A Survey of the E-governance Response to the December 26, 2004 Tsunami in South India

Stan Kachnowski[1]* and Ryan Blum[1]

ABSTRACT

The Tsunami that struck coastal territories around the Indian Ocean on December 26, 2004 affected and displaced nearly 3 million Indian citizens in Kerala, Tamil Nadu, the Andaman and Nicobar Islands, Andhra Pradesh, and Pondicherry. It killed an estimated 16,389 people and destroyed nearly a hundred health facilities, including 13 primary care centers.[1,2] Seawater traveled up to 3 kilometers inland, destroying homes, spoiling groundwater supplies, ruining crops and creating potential breeding grounds for major infectious disease vectors.[3,4] In the immediate aftermath of December 26, Information and Communications Technologies (ICT) were utilized by local, state and international agencies from both public and private sectors to help manage the considerable physical, economic and psychological debris. Technology was integral in organizing aid supplies, tracking missing persons and unidentified bodies, setting up a comprehensive infectious disease surveillance network, conducting trainings and therapy in psychosocial relief and helping victims of the disaster resume some semblance of their pre-tsunami routines.

1. Background

How many lives have saved through ICT intervention which would otherwise have been lost to the tsunami and its aftermath of disease and displacement? To answer this question would be to assess fundamental features of every aspect of disaster recovery as it played out in South India. Overall, routine and innovative uses of technology ranging from satellite phones to text messages have been centrally involved in all phase of responding to this natural disaster and its ensuing humanitarian crisis, from before the wave even struck the Indian coastline through various phases of disease susceptibility and humanitarian need, to rebuilding the concrete, economic and social infrastructure destroyed by the catastrophic event.

The complex nature of humanitarian/technological interventions will challenge a few aspects of this survey and further analysis of the issues raised therein. Firstly, it will be difficult to analytically separate the direct effect of ICT on the disaster response because ICT is so deeply entrenched in every level of aid, even for supposedly 'unconnected' villages. Secondly, grassroots ICT use will appear in epidemiological data as a difference of degree, but in lived experience this technology constitutes a profound qualitative shift towards social development. Nevertheless, a holistic statistical approach will probably reflect the impact of certain ICT systems on all factors of community health, from incidence of infectious diseases and diabetes-related syndromes to birthrates, stress level, and rates of reemployment.

[1] Lasker Hall, HIT Lab, Columbia University, 3960 W. 166th St., NY, NY 10032, USA
* *Corresponding Author:* (Email: swk16@hitlab.org)

2. Avoiding Harm's Way: Everyday Technologies in Extraordinary Situations

Tsunami warning systems, the first line of technological defense for potential victims, largely failed in the December 26 disaster,[5,6] but a few isolated cases showed the potential power for a unified and secure system utilizing everyday, community-centered technologies to prevent the massive loss of life from such an event.

27-year-old Vijaykumar Gunasekaran, who grew up in a fishing family in Nallavadu village, was working in Singapore when he received news of the massive earthquake in Aceh, Indonesia, which faced his home of Nallavadu across the Indian Ocean. What follows is perhaps the most dramatic, and in turn most documented, use of technology in the entire episode: Vijaykumar called his sister who helped spread news of a possible tsunami throughout his 500-family village via a public announcement system, and not one of the 3630 people living there were killed, even though 150 of their homes and 200 fishing boats were destroyed. By contrast, a set of fishing villages around Pichavaram, a few hundred kilometers South of Nallavadu, lost more than 150 fishing boats and over 1700 lives in the wave.[7]

What escaped most reports in the heavy coverage of this story was the fact that Vijaykumar had been a volunteer in his village's telecenter, an ICT kiosk set up by the M.S. Swaminathan Research Foundation (MSSF) and the Open Knowledge Network (OKN), groups dedicated to sustainable, locally-centered development in agriculture and information.[8,910] The telecenter was connected to a public alert system, which saved hundreds, maybe thousands, of lives because the village was primed for information sharing. Indeed, some news stories report that another former villager had called in simultaneously, further showing that these villagers were not only privileged to have some ICT in place but ready to utilize these technologies to save one another.

Why were there not more stories like this? One reason is the relative rarity of the equipment itself. For all the work of groups like MSSF, only 3% of Indians are online in a country with one computer for every 200 people, at least three-fourths of those are concentrated in industry.[11,12] That puts the number at about 1000 civilians per computer, making difficult the task of keeping everyone only a step removed from information. Moreover, merely having access to the internet does not make a community truly connected. The village telecenter was one of the initial models of what are now known as Rural Knowledge Centers (RKC).[13] These points of access are now being built all over the region (see Table) by MSSF in conjunction with groups such as the Tata Relief Committee, Microsoft, and the Indian Space Research Organization. The United Nations Development Program has upgraded similar installations which it calls Village Information Centers (VIC), which link directly to district recovery centers.[14] These systems are not only internet kiosks but sources of information and connection which are tailored to the village's particular needs in agriculture, healthcare and social organization.[15,16]

Another reason why fewer lives were saved by technology was that most primary telecommunications channels were blocked in the chaos caused by the tsunami itself. However, the New York Times reported that even when landlines and cellular voice calling were blocked, 23-year-old Sri Lankan Sanjaya Senanayake was able to search for lost loved ones via text messages (also known as Short Messaging System or SMS) which eventually became part of record of the event posted to his weblog via a fried in Bombay.[17] The Swedish government made another notable use of SMS technology when they were able to rapidly make contact with all Swedes who had made cellular calls from Thailand.[18]

Since text messaging was largely available during the crisis, commentators and government groups alike have decided that a simple ICT solution to disaster notification would be to use these channels, which are already integrated in daily life.[19] In fact, within a few days of the event, a group of programmers had created the "Alert Retrieval Cache," an SMS-distribution system based on keywords and subscriptions.[20]

This action was possible due to the legal freedoms allowing governments in Scandinavia and Southeast Asia access to databases which if used improperly, could cause mass confusion and great expense, and ultimately render the gesture permanently ineffective.[21] Radio, too, has drawn its share of attention: since commercial and amateur bands were utilized in the response, community-based radio initiatives have been constructed in Nagapattinam and in Poonthura, Veli and Velithura on the coast of Kerala. These stations will serve as emergency notification systems and as conduits for local fisherman to receive daily weather reports.[22, 23]

Table 1: Metrics used to study Tsunami-affected populations

Metrics	***Agency***	***Tsunami correlation***	***ITC elements***
Stress score	Diabetes Research Ctr, MV Hospital for Diabetes (WHO Collab.), Chennai	+, esp. women/youth	
Total diabetes		None	
Undetected diabetes		+	
Impaired glucose tol		+	
ID vectors	Vector Control Research Centre, Pondicherry	+	
Fever			
JE			
Measles	Field Epidemiology Training Programme, National Institute of Epidemiology (ICMR), Chennai; Directorate of Public Health and preventative med, TN		
Reproductive health		+	
Psychosocial	SNEHA	++	
	SCARF		
HIV/AIDS succeptibility	OXFAM	+	

Table 2: Sponsor, type, and location of projects to connect rural villages with ICT kiosks

SATHI Oxfam	Healing Touch Project	Dharmakulam, Nagapattinam? Karaikal, Cuddalore?
M.S. Swaminathan Foundation Open Knowledge Network	Rural Knowledge Centers	Nallavadu (pre-Tsunami) ?
Tata Relief Committee Microsoft Canadian International Development Agency Open Knowledge Network	Village Knowledge Centers In Cuddalore, Nagapattinam, Kanyakumari – in place	Kovalam (Kancheepuram Dist) Akkaraipettai (Nagapattinam, Financial Express Article) Kadiapattinam (Kanyakumari) Keelamanakkudi (Kanyak)
	VKC Exposure visits	Samiarpatty, Mzhkuthurai, Madavmedu
	Planned Exposure visits	Kzhavanjoor, Pattinamcherry (Karikal, Pondi)
Above, with support of Dept of Biotechnology, Govt of India	June 11, 2005	Sadraskuppam
Amrita Vishwa Vidyapectam ISRO (Indian Space Research Organization, also does telemedicine)	Inaugurated according to Financial Express article (6 villages getting teleeducation and telemedicine)	Ettimadi (Coimbatore dist., TN)
RASI Scheme, TN	CorDECT Wireless System	Mellur taluk (Madurai)
PURA, Ministry of Ag Telecommunication Consultants India Ltd (TCIL)	Kisan Call Center	

An accurate and responsive universal tsunami warning system has the potential to save thousands of lives, but how this information is passed through an affected region depends on the connectedness of the people therein. The foregoing examples illustrate that ICT initiatives that utilize locally-centered and everyday—or grassroots—technologies will make staying informed about potential disasters less of a bureaucratic responsibility to be shirked and more a custom of village life, part of the hoslistic social development of a people. Moreover, the use of technologies such as cellular phones and radio transmitters may "leapfrog" many of the problems of so-called traditional development dependent on physically wiring a remote locale.[24,25,26]

3. Disease Surveillance and Remote Care giving

After the initial stage of recovery the disaster began to evolve in a series of steps, each one with its own logistical and public health-related concerns. One traumatic injuries were dealt with, the main priorities were immediate distribution of basic aid and disease surveillance and prevention of major outbreaks of infectious diseases. Supply tracking and distribution is a process out of the scope of this paper which is implicit in the health-related data and which relies heavily on the same technologies, and often the very same databases that public health officials utilized.

Through mid-2005, by many reports, infectious diseases were controlled with remarkable efficacy. Within a week of the Tsunami, the Indian government was fighting potential measles outbreaks with vaccines and vitamin A supplementation, preventing one of the major killers (along with diarrhea, acute respiratory infection and malnutrition) of children in a humanitarian crisis.[27] The United Nations reported that not a single child died in India of a preventable disease.[28] Only a few unusual cases of Japanese Encephalitis, and no real outbreaks of dengue, cholera or malaria had been documented, even though vectors for all the above, as well as lymphatic filiarsis, had been found in seawater deposits or drinking water.

The success in controlling infectious diseases is attributable to a range of factors including the salinity of the water deposited on shore, the lack of movement amongst unemployed fisherman, the reliance on imported drinking water, and amplified public health measures, especially the utilization of a comprehensive disease surveillance network.[29] Existing systems included the World Bank-funded Integrative Disease Surveillance Program, the disaster-specific IndusData database, as well as local efforts such as studies of depression and morality extracted from the Vellore Christian Medical College's 20-year record of births and deaths within the 108,000 people living in villages in Kanyambadi, Tamil Nadu—a rare dataset to have on village-level population.[30,31,32, 33] These systems were augmented with state-of-the-art ICT equipment supplied by firms such as IBM and Pfizer, systems which at their very best were accessible, shared and well-maintained with software which is open-source, and web-ready interfaces built on a GIS backbone.[34,35]

These networks enabled public health officials to communicate with fieldworkers and laboratory technicians, ultimately addressing outbursts of disease before any epidemics ensued. In Southern India, officials work in concert with the UN, WHO, the CDC, various NGOs, and hospital and university laboratories to test whether incidences of fever were indicative of infectious disease and keep these infectious isolated. By this method outbreaks of dystentery and hepatitis were stopped from becoming major causes of death in the region.[36]

One of the most pressing needs in the wake of the tsunami was psychosocial care.[37 ,38] Dr. S.B. Gogia, the founder of the nonprofit Society for the Administration of Telemedicine and Healthcare Informatics (SATHI), explained that after conducting a needs assessment early in January of 2005, he realized that many of the typical public health measures were well taken care of, but that the need for one-on-one counseling was great.[39] To meet such demand, and to prove the benefits of telemedicine to meet such

immediate needs, SATHI and OXFAM set up the Healing Touch Project. The initiative consisted of links between the Schiztophrenia Research Foundation (SCARF) in Chennai and satellites in the villages of Dharmakulam, Sirkali Taluk, Nagapattinam District and Karaikal, Pondicherry. The initiative was initially stalled by financing, but eventually went into operation using ISDN lines (the Indian Space Research Organization asks high fees of non-governmental entities wanting to use satellite technology).

+ More on the effects of SATHI's initiative. Look at case studies in the Evaluation Report, outline how one might qualitatively and quantitatively pursue this line of analysis.

Disease surveillance, for all its successes, was complicated by the fact that baseline measures were spare in many places. Some areas were missing even the most basic epidemiological profile of their endemic diseases,[40] and many Indian states did not have the "comprehensive village-level databases" necessary to identify major disruptions and to establish measures of disease under "normal" circumstances.[41] Furthermore, relief organizations were unprepared for the job: subcontractors were negotiated with and contracted in the moment rather being put to work based on existing contracts,[42] such as the surveillance software that the UN commissioned from Price Waterhouse Coopers to be completed a full year after the tsunami.[43] Additionally, there were many reports throughout the region of redundant and incomplete coverage of affected populations, signifying a lack of coordination between agencies. [44,45] In Aceh there was a lack of mobile laboratories and a glut of field hospitals.[46]

Another complicating factor was the range of data which is needed to truly reflect the public health realities following a disaster of this magnitude. Not only were displaced populations at risk for malaria and dengue, but in the physical and social stress secondary to the tsunami, many new diagnoses of diabetes were made, existing diabetics lost metabolic control at an increased rate, and the rates of HIV infection has reportedly risen markedly after the initial halt on human traffic.[47,48] Other researchers have studied the tsunami's effect on reproductive health, childhood mortality rates, and the microbial species responsible for pneumonia infections amongst survivors.[49,50,51] A situation of such complex humanitarian need exacerbates illnesses and disrupts the mechanisms of everyday health. Adequate intervention should appear statistically in categories across the board, not just in "direct" effects such as incidence of malarial infection and rates of depression.

4. Concluding Remarks: Avoiding the 4th World

For all of the public health successes by private and governmental agencies making use of state-of-the-art as well as innovative grassroots technologies, measures still need to be established and maintained for the long-run. Firstly, the dangers of this disaster have not yet passed: researchers have noted how surprisingly adaptive many disease vectors have been, urban disease vectors beginning to flourish in the brackish deposits before the dry Summer months, and the unexpected resistance of some *Anopheles* mosquitoes to saline conditions. These findings, combined with a habitat which is newly-diluted from the Winter monsoons, could yet prove to be sources of outbreak.[52,53] Secondly, these systems of care should not only be triggered by catastrophe. Critics lauded the quick and massive response to the tsunami alongside noting that the affected countries are lacking in overall public health infrastructure.[54] Measures should be secure before the inevitable next disaster in the ultra-dense subcontinent. Even though money and technology is concentrated in the United States and Europe, aid should not be subject to the "tourism effect" seen recently in Reunion Island, where locals suffered from the rare plague Chikungaya with moderate attention until a tourist fell ill and the world decided there was need for urgent intervention.[55]

Indeed, the tsunami and its aftermath shed light on the function of ICT in the developing world at large, a place which grapples daily with diseases like MDRTB and HIV which necessitate complex, continual public health surveillance. ICT is more than a profoundly useful tool in crisis management: it is a necessary

ingredient of production in a global economy and a integral feature in social development.[56,57] Referring to rebuilding efforts in local schools, Sri Lankan official stressed the importance of developing skills in both language and technology, predicting that "future generations devoid of the knowledge of English and ICT could not survive."[58] ICT architects must meet local communities half way, building the capacity for locally-relevant content which groups like the Open Knowledge Network help villagers supply themselves. Those who are excluded from the effects of Information and Communications Technology, like the Dalit caste members who were reportedly left out of the relief effort in some places in South India[59] or those coastal residents who are having their land taken away from them to build new tourist facilities,[60] are in many ways left for dead in the "4th World," to use Castell's phrase. It is sobering to realize that the treatable effects of poverty—malnutrition, diarrhea and respiratory disease—kills a Tsunami's worth of children every five days, almost entirely within in the poorest countries of the world.[61]

---

[1] World Health Organization Regional Office for South-East Asia. "Responding to Communicable Disease Following the Tsunami in South-East Asia" New Delhi, Dec 2005.
[2] United Nations Team for Recovery Support.
[3] United Nations. "Tsunami One Year After: A Joint UN Report—India"
[4] Gunasekaran et al."Malaria Receptivity in the Tsunami-hit coastal villages of Southern India." *The Lancet Infectious Diseases,* Vol 5 Sept 2005: 531-532.
[5] Marris, E Nature. 2005 Jan 6;433(7021):3-5.
[6] Kerr, Richard *Science* 2005, vol. 307, n°5707, pp. 201-201
[7] MS Swaminathan Research Foundation "Tsunami & Pichavaram mangroves" *Tsunami Report*. http://www.mssrf.org/tsunami/tsunami_mangroves.htm Accessed 29 November 2006.
[8] Carvin, Andy "The Tsunami as a Wake-Up Call to Bridging the Digital Divide" *Digital Divide Network.* January 4th, 2005 *at http://www.digitaldivide.net/articles/view.php?ArticleID=84*
[9] Oneworld's OKN-one step ahead *A. R. Thiagarajan* 17 June 2005 At Digital Opportunity Channel, Mainstreaming ICTs, Mar-Apr <http://www.digitalopportunity.org/article/view/113531/1/>
[10] Oneworld's OKN-one step ahead *Digital Opportunity Channel A. R. Thiagarajan* 17 June 2005 http://www.digitalopportunity.org/article/view/113531/1/
[11] "Asia Internet Usage and Statistics" *Internet World Status: Usage and Popluation Statistics http://www.internetworldstats.com/stats3.htm#asia* accessed 27 November 2006.
[12] « Toolkit for setting up Rural Knowledge Centers » MS Swaminathan Foundation 2006?
[13] Toolkit ibid.
[14] UN report from April 2006
[15] APJ Abdul Kalam "Empowering Rural India" *Financial Express* http://www.financialexpress.com/fe_full_story.php?content_id=99278 (accessed 23 Jan 2006).
[16] Women and ICT at Tsunami reconstruction. http://www.digitalopportunity.org/article/view/118239/1/ Harsha Liyanage is an independent consultant (ICT for Development and Community Development Projects) and is presently based in London, UK.
[17] JOHN SCHWARTZ "ASIA'S DEADLY WAVES: CELLPHONES; Text Messaging Pushed for Use as Disaster Warning Systems" *NY TIMES* December 31, 2004
[18] Carvin 2005
[19] "Radio Alakal Makes Waves on Kerala Coast" *Tsunami Response* Watch May 1, 2006. http://www.tsunamiresponsewatch.org/trw/2006/05/01/aliakal-ushers-in-safe-fishing-and-waves-of-change-for-coastal-folk/ Accessed 30 Nov 2006.
[20] Tarin Rampersand "Disaster Relief System: SMS and Email." KnowProSE.com January 2, 2005
[21] Schwartz 2004
[22] http://www.tsunamiresponsewatch.org/trw/2006/05/01/aliakal-ushers-in-safe-fishing-and-waves-of-change-for-coastal-folk/
[23] UN April 2006 Report
[24] *Nandini Lakshman "Going Mobile in Rural India" Business Week 24 July 2006http://www.businessweek.com/globalbiz/content/jul2006/gb20060721_375326.htm?chan=search*
[25] (Sachs 1999,
[26] Keniston 2002)

[27] Oriella, Claudia. "Tracking Infectious Diseases in the Tsunami's Wake" *The Lancet Infectious Diseases*, 5(2) Feb 2005:73
[28] UN 1 yr after report
[29] Balaraman, et al. "Risk of outbreak of vector-borne diseases in the tsunami hit areas of southern India" *The Lancet Infectious Diseases*, Vol 5 March 2005: 128-129.
[30] Vellore CMC
[31] IDSP
[32] Bose et al 2006 "Mortality rate and years of life lost from unintentional injury and suicide in South India" *Tropical Medicine & International Health* Volume 11 Page 1553 - October 2006
[33] Bose et al 2006 "Mortality rate and years of life lost from unintentional injury and suicide in South India" *Tropical Medicine & International Health* Volume 11 Page 1553 - October 2006
[34] de Silva et al 2005
[35] Herold Et al. 2005
[36] WHO Interagency Radpid Health Assessment
[37] WHO « Report of the Psychosocial Support Programme in tsunami-affected populations in India" International Review of Psychiatry, June 2006; 18(3): 299–308
[38] Vijaykumar et al. « Psychosocial Interventions after the tsunami in Tamil Nadu, South India » International Review of Psychiatry, June 2006; 18(3): 225–231
[39] Personal communication, also Sathi papers
[40] The WHO Inter-agency rapid health assessment
[41] Inter-state Council Secretariat Ministry of Home Affairs. *Good Governance: Concetpual Framework and Action Plan*. Vigyan Bhavan Annexe, New Delhi.
[42] de Silva et al 2005
[43] UN April 2006
[44] de Silva et al 2005
[45] WHO *Responding*
[46] Oriella 2005.
[47] Diabetes
[48] HIV
[49] Reprod
[50] Childhood mortailiy
[51] NEJM Pneumonia
[52] Gunasekaran et al."Malaria Receptivity in the Tsunami-hit coastal villages of Southern India." *The Lancet Infectious Diseases*, Vol 5 Sept 2005: 531-532.
[53] MSF article from 16 Dec 05 « Monsoon Rains and Floods Hit Tsunami-Affected Areas of Tamil Nadu, India »
[54] Should have been building the infrastructure (Padma, T V "Tsunami Aid Spending Draws Fire Over Public Health" *Science* 11(3), March 2005: 237.
[55] Chikungunya
[56] Wilson, Ernest J. Globalization, Information Technology, and Conflict in the Second and Third Worlds: A Cricial Review of the Literature. Project on World Security, The Rockefeller Brothers Fund, New York: 1998.
[57] Castells, Manual. "Information Technology, Globalization and Social Development." UNRISD Discussion Paper No. 114, September 1999.
[58] ("ICT to assist tsunami affected in Sri Lanka" *Tsunami Recovery Network* Sunday Observer 21 Aug 2005. Accessed 12 Jan 2006.
[59] Walls, Michael. "Executive Summary" *Tsunami Recovery Review*, 22 June 2005: 4-13
[60] « Workshop on realizing housing and land rights" http://southasia.oneworld.net/article/view/142151/1/
[61] *Lancet IDes* Feb 2005

About the Author

Stan Kachnowski is currently a health information technology management professor at the Mailman School of Public Health at Columbia University. He has taught and consulted with organizations around the world in the areas of healthcare technology and e-commerce strategies. He currently serves on several Advisory Boards including Oncology.com, the Internet Healthcare Capital Group, and Framfab, Europe's largest Internet solutions company.