams are alongside officials from the United Nations Disaster Assessment and Coordination team (UNDAC) in making the earliest assessments of need in a location. It is also a partner of the European Commission's humanitarian aid department, ECHO. Several groups, including The Vodafone Foundation and the UN Foundation, support TSF.

TSF will deploy a team from one of its three bases (Pau, France; Bangkok, Thailand; and Managua, Nicaragua) aiming to reach an emergency location within 24 hours, although it can take 48 hours. The equipment for a telecommunications center can be carried on a plane in three

Credit: Télécoms Sans Frontières.

cases. This includes the workhorse BGan satellite receiver, provided by Inmarsat, and an array of phones including Global System for Mobile (GSM) mobile phones with local Subscriber Identity Module (SIM) cards.

TSF's core emergency response activities have two aspects. One is the provision of communications to the UN agencies and to NGOs providing emergency relief. As all the humanitarian workers are sharing the same facilities, TSF's telecommunication centers facilitate greater coordination of the relief effort, particularly between the United Nations and NGOs.

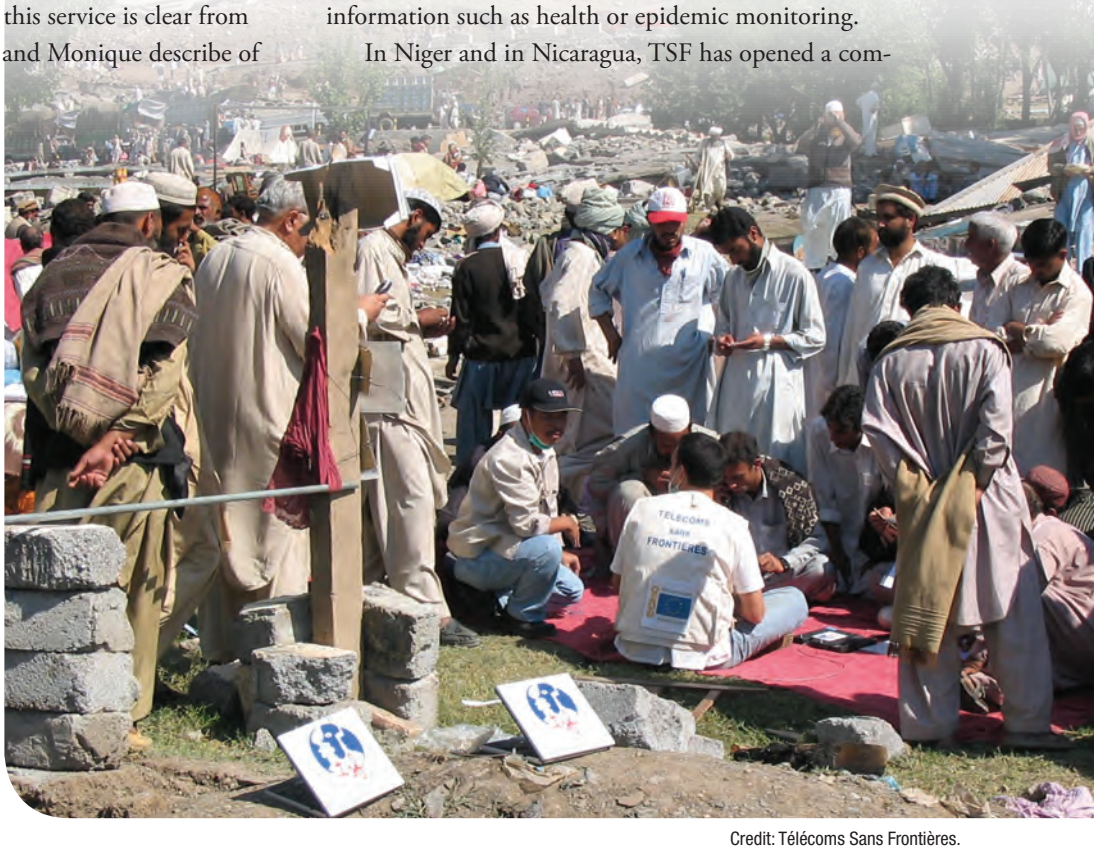
The second is providing a free phone call (at a cost of about $5 per family) to the people affected by the disaster or conflict. The human impact of this service is clear from the many examples Jean-François and Monique describe of people's lives transformed for the better—or lives saved—thanks to the ability to communicate. But the numbers tell an impressive story too: in 2008 alone, more than 5,300 families in areas affected by natural disaster or conflict could make contact. This was achieved at an average daily cost of an emergency team in the field of just under $1,158 (from 2006 to 2008).

TSF is developing three new types of longer-term activity: poverty reduction and economic development; crisis prevention; and disaster preparedness.

The innovation in *disaster preparedness* is providing training in emergency telecommunications response to technical experts—information technology or logistics officers, for example—from other NGOs. In summer 2009, TSF ran its first training course for 20 people in each of its Bangkok and Managua bases. The aim is to ensure that there is capacity in the NGO community to make emergency telecommunications operational as quickly as possible.

Turning to *early warning and prevention*, since 2006, TSF has been offering satellite communications in 12 remote and unconnected areas of Niger in order to implement an early warning system aimed at averting food crises.[57] Each site costs about $200 to install. The importance of early warning about impending food crises has been emphasized by recent economic research; there is evidence that conflict, which has trapped some African countries in poverty, is caused by the onset of food crises. TSF has installed telecommunications centers (each covering several villages) using RBGan terminals from Inmarsat and a computer connected to a small data transmitter. It has also developed (with the Université de Pau et des Pays de l'Adour) software to compress substantially the data collected, reducing running costs significantly. TSF is piloting its use in conjunction with FrontlineSMS, described in Section 5. The data forms provide real-time information to the authorities on agricultural, nutritional, and market indicators and can be adapted to deliver a range of other types of early warning information such as health or epidemic monitoring.

In Niger and in Nicaragua, TSF has opened a com-



Credit: Télécoms Sans Frontières.

> "In each category—emergency response, preparedness, early warning/monitoring, and development—TSF sees more potential than they are able to deliver at present."

munity communications center, funded by the IT Cup (an annual charity soccer tournament between companies in the information technology sector). These are longer-term *development* projects aimed at bridging the digital divide. They offer cheaper and more efficient shared communications to NGOs operating in each area, and the international NGOs are taking over the running costs. The centers also provide internet and email access to local people, and computer and internet courses to young people in the area to equip them better for finding work. In Dakoro in Niger, for example, more than 30 NGOs use the center, which saves them money and the time they used to spend driving six hours each way to send an email.

In each category—emergency response, preparedness, early warning/monitoring, and development—TSF sees more potential than they are able to deliver at present.

One reason the benefits of emergency communications continue to be enhanced is continuous *technological innovation.* Equipment manufacturers often now provide TSF with beta versions to test in the field—an item that works well in a crisis will work well when it goes to market.

TSF carries out its own innovation work as well, often with university partners. One example is the TSF Box, currently being rolled out. This improves the management of the telecommunications centers by managing access rights for the different organizations, prioritizing traffic, and collecting data automatically. It economizes on costs and captures the information needed to improve efficiency.

Another innovation under development is a wi-fi mesh system for deployment in emergencies. Wi-fi mesh systems interconnect a number of powerful routers to extend the range of wi-fi beyond a few feet (for a single router) to hundreds or thousands of feet. TSF aims to establish the first cyber café for refugees before long.

Another route for enhancing the positive impact of access to communications would be for TSF to work with *partners who can provide services* needed by refugees or those affected by a crisis. People most often make phone calls asking for money; overseas diasporas are an important source of emergency finance. TSF has been supported by Western Union, which has a global presence and can sometimes enable families and friends to wire cash. There are obvious advantages in using mobile transactions schemes, such as the cash transfer by the M-PESA system piloted by the Irish charity Concern in 2008 during the post-election violence in Kenya (described below).[58]

Impact of social networks in Iran

User-generated content online is a potentially important source of information. This is particularly true in crises that are largely inaccessible to journalists. Social networking tools like Twitter, Facebook, YouTube, and Flickr, for example, made frontline news during the Iranian post-election protests in mid-2009 when the mainstream media was lagging far behind in reporting the escalating crisis, at least until the Iranian authorities started to limit and monitor online access. According to Matthew Eltringham, in charge of the use of User Generated Content by the BBC's news operation, they received about 20 video clips and 100 still images a day immediately after the election, although this fell sharply as the authorities cracked down on street demonstrations.[59]

However, the mainstream humanitarian and human rights community remains largely skeptical of social media. While the Iranian example shows that some suspicions are indeed well founded, the use of social media also provided critical information that would otherwise have gone unreported. Some Twitter users—@persiankiwi in particular—were vital gateways to events for the outside world.

The inability to verify (easily) a Twitter user's identity and the information s/he tweets are two important factors that explain why many in the humanitarian community see little added value in following social media. Tweets can certainly misinform and there were many such examples in Iran.

To take one of these, one assessment of Twitter use stated, "several people tweeted that 700,000 people had gathered at the Ghoba mosque in Tehran. Several people re-tweeted it and even posted the news on their blogs. Meanwhile mainstream international media estimated the number of protesters was between 3,000-5,000 people."[60] This becomes particularly problematic when such Tweets are re-tweeted.[61] One study noted that one in four tweets on Iran was a re-tweet. It is also worth noting that Twitter's use *within* Iran was nearly zero and that most of the traffic was in English, not Farsi.[62]

Although usage of Twitter inside Iran is extremely low,

the small minority of Twitter users in the country made active use of the social network to report events. Despite the number of retweets, 51.3% of all tweets on 11 June 2009 (the day before the election) with the hashtag #iranelection came from Iran, with only 27% coming from outside the country and 21.6% not including a location.[63] The number of Iran-based tweets decreased during the following days but still the majority of #iranelection tweets during the first few days of the crisis came out of Iran itself, a handful giving vital eyewitness reports on the escalating unrest. In the meantime, the mainstream media was prevented—in fact censored—from reporting on early developments.

Twitter therefore amplified the voices of a minority who were not representative of Iran's population. The few Iranians living in Iran and using Twitter were generally young and affluent. Many Iranian Twitter users who were actively (re-)tweeting were actually based in the United States, which is also where many of their Twitter 'followers' (readers) were based.[64]

Twitter, unlike other social media platforms, is also quasi-censorship proof. Twitter applications like Twhirl, Tweetie, and Tweetdeck do not need the website twitter.com to operate. Furthermore, tweets, pictures on Flickr, and YouTube videos can all be tagged as related to Iran, which makes it easier to find and copy the items "faster than any government could delete them."[65] The government would have had to ban all access to the Internet to impose a full digital blockade on the country, and it did indeed limit access at certain times. But doing so "might have risked shutting down vital government and economic services as well."[66]

Credit: Flickr/Faramarz

Credit: twitter.com

Some have suggested that the regime permitted access to Twitter and Facebook so they could track dissident activities. In addition, as with other uses of social media, there is an issue about the reliability of tweets coming out of Iran. A number of online activists created Twitspam, "a social-networking site that encourages users to identify and block malicious 'tweeters' on Twitter," which hosted an interactive Web page where users discussed possible 'Iranian agents' operating online.[67] Twitspam users would flag Twitter accounts that posted spam (i.e., multiple comments of the same sort), obviously sought to entrap Twitter users who were tweeting from Iran, or clearly tried to spread misinformation. If users were not completely sure, they would flag the account as suspected.

Nevertheless, crowdsourced validation might not be appropriate in all types of crisis. In his review of the role of social networking in the Iran situation, James Carafano notes, "An effective crisis communication must be credible, understandable, and actionable. Under great stress and limited time, as well as limited information, it is unrealistic to hold that negotiated online interactions are an effective mechanism for determining factual and dependable information."[68] This review also described Ushahidi's development of Swift River, designed to validate crowdsourced crisis

> **"An effective crisis communication must be credible, understandable, and actionable."**

Social media, citizen journalism, and the Mumbai terrorist attacks

Terrorist attacks on 27 November 2008 in the railway station, two luxury hotels, a tourist café, and a Jewish center in the city of Mumbai involved many international visitors. The death toll after 60 hours of terror was 195, including both residents and international visitors. A large global audience, many worried about colleagues, friends, or family members, was in the city.

In a situation of this kind, the overwhelmingly important response comes from the police and army. But the attacks in Mumbai meant there was intense demand on all means of communication: news channels, telephone calls, online news including citizen journalism (or 'user-generated content') and, importantly, social networks, especially Twitter.

These sources of information fed each other—people repeated what they had heard on the news—and Mumbai marked an important step in the use of online material by traditional broadcast organizations. The many means of communication meant that any information, both accurate and not, circulated widely.

This was a major and dramatic news story, with plentiful pictures. A large increase in traffic affected many media, especially the online media.

For example, Google trends revealed that the number of web searches for terms such as 'Mumbai terror' was more than 100 times the recent norm. Photos and videos were posted to sites such as Flickr and You Tube.

In another example, an analysis of traffic to bbc.com, the BBC's internationally focused website, showed the number of daily visitors to the site reached more than 2.2 million, a bit short of the 2.5 million peak for the U.S. election night earlier in the month. Outside of the United States (where it was the Thanksgiving holiday) the peak for 27 and 28 November (the day of the attacks and the day after) was higher than for 5 November (U.S. election night). Traffic to the site from within India itself rose by 136%, and there were large increases in traffic from Canada, Australia, and Germany.

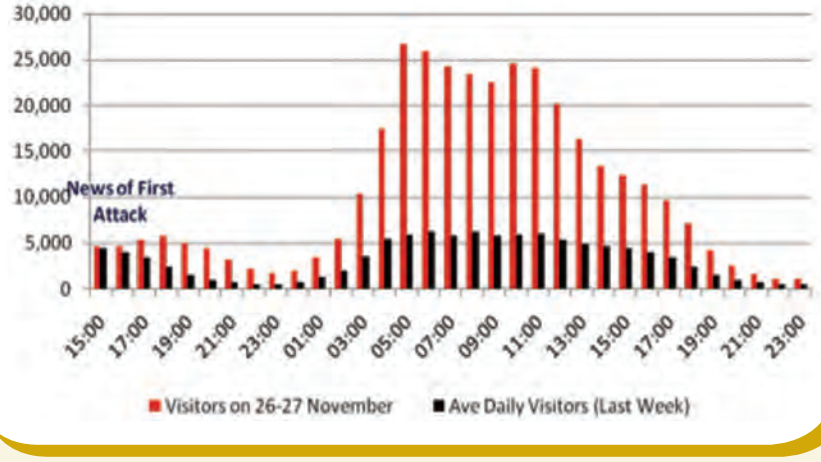
Mobile networks also showed jumps in activity, according to data provided by some of the operators covering Mumbai. Voice traffic rose by 4 to 5% compared with the normal level for the day of the week, with considerable network congestion, due perhaps to the communications needs of the security services. SMS traffic for the operators for which we have figures jumped by up to one-third compared to normal.

Twitter, the 'microblogging' site, came to prominence outside technology circles for the first time during the Mumbai attacks. At the height of the events, there was more than one tweet per second tagged #mumbai. Social media blogger Gaurav Mishtra, monitoring the events live as they occurred, wrote, "Now the volume of tweets on the Mumbai terrorist attacks is so high that I can't keep up!"[69] Mainstream news organizations were monitoring tweets and posting them as eyewitness comments to make the events vivid for visitors to their websites.

But the risks in user-generated material were also apparent. Some speculation that turned out to be incorrect was widely circulated in this way.

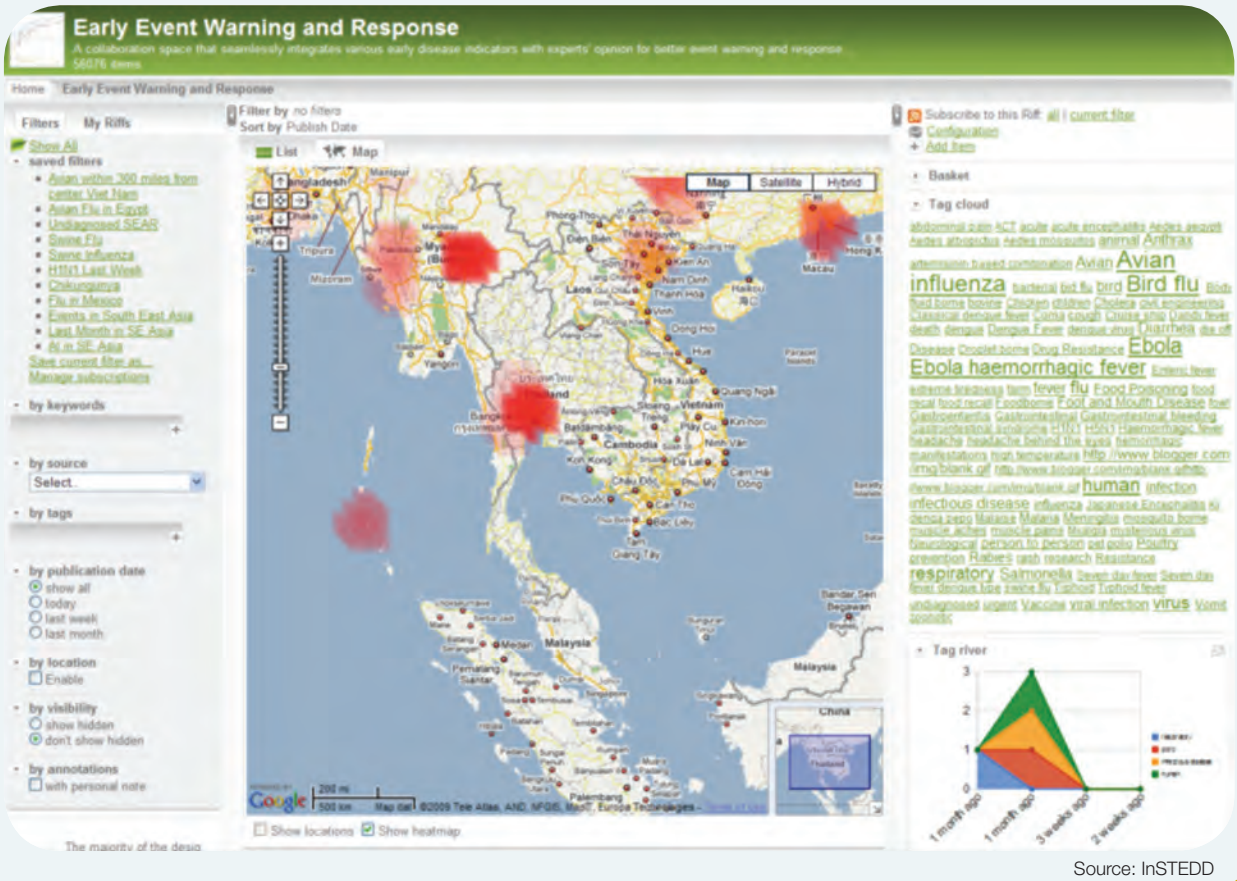
The head of the BBC's news hub for user-generated content, Matthew Eltringham, says "We wouldn't consider any of it legitimate information without checking. We try to identify individuals to do so; but Twitter is like Chinese whispers." He says, however, that social media such as Twitter, Facebook, and Orkut are increasingly important sources.

Daily visitors to bbc.com in November 2008



Source: BBC

Screenshot of Riff



Source: InSTEDD

information. Tweets can be tagged as #iranelection, but so can pictures on Flickr, footage on Ushahidi, blog posts, SMS, and online media. Swift River will exploit the wealth of these tags produced by individuals to cross check information across different media.

Global Systems for Coordination and Response

The information flows needed for effective emergency response can be either 'bottom-up' within the affected community, as in the examples of social media discussed above, or 'top-down', serving the humanitarian community. We turn next to some innovations in the latter category.

Global Disaster Alert and Coordination System (GDACS)

A number of global systems for coordination and response have been developed over the years. One of the most sophisticated is the European Commission's Joint Research Centre's (JRC) Global Disaster Alert and Coordination System (GDACS).[70]

GDACS combines existing disaster information management systems. Early information is expected to be uncertain and can be updated as better information becomes available. GDACS sends out alerts on natural disasters in near real-time and provides tools to help response coordination, including media monitoring, map catalogues, and an on-site coordination center.

The system produces near real-time automatic situation reports based on statistical modeling, rapid situation reports from the field, an online discussion forum for emergency responders, integration with established news services, and mapping products based on post-disaster satellite imagery.[71] The system can estimate the humanitarian impact of a natural disaster in near real-time and calculate within minutes the approximate financial aid that will be needed for the relief efforts. GDACS is activated the moment a disaster is forecast or has occurred and remains active until the end of the relief phase. The platform has been used to detect floods in Vietnam, fires in Nigeria, and internally displaced person camps in Sri Lanka.

Innovative Support to Emergencies, Diseases and Disasters (InSTEDD)

A new platform, which focuses on public health but can be applied to other types of emergency, is Riff, launched by the non-profit group Innovative Support to Emergencies, Diseases and Disasters (InSTEDD). InSTEDD was launched by Larry Brilliant in 2006 in a talk at the high-profile Technology, Entertainment, Design (TED) conference. InSTEDD seeks to leverage open source technology to improve information flow and cross-sector collaboration and to make collective action more effective.[72] The team's Evolve platform combines data exploration, integration, search, and inferencing for crisis detection, prediction, and response.

According to InSTEDD, a number of organizations are using Riff to explore its applicability to humanitarian crisis reporting and conflict early warning. For example, one organization recently trained Riff's integrated machine learning engine to identify hate speech and other potential indicators of geopolitical deterioration in news reports.

In the public health domain, Riff helps synthesize health-related event indicators from a wide variety of information sources (formal and informal). Its automatic classification includes seven syndromes, ten transmission modes, more than 100 infectious diseases, 180 microorganisms, 140 symptoms, and more than 50 chemicals.

In spring 2009, InSTEDD piloted Riff in the Mekong Basin in Southeast Asia to understand and more effectively track multiple data streams (both specialized alerts and generic sources such as news reports and Twitter) for earlier disease detection. This has made it much easier to track, manage, and detect outbreaks and the evolution of diseases in the region and impacts related to them. The pilot helped to improve the user experience of Riff including the analytics and visualization.

Credit: Allie Caulfield

> **"The growing availability of sophisticated aerial images helps speed emergency response and has the potential to contribute to better early warnings—perhaps even to pre-empt crises."**

What is particularly novel about Riff is its integration of several capabilities, including a data aggregation and gathering module; an automated feature extraction, data classification, and tagging module; a human input, hypotheses generation, and testing module; and a predictions and alerts output and field confirmation and feedback modules. This makes it very flexible. For example, the data aggregation and gathering module enables the user to collect or extract information from a range of different sources such as SMS, RSS feeds, email lists, existing databases, and online documents. The human input and review module allows users to collaborate by commenting, tagging, and ranking sets of related evidence, for example.

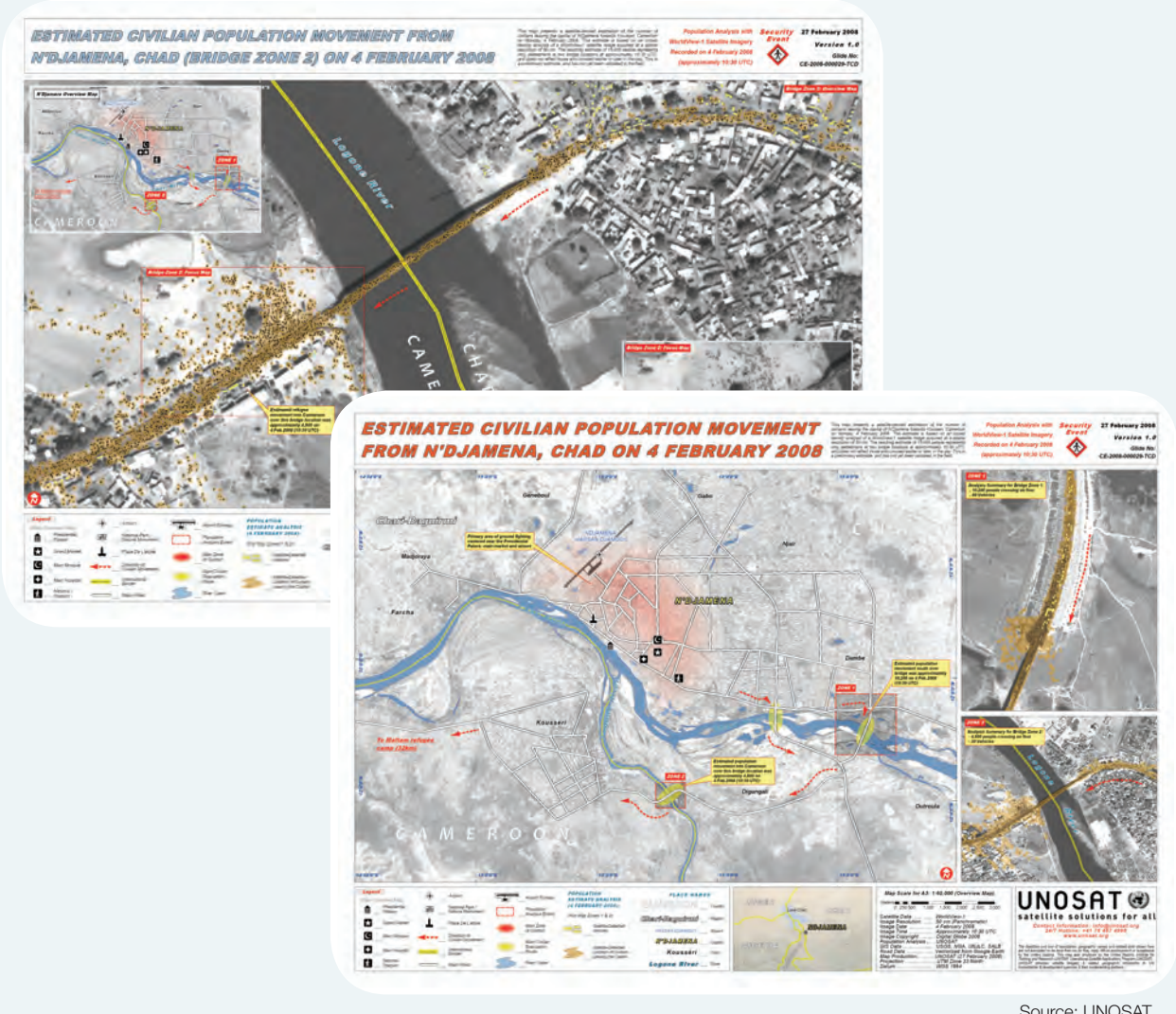
Satellite Imagery and unmanned aerial vehicles (UAVs)

The final example of a technology increasingly used for disaster response is that provided from overhead. Images from satellites and unmanned aerial vehicles (UAVs) are increasingly being used to monitor the impact of crises and natural disasters. The growing availability of sophisticated aerial images helps speed emergency response and has the potential to contribute to better early warnings—perhaps even to pre-empt crises. This is especially true for crises that occur in geographically remote or politically inaccessible locations.

UN Operational Satellite Applications Program UNOSAT

The mission of the United Nation's Operational Satellite Applications Program (UNOSAT) is "to deliver integrated satellite-based solutions for human security, peace and

UNOSAT Refugee Movement Satelite Images



Source: UNOSAT

socio-economic development." Established in 2000, it provides satellite images and analysis to relief and development organizations and comprises UN fieldworkers, satellite imagery experts, geographers, geologists, development experts, database programmers, and internet communication specialists.[73] For example, it analyzed satellite imagery during Sri Lanka's military attack in April 2009 to assess the impact of civilians trapped in no-fire zones. UNOSAT works closely with UN member states and organizations like the International Federation of the Red Cross and Red Crescent Societies (IFRC), Médecins Sans Frontières (MSF), and Télécoms Sans Frontières (TSF), responding to requests for assistance from organizations such as these. UNOSAT also has a telephone hotline to the UN Office for the Coordination of Human Affairs in New York to provide immediate mapping services.

UNOSAT acquires and processes satellite data and has produced over 1,000 analyses since 2000. The number of crises it covers annually grew from 3 in 2003 to 47 in 2007.

In 2003, UNOSAT created a humanitarian rapid mapping service that has been activated over 120 times by relief and coordination agencies. The service consists of rapid acquisition and processing of satellite imagery and data for the creation of maps and other spatial data to help coordinate emergency response and humanitarian relief efforts.

UNOSAT has also developed a wide network of field-based contacts, which is important for adding social context to the analysis. In one case in the Democratic Republic of Congo (DRC), UNOSAT received early warning that a specific village was going to be attacked. The team was able to reroute a satellite ahead of the offensive to capture evidence of the attack. This is not an isolated example: *UNOSAT is getting more frequent early warnings as a result of working closely with field-based organizations. Whether geospatial*

technologies can eventually go beyond early warning to serve as a deterrent mechanism remains to be seen.[74]

American Association for the Advancement of Science (AAAS)

The AAAS's Geospatial Technologies and Human Rights Project uses satellite imagery to monitor and document human rights abuses. The project has completed a number of case studies ranging from Chad and Sudan to Lebanon and Sri Lanka. The AAAS team documented past attacks by Sudanese-backed militias in Darfur. In Lebanon, it used satellite imagery to assess damage to civilian infrastructure to determine whether this destruction was deliberate or the result of 'collateral damage.' In Sri Lanka, the project responded to international concerns over the targeting of civilians and provided corroborating evidence taken from satellite imagery and analysis. AAAS is currently developing methods for tracking ongoing attacks in the Sudan and Chad.

Unmanned Aerial Vehicles (UAVs) for Crisis Response

The use of UAVs or 'drones' has the distinct advantage of being able to produce cheaper and much higher-resolution aerial imagery than satellites. Nor are UAVs hampered by cloud cover. The use of UAVs for information collection during and after humanitarian crises is likely to increase significantly over the next three years, if the appropriate regulation for their use is developed.

The Information Technology for Humanitarian Assistance, Cooperation and Action (ITHACA), a partnership between the World Food Programme and the Polytechnic University of Torino, Italy, has developed two fully operational UAV prototypes.

The aim of the ITHACA UAV project is to develop and construct remotely controlled mini aircraft that will capture the visual data needed to plan emergency and relief food aid. The project therefore aims to support disaster management through rapid mapping early in the impact stage.[75] The drones fly autonomously except for takeoff and landing. They are easily transportable on normal aircraft and require two operators. The operators can create a flight plan on a preloaded map and upload them during the flight.

For its part, the JRC has developed a prototype UAV in partnership with TerraPan Labs and University College, London. The UAV project, the Low-Cost Unmanned Imaging System (LOUIS) is intended to be—as the name implies—a cheap and portable system to support post-

UNOSAT images at work

The speed at which satellite images can be made available makes an important contribution to the effectiveness of relief efforts. For example, in the cases of Cyclone Nargis in Burma in 2008 and in Sri Lanka during the military attacks in 2009, UNOSAT provided satellite imagery and analysis within 24 hours.

A compelling example of UNOSAT's work is its monitoring and assessment of population movement along the Chad–Cameroon border in February 2008. Thanks to very high-resolution (VHR) satellite imagery, a combination of manual and automated analysis allowed the UNOSAT team to estimate the population crossing the bridge in the image. This analysis was particularly important to inform UN field-based agencies in Cameroon of the number of refugees to expect in their camps in the coming days. This shows that VHR satellite imagery can act as an important early warning indicator to estimate large-scale population movements.

In Sri Lanka, UNOSAT provided independent evidence that the Sri Lankan army had continued to shell civilians in no-fire zones despite claims by the government that military hostilities had ceased. As in many other cases, the use of satellite imagery in this instance was invaluable since areas of Sri Lanka were completely inaccessible to journalists and independent observers. This example also demonstrates that UNOSAT is not just a technical unit but can provide direct and independent evidence to the UN Secretary-General upon request. While the Sri Lankan Ambassador to the UN claimed the imagery was fabricated, this outlandish accusation served to strengthen UNOSAT's credibility.

"The use of UAVs for information collection during and after humanitarian crises is likely to increase significantly over the next three years, if the appropriate regulation for their use is developed."

UAVs being tested for humanitarian response

Source: Development Seed

> **"Satellites and UAVs are relatively new technologies that are likely to be increasingly accessible to a larger professional audience. Costs of satellite and aerial imagery are expected to decrease."**

disaster relief operations and logistics. LOUIS can be assembled in less than three minutes and is geared to use by beginners who do not have experience in flying UAVs. The JRC's specific interest in UAVs is in the potential of such an inexpensive—in fact, disposable—tool for collecting data that can be integrated in near-real time into the analytical impact models that the Centre runs. The team expects to pilot the UAV in the field in the near future.

A week-long exercise to test UAVs for crisis response—the first of its kind—took place in California in August 2009. The exercise combined the use of UAVs with SMS, VHR image processing, and open source GIS applications and was held at Camp Roberts in California. The exercise focused on two scenarios—stability operations in Afghanistan and planning for a natural disaster in Central America. Participants included geographers, software developers, and crisis mapping experts. They developed a novel approach to information collection by using UAVs, SMS, low-bandwidth satellite connections, and high-resolution satellite imagery of Afghanistan.

For example, they integrated Open Street Map's new Walking Papers application and combined this with the images taken by UAVs. Walking Papers works by enabling a user to download any part of a map to a printable file, which includes a bar code. Users can then annotate the hard copy map with a pen or pencil when they are out in the field. They can then scan the annotated map and upload the new data online. This provides a method of mapping field data even when Global Positioning System (GPS) units are not available and network connections are down. It also enables local people to point out spots on the paper map.

Satellites and UAVs are relatively new technologies that are likely to be increasingly accessible to a larger professional audience. Costs of satellite and aerial imagery are expected to decrease. UAVs are becoming smaller and easier to use. Charting flight paths is as simple as using a mouse to click

and drag path on a computer screen.

The technologies do face obstacles. In the case of satellites, cloud cover continues to present problems and while radar satellites can circumvent this, radar imagery is more difficult to interpret. And membership in the International Charter[76] is restricted to major national space agencies, which excludes some important field-based NGOs.

In the case of UAVs, the lack of an agreed regulatory framework limits their potential. Humanitarian organizations do not know where, when, and under what conditions the transport and use of UAVs is permissible. Insurance companies remain reluctant to cover use of UAVs. Furthermore, low-cost UAVs have very short endurance times, often less than 30 minutes. They must be flown to a specific point of interest and quickly collect imagery from as many angles as possible.

In addition, as UAVs have to date been used primarily for military purposes they carry a negative connotation. *Changing this perception will continue to be a challenge.* That said, the same was also true of satellite imagery in the past. Satellites were typically associated with the Cold War but Google Earth has greatly helped to demystify satellite imagery.

Conclusions

Emergency response can be enhanced by information flows, both within and from the affected population and gathered by external agencies. *But the effective collection and use of information does not just depend on technological innovation.* The technologies need to be widely adopted and used properly.

Credit: Télécoms Sans Frontières.

> **"Information will make its greatest contribution to emergency relief—and therefore saving lives—if the advantages of 'bottom-up' and 'top-down' information sources can be combined."**

The positive impact of access to communications on people affected by a disaster or conflict is beyond doubt. Beyond the immediate humanitarian impact, demonstrated by the importance of TSF's emergency response, *it is the people concerned who themselves have the most detailed and immediate information needed for humanitarian agencies to deliver an effective response.*

Innovative social media offer tools that enable this information to be shared with humanitarian and aid agencies, and with more traditional media organizations that play such an important role in focusing the world's attention on areas of need. *While they make available information that would not have emerged otherwise, they pose a serious challenge in terms of authentication. Validation is a fundamental issue in the further use of social media in situations of conflict and disaster.*

Other new technologies, both the online tools and satellite and aerial imagery described in this section, overcome the problem of authentication. The technologies are rapidly becoming less expensive and more widely available. *The regulatory framework must evolve to allow the use of these tools as necessary.* The tradeoff for greater reliability is that the information gathered is restricted to the humanitarian agencies.

Agencies should consider what information to share with the people they aim to help, and how to do so effectively. *The humanitarian community needs to make rapid progress in developing techniques and tools for communication with those they aim to help.* If they do not, other, less reliable and objective information, will likely fill the vacuum.

Information will make its greatest contribution to emergency relief—and therefore saving lives—if the advantages of 'bottom-up' and 'top-down' information sources can be combined.

Credit DataDyne

5 Rebuilding
Post-crisis services and development

The faster affected communities can move from emergency response to rebuilding, the better. Reconstruction is easier when suitable communications technologies and infrastructure are in place. This section focuses on the reconstruction phase, giving examples of existing services that already do or could have a valuable post-disaster role.

Some of these, such as mobile transactions and job matching services, are on the boundary between reconstruction and longer term economic development. But they are also key to enabling affected populations to help themselves in the aftermath of a crisis and to rebuild their livelihoods. *In the reconstruction phase, as in earlier phases, a people-centered approach is likely to be most effective.* The examples in this section look at initiatives for the post-crisis phase developed by the global policy community, and at several post-crisis and developmental applications that NGOs are using and/or developing.

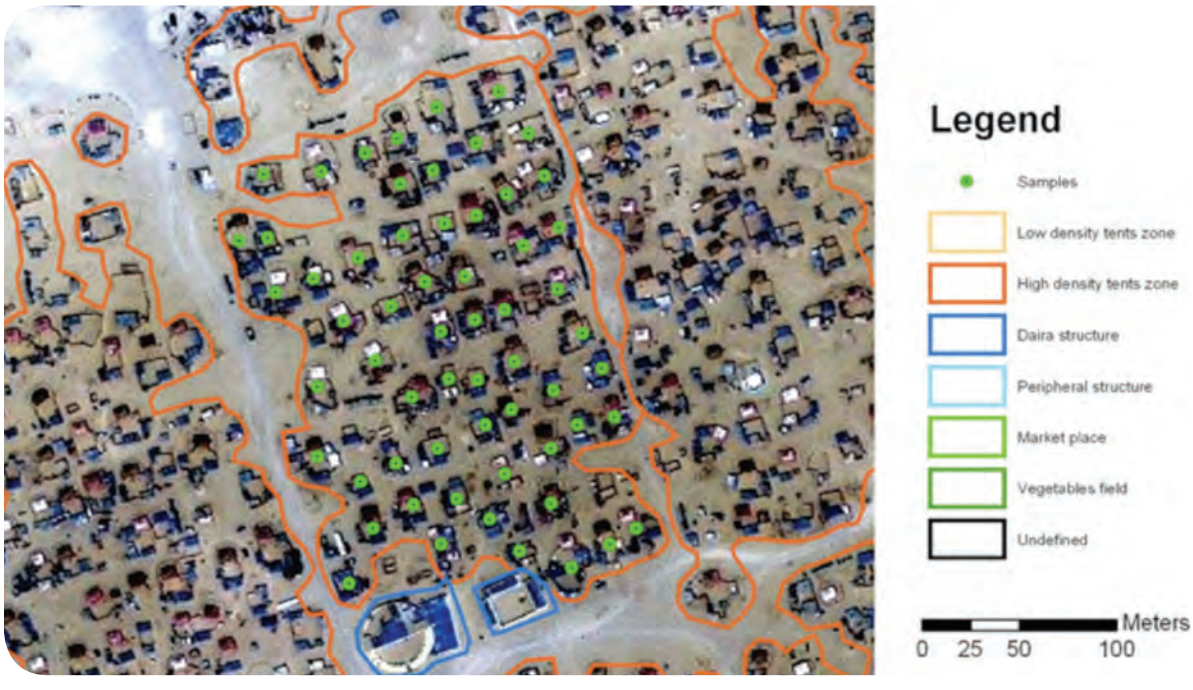
The UNDP's Threat and Risk Mapping Analysis (TRMA)

Crisis mapping, which is essential in responding to the immediate aftermath of an emergency, and is making a

Example of a crisis map produced by TRMA

Source: UNDP Sudan

Family dwelling units demarcated automatically



Source: European Commission Joint Research Centre/Geo-Spatial Information Analysis for Global Security and Stability (JRC/ISFEREA)

growing contribution to early warning, is also an important post-crisis or post-conflict tool. One example that demonstrates these multiple uses of mapping is the Threat and Risk Mapping Analysis (TRMA) program established by the United Nations Development Programme (UNDP) in Sudan to improve its effectiveness in immediate-post conflict environments. The dynamic mapping platform can visualize and analyze the micro-level conflict data collected by UNDP workers to inform their decisions. TRMA is operational in all the states of Eastern Sudan, the Transitional Areas, and Darfur and due to roll out to all states of Southern Sudan by the end of 2009.

TRMA is at the cutting edge of crisis mapping. It uses baseline data collected from the government, UN agencies, and NGOs. In addition, participatory mapping workshops at the local level allow communities to identify the most pressing crisis and risk factors in their area. In this way, rich local knowledge is geo-referenced and added to the map.

In response to the specific needs of partners, a set of four different user interfaces that are all compatible and based on the same GIS-enabled mapping display will soon be integrated with TRMA. These modules present the mapping data in a dynamic format that users can manipulate and populate. Each module has a data entry component, a dynamic visualization tool, and a reporting/statistical function, as well as—crucially—a simple export/import function that allows for internet-based sharing and updating of the user network. Users can switch from one module to the other and combine different datasets according to need.

One of the four interfaces is the 4Ws tool, standing for Who-does-What-Where-When. Users can input their own project-specific information into a database that allows for immediate visualization and reporting on project coverage, funding, targeting, and tracking. At present, data are available for all the states of Eastern Sudan, the Transitional Areas, and Darfur.

Using Geospatial Technologies for the Post-Crisis Phase

Previous sections have described JRC innovations for the preparedness and emergency response stages of a crisis. JRC's Geo-Spatial Information Analysis for Global Security and Stability Program (ISFEREA) includes a number of cutting-edge projects that can also serve for post-crisis support and development. For example, using very high-resolution satellite imagery, the JRC has tested the automatic assessment of infrastructure damage after conflicts. Another project uses remote sensing to analyze different types of refugees

and internally displaced persons. JRC's applied research represents some of the most cutting-edge innovations in the use of technology in conflict and emergencies.

The rationale for this innovation is that the European Commission and member states routinely monitor the impact of international crises to provide humanitarian support and post-crisis development programs. Detailed damage assessment is required to work out what is needed and to monitor reconstruction, if the EU's support is to be effective. Satellite imagery can help make damage assessments. The JRC has recently carried out damage assessments for Lebanon, Georgia, and Gaza.

In another project, the JRC has started to use very high-resolution satellite imagery to locate refugees and internally displaced people, in order to support UN decisions and humanitarian agencies. Mathematical algorithms automatically detect camp boundaries. Satellite pictures can then be used to measure the size of camps and estimate their total population. Maps and analysis produced from these satellite images are then passed on to humanitarian agencies. The JRC is drawing on this approach to create the first dataset on the total world population of refugees.

"Many NGOs are increasingly turning to mobile phones, particularly the use of SMS, to take advantage of the relative resilience of local mobile networks."

FrontlineSMS: mobile-enabled tools

Internet-based communication, including innovative mapping tools, has become essential for NGOs, especially in conflict and post-conflict areas. However, online communication is difficult when the necessary communication channels are cut off. Many NGOs are increasingly turning to mobile phones, particularly the use of SMS, to take advantage of the relative resilience of local mobile networks.

Frontline SMS is one of the leading free software platforms for SMS communication; other examples include EpiSurveyor and RapidSMS. The World Food Programme is developing innovative SMS platforms for post-conflict use. As noted in Section 4, TSF is working with FrontlineSMS, which has been used in multiple conflict and post-conflict settings such as Afghanistan, Iraq, Kenya, Madagascar, Pakistan, and Zimbabwe.

FrontlineSMS was founded by Ken Banks, a social anthropologist and social entrepreneur. He says, "FrontlineSMS provides the tools necessary for people to create their own projects that make a difference. It empowers innovators and organizers in the developing world to achieve their full potential through their own ingenuity." It allows users to send text messages to groups of people and to receive messages on their mobile phones and computers.[77] The platform does not require

FrontlineSMS interface and set-up

Source: Kiwanja.net


Credit: Save the Children

an internet connection and can work with any plan on all GSM phones, modems, and networks. It has been designed to operate from a laptop so that it can be used during power outages or while traveling. The software becomes a communications hub where the numbers of incoming or outgoing SMS messages are saved. The product is scalable and can be used to reach large groups. It can be used worldwide by switching the SIM card.

The tool has many applications. It can be used for human rights monitoring, emergency alerts, field data collection, healthcare information requests, and public surveys, among many others. In short, the software can be used for almost anything that requires two-way communication between two parties, or between a central party and a crowd.

Here are a few examples of its use, out of many applications around the world:

Media Support Partnership Afghanistan (MSPA) is currently using FrontlineSMS in a UK-funded radio program for young people. One of the elements is a national competition for young people to produce short videos on their mobile phones. FrontlineSMS works as a central hub where listeners' views on a variety of topics are collected, enabling an active dialogue on a variety of issues ranging from the activities of North Atlantic Treaty Organization (NATO) forces in the country to health services.[78] Young people in the conflict-ridden south of the country often feel isolated and trapped, and are eager to hear programs on issues important to them, and to contribute to the debate. About 84% of households have radios and 38% have televisions, so the program presents a tremendous opportunity for participation when many development activities have been suspended because of the security problems.

The Network of Mobile Election Monitors (NMEM) used FrontlineSMS during the most recent Nigerian elections. Text messages were used to feed people's observations to a central computer hub in order to avoid fraud. The information collected was then passed to other monitoring groups and authorities including the European Union. Then, observations coming from more than one volunteer were verified in order to ensure their accuracy. In this case, FrontlineSMS facilitated the crowdsourcing of information, thus making the election process even more transparent.[79]

Zimbabwean NGO Kubatana has been using FrontlineSMS since 2005. This grassroots organization reaches

out to civil society and was very active during the 2008 elections. They sent out election updates via SMS. In April, in the midst of the campaign, they asked their subscribers to text in what a free Zimbabwe would look like. Replies included:

I desire everything to be in order - no corruption
Want stable currency and return to real money - not bearer cheques
Mainly I am concerned with return of the environment of happiness we used to have
We want the new govt to free the airwaves

FrontlineSMS served as a repository of all this information.[80]

Money on mobiles: fundraising and mobile transactions

The possibility of making financial transactions by mobile phone holds out the promise of long-term economic benefits, as well as emergency relief of the kind envisaged by TSF and put into practice in Kenya's post-election violence.

The Indian Ocean tsunami was a trigger for the use of mobiles in the aftermath of a disaster, as indeed it was for so many other technological innovations. One noteworthy development in the response to the tsunami was the potential of mobiles for fundraising. For example, in the United Kingdom, the mobile operators (3, Fresh, O2, Orange, T-Mobile, Tesco Mobile, Virgin Mobile, and Vodafone) provided a single, no-fee text number to accept donations by SMS to the Disasters Emergency Committee (the umbrella body for NGOs). The amount raised reached £1 million in a month. A Spanish campaign organized by television station Antena 2 reported raising €4.5 million in just two days.[81]

The use of SMS as a means of fundraising by the voluntary sector and NGOs has become widespread since then. A recent example is the earthquake that struck the Italian town of Aquila on 6 April 2009. Mobile operators Wind, Tre, and Vodafone made a single number available for SMS donations to earthquake victims, which raised a reported €18 million.

M-PESA use during Kenya's post-election violence

Safaricom's M-PESA money transfer system has grown rapidly since its commercial launch just over two years ago. By mid-2009, it had nearly 7 million registered customers and 10,000 agents (Kenya's population is nearly 32 million). Since its launch, customers have transferred 177 billion Kenyan shillings (US$2.3 billion), and in mid-2008, transfers were running at about 93 million shillings per day.

During the violence that followed the December 2007 election, the Irish charity Concern partnered with Safaricom to use M-PESA to transfer cash to nearly 600 households in the Kerio Valley, rather than undertaking a conventional food distribution. Households presenting identity documents were issued with an M-PESA enabled SIM card (usually given to the woman). The pilot scheme also gave households in the district 45 handsets and 60 solar chargers.

Altogether 2.88 million Kenyan shillings were distributed on two dates one month apart. Safaricom agents travelled from nearby towns with cash to make the distribution.

An evaluation of the pilot scheme noted some disadvantages. In particular, the cost of the handsets and chargers raised the overall costs to Concern, although the cash transfer costs were well below those of shipping in food.[82]

However, there were significant advantages. Safaricom took responsibility for the cash distribution, and it was easier to conceal a large sum of cash (which fits in a suitcase) than to guard a large food convoy. Importantly, the scheme had a positive impact on local markets, whereas food handouts often have a negative impact.

The study's author, Mike Brewin, also noted "It appears the pilot had a strong impact on beneficiary empowerment and sense of dignity…Concern places great value on the extent to which dignity and choice is upheld."

Although the use of mobile money transfers had pros and cons, this evaluation concludes that it is an attractive option—for donors and recipients—when there are reasonably well functioning local food markets in which the cash can be spent. The wider the existing mobile phone ownership, the better the value for money.

Credit: ROSHAN

> **"Although there are still obstacles to widespread use of mobile transactions, the potential benefit is greatest for people who have the least alternative access to formal finance."**

Mobile phones have also become an important channel for migrant workers sending remittances home, and the existence of this channel in normal times makes it easier to send emergency funds as well. A recent World Bank assessment concluded that, "Remittances increase in the aftermath of natural disasters in countries that have a larger number of migrants abroad."[83]

Remittances from diaspora communities are all the more important when a disaster or conflict occurs in a poor country where few people have bank accounts or savings. The lack of access to financial services is one of the main barriers to financial security for poor people. They are locked into the informal cash economy and cannot save safely.[84]

Although there are still obstacles to widespread use of mobile transactions, the potential benefit is greatest for people who have the least alternative access to formal finance. Mobile infrastructure, including agents who are the points of contact for putting cash in and taking it out, is much more widespread than banking infrastructure in poor countries.[85]

The introduction of a mobile transactions scheme called M-Paisa in Afghanistan, although in its early days, demonstrates some of the potential benefits. The scheme is similar to the successful M-PESA scheme run by Safaricom in Kenya, on whose experience it was based (see box on a page 49).

Afghanistan has a population of about 32 million, more than half of them living in poverty, and half under the age of 15. It is dangerous, with limited infrastructure—roads, power, fixed telecommunications—and only rudimentary banking. There is a small microfinance industry with about 400,000 clients.

However, Afghanistan has nearly 6 million mobile phone subscribers, with numbers growing by over 100,000 a month. Five operators cover over 50% of the population. Roshan, the operator that won the second GSM license in the country in 2003 and now has 2.4 million subscribers, in 2009 launched the M-Paisa mobile money transfer service in partnership with Vodafone. At this early stage, M-Paisa has 64,000 active customers and 569 agents.

The scheme consists of several applications: loan repayments, peer-to-peer money transfer, airtime purchases, and salary payments. In the future, utility payments and payment for goods will be included.

Security is an enormous benefit of the M-Paisa scheme. An estimated US$30 million in cash in transit was lost to robberies in Kabul in three months of 2009 alone. The heroin trade means there are large illicit money flows. Travel around the country is often deadly.

For example, Roshan is working with the Afghan government to set up salary payments for the police through the M-Paisa service. At present, when policemen are paid they travel home to transfer their salaries back to their families, Not only is there personal danger involved, it means there was inadequate police cover in areas of the country due to this travel. Policemen can in future receive their pay by M-Paisa and send it directly to their family.

M-Paisa is also in partnership with a microfinance institution, First MicroFinance Bank. Customers can repay their loans with M-Paisa, which has allowed the bank to expand its reach to potential customers. The reduction in costs has also made possible a reduction in interest rates charged—rates are expected to fall by about one-fifth when the system reaches a larger scale.

Job-matching schemes: Souktel in Gaza and LabourNet in Bangalore

After access to finance, the opportunity to build sustainable livelihoods is the key to reconstructing communities affected by disasters or conflicts. Two new technologies can combine to create the scope for matching people seeking work with employment opportunities: an internet database operated by an employment agency or NGO; and mobile phones accessed by individuals seeking work.

Souktel

Souktel is a mobile service that uses text messages for two purposes: to connect young people with job opportunities *(JobMatch)* and to connect humanitarian and aid agencies with people who need assistance *(AidLink)* and vice versa.[86] Created in 2005, it operates in the West Bank, Gaza, Somaliland, and Iraq. Souktel's bulk SMS services can be managed from the most basic handsets.

AidLink allows humanitarian and aid agencies to send SMS alerts to customized lists of individuals. People receive personalized messages about emergency aid and other services in their area. When the conflict in Gaza erupted in late December 2008, internet service providers as well as

Jobmatch Program

Source: Souktel JobMatch

landlines were down. Mobile telephony was the only medium that was somewhat reliable.[87]

Several relief agencies that were already partnering with Souktel established mobile-based data collection and alert systems during the conflict. The Red Crescent created alert groups for each blood type and ran a blood registry.[88] Within 24 hours, Ushahidi and Al-Jazeera set up a system in which individuals, reporters, and relief workers could report incidents.[89] Ushahidi provided the geo-location/mapping portion of the system, and Souktel provided the SMS gateway for people sending eyewitness accounts.[90] In other examples, MercyCorps used a polling mechanism to determine how much food remained in each home, and what was needed urgently, while CHF International organized the distribution of medical supplies via SMS.[91] Each SMS costs 8 cents (US) to send. Many agencies have set up reverse charges, and in other cases, users are reimbursed with airtime. However, in some cases individuals have had to pay the costs.[92]

Souktel's *JobMatch* allows young people to create an SMS mini-curriculum vitae (CV). The CV is sent from a mobile phone to a central database. Employers can also design SMS job advertisements. The matching occurs automatically once information is uploaded into the system's main database. Once a match is found, the system sends alerts to either party and if employers are interested, job seekers will receive an SMS requesting them to attend an interview. Souktel launched this service in the West Bank in 2005 and subsequently in Somaliland.[93]

With about 82% of West Bank residents using mobile phones, this seemed an obvious way to increase access to job information.[94] *JobMatch* started with a focus on recent college graduates and employers seeking skilled people, using existing university databases of job seekers, but it will scale up to the much larger potential market for unskilled work in the near future.

Between 40 and 60 people currently find jobs each month, at an average salary of US$500 a month. Employ-

LabourNet

Source: LabourNet

ers claim that their hiring time has been cut in half. The individuals who subscribe to *JobMatch* report that, on average, they find jobs within one to two weeks. About 9 out of 10 applicants accept the jobs they are offered through the service. There are currently (mid-2009) 4,234 job seekers using the service.

LabourNet, Bangalore

Bangalore's information technology boom has led to a construction boom, with a large and mainly unregulated and exploitative labor market for unskilled workers. In most construction projects, a Maistri (a small subcontractor or independent foreman) brings together the team of workers.

The LabourNet initiative was started in 2004 by MAYA (Movement for Alternatives and Youth Awareness), a non-profit agency based in Bangalore. It has created a network of previously informal workers for the construction, housekeeping, gardening, and transportation sectors.

Potential clients call LabourNet's call center where staff can use the database to match clients needs with workers with appropriate skills and agree upon fees. Clients can access the worker's individual history and employment record.

All workers registering with LabourNet require a mobile phone that they can be reached with if there is work for them. As they typically live in the urban slums, they cannot be reached in any other way. Workers get a formal identity card they can use in many other situations. The tracking of their performance can help them negotiate higher pay over time. In addition, registered workers can open their own bank accounts, usually an extremely difficult task for laborers of this kind. All registered workers get accident insurance and can opt to buy health insurance—a substantial source of security in the vulnerable world that most informal workers inhabit.

The number of LabourNet registrations has more than doubled each year since the initiative started in 2004, reaching 5,452 in 2008.[95]

In both examples, Souktel's JobMatch and LabourNet, improved information flows are improving people's living standards during and after times of conflict. Technology enables development and reconstruction by stimulating the economy through job creation and through quick and transparent communication. It acts as a gateway between crisis and development, becoming a powerful tool for reconstruction.

Conclusions

The need for access to communications and information does not end when the immediate aftermath of a crisis gives way to the long-term challenge of reconstruction. On the contrary, information is so essential to economic development that *innovations in technologies used at earlier stages can and should be leveraged to serve these longer-term purposes.* Agencies developing tools for use in disaster preparedness and emergency relief should include consideration of their potential for communities' post-disaster or post-conflict needs.

> **"Investment in communications for developmental purposes, including access to radios, mobile phones, and the internet, will pay dividends in post-crisis reconstruction—just as it helps in terms of preparedness for emergencies."**

The opportunities for doing so are greater the more the necessary communications infrastructure is in place before disaster strikes. There is a growing body of evidence on the favorable impacts of communication technologies on economic development. Investment in communications for developmental purposes, including access to radios, mobile phones, and the internet, will pay dividends in post-crisis reconstruction—just as it helps in terms of preparedness for emergencies.

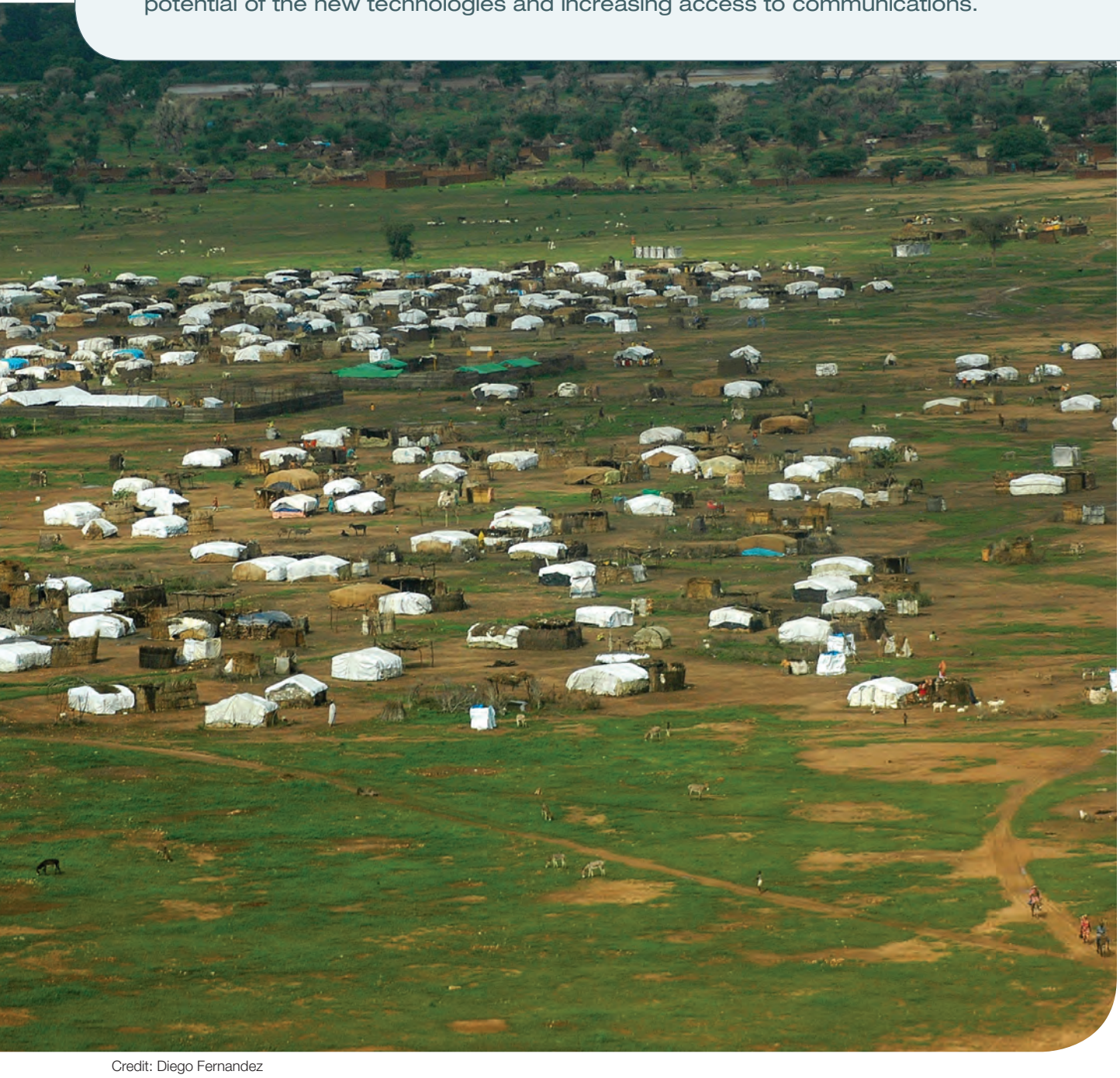
For developing country governments and aid donors, the challenge is to ensure that communications infrastructure and access is enhanced, among all the competing demands for funds. Communications is not a luxury that can be postponed, but an essential tool for individuals and organizations.

As with the issue of preparedness, more progress is needed to ensure vulnerable communities can access the communications and the information they need. *NGOs and humanitarian agencies should include as part of their programs the use of traditional and new media to communicate with the communities they serve.*

There is also much potential for new development tools. Emerging technologies and applications offer the potential for greater effectiveness in development assistance programs.

6 Recommendations

This report has described the potential for many new information and communication technologies to enable a more effective response in emergencies and conflicts, both through the actions of the affected communities and the responses of humanitarian agencies. Here we present a number of recommendations that would help realize the potential of the new technologies and increasing access to communications.



Credit: Diego Fernandez

Remove regulatory barriers

Some regulatory barriers to effective early warning systems and emergency response remain, despite the great progress made in these aspects since the Indian Ocean tsunami. We identified:

- 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 inter-operability between public networks and networks dedicated to emergency communications; and
- a need for priority access by emergency services personnel to communications.

Furthermore, governments must extend the regulatory framework to new and emerging technologies. Regulation is lagging behind innovation. In particular:

- the international community needs to create a legal framework enabling the use of unmanned aerial vehicles, which hold great promise for collecting information for use by humanitarian agencies but are currently unable to be deployed due to legal uncertainties.

Put more resources into local preparedness

People-centeredness has been one of the themes of this report. The people affected by an emergency are in the best position to know what is happening and what they need.

Preparedness requires long-term investment by humanitarian organizations, including investment in public education and capacity building in local media.

Information provision should be recognized as a standard part of both preparedness and aid delivery, and might include:

- preparation of off-the-shelf material agreed on between humanitarian and aid agencies (what to do in an earthquake, basic sanitation advice, for example);
- training humanitarian agencies in communication skills, including receiving and using feedback from communities; and
- the inclusion of a wind-up radio in aid packages.

“The humanitarian community can support the development of innovative platforms that address the issue of verification as well as provision of information by users.”

Information needs to be collected and deployed to be effective. Often this will be done by official agencies, but their responsibilities may be overlapping and uncoordinated.

Preparedness also requires the international humanitarian community to be able to act themselves in a coordinated way on the information and analysis enabled by these emerging systems.

Agencies should share best practices with each other. Agencies developing tools for use in disaster preparedness and emergency relief should also include consideration of their potential for communities' post-disaster or post-conflict needs, to leverage the investment of resources as effectively as possible.

Governments—especially in developing countries where access is not ubiquitous—also need to consider enhanced access to communications and investment in infrastructure, among all the competing demands for resources.

Leverage new media and crowdsourcing

Some of the most promising applications of new technology in emergencies use social media, often through crowdsourced applications.

As this report has shown, the issue of authentication is a key barrier to overcome. The development of methods and applications for verification of crowdsourced information should be a priority. The humanitarian community can support the development of innovative platforms that address the issue of verification as well as provision of information by users.

At the same time, it is important to ensure that communications technologies can offer their users a sufficient degree of anonymity and protection. This will depend on technological solutions but also, importantly, the legal framework and public debate about the risks as well as benefits of anonymity.

Endnotes

[1] http://www.ft.com/cms/s/0/f317a12e-5acc-11de-8c14-00144feabdc0.html accessed 1 Oct 2009.

[2] Kucera, J., "What if Twitter is leading us all astray in Iran," http://trueslant.com/joshuakucera/2009/06/15/what-if-we-are-all-wrong-about-iran/ accessed 1 Oct 2009.

[3] Human Security Report Project, "mini-atlas of Human Security," http://www.miniatlasofhumansecurity.info/en/access.html accessed 1 Oct 2009.

[4] Data transferred to new Global Terrorism Database, http://www.start.umd.edu/gtd/ accessed 1 Oct 2009.

[5] Hughes, A., L. Palen, J. Sutton, S. Liu, and S. Vieweg, *"Site-Seeing" in Disaster: An Examination of On-Line Social Convergence*, connectivIT lab & the Natural Hazards Center, University of Colorado, Boulder, May 2008.

[6] *Ibid*.

[7] International Telecommunication Union, *Measuring the Information Society—The ICT Development Index*, March 2009.

[8] This is a 2007 figure.

[9] http://www.comscore.com/Press_Events/Press_Releases/2009/1/Global_Internet_Audience_1_Billion

[10] http://www.internetworldstats.com/stats.htm accessed 1 Oct 2009

[11] World Bank, *Information and Communications for Development 2009: Extending Reach and Increasing Impact*, 2009,. http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/EXTIC4D/0,,contentMDK:22229759~menuPK:5870649~pagePK:64168445~piPK:64168309~theSitePK:5870636,00.html accessed 1 Oct 2009

[12] Universal McCann, "Wave.4. Power to the People. Social Media Tracker," July 2009.

[13] Schonfeld, E., "Facebook Is Now the Fourth Largest Site In The World," 4 Aug 2009, http://www.techcrunch.com/2009/08/04/facebook-is-now-the-fourth-largest-site-in-the-world.

[14] http://www.comscore.com/Press_Events/Press_Releases/2009/2/India_Social_Networking/(language)/eng-US, accessed 1 Oct 2009.

[15] Cheng, A., M. Evans, and H. Singh, "Inside Twitter: an in-depth look inside the Twitter world," sysomos, June 2009.

[16] International Federation of Red Cross and Red Crescent Societies, *World Disasters Report 2005*, http://www.ifrc.org/publicat/wdr2005/, accessed 1 Oct 2009.

[17] "Disaster-prone Bangladesh trials cell phone alerts," Reuters, http://www.alertnet.org/thenews/newsdesk/SP256907.htm.

[18] "Disaster reduction and the human cost of disaster," UN OCHA IRIN News, http://www.plusnews.org/Report.aspx?ReportId=62446#at accessed 1 Oct 2009.

[19] In Aceh, for example, mobile network traffic jumped by 25 to 30%. http://ioc-unesco.org/hab/components/com_oe/oe.php?task=download&id=3771&version=1.0=1&format=2 accessed 1 Oct 2009

[20] "Nearly 2.1m text Live 8 to make it most successful SMS push," http://www.brandrepublic.com/news/479891/nearly-21m-text-live-8-successful-sms-push/.

[21] "Girl, 10, uses geography lessons to save lives." *Daily Telegraph*, 1 January 2005.

[22] See for example, 'Tsunami Came Too Fast for Warnings to Reach All,' Wall Street Journal, 1 October 2009, http://online.wsj.com/article/SB125429147125151927.html, accessed 2 Oct 2009.

[23] Samarajiva, R., Mobilizing information and communications technologies for effective disaster warning: lessons from the 2004 tsunami, *New Media & Society*, 7(6):731-747, 2005.

[24] Wall, I., "Where's My House?", UNDP, August 2005, http://www.humanitarianinfo.org/srilanka/catalogue/Files/Info%20Centre/TEC/TEC020_undp_Wheres_my_house_20050905.pdf, accessed 1 Oct 2009.

[25] http://www.ewc3.org.

[26] International Federation of Red Cross and Red Crescent Societies, *World Disasters Report 2005*, http://www.ifrc.org/publicat/wdr2005/, accessed 1 Oct 2009.

[27] http://www.reliefweb.int/telecoms/tampere/index.html.

[28] "New Media and Development Communication," http://www.columbia.edu/itc/sipa/nelson/newmediadev/Emergencies.html, accessed 2 Oct 2009.

[29] "Status Quo Of The Tsunami Early Warning System For The Indian Ocean," Science Daily, http://www.sciencedaily.com/releases/2007/12/071220110327.htm, accessed 2 Oct 2009.

[30] http://www.itu.int/ITU-D/wtdc06/DohaDeclaration.html.

[31] United Nations International Strategy for Disaster Reduction Secretariat, *Global Assessment Report on Disaster Risk Reduction (2009)*, United Nations, Geneva, Switzerland, 2009, http://www.preventionweb.net/english/hyogo/gar/report/index.php?id=9413, accessed 2 Oct 2009.

[32] Nyheim, D., *Preventing Violence, War and State Collapse: The Future of Operational Conflict Early Warning and Response Systems*, OECD, on behalf of The DAC Network on Conflict, Peace, and Development Co-operation and the DAC Fragile States Group, 2009, http://www.oecd.org/document/41/0,3343,en_2649_33693550_42233001_1_1_1_1,00.html, accessed 1 Oct 2009.

[33] Meier, P., "Fourth-Generation Early Warning Systems," 2009, http://earlywarning.wordpress.com/2009/03/06/fourth-generation-early-warning-systems.

[34] Nyheim, D., *Preventing Violence, War and State Collapse: The Future of Operational Conflict Early Warning and Response Systems*, OECD, on behalf of The DAC Network on Conflict, Peace, and Development Co-operation and the DAC Fragile States Group, 2009, http://www.oecd.org/document/41/0,3343,en_2649_33693550_42233001_1_1_1_1,00.html, accessed 1 Oct 2009.

[35] Udu-gama, N., *Mobile Cell Broadcasting for Commercial Use and Public Warning in the Maldives*, Lirneasia, August 2009, http://lirneasia.net/wp-content/uploads/2009/07/CB_Maldives_FINAL_2009_041.pdf, accessed 2 Oct 2009.

[36] "Bangladesh develops instant early disaster warnings through cell phones," 4 June 2009, http://www.undp.org.bd/info/events.php?newsid=421&t=In%20News.

[37] *Global Survey of Early Warning System: An Assessment of Capacities, Gaps and Opportunities toward Building a Comprehensive Global Early Warning System for All Natural Hazards*, A report prepared at the request of the Secretary-General of the United Nations (Pre-print version released at the Third International Conference on Early Warning, Bonn, 27-29 March 2006), http://www.ewc3.org.

[38] Robinson, L. and I. Wall., Left in the Dark: The Unmet Need for Information in Humanatarian Response. BBC World Trust, November 2008. http://downloads.bbc.co.uk/worldservice/trust/pdf/humanitarian_response_briefing.pdf

[39] Gilbert, C., "Studying Disaster: Changes in the Main Conceptual Tools," in Quarantelli, E. L. *ed. What is a Disaster? Perspectives on the Question*, Routledge, London and New York, 1998.

[40] Howe, J., "The Rise of Crowdsourcing," *Wired*, June 2006, http://www.wired.com/wired/archive/14.06/crowds.html.

[41] International Federation of Red Cross and Red Crescent Societies, *World Disasters Report 2005*, http://www.ifrc.org/publicat/wdr2005/, accessed 1 Oct 2009.

[42] Robinson, L. and I. Wall., Left in the Dark: The Unmet Need for Information in Humanatarian Response. BBC World Trust, November 2008. http://downloads.bbc.co.uk/worldservice/trust/pdf/humanitarian_response_briefing.pdf

[43] http://www.voicesofthevulnerable.net.

[44] http://portal.unesco.org/en/ev.php-URL_ID=45001&URL_DO=DO_PRINTPAGE&URL_SECTION=201.html

[45] GIVAS Concept Paper, 2009.

[46] EPIC Concept Paper, 2009

[47] World Vision, *Last Mile Mobile Solutions: Enhancing Food Aid Management Through Innovation*, 2009.

[48] "US Calls for UN Aerial Surveillance to Detect Preparations for Attacks," http://irevolution.wordpress.com/2009/08/14/un-aerial-surveillance.

[49] http://www.fordham.edu/halsall/mod/1960summit-statements1.html.

[50] http://shr.aaas.org/geotech.

[51] http://isferea.jrc.ec.europa.eu/Pages/default.aspx.

[52] "Ushahidi: From Croudsourcing to Crowdfeeding," March 2009, http://irevolution.wordpress.com/2009/03/27/ushahidi-from-croudsourcing-to-crowdfeeding.

[53] See *Wireless Technology for Social Change: Trends in Mobile Use by NGOs*, United Nations Foundation and Vodafone Group Foundation Report, April 2008, for a case study.

[54] *The Kenyan 2007 Elections and their Aftermath: the role of media and communication.* Policy Briefing no 1, BBC World Service Trust, April 2008, http://downloads.bbc.co.uk/worldservice/trust/pdf/kenya_policy_briefing_08.pdf. See also Heacock, R. *Mobile Activism in African Elections: A Comparative Case Study*, DigiActive Research Series, March 2009.

[55] Goldstein, J. and J. Rotich, *Digitally Networked Technology in Kenya's 2007–2008 Post-Election Crisis*, Berkman Center for Internet and Society, September 2008, http://cyber.law.harvard.edu/publications/2008/Digitally_Networked_Technology_Kenyas_Post-Election_Crisis.

[56] The World Food Programme is the leader of the UN Telecoms Cluster.

[57] Miguel, E., S. Satyanath, and E. Sergenti, Economic Shocks and Civil Conflict: An Instrumental Variables Approach, *Journal of Political Economy*, 112:4, 2004.

[58] Brewin, Mike. 2008. Evaluation of Concern Kenya's Kerio Valley Cash Transfer Pilot (KVCTP). Dublin, Ireland: Concern Worldwide. Available at http://www.concern.net/documents/1244/KenyaCashTansferPilot-EvaluationReport-July08.pdf.

[59] The BBC's Persian TV service received many more.

[60] "Iran: Myth and reality about Twitter," July 2009, http://globalvoicesonline.org/2009/07/04/iran-myth-and-reality-about-twitter.

[61] http://webecologyproject.org.

[62] http://www.alexa.com/siteinfo/twitter.com.

[63] http://blog.sysomos.com/2009/06/21/a-look-at-twitter-in-iran/.

[64] http://www.wired.com/dangerroom/2009/06/iran-before-you-have-that-twitter-gasm.

[65] http://techpresident.com/blog-entry/iran-independence-day-and-limits-online-politics.

[66] http://www.heritage.org/Research/InternetandTechnology/bg2300.cfm.

[67] *Ibid*.

[68] *Ibid*.

[69] http://www.gauravonomics.com/blog/real-time-citizen-journalism-in-mumbai-terrorist-attacks/.

[70] http://www.gdacs.org.

[71] GDACS collects news, damage maps, and humanitarian situation reports automatically from over 1,000 online sources, including Relief Web and AlertNet. JRC contributes with the European Media Monitor system.

[72] http://www.ted.com/talks/lang/eng/larry_brilliant_wants_to_stop_pandemics.html.

[73] http://www.unitar.org/unosat.

[74] http://irevolution.wordpress.com/2009/02/08/gis-technology-for-genocide-prevention.

[75] http://www.ithaca.polito.it/projects/uav.php.

[76] The International Charter aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through Authorized Users. Each member agency has committed resources to support the provisions of the Charter and thus is helping to mitigate the effects of disasters on human life and property. http://www.disasterscharter.org/home

[77] http://www.frontlinesms.com.

[78] http://www.kiwanja.net/blog/2009/02/frontlinesms-peacebuilding-in-afghanistan/.

[79] http://news.bbc.co.uk/2/hi/technology/6570919.stm.

[80] http://www.kiwanja.net/blog/2008/07/zimbabweans-speak-out-through-sms/ and http://www.kiwanja.net/blog/2008/04/kubatana-reaches-out-with-frontlinesms-in-zimbabwe/.

[81] http://www.textually.org/textually/archives/2005/01/006675.htm.

[82] Brewin, Mike. 2008. Evaluation of Concern Kenya's Kerio Valley Cash Transfer Pilot (KVCTP). Dublin, Ireland: Concern Worldwide. Available at http://www.concern.net/documents/1244/KenyaCashTansferPilot-EvaluationReport-July08.pdf.

[83] Mohapatra, S., G. Joseph, and D. Rath, *Remittances and Natural Disasters: Ex-post Response and Contribution to Ex-ante Preparedness*, World Bank Policy Research Working Paper 4972, June 2009.

[84] Collins, D., J. Morduch, S. Rutherford, and O. Ruthven, *Portfolios of the Poor: How the World's Poor Live on $2 a Day*, Princeton University Press, 2009.

[85] *The Transformational Potential of M-Transactions*, Vodafone Public Policy Series number 7, July 2007, http://www.vodafone.com/publicpolicyseries.

[86] http://www.souktel.org.

[87] *Ibid*.

[88] Souktel's Gaza Relief campaign overview.

[89] "Gaza Mapping Initiatives," Reuters AlertNet, http://www.alertnet.org/thefacts/reliefresources/123124884240.htm.

[90] Interview with Jacob Korenblum, 13 July 2009.

[91] *Ibid*.

[92] *Ibid*.

[93] *JobMatch* was launched in Somaliland in June 2009.

[94] http://www.souktel.org/About.htm.

[95] This draws on research done for *India: The Impact of Mobile Phones*, Vodafone Public Policy Series No. 9, January 2009.

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www.unfoundation.org/emergencies-report