L I R N E . N E T

Learning Initiatives on Reforms in Network Economies

Session Title:
Making Communities Disaster Resilient

Promoting Community Disaster Resilience through Technology, Training and Community Empowerment: The HazInfo Experience

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Abstract:

In December 2005, LIRNE*asia*, an ICT policy and reform research organization, initiated a research project to evaluate the “last-of-the-mile” communication component of an all-hazards warning system for Sri Lanka. The project entitled, “Evaluating Last-Mile Hazard Information Dissemination”, otherwise known as “HazInfo”, was funded by the International Development Research Centre[1] of Canada (IDRC). Its research design was based on recommendations of a “participatory concept paper” for a national early warning system (NEWS:SL) that was completed in the months following the 2004 tsunami. The paper noted that although the government was responsible for issuing of public hazard warnings, it is unlikely that solely government can provide Last-Mile hazard information dissemination. Rather, it requires a partnership of all concerned including private, government and non-government sectors. HazInfo is an innovation aimed at providing the Sri Lankan communities a system to receive hazard information for early warnings. This paper will discuss the main themes of community and technology defining HazInfo that have contributed to the success of the pilot and ways in which the expansion of the project may contribute to sustainability and disaster resiliency at the community level while utilizing appropriate information communication technologies (ICTs).

1 International Research and Development Centre (IDRC) of Canada <www.idrc.org>.

1.0 Introduction

The "Making Communities Disaster Resilient" session at the GK3 conference will focus on the main themes of technology and community as leading factors in the overall success of the pilot research project entitled "Evaluating last-mile hazard information dissemination" (HazInfo) conducted through a consortium of partners including LIRNE*asia*, the Lanka Jathika Sarvodaya Shramadana Sangamaya Movement (or, Sarvodaya), Dialog Telekom and WorldSpace Corporation.

1.1 Emerging people and emerging technology

This session is most relevant to the GK3 themes of "Emerging Technology" and "Emerging People" as it tested the appropriateness of five different ICTs to determine the most reliable and effective in regards to the reception and feedback of hazard information dissemination for communities, the so-called "last-mile". The HazInfo project recognized the overarching importance of people in hazard information dissemination for natural hazards as it incorporated community members into the structure of the project - as guardians of the deployed ICTs (dubbed "ICT guardians", or ICT-G), and active responders and implementers of community-emergency response (dubbed "ERP coordinators", or ERP-C).

1.2 Author contribution and perspective on theme

This paper is written from the perspective of a disaster manager with experience and interest in disaster mitigation and preparedness, community-based disaster risk management, the use of appropriate technologies for disseminating reliable hazard information to communities in historically under-served areas (both urban and rural), and determining sustainable practices towards the achievement of community disaster resiliency.

In order to understand the context in which this paper is written, it is important to note several key definitions. 'Resilience' should be understood as comprising the following elements: having the capacity to absorb stress or destructive forces through resistance or adaptation; capacity to manage, or maintain certain basic functions and structures, during disastrous events; and, capacity to recover or 'bounce back' after an event. The 'disaster-resilient community' is an ideal. No community can ever be completely safe from natural and man-made hazards. It may be helpful to think of a disaster-resilient or disaster-resistant community as 'the safest possible community that we have the knowledge to design and build in a natural hazard context' (Geis 2000: 152), minimising its vulnerability by maximizing the application of DRR measures.

1.3 Approach overview for paper and presentation

Therefore, this session paper will provide a brief background of the HazInfo pilot project and turn the main focus on elements of HazInfo that may contribute to disaster-resilient communities in the Global South. Particularly, the paper will showcase the project's innovative base of combining the use of modern ICTs in vulnerable communities to ensure reliable and effective hazard information. Pilot findings demonstrate early progress towards disaster resiliency in the selected communities and implications for widespread expansion and implementation.

Through two 45-minute mini sessions during the "Making Communities Disaster Resilient" session, the project partners will discuss the impact of the technologies utilized and the impact of technology upon communities' capacity to obtain reliable and effective hazard information. The first mini session will focus upon technology featuring the perspectives of the two leading technology partners, Dialog Telekom and WorldSpace Corporation, whose technologies were deployed in HazInfo. The second session will focus upon Community, with Sarvodaya sharing the information about the impact of HazInfo upon pilot communities and LIRNE*asia* sharing the knowledge gained regarding policy implications and overall best practices for community disaster resiliency. Each session will begin with a portion of the HazInfo pilot project video, 'The Long Last Mile,' to facilitate the illustration of the session's dual emphasis on technology and community.

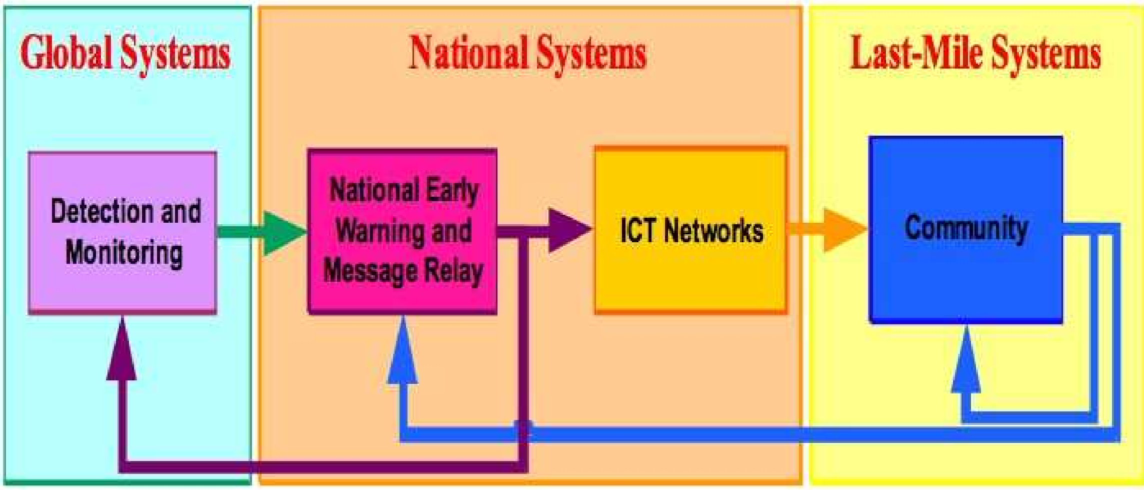

Figure 1: Early warning chain of systems

2.0 Community of Brahamanawatta, Sri Lanka reveals a shortcoming in one of the piloted ICTs

On November 26, 2006, HazInfo research simulations were conducted in the community of Brahamanawatta[2]. At 10:00am, the community was prepared to rehearse their emergency response plans. The community was equipped with a WorldSpace Satellite Radio to receive a Common Alerting Protocol (CAP) Message. The Satellite Radio was functioning in its normal mode and was receiving audio programs clearly. Professor Peter Anderson, a world renowned Canadian expert in telematics and disaster management, was observing the community's activities. He called the Hazard Information Hub at 10:45 am to inquire about the delay and he was told that the alert was already issued at 10:15 am. Thereafter, he decided to realign the antenna of the satellite radio to improve the signal. At that very moment the alert came through and the community completed their drills.

The HazInfo project consulted WorldSpace to investigate the shortcoming. This lead to the discovery that the CAP alert messages were not encrypted using one of the most reliable encoding techniques known as the Forward-Error- Correction method and because of the weak signal, the radio could not decode the alert. WorldSpace has taken this valuable lesson to make their satellite radios more reliable.

[2] Brahamanawatta is a Sarvodaya community on the southwestern seaboard of Sri Lanka; It is a highly developed community which is at stage 4 in its development process. Sarvodaya practices a 5-stage development process.

The experience in Brahamanawatta clearly demonstrated that the main issue the HazInfo pilot project dealt with is the use of technologies as part of a last-mile hazard warning system. Clearly, hazard information dissemination cannot be determined without field simulation in the community environments in which it will be used.

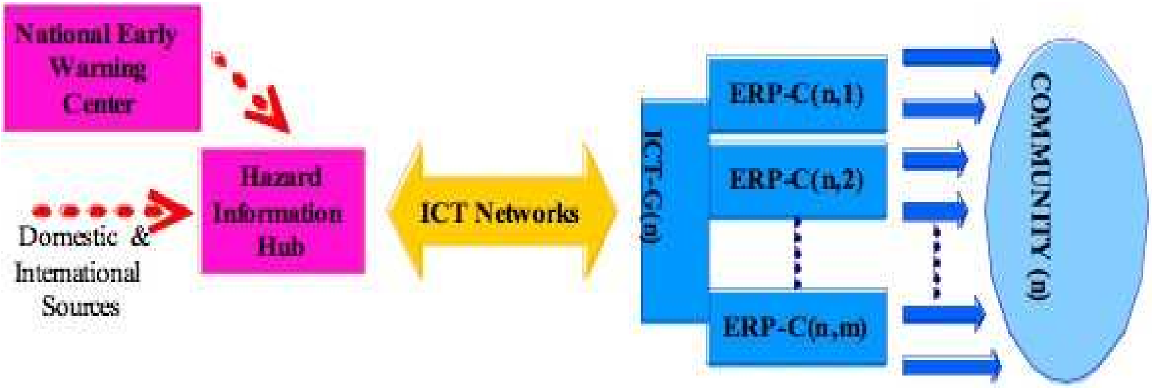

Figure 2: HazInfo alerting and notification process

Figure 3: HIH hazard information relay

2.1 Technology

The primary objective of the research project was to evaluate the suitability of five wireless ICTs deployed in varied conditions in the 'last-mile' of a national disaster warning system for Sri Lanka and possibly by extension in other developing countries. The aim of the HazInfo project was to deploy and assess various alert and notification technologies intended to reduce the vulnerability of local communities to natural and manmade hazards in rural Sri Lanka. Briefly, the five wireless ICTs were:

2.1.1 Dialog remote alarm devices (RADs)

RADs are stand-alone units that incorporate remotely activated alarms, flashing lights, a broadcast radio receiver that can be turned on or off, displayed SMS messages, as well as self- test, message acknowledgement and hotline GSM call-back features.

2.1.2 GSM Java enabled SMS mobile phones (MPs)

MP receives text alerts in Sinhala, Tamil and English (Java Phone), then activates a Java applet to sound an alarm, and offers hotline GSM call-back features.

2.1.3 Disaster warning recovery and response addressable satellite radio for emergency alerts (AREA)

AREA is a WorldSpace satellite radio system that can issue address hazard information directly to those communities at risk. Global Positioning System (GPS) technology incorporated into the radio receiver set, along with the unique code assigned to each receiver, allows for hazard warnings to be issued to sets that are within a vulnerable area or just to radio sets with specifically assigned codes.

2.1.4 Very small aperture c-band satellite terminals (VSAT)

VSAT terminals have been installed in two communities and at the HIH. These facilities provide up to 512 kbps Internet connection and enable the testing of the Internet Public Alerting System (IPAS). An IPAS client application installed on a computer enables pop-up messages to appear on a PC screen and an audio alert tone to be played on the computer's sound system.

2.1.5 CDMA fixed wireless phones (FPs)

FP is a CDMA phone with built-in speakerphones to provide voice communication via the public switched telephone network.

As the simulation in Brahamanawatta revealed, the WorldSpace AREA satellite radio system did not encrypt CAP messages adequately and exposed a major shortcoming in the use of the technology for hazard information dissemination in pilot communities. However, the HazInfo project found that the optimum configuration was the combination of the technologies used together (such as AREA + MP). This was termed by the project as 'complementary redundancy.' Two technologies used concurrently can offset the shortcomings of each other and can significantly improve reliability, effectiveness and bi-directionality.[3] It is evident that technology can only be effective for hazard information dissemination through actual application in a community setting.

During the technology mini session of 'Making Communities Disaster Resilient' the audience heard about lessons learned and priorities for action from the two major ICT providers in the HazInfo project – Dialog Telekom and WorldSpace Corporation. Each described the respective strengths of the RAD/DEWNS system and the AREA +/ANNY system.

[3] Bi-Directionality is an indicator to measure the ability of the device to permit upstream communications from local communities to the Message Relay as well as downstream communication from the Message Relay to the Communities.

Figure 4: Certainty & efficiency by ICTs

2.2 Community

There are several 'communities of practice' within the HazInfo project as, 'community' can also denote not only villages but other groups with common interest. Examples include HIH where the main focus is on making villages/ communities disaster resilient.

Communities selected for participation in the HazInfo project came from the Sarvodaya network of over 15,000 villages. Sarvodaya is a non-profit, non-governmental organization that provided oversight, training, and an information hub for the monitoring of hazard threat conditions and for the initiation of alert messages to local communities in the Sarvodaya network of villages. The thirty-two villages that participated were randomly selected from nine coastal provinces affected by the 2004 Indian Ocean tsunami. The HazInfo project found that participating communities were capable and willing to adopt appropriate technologies for use in hazard information dissemination. For communities to become disaster-resilient, they must adopt an integrated project strategy incorporating appropriate technology within community socio-cultural settings. This is paramount and a key to sustainability.

2.2.1 Community organization

Each of the communities in the Sarvodaya network is organized into a hierarchy of communities based on Sarvodaya requirements of community organization. The HazInfo participating communities were from levels 1 through 4 as currently, no communities in Level 5 exist. The more organized communities had greater capacity to plan activities related to simulations and information dissemination, and were better able to handle more advanced ICTs (such as AREA and RAD), than the less-organized communities.

	With ERP Training				No ERP Training			
Sarvodaya Stage 1, 2, 3	**VSAT** Urawatha (Galle)	**MoP** Nidavur (Batticalo)	**FxP** Thirukadalar (Trincomalee)	**AREA** Moratuwella (Colombo)	**MoP** Meddhawatha (Matara)	**MoP** Thambiluvil (Kalmunai)	**FxP** Oluville (Kalmunai)	**AREA** Maggona (Kalutara)
	AREA + RAD Modarapallassa (Hambantota)	**AREA + FxP** Wathegama North (Matara)	**AREA + MoP** Palmunnai (Batticalo)	Control Village Abeyasinghepura (Ampara)	**AREA + RAD** Thondamanar (Jaffna)	**AREA + FxP** Karathivu (Kalmunai)	**AREA + MoP** Munnai (Jaffna)	Control Village Modara (Colombo)
Sarvodaya Stage 4	**VSAT** Modaragama (Hambantota)	**MoP** Diyalagoda (Kalutara)	**FxP** Periyakallar (Batticalo)	**AREA** Panama North (Ampara)	**MoP** Satur-kondagnya (Batticallo)	**MoP** Samodhagama (Hambantota)	**FxP** Indivinna (Galle)	**AREA** Brahamana-wattha (Galle)
	AREA + RAD Kalmunai II (Kalmunai)	**AREA + FxP** Samudragama (Trincomalee)	**AREA + MoP** Valhengoda (Galle)	Control Village Mirissa South (Matara)	**AREA + RAD** Venamulla (Galle)	**AREA + FxP** Kottegoda (Matara)	**AREA + MoP** Thallala South (Matara)	Control Village Thalpitiya (Kalutara)

Figure 5: Community organization level, ICT and training matrix

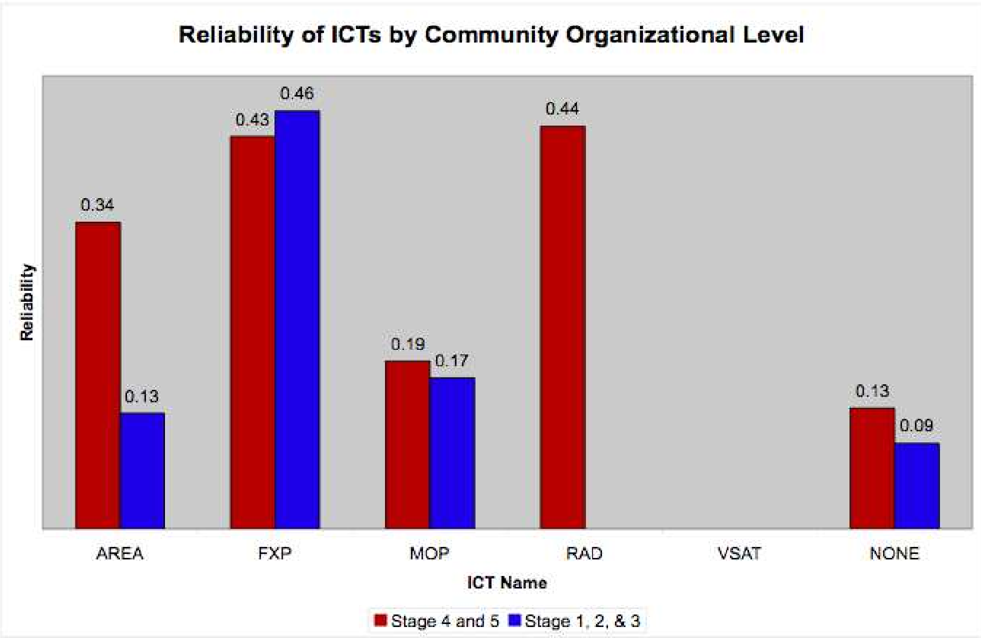

Figure 6: Relationship of community organization to the use of deployed ICTs

2.2.2 Gender Issues

In Brahamanawatta and other communities in which the HazInfo project was piloted, the majority of simulation and training participants were women. Women formed the majority of participants during the HazInfo exercises for several reasons:

1. Most worked at or near their homes, while men worked far from home.
2. Data from Live-exercises reveals that over 90% of adult participants were female because the simulations were conducted between 9am and 12pm when most males were occupied with their jobs. (i.e. Fishermen would return

home around 11am after selling their catch to the merchants and cleaning their nets/boat.)

3. Women showed enthusiasm and willingness to participate in HazInfo activities because they recognized the impact the project might have upon the safety of their families and community in the event of disaster.

The HazInfo project did not investigate further as to why women participated in this project. Although their participation may have been predominantly circumstantial, it should be noted that within Sarvodaya villages, women generally play a significant role. During a Ministry of Disaster Management and Human Rights visit to another outstanding HazInfo community which is called Mirissa, the most vocal, active and enthusiastic participants were the female leaders. More often than not, the women provided the best feedback on the running of the simulations in the community and provided critical feedback on the further future implementation of the technologies in their communities and beyond.

2.3 Training: Youth and Future Social and Economic Development

The most important element in the implementation of the HazInfo pilot project was training. Without training, Brahamanawatta community members would not have been ready and able to test out their emergency response plans on time and might not have caught the deficiency in the WorldSpace satellite radio. Training was conducted for both Hazard Information Hub (HIH) [Sarvodaya] monitors as well as for ICT guardians (ICT-G) and Emergency Response Plan coordinators (ERP-C). The project developed a guideline by which the HIH monitors were supposed to receive and disseminate hazard information. This detailed training enabled them to develop a streamlined routine for corresponding and collating hazard information so that it could be sent to communities accordingly. The training at the HIH was instrumental in the measurement of reliability and effectiveness of the overall last-mile system.

At the community level with the ICT-G and ERP-C, training included becoming aware of the procedure at the HIH, learning the process of receiving and relaying the message (ICT-G), and then activating the community's emergency response plan so that community members could evacuate quickly and efficiently (ERP-C).

Training was a crucial component in closing the gap between technology and community and was essential in the implementation of the project. For HazInfo to continue to be effective, training must be continuously updated and periodically refreshed. Above all, the training regime instituted through HazInfo serves as a preliminary model for the national early warning system. Currently, the Sri Lankan system does not have ideal procedures for the relay of hazard warning messages from the national level to identified recipients of hazard warnings. Further, these recipients are not yet clarified.

All trained villages in this project created 'Emergency Disaster Management Committees.' These committees were composed mainly of Sarvodaya's Shanthi Sena volunteers who are youth leaders trained in a variety of social development capacities. Their role in the HazInfo project was to support communities by observing and ensuring that simulated evacuation procedures as per emergency response plans were orderly and safe.

2.4 Policy Implications and Implementation Issues

How can the findings and lessons learned from the HazInfo pilot project contribute to community disaster resiliency? There is much that can be applied to enabling community disaster resiliency and that must be adapted to policy in order to be useful and effective.

- In terms of training, tabletop exercises revealed that guidance and assistance are needed to strengthen the resilience of the communities.

- Technology adopted by communities must be appropriate and easily integrated into the everyday lives of the community so that the technology stays active and relevant. Partners in the HazInfo project must endeavour to strengthen the deployed system and remove kinks so that the products suit the users' needs to the greatest extent possible.

- National and organization policy must support *practice* at the grassroots for effective disaster communication.

- The HazInfo community-based last-mile hazard information system has designed methods and procedures that can be adapted for decision-makers at the national level. Decision-makers must be open and willing to learn from community-based hazard information systems so that national early warning systems may be strengthened to support community initiatives.

- Access to the technologies piloted, particularly the WorldSpace solution, must be solved in order to ensure robust implementation within communities. In this case, cost is the main obstacle to access. To expand implementation of HazInfo beyond the initial thirty-two villages, a source of funding to meet the high cost of securing the WorldSpace solution will have to be found and sustained. This will require NGO cooperation and coordination with government, international donors and the private sector.

- Single-input, multi-output Common Alerting Protocol (CAP) brokers must be in order to meet the hazard information demands of a multi-lingual society. It is of utmost importance that an effective CAP broker be developed to ensure that effective, reliable, and quality hazard information is received by communities.

- Deployment of multiple devices with the aim of achieving complementary redundancy in reliability and effectiveness: Results from initial field tests comparing reliability with effectiveness suggest that appropriate combinations of wireless technologies will provide the best performance if they exhibit complementary redundancy. These results have a number of implications for emergency planners.

- Reliability and effectiveness can be improved only through continued training regimens, relevant guidance and assistance to each part of the system (from HIH monitors to community members). This may be achieved by finding a sustainable source of income for the expansion of the project and attending to the request from pilot communities to prevent further disaster reduction initiatives from failing.

3.0 Conclusions

The HazInfo project demonstrates that a combination of community involvement and technology coupled with training is essential in the goal of making communities disaster resilient. However, as a pilot research project, it cannot seek further expansion and implementation without a number of factors. Further research must include:

1. Development of a single-input, multiple output CAP broker.
2. Ensuring suitable access to complementary technologies required to meet best practice in effectiveness and reliability of hazard information dissemination.
3. Enabling clear and transparent bi-directionality to allow for a consistent flow of hazard information.
4. Refreshing training courses for HIH monitors, ICT-G and ERP-C so that community involvement remains high and use of technologies improves in reliability and effectiveness.
5. Finding effective methods of integrating technologies into the everyday lives of community members.

Within the context of resilience, the HazInfo project contributes predominantly within the thematic area of disaster preparedness and response. It is considered a crucial component to the effectiveness and reliability of an early warning system as it relies upon communities. The HazInfo project recognizes that community interest and acceptance of its role in the warning process is essential in the chain of systems for early warning. Further, it integrates modern technologies designed to augment hazard information dissemination in communities with a complete training regimen for all involved stakeholders so that communities become an active participant in the early warning system. Thus, these communities are well on their way to becoming self-reliant, disaster-resilient entities through the coordinated cooperation of a diverse group of technological, social, and research organizations. The focus on community-based hazard information systems within an early warning system is an indispensable component in a community's development progress. A community can strive towards sustainable development in all sectors once it feels empowered and self-reliant. Hence disaster resiliency is key to this process.

References

Geis, D. (2000). ‘By Design: the Disaster Resistant and Quality-of-Life Community’. *Natural Hazards Review* 1(3): 152.

Gow, G., Anderson, P., Waidyanatha, N. (2007). “Community-Based Hazard Warnings in Rural Sri Lanka: Performance of Alerting and Notification in a Last-Mile Message Relay”.

LIRNE*asia*. (2007). “Evaluating Last-Mile Hazard information Dissemination: A Research Proposal (HazInfo Project)”. June. http://www.lirneasia.net/projects/current-projects/evaluating-last-mile-hazard-information-dissemination-hazinfo/

LIRNE*asia*. (2006) “Research Project: Evaluating Last-Mile Hazard Information Dissemination (HazInfo)”, October 2007. http://www.lirneasia.net/projects/current-projects/evaluating-last-mile-hazard-information-dissemination-hazinfo/

Twigg, J. (2007). “Characteristics of a Disaster-Resilient Community: A Guidance Note”. *DFID Disaster Risk Reduction Interagency Coordination Group*. Version 1. June.

Waidyanatha, N. et al. (2007) “Challenges of Optimizing Common Alerting Protocol for SMS based GSM Devices in Last-Mile Hazard Warnings in Sri Lanka”.