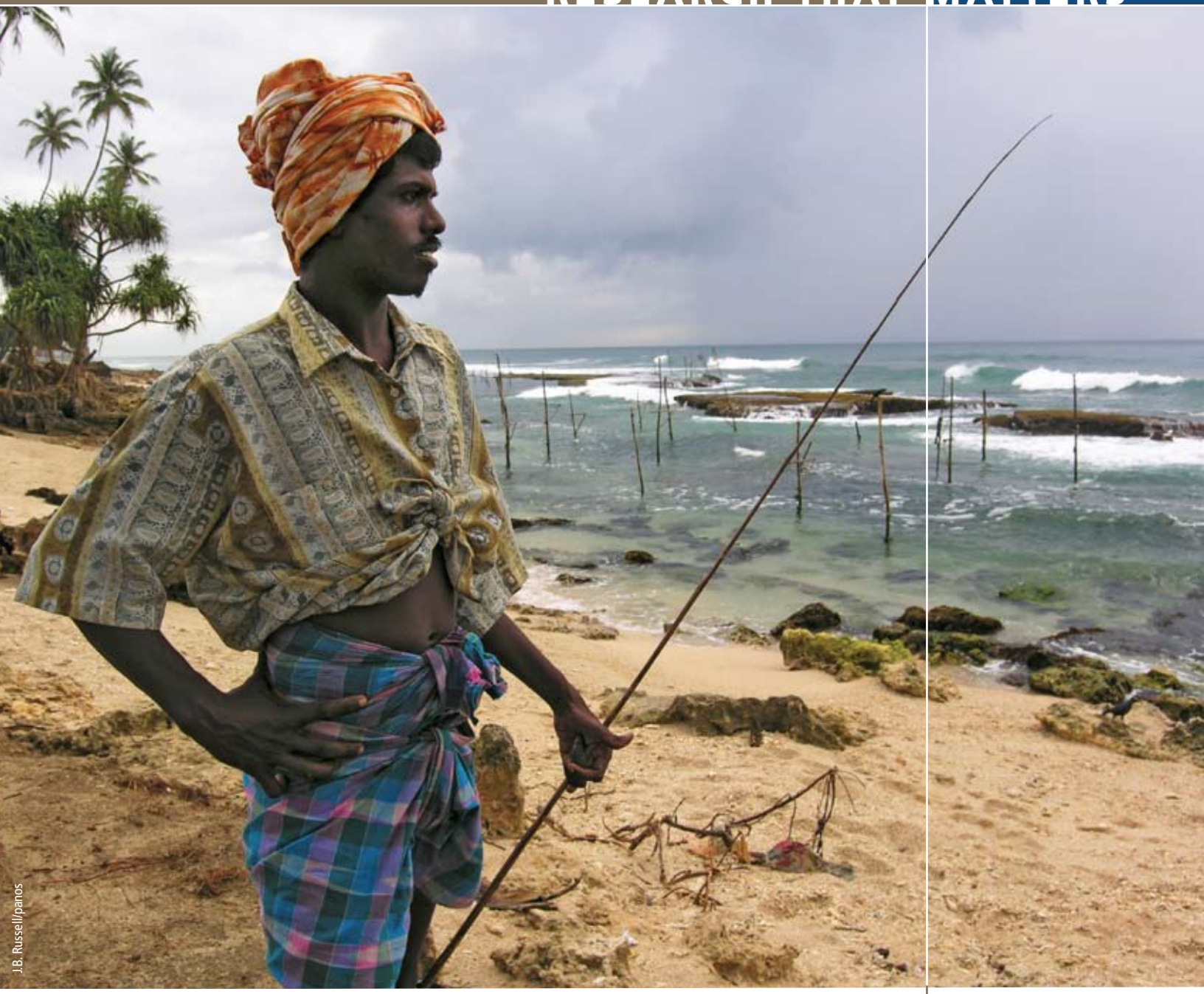

J.B. Russell/panos

For Easy Sleep along the Shore:
Making Hazard Warnings More Effective

In Sri Lanka, a grassroots pilot study combines advanced communication technologies with local volunteer networks to alert coastal villages to danger coming from the sea.

IDRC CRDI

Canada

One of the biggest lessons we learned from the tsunami was how lacking Sri Lanka was in terms of an emergency warning system. The most tragic aspect of the events of December 26, 2004 was the needless loss of life.

Vinya Ariyaratne,
Executive Director,
Sarvodaya

The best tribute we can pay to all who perished or suffered in this disaster is to heed its powerful lessons. We need to address the long-term issues of better disaster preparedness, functional early warning systems and realistic arrangements to cope with not just tsunamis, but a multitude of other hazards. Technology can certainly be part of that solution, but in the end, it depends critically on sound management and nations working together.

Sir Arthur Clarke, late science fiction writer who first proposed the idea for geostationary orbit for communication satellites

The Development Challenge: Raising the alarm

The Indian Ocean tsunami of December 2004 was a cataclysm almost beyond comprehension. In its aftermath few expected to hear much positive news. One encouraging story, however, did emerge.

Residents of a village near Puducherry, India, survived the wave following a timely alert by telephone from Singapore. Locals hurried to the community centre — a facility of the Swaminathan Foundation, itself supported by Canada's International Development Research Centre (IDRC) — and sounded the siren. In that village, everybody ran, and everybody lived.

The villagers' incredible escape demonstrated that thousands more could have been saved had effective hazard alerts been in place. The experience convinced non-governmental organizations (NGOs) in the region of the need to improve disaster warning systems.

Since the tsunami, IDRC has been funding a large action research project in Sri Lanka — another country hardhit by the monster waves — in an effort to learn from field experiments how these alert systems can be made more effective.

IDRC: Peter Bennett

The Idea: A focus on the last mile

For any disaster warning system to succeed, several components are necessary: technology to detect and monitor the hazard; communication systems to alert the public; local leaders trained to make the right decisions; a public that is educated to react appropriately to warnings; and response protocols — such as evacuation plans — prepared and rehearsed well in advance of the threat. All these elements must work well, both individually and in harmony.

In Sri Lanka, coastal villages are especially vulnerable to adversity. Calamity can come from the sea, not only in the form of tsunamis but also cyclones, tidal surges, and water spouts. These villages, meanwhile, suffer from having limited access to emergency services and organizational resources.

The research effort decided therefore to concentrate on communicating more effective danger signals to the remote "last mile" in the response chain and providing training so that people living along the coast could, as the investigators put it, "sleep easy at night."

The Research: Technical and human networks

IDRC's lead research partner was LIRNEasia, a non-profit organization that aims to improve the lives of Asia's people by using information and communication technologies (ICTs). LIRNEasia has had considerable experience on the use of ICTs in disaster situations. The project also drew upon the extensive networking resources of Sarvodaya, a large village-based self-help movement in Sri Lanka, and upon the disaster communication expertise of Buddhi Weerasinghe of TVE Asia Pacific, Peter Anderson of Simon Fraser University, and Gordon Gow of the University of Alberta, among other partners.

The pilot study had two broad objectives.

First, it sought to evaluate the suitability of various configurations of five technical systems, each with unique capabilities, for reaching Sri Lankan local leaders in an emergency:

- a stand-alone "remote alarm device" incorporating a radio, siren, and flashing lights;
- versatile Java-enabled mobile phones set up to receive text alerts in English, Sinhala, and Tamil;
- "addressable" satellite radio sets capable of remote activation and of issuing targeted messages to vulnerable areas;
- a warning system based on Very Small Aperture Terminal (VSAT) satellite technology that delivers pop-up screen alerts to personal computers; and

- conventional fixed wireless telephones linked to the public network.

These options were tested for reliability under varying conditions, reaction time, bidirectionality (so that alerts can be confirmed and false warnings minimized), and degree of integration into daily life.

Second, the researchers evaluated the effectiveness of the human element of the warning system, which comprised three components:

- Near Colombo, a Sarvodaya-staffed "hazard information hub" downloaded bulletins from abroad and from the National Warning Centre, confirmed their validity, and relayed them to the ICT guardians in each community.
- ICT guardians maintained the equipment, received the crisis alerts from the hub, and conveyed them to the local emergency response coordinators.
- Emergency response coordinators trained the villagers to take appropriate action and ensured that, as soon as a warning arrived, the people were alerted and did react.

During 2006–2007, the researchers conducted training exercises and live drills to test both the technical and the human networks.

On the Ground: Teamwork for reliability

The findings provided a rich source of new knowledge about ways to make hazard warning systems more effective. As in any pilot project, the research showed up weaknesses in technologies as well as in the human agents working in real-life conditions.

The satellite radio set, for example, could transmit music even when the antenna was not optimally aligned, but for the alert to be delivered perfect alignment was essential — a discovery that could not have been made in a laboratory. Other banal reasons for transmission failures were forgotten logon passwords, accidental deletion of Java software on the cellphones, and cancellation of telephone service for non-payment of bills.

A less banal human factor was the civil conflict in Sri Lanka's northeast. On the day of one live exercise, the government ordered the shutdown of all telephone service in the conflict zones. The tests were conducted with much improvisation. The best results in this instance came from satellite radio, which is immune to terrestrial shutdowns, natural or otherwise.

That experience illustrates one of the key findings of the study: the value of complementary redundancy.

The addressable satellite radio system enjoys one-way capability only, but its orbital base makes it immune to most local disruptions. Meanwhile, the Java-enabled mobile phone benefits from its language capacities, but is subject to local shutdowns and congestion. When both systems are joined, their complementary redundancy makes for a more reliable link.

The need for different types of media to work together seamlessly in transmitting messages highlights the importance of the Common Alerting Protocol (CAP). The CAP is an international standard for data interchange that allows alerts to be transmitted over multiple media in varied jurisdictions. For example, the CAP converts a single alarm into Internet messages, news feeds for television and radio, automated telephone calls, even highway pixel boards.

However, the researchers found shortcomings in the CAP protocol that raised questions about achieving perfect "interoperability." Some types of ICT terminals, for example, were able to display only partial warning messages because of limitations on message length. In one live exercise, this resulted in communities mistakenly executing an evacuation plan for a tsunami and running to higher ground, rather than for a cyclone and seeking shelter at lower levels. Likely, modifications to the CAP can solve this problem.

Most of the adults who took part in the exercises were women, either because the men were at work or because many of the Sarvodaya village societies were headed by women. When

All the sophisticated technology won't matter if we don't reach real communities and people. Satellites, buoys, data networks will make us safer, but we must invest in the training, the institution building, the awareness-raising on the ground.

Bill Clinton, former United States President and former United Nations Special Envoy for Tsunami Recovery

IDRC: Peter Bennett

men did participate, they tended to be more vocal and aggressive than the women. They were also less inhibited by cultural attitudes, for example those frowning upon travel by female response coordinators. Such gender differences in the capacity to take a leadership role may affect a community's behaviour during an actual emergency.

Obviously, for ICTs to serve as warning terminals, they must be in working order all the time. The researchers looked at ways, aside from the alert function, that the various communication systems could be integrated into everyday life, thus increasing the likelihood the terminals would remain in good order. They found that, overall, every type of ICT possesses some unique feature that contributes to the daily life of the community, and that if the technology is provided and the operating cost is low, people will use it.

The Impact: Trial by water

This last-mile system aims to complement and "amplify" the Sri Lankan government's national alerting function, rather than to issue official public warnings. Project leaders hope that if they can demonstrate an efficient last-mile mechanism, the government will adopt it.

This goal may be advanced by pressure from Sri Lanka's coastal villagers themselves. The project's training exercises heightened their awareness of the importance of disaster preparedness, and many communities have demanded that such programs be continued and expanded. Many of the Sarvodaya villages have started emergency response committees to strengthen local disaster resilience.

Meanwhile, the technology and the training have been tested in an actual emergency situation. In September 2007 an earthquake triggered a government order for coastal areas to evacuate ahead of a possible tsunami. Most villages did so, but at least one community — thanks to links with the Colombo hub by satellite radio and Java-enabled phones — decided instead to monitor the situation. The emergency response coordinators observed the ocean before mobilizing the people to flee. In the end, the tsunami did not happen. The government order had been an overreaction, and so the system served to avoid a costly and needless evacuation.

Future Challenges: Remaining vigilant

This multi-faceted research endeavour has drawn attention to the many technical and people-centred problems that must be confronted if such hazard alert systems are to work.

The investigation was the first test of the CAP mechanism in a multilingual environment. The researchers stress the need to further develop and apply this crucial communication tool. They recommend establishing a special working group to tackle interoperability issues like language and message display capabilities.

The exercises made plain the difficulties of providing effective training using volunteer trainers. A follow-up project seeks to remedy this problem by offering training and related services to coastal tourist hotels, in addition to Sarvodaya villages.

A related challenge concerns the shortness of any society's attention span. In the absence of frequent crises and alerts, how can a nation — or even a village — sustain the continuing levels of preparedness essential to ensure that, when the next big wave comes rolling in and the sirens sound, its people will have the motivation and the capacity to act? The follow-up project seeks to address this worry by preparing the hotels and villages to respond to different types of hazards, rather than only to the relatively rare tsunamis.

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