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MULTI-HAZARD EARLY WARNINGS;

The Importance of Managing Stakeholders for Effective Disaster Response

Stakeholders in Disaster Management are those individuals or organizations that may contribute to, be affected by or can be influenced in all the phases of the disaster risk management cycle [1]. They can be government agencies, private organizations, media, NGOs/donors, emergency insurers services and the public. There are various fundamental roles that disaster risk management stakeholders have to fulfil in mitigating disaster prevalence. Hazards do not occur in isolation and two or more can be overlapped at the same time. Therefore, disaster management mechanisms should be equipped with adequate preparedness and response capacities. In this regard, Multi-Hazard Early Warning (MHEW) Systems play a vital role.

In most cases, official institutions and organizations disseminate the early warnings while the general public is mostly at the receiving end. However, MHEW systems must be multi-directional, multi-dimensional, and multi-sectoral. For instance, most updated hazard/disaster information has to be obtained from the affected or at-risk communities to enhance the level of prepredness for effective emeregency response. This will enable responsible authorities to grasp the real scenario at the grass-root level and distribute disaster-related information accordingly. Furthermore, the coordination between stakeholders such as officials is also paramount for a MHEW to be effective.

Managing Different Phases of Multi-Hazard Early Warning Systems

A Multi-Hazard Early Warning System can be broadly classified into three main phases named: upstream, interface, and downstream [2]. In general, monitoring, detection, and prediction of hazards occur at the upstream phase. The downstream phase consists of the process of disseminating early warnings and evacuation orders to at-risk communities. However, the decisions of issuing warnings and orders take place at a phase between upstream and downstream phases, called the interface. Stakeholders of these phases range from international co-operations at the upstream to local actors and at-risk communities downstream. National agencies and local actors carry out activities in the interface phase. Therefore, altogether there are many stakeholders engaged in this MHEW process. A study carried out by the Disaster Risk Management research team of the Department of Civil Engineering, University of Moratuwa has developed a conceptual framework to illustrate the stakeholder behaviour of the MHEW mechanism in their respective phases in the disaster management cycle [3]. As shown in Figure 1, activity flow among stakeholder levels has been sequenced and mapped against time. The developed conceptual framework was applied to two disaster scenarios that occurred in Sri Lanka for illustration purposes; 1) Indian Ocean Tsunami 2004 and 2) Meethotamulla Garbage Dump Collapse 2017 (see Figures 2 and 3).

Target-F of Sendai Framework for Disaster Risk Reduction [SFDRR 2015-2030] highlights the paramount importance of national agencies to work collaboratively with international agencies. Therefore, as depicted in Figure 1, the ideal scenario would be the international and national stakeholders carrying out the activities in the upstream such as hazard detection and monitoring collaboratively. If there is an impending disaster, early warnings should be passed to national and local actors to evacuate the at-risk communities within a given short period (Δt). Thus, the damage to at-risk communities can be minimized.

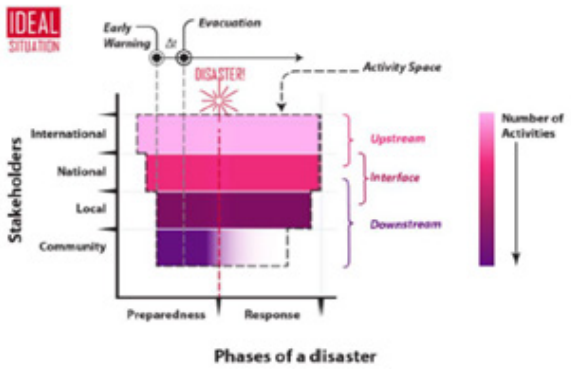

Figure 1: Activity Flow Variation For An Ideal Disaster [3]

Figure 2: Conceptual model developed for Meethotamulla garbage dump collapse [3]

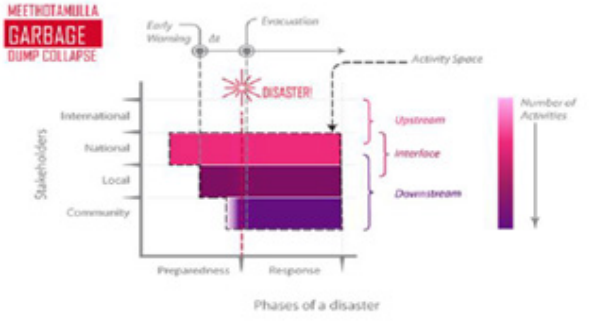

Figure 3: Conceptual model developed for the Indian Ocean tsunami in 2004 [3]

Capturing the Connectivity of Stakeholders in an MHEW system

In order to identify the behaviour of stakeholders in the MHEW environment, visualization of the communication network of stakeholders is paramount. Based on legally mandated emergency operation procedures in Sri Lanka. During a study conducted by the research team, the communication networks

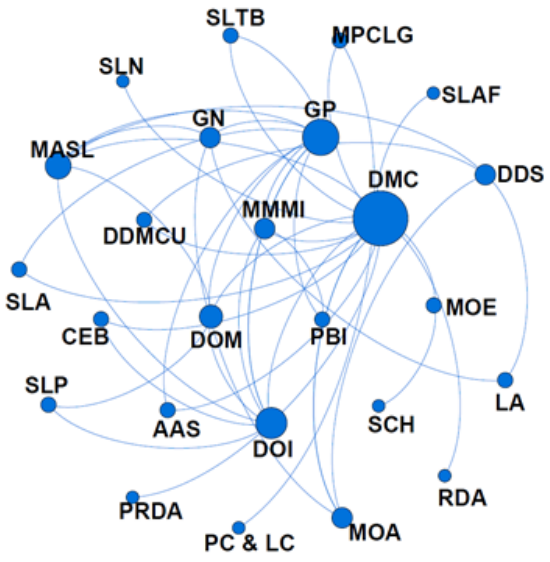

Figure 4: Stakeholder communication network for Floods [4]

of stakeholders were modelled for five frequently occurring and most severe hazards in Sri Lanka, floods, landslides, tsunami, cyclones, and droughts using Social Network Analysis (SNA) (see Figure 4). Stakeholders and their interrelationships were identified using the National Emergency Operation Procedures (NEOP) [4]. In Sri Lanka, Disaster Management Centre (DMC) acts as the key centralized stakeholder according to the centrality parameters used for the analysis. Therefore, DMC has a great significance in terms of receiving alerts from technical agencies and the dissemination of warnings.

Although DMC has been playing a leading role as a centralized stakeholder in most of the MHEW scenarios, a recent study conducted by the research team has revealed that the early warning system for biological hazards in the country is a health sector-led process [5]. Divisions functioning under the purview of the Ministry of Health are playing key roles in areas under the MHEW system. For instance, the epidemiology unit and quarantine unit are legally mandated as International Health Regulations focal points in the country while issuing early warnings pertaining to an impending outbreak. Furthermore, the Health Promotion Bureau [HPB] plays a key role in risk communication during health crises [6]

Tsunami Early Warnings and Evacuation Procedures

Tsunamis are one of the deadliest hazards that can occur at the moment. Among all types of hazards, Sri Lanka has the highest risk index for tsunamis (8.9 of 10), although the frequency of occurrence is comparatively [7]. Therefore, the effectiveness of early warning systems for tsunamis is paramount in mitigating its devastating impacts. Several studies were conducted by the Disaster Risk Management research team of the Department of Civil Engineering, University of Moratuwa, in collaboration with local and international institutions to investigate the efficacy of MHEW systems focusing on coastal hazards mainly. Use of technological platforms for early warnings, special needs of vulnerable communities in evacuation and shelter management, risk governance, and use of social media for disaster risk communication are a few areas that have been investigated by the research team [1], [8]–[11].

One of the research findings has emphasized the need for the stakeholder communication network

for rapid onset hazards like tsunamis has to be more simplified in order to avoid complexities. In this regard, a study that has utilized the SNA has modelled and compared communication networks using the relationships given in both National Emergency Operation Procedures (NEOP) and improved Standard Operation Procedures (SOPs) for tsunami response in Sri Lanka (see Figures 4 and 5) [4]. According to the comparison, the network developed through improved SOPs specifically denotes the relevant stakeholders in a much simpler way where the Early Warning information needs to be disseminated. Furthermore, it has identified the importance of including relief services such as NGO/INGOs and National Disaster Relief Service Centre within the network of stakeholders.

According to the survey findings of the research team, most communities in Sri Lanka believe that they are safe from disasters. Due to this overconfidence, they are reluctant to respond to early warnings. Furthermore, most people are attached to their personal belongings and do not comply with evacuation orders. Lack of trust in disaster management authorities is another reason for the public reluctance to respond [9]. Addressing the needs of marginalized and communities with special needs is another area that MHEW system needs to pay attention [12].

Although technological platforms for early warning dissemination have become a global trend, Sri Lankan communities are still relying heavily on traditional modes of communication such as Television and Radio to receive disaster risk information than modern methods such as social media. However, most of the communities

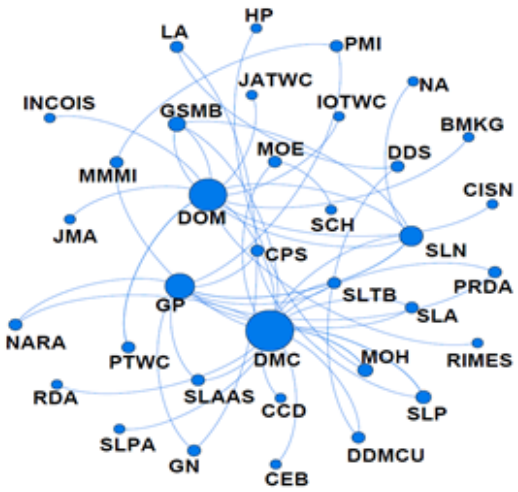

Figure 5: Communication Network for Tsunami Early Warning based on NEOP [4]

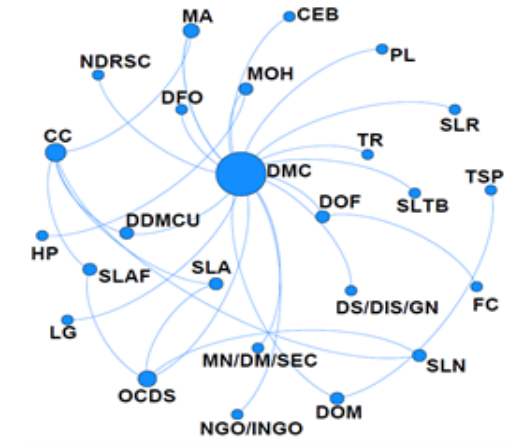

Figure 6: Communication Network Developed for Tsunami Based on Standard Operation Procedures [4]

believe that delivering early warnings as a text message would be more effective and useful for them. Although such systems are limited in the Sri Lankan context currently, SAYURU is a short message system that has become rapidly popular in the coastal region among fishing communities. This SMS based hazard alert warning system was initiated by the Department of Fisheries in collaboration with Dialog Axiata PLC.

An MHEW system is a complex system that includes various stakeholders and stages. Therefore, the complexity within an MHEW system is also high. Since the high complexity can reduce the effectiveness of the MHEW, more simplified technology enabled processes should be utilized in managing the system.

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