Bridging the Long 'Last Mile'

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In the months following the tsunami of December 2004, some believed that it had caught the Indian Ocean rim countries entirely by surprise. This misconception, repeated by governments and aid donors alike, was included even in some independent analyses.

While the countries of South and Southeast Asia were largely unprepared to act on the tsunami, the disaster did not entirely arrive as a surprise. As the killer waves originating from the ocean near Indonesia's Sumatra Island radiated across the Indian Ocean at the speed of a jetliner, the alert about the impending tsunami moved through the Internet at the speed of light. Scientists at the Pacific Tsunami Warning Centre (PTWC) in Hawaii, who had detected the extraordinary seismic activity, issued a local tsunami warning one hour and five minutes after the undersea quake.[1]

That was a bit too late for Indonesia -- which, being closest to the quake's epicentre, was hit soon after the seismic event – but it could have made a difference for countries further away, such as India, Sri Lanka and Thailand. As is now well established, an authentic warning was delivered to each country, but there were few listeners at the receiving end -- *and even fewer to act on it*.

For example, the warning went unheeded by the centres of power in Sri Lanka: no one reacted with the swiftness such information warranted. Institutional, technological and societal failures combined to prevent the timely sharing of this international warning within the island of Sri Lanka. There was also a communications failure in sharing an alert across the country. The tsunami progressively pounded the tear drop-shaped island for nearly four hours, starting on the eastern coast south at around 8.30 am local time, and then spreading northwards and southwards. If only the rest of the island had been alerted soon after the east was first hit, coastal evacuation could still have significantly reduced deaths elsewhere.[2]

But alas, that too did not happen. As a result, over 35,000 people died, most of them needlessly.[3]

Where were all the ICTs?

It was astonishing that a disaster of this magnitude could arrive without any public warning in many places across Asia despite the rapid proliferation of information and communications technologies (ICTs). With thunderous impact, the tsunami drove home the point that the timely and efficient delivery of disaster warnings involves much more than mere technologies.

As Sir Arthur C Clarke, author and long-time resident of Sri Lanka, later remarked: "The Asian tsunami's death toll could have been drastically reduced if the warning -- already known to scientists -- was disseminated quickly and effectively to millions of coastal dwellers on the Indian Ocean rim. It is appalling that our sophisticated global communications systems simply failed us that fateful day."

Clarke, best known for inventing the communications satellite, added: "We need to address the long-term issues of better disaster preparedness, functional early warning systems and realistic arrangements to cope with tsunamis and a multitude of other hazards. It is imperative that we improve our monitoring and early warning systems, but we must also put in place a fail-proof plan to sound the alarm as and when necessary."[4]

In response to the Indian Ocean tsunami, the United Nations and aid donor countries embarked on building a high-tech tsunami early warning system in the Indian Ocean. By June 2006, UNESCO -- whose Inter-governmental Oceanographic Commission (IOC) coordinated the effort -- reported that the system was 'up and running'. Some 25 new seismographic stations would detect underwater earthquake tremors, it said, while three deep-seabed sensors were in place to detect tsunami waves through tiny changes in water pressure. More equipment, including satellite sensors and additional seabed sensors, are to be added to the system by 2008. A network of 26 national information centres will enable Indian Ocean countries to receive and distribute warnings of potential tsunamis.[5]

However, all these elaborate arrangements address only part of the challenge. As I wrote in December 2005: "Developing effective early warning systems for multiple hazards is an urgent priority for the Indian Ocean rim countries. But setting up a state-of-the-art, high tech and high cost system is not a solution by itself. Because the most advanced early warning system in the world can *only do half the job*: alert governments and other centres of power (e.g. military) of an impending disaster. The far bigger challenge is to *disseminate* that warning to large numbers of people spread across vast areas in the shortest possible time."[6]

The crucial question remains: *how can we travel that all important 'last mile'?*

Uncertainties and difficulties

Issuing and disseminating public warnings about rapid onset disasters like tsunamis is fraught with uncertainties and practical difficulties. This has been underscored by recent experiences in the Indian Ocean rim countries. Two examples:

- **On 17 July 2006**, a magnitude 7.7 undersea earthquake occurred off the resort town of Pangandaran on Java island in Indonesia. The tremor was detected by various groups of seismologists overseas, and within 17 minutes, the PTWC issued a tsunami warning. That warning reached the Indonesian capital in two minutes by email -- but officials there lacked a proper system to get the warning across to areas at risk in their vast, archipelagic nation. Two-metre high waves hit the southern Java coastline 37 minutes after the quake. A timely public warning and evacuation could have saved many of the nearly 600 people who died.[7]

- **On 12 September 2007**, a magnitude 8.4 earthquake shook western Sumatra, with the epicentre located undersea off the city of Bengkulu. Following seismic reports, repeated tsunami warnings were issued in Indonesia, as well as in Sri Lanka, but the quake did not produce a tsunami. While coastal evacuations took place in Sri Lanka, there was considerable confusion and panic which indicated that systems and procedures were not yet in place to respond rapidly and appropriately to such a warning.[8]

To warn communities about rapid onset disasters, improvements are required on at least three parallel fronts:

- the science of rapid detection and analysis needs to be fine-tuned;
- proper institutional arrangements have to be in place to decide on and issue credible, swift warnings; and
- there should be effective ways of communicating these warnings to everyone at risk.

One 'ready-made' option for rapidly disseminating disaster warnings in Asia is to use the broadcast media, i.e. radio and television. Since the early 1990s, Asia's airwaves have become crowded with a cacophony of FM radio and television channels that today reach out to most households day and night. Using the airwaves -- a public property -- these channels inform, titillate and occasionally educate their audiences. Most channels would willingly carry authentic, official warnings and other public interest messages in times of crisis, including when a hazard turns into a disaster.

Indeed, partnerships with the broadcast media can make a big difference in going the last mile. Yet there are inherent limitations in using radio and TV channels, which are engaged in peddling content and messages mostly in a single direction (from producers or journalists to their audiences). Ordinary radio and TV receivers also cannot receive warnings when they are switched off.

As the world grapples with the increasing frequency and intensity of disasters, the search continues for other ways in which life-saving warnings can be delivered quickly, reliably and effectively.

Can the potential of ICTs be tapped to augment the broadcast media and official methods (e.g. police or military communications) in this process? What is the right mix of technology, preparedness and community mobilisation that would help create more disaster resilience at the grassroots?

Technology, training, action!

These questions were at the heart of a path-breaking initiative implemented in Sri Lanka during 2006-2007. 'Evaluating Last Mile Hazard Information Dissemination Project' (HazInfo project for short) was an action research project by LIRNE*asia* to find out how communication technology and training can be used to safeguard grassroots communities from disasters. It involved Sarvodaya, Sri Lanka's largest development organisation, and several other partners that included telecom operators, civil society organisations, IT companies and the media (see box for full list). The research was supported by International Development Research Center (IDRC) of Canada.

The project studied which ICTs and community mobilisation methods could work effectively in disseminating information on hazards faced by selected coastal communities. The exercise was not confined to tsunamis alone; other rapid onset disasters such as cyclones and floods were also covered.

HazInfo project partners

LIRNE*asia (*www.lirneasia.net) brought together the following institutions and experts:

- Sarvodaya, www.sarvodaya.org
- TVE Asia Pacific, www.tveap.org
- WorldSpace Corporation, www.worldspace.com
- Dialog Telekom, www.dialog.lk
- Microimage, www.microimage.com
- Solana Networks, www.solananetworks.com
- Lanka Software Foundation, www.opensource.lk
- Vanguard Foundation
- Innovative Technologies
- Dr Peter Anderson, Simon Fraser University
- Dr Gordon Gow, University of Alberta

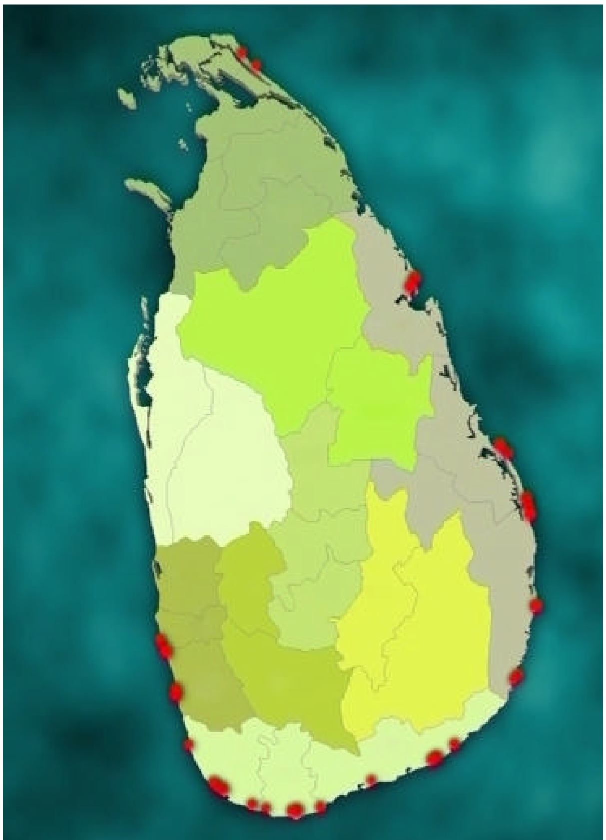
The project grew out of a participatory concept paper that LIRNE*asia* developed in the aftermath of the 2004 tsunami.[9] It noted that a national early warning system was a 'pure public good', and the responsibility of its supply would normally fall on the government. However, the paper acknowledged that, due to lack of capacity, "it is unlikely that the last mile of such a system will be provided by the local government or private firms operating in the marketplace".

The HazInfo project addressed that vacuum. It was designed around a governance structure where a non-profit, non-governmental organisation (Sarvodaya) would provide the necessary oversight, training and the sourcing of critical information, i.e. disaster warnings. The project was rooted in the model of village self-governance that has been evolved for half a century by Sarvodaya, whose work encompasses 15,000 villages in all parts of the island.

"We played multiple roles in the project," recalls Dr Vinya Ariyaratne, Executive Director of Sarvodaya. "At a community level we were involved in selecting a suitable sector of villagers for this research project. The project was carried out in villages which have been involved with Sarvodaya work for a long time. And then we implemented the project and served as the interface to the community."

The project involved several steps:

- At its headquarters in Moratuwa, just south of the capital Colombo, Sarvodaya set up a Hazard Information Hub (HIH) to maintain round-the-clock links with the government's designated disaster warning agencies as well as international sources monitoring various hazards in the Indian Ocean region.



Sri Lankan coastal locations covered by the first phase of HazInfo project (Source: LIRNEasia)

- Twenty-six youth leaders from Sarvodaya's voluntary Peace Brigade (Shanti Sena) received training in community-based disaster preparedness. They took this knowledge and training to 32 chosen coastal villages (see map - all were impacted by the Indian Ocean tsunami) and mobilised local communities from muslim, Sinhala and Tamil backgrounds.

- In each village, a first responder was identified by the community to receive a warning from Sarvodaya's HIH and activate the local method of sounding the alarm. This voluntary responsibility was assigned to local level Sarvodaya leaders.

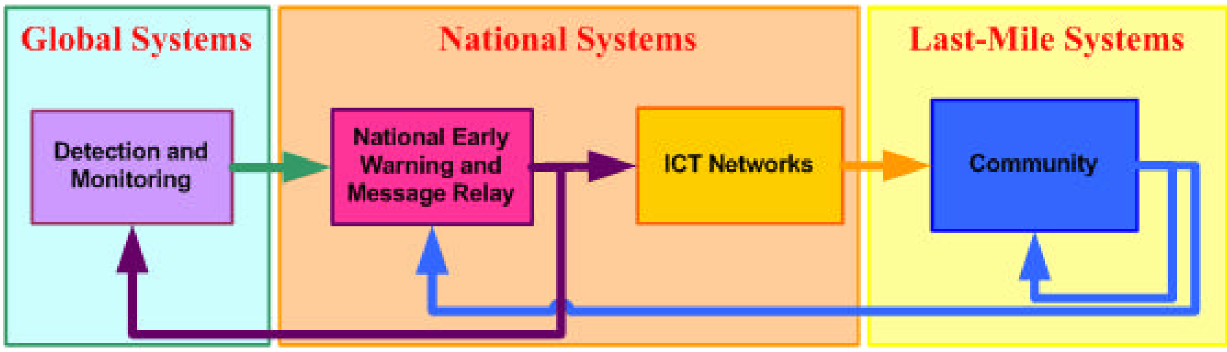
- Based on a participatory hazard mapping process, each community prepared a plan on how to respond to such an alert or warning. This included identifying vulnerabilities, demarcating evacuation routes and designating safe locations for community members to assemble after evacuation.

- Communities also decided on the most effective ways for locally communicating a disaster warning they would receive: choices ranged from runners and loud-speakers to temple bells.

- To assess how all these factors blend together, hazard warning simulations (which included evacuation drills) were conducted in each participating village.

Relay and amplification

The result of these interventions was not a traditional warning system that is usually used by governments but a community-based model used for alert and notification, emphasizes Dr Rohan Samarajiva, Executive Director of LIRNE*asia*.



He adds: "This is not in any way, shape or form a public warning system that lots of people talk about. When you talk about a community-based warning system, we are not talking about reaching every member of the community. We are talking about a representative of the community, a designated 'first responder'."

The research component of the project involved evaluating factors that contribute to effective last mile hazard information dissemination. These included the reliability and effectiveness of various ICTs; how training and the level of organisational development in a village influence community responses; and how women participated in these exercises.

To transmit information from the hub to the grassroots, five ICT tools in eight combinations were tested out in the participating villages. The tools Fixed telephones (using wireless CDMA technology)

- Java enabled mobile phones customised to carry text alerts in English, Sinhala and Tamil
- Very Small Aperture Satellite Terminals (VSATs)
- Addressable Radios for Emergency Alerts (AREA), developed by the WorldSpace Corporation (which this project was the first to field test)
- A remote alarm device (RAD) developed by Dialog Telekom and University of Moratuwa.

It was akin to running a relay – from the Hub to the first responders, and from them to the communities at risk. Speed and accuracy were of essence at each step of the transmission.

Four ICTs tested (clockwise fm top left) - AREA, CDMA phone, Dialog RAD, mobile phone

The HazInfo project was among the first in the world to apply the Common Alerting Protocol (CAP), an international standard method to exchange emergency alerts and public warnings among different alerting technologies.[10] CAP helps standardise the collection and relaying of hazard warnings and reports locally, nationally and regionally for input into a variety of dissemination systems.

LIRNEasia analysed how each ICT tool or combination was integrated into communities to deliver timely warnings to those designated as first responders. The factors needed for efficient functioning of the hazard information hub were also studied.[11]

The front-runner was AREA combined with fixed or mobile phones. Under normal circumstances, AREA works as a radio, receiving digital radio transmissions from WorldSpace satellites in geosynchronous orbit. But they can be switched on remotely from a central location, whether or not the user has turned it on at that moment, converting them instantly into a hazard alert system. Each radio has an in-built Global Positioning System (GPS) and a unique code. This enables hazard warnings to be issued to only those units known to be within a vulnerable area -- or just to those units with specific assigned codes.[12]

Mobile and fixed phones, on their own, were also found to be reliable, although having two communication technologies ensured at least one would work at critical moments. AREA and RAD units also worked well as a combination.

For tsunami-affected communities anxious to safeguard themselves from future disasters, communication technologies epitomised reliability and dependability, says Dr Samarajiva. "If you don't have the technology, if you don't have the assurance and the trust that is built up over time that the messages will be reliable, they will come rain or shine, they will come in the middle of the night when I'm sleeping, they will come in the middle of the day when my husband is not here. It’s basically a trust relationship that has to be anchored by the technology."

The project findings highlight the importance of the sociology of communication. As Sarvodaya's Dr Ariyaratne says: ""We learned there are so many social elements. One is the way the community behaves in a situation when a hazard alert is given. And also the collective behaviour of the community and the knowledge that they had before the event is so vital…We were able to identify in very specific terms what technological, social and legal as well as other elements are required to make a community warning system work."

Living with hazards

The HazInfo project's basic premise was not to issue any warnings, but to amplify and relay them once they have been issued by designated governmental authorities. The project collaborated with the government’s civilian and military personnel trained on disaster preparedness, warning issuance and emergency response.

The generic lessons (see box) are helping Sarvodaya to integrate disaster preparedness into its village development programmes. Says Dr Ariyaratne: "Our main objective is to make the 15,000 Sarvodaya villages disaster resilient. Ultimately it is the community which is responsible for making the decision and doing the most effective work. And that was proven during the tsunami disaster…the community response was the best response."

The Last Mile HazInfo Project can be a pathfinder for Asian countries that united in grief when the tsunami struck. They can now unite again in ensuring public safety through the right use of communications technology, community preparedness and training .

Lessons from the Last Mile

As these findings are documented and discussed by researchers, the key generic lessons may be summed up as follows:

- **Trusted technology**: Use ICTs that are reliable in performance, accessible at the local levels and trusted by the people.
- **Complementary redundancy**: Always have at least two different ICTs delivering information, to minimise transmission failures.
- **Credible information**: Tap only the most authentic sources of information at national and international level, reducing room for misinformation and rumour.
- **Right mix**: Achieve the appropriate combination of technology, training and institutional arrangements at the grassroots.
- **Be prepared**: Raise localised awareness and provide experiential training so community know what to do when crisis occurs.

Community members speak...

Testimonies for the HazInfo project's need and relevance have come from many community members in the villages that were involved. A sample:

"If only we knew how to protect ourselves and our belongings in December 2004, we wouldn't have lost lives and property."
- **Sinnathambi Thangarani**, Karativu

"This has helped us to get rid of fear and hesitation in our minds. Now we know what we should do when a disaster strikes."
- **J A Malani**, Hambantota

"Earlier we had no way of knowing about a disaster in advance. But now Sarvodaya has given us this facility which will inform us about a disaster two hours ahead. That will help us very much to save ourselves and our belongings."
- **Annandaraja Niroshan**, Karativu

Excerpts of interviews from TVEAP film, *The Long Last Mile*. See: http://www.tveap.org/news/0710lon.html

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The au thor thanks Dr Rohan Samarajiva, Nuwan Waidyanatha and Natasha Udu-gama of LIRNEasia and Dr Vinya Ariyaratne of Sarvodaya for their inputs and references.

Endnotes:

[1] A collaboratively prepared timeline for the 26 December 2004 tsunami is found at: http://en.wikipedia.org/wiki/Timeline_of_the_2004_Indian_Ocean_earthquake

[2] There is evidence to suggest that the government did not react to news (from reliable security sources) of the tsunami first hitting the east coast.

[3] http://www.lirneasia.net/projects/completed-projects/national-early-warning-system/

[4]http://unesdoc.unesco.org/images/0014/001448/144870e.pdf#search=%22Arthur%20C%20Clarke%20UNESCO%20Tsunami%22

[5] http://www.scidev.net/News/index.cfm?fuseaction=readNews&itemid=2945&language=1

[6] http://www.scidev.net/content/opinions/eng/a-long-last-mile-the-lesson-of-the-asian-tsunami.cfm

[7] "Precious minutes: how Java's tsunami exposed the flaws in a warning system", *Financial Times*, 9 August 2006. www.ft.com/cms/s/b2a6bb58-27d4-11db-b25c-0000779e2340.html

[8] Lessons from the Vanished Tsunami by Chanuka Wattegama, *Financial Times on Sunday*, Sri Lanka: http://sundaytimes.lk/070930/FinancialTimes/ft333.html

[9] http://www.lirneasia.net/projects/completed-projects/national-early-warning-system/

[10] http://en.wikipedia.org/wiki/Common_Alerting_Protocol

[11] http://www.lirneasia.net/wp-content/uploads/2007/11/dhaka-hazinfo-session-i-udu-gama.pdf

[12] http://www.lirneasia.net/wp-content/uploads/2007/11/dhaka-hazinfo-session-ii-waidyanatha.pdf

Text finalised in November 2007, when all the above online references were valid.

Illustrations courtesy LIRNEasia and TVE Asia Pacific.