

# Key Issues of Disaster Management in India - During Cyclones and Flooding Emergencies

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## Abstract

*The aim of this paper is to examine the factors which drive and impedes the implementation of disaster management protocols during selected emergencies in India. The paper further discusses in detail the existing national and state-led disaster risk management and the communication procedures, particularly highlighting the gaps in current methods and areas to improve in the future. Gaps within current Disaster Risk Management strategies and their practices before, during, and after the occurrence of the disaster were also identified which has assisted in the recommendations of Community-Based Disaster Risk Management (CBDRM). The paper highlights the outcome of the training programmes and how CBDRM can be a vital tool towards enhancing the nation's disaster risk management. This could contribute to a more responsible way of addressing disaster risks, and support towards future resilient communities and developments. The suggested approaches and measures may also help governments, planners, engineers, builders, forecasters, emergency managers, relief workers, regional bodies, insurance, civil protection organisations, public and private officials of all the developing countries, to reduce future losses, where there is not the same supportive development infrastructure.*

**Keywords:** *Community-based Disaster, Communities, Climate Change Adaptation and Mitigation, Capacity Building, Local Government Institutions, Community Based Organisations.*

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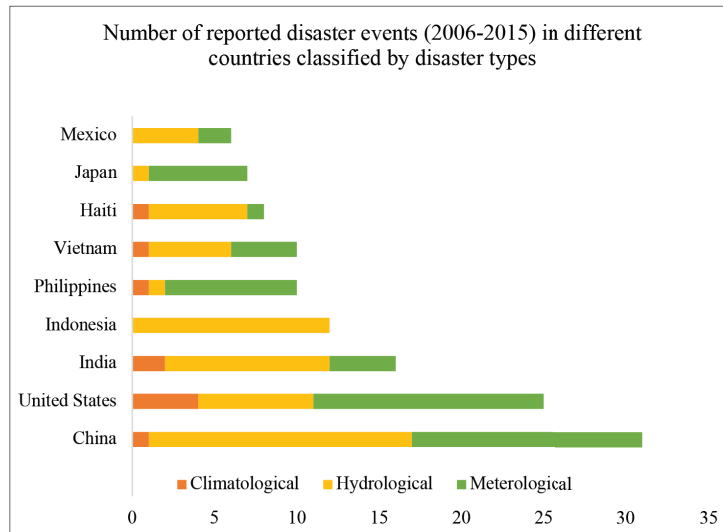
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## 1. Introduction

Natural, man-made or hybrid disasters, the three major types of disasters, impede and affect communities and their livelihood at various levels. India contributes to just less than one-fourth (24%) of the disasters in Asia. India ranks among the first five countries and is prone to almost all major natural disasters such as earthquakes, tsunamis, floods, cyclones, cyclones-triggered-storm surges, and droughts due to the country's geo-climatic conditions. About 7516 km of India's east coastline is prone to cyclones and cyclones-triggered storm surges and other coastal floodings (Khanna, 2009). The country's ever-growing population in combination with the changing hazard pattern further amplifies the socio-economic-environmental risks (Bathi & Das, 2016), (Kumar, Walia, & Chaturvedi, 2012). Many developing countries still lack a proper disaster management protocol in place or have yet to identify the best practices that mostly suit the local communities. By analysing the disaster governance and practices in India, insights into key lessons and future approaches may lead to potential areas of improvement within Disaster Risk Management (DRM).

## 2. Changes in Intensity and Frequency of Tropical Cyclones

The attribution of global warming to cyclone activity was not directly established until the 1990s. Soon after, some significant cyclone events which occurred globally were identified to have a link with the changing precipitation and the hydrological cycle of these tropical cyclones particularly the extreme weather events (Trenberth, 2008). In reflection of the Intergovernmental Panel for Climatic Change (IPCC) Fourth Assessment Report, climate change and global warming are said to bring both negative and positive impacts equally. The report reveals that Europe, America, and South-East Asia were likely to be affected by the negative impact of climate change. The negative impacts mentioned were different sources of flooding such as frequent in-land flash floods (from heavy downpours), coastal, river, and surface water flooding with increased soil erosion (IPCC, 2007), (IPCC, 2015). The report further comprehends that, with severely growing weather events and changes in climate patterns, many disastrous events are prone to occur in shorter intervals than previously.



**Figure 1: Annual Disaster Review 2016: Statistics and Trends for 2006-2015 (Guha-Sapir D, 2017)**

The Emergency Management Database (EM-DAT) is an international database for globally reported disasters. Observed trends of disasters between the period 2006-2015 are shown in Figure 1 in which India is at the third place only after China and the United States of America. The figure also shows how each country is affected by a combination of hydrological (coastal, riverine, flash floods) and meteorological (tropical cyclones) more than climatological disasters (EM-DAT, n.d.), (Guha-Sapir D, 2017).

The Bay of Bengal is observed to have a 'deep layer of warm water', which fuels the energy of the tropical system to quickly organise and develop further strengthening within a shorter period (Hoarau, Bernard, & Chalonge, 2011). Observations listed in Table 1 highlight how the last decade was significant in the history of tropical cyclones in India.

**Table 1: List of Disasters occurred in India (2011-2020)**

Tropical Cyclone	Damages (Cost in US \$)
Cyclone Thane (2011)	Affected the Puducherry and Cuddalore regions of Tamil Nadu.
Cyclone Nilam (2012)	Affected Tamil Nadu and Andhra Pradesh killing 75 people.

<b>Cyclone Phailin (2013)</b>	Made landfall in Odisha initiating a mass evacuation of more than a million people since 1999.
<b>Tropical Depression ARB02 (2015)</b>	US \$260 million and 81 deaths affecting Gujarat.
<b>Cyclone Komen (2015)</b>	Made a landfall killing 285 people in East India.
<b>Chennai Floods (2015)</b>	Mainly occurred due to the poor decision-making by State Government. The Unofficial record states more than 500 killed with damage costing up to US\$ 15 billion.
<b>Cyclone Vardah (2016)</b>	Killed 12 people with an estimated damage of US\$ 4.3 billion.
<b>Cyclone Mora (2017)</b>	Made landfall in Bangladesh impacting adjacent North-East India killing 20 people.
<b>Cyclone Ockhi (2017)</b>	Official 318 and unofficial 800 (mostly fishermen) and many displaced affecting 30 km of the southern tip of Tamil Nadu.
<b>Cyclone Titli (2018)</b>	Made landfall in Andhra Pradesh killing 77 in Odisha.
<b>Cyclone Gaja (2018)</b>	52 killed and caused severe crop damage in coastal Tamil Nadu.
<b>Cyclone Phethai (2018)</b>	Reportedly 8 people were killed.
<b>Cyclone Fani (2019)</b>	Cost of damage was estimated at US\$ 8.1 billion.
<b>Cyclone Amphan (2020)</b>	Landfall in West Bengal and 128 deaths were observed with US\$ 13 billion damage cost.
<b>Depression BOB 02 (2020)</b>	Triggered torrential rain, resulting in flash flooding, and killed 80 people in Hyderabad.
<b>Cyclone Nivar (2020)</b>	Landfall in Tamil Nadu resulting in US\$ 600 million and 14 direct deaths.

Table 1 does not only highlight the socio-economic losses resulting from cyclones and severe weather events but also underlines the impending future threats. It is essential to re-assess the risks, changing risks, and differential vulnerabilities to develop innovative approaches, emphasizing adaptation and resilience with continuous development as a key priority. But executing these strategic decisions and implementing them is not straight forward in many developing and less developed countries due to various social inequalities and economic imbalances. Community participatory approach could be one of the feasible solutions particularly for countries like India. Engaging community members in developing plans, adaptation strategies, and approaches to mitigation are critical, particularly for developing countries to prepare effectively.

### 3. Disaster Management Approaches in India

A typical disaster management life cycle involves four key phases such as (i) mitigation (ii) preparedness (iii) response (iv) recovery (Baird et al., 1975). This is a common approach to understand how a disaster is approached by a country or its government through different stages like before-impact, during-impact, and post-impact. However, a typical disaster management continuum comprises six stages as Prevention, Mitigation, Preparedness, Response, Rehabilitation, and Reconstruction making it a complete approach.

The Disaster Management Act was enacted in 2005 which further led to the formation of the National Disaster Management Authority (NDMA). The NDMA manages the integrated process of planning, organising, and coordinating necessary measures during disasters. The National Institute of Disaster Management (NIDM) is a statutory body established in 2006 under the Disaster Management Act, 2005 and operates under the guidelines of NDMA. The NIDM's mandate includes training, education, research, documentation, publication, policy assistance, awareness generation, and capacity-building measures on all aspects of DRM within India and outside. This approach, taken as a paradigm shift towards Total Risk Management (TRM), is a holistic and effective solution for DRM (NIDM, 2018), (Shah, 2011). These institutions work in a collaborative structure and do not operate autonomously during emergencies. Although they interact and associate at the national level, local authorities, and regulators were identified with a lack of synergy supported by these national and state-level associations. This often results in hampering the efforts of capacity-building activities in DRM.

In 2005, the United Nations adopted a 10-year plan focusing on reducing the disaster risk called the Hyogo Framework for Action (HFA) with a goal period from 2005-2015 in which 168 governments participated (PreventionWeb, n.d.). The HFA was aimed at reducing the socio-economic and environmental losses from disasters (UNISDR, 2007). The third UN World Conference on Disaster Risk Reduction proposed the Sendai Framework for Disaster Risk Reduction (SFDRR) which is the successor of the previous HFA with a goal period of 2015-2030 (PreventionWeb, n.d.). India is one of the participating countries of the SFDRR with disaster risk reduction as a key goal in achieving a disaster-resilient and sustainable society. India drafted its first Disaster Management Plan in 2016 (NDMA, 2016). Despite holding a multi-disaster risk profile, having a history of extreme weather events, and being one of the participating countries

in SFDRR goals, NDMA released the first disaster plan only in the year 2016. Progress within DRM and Disaster Risk Reduction (DRR) strategies cannot sustain unless the process of ‘culture-driven community-based mitigation’ is integrated with a well-developed plan.

The National Disaster Response Force (NDRF) is a trained team of emergency responders which operates under the Ministry of Home Affairs, Govt. of India. NDRF consists of standard battalions of para-military forces who are deployed in disaster-affected areas to perform the search, rescue, and relief operations (Misra, et al., 2011), (Satendra, Kumar, & Naik, 2014). The NDRF team has effectively operated during the Gujarat Floods (2007) to the most recent glacial outburst floods in Chamoli District, Uttarakhand (2021). The NDRF is responsible for several organised rescues as part of the response and recovery phases of the disaster management cycle (Misra, et al., 2011). Although these teams and military forces were involved in the disaster phase, they mainly engage during the response and the recovery phases i.e., the post-disaster phase. The other key phases such as preparedness and mitigation were mostly overlooked and in most of the disaster situations, the local population used to be the first responders.

To promote the right attitude among the rural communities towards better preparation for tropical cyclones and flooding as well as to enable them to take ownership in the management of disasters, a community-centric approach could be beneficial. It is viewed that ‘local-residents and communities themselves were the best to understand and interpret the local opportunities and constraints better than the government and authorities, whose involvement is essential in the identification and resolution of disaster risk-related issues. Nobody is more interested in understanding the local affairs than the community whose survival and well-being are at stake’ (Abarquez & Murshed, 2004).

As India is a multi-diverse country with varied cultures being the central part of the system, a Community-Based Disaster Risk Management (CBDRM) could benefit much more in the long run. In the operationalization of CBDRM at the field level, the Local Government Institutions (LGI) could play a significant role. It is significant to note that ‘Local Government is in a better position to understand the social vulnerability of the disasters with differential impacts on children, women, differently-abled, the sick and the elderly, which is imperative in disaster preparedness and risk reduction’ (Gireesan K. , 2013). It is noted that ‘ignoring the potentials of local resources and capacities will

increase the vulnerability of the community. The emphasis is on community-based disaster management, which provides adequate space for active involvement of the vulnerable population in the planning and management of various measures along with the state and non-state actors (Gireesan & Sreeja, 2017). A study identified how CBDRM was effective within the fisherman communities during the 2018 Kerala floods. The gaps identified through the study also highlighted the importance of CBDRM as a bottom-up approach in DM, and how they are capable of promoting training and workshops and preparing these vulnerable communities for any future disasters (Joseph, et al., 2020).

A selected group of volunteers from Community-Based Organisations (CBO) such as Youth Organisations, Women Organisations, and other grassroots organisations can act as flood-wardens. Their association with the elected members and officials of LGIs as well as key functionaries of different government departments at the field level can potentially lead the communities during mitigation and preparedness phases. In the case of communities living in a tribal hamlet or in a distant settlement, a single flood warden can perform the activities. These volunteers could be trained in the mapping of resources and facilities in the locality, preparation of emergency kits, disaster-specific drills, operation of emergency power and communication equipment, application of first aid, safe evacuation procedures, etc. The designated volunteer shall be trained to act as a primary focal point to disseminate the disaster-specific information received from authorities and comprehend the same to the residents.

#### **4. Training Programmes in Rural and Remote Areas of India**

Several training programmes were organized in different parts of India drawing participants from the youth organisations such as National Service Scheme (NSS) and Nehru Yuva Kendra Sangathan (NYKS); young, elected members of LGIs and key functionaries of Women's Groups such as Mahila Mandals/Self Help Groups. The second author was personally engaged in conceiving and organizing programmes in Chamoli District of Uttarkhand and in several districts in different Indian states such as Gujarat, Jammu and Kashmir, Kerala, Odisha, and Tamil Nadu. As part of the programme, lectures and practical sessions were organised. Each programme included topics such as the overview of Disaster Management Act (2005) and National Disaster Management Policy (2009); Impact of disasters in socio-economic development; Disaster preparedness and health; Role of local governments in disaster preparedness; Gender dimensions

in disaster; Role of youth and youth organizations in disaster preparedness; Disaster preparedness – Mock drills and other precautionary measures; Safe evacuation procedures; Resource mapping; Vulnerability mapping; Use of community radio and Ham radio; Village Disaster Preparedness Plan and Preparation of the action plan for the area/region.

The training programmes incorporated a perfect blend of theory, demonstration, and practical sessions to empower the local leaders, youth volunteers, and other community members in disaster preparedness. Most of the participants were ignorant about the practical aspects of disaster preparedness. The sessions on resource mapping, vulnerability mapping, mock drills, emergency kit preparation, first aid, safe evacuation procedures, application of communication and stand-by power supply sets, etc. were received with a lot of enthusiasm by the participants. The resource persons used different tools and techniques to enhance the knowledge, attitude, and skills of the participants. Resource persons were drawn from different departments and institutions such as Education, Health, Rural Development, Youth Affairs, Women and Child Development, NDRE, Indian Army, Indo-Tibet Border Police, Indian Red Cross Society, etc.

Training programmes were organised for five to seven days with a minimum of two days exclusively earmarked for providing practical exposure to the delegates. On the first day of the programme, a training need assessment was done to understand the specific needs to plan and operationalize the programmes in the subsequent days while considering the local context and priorities. In view of the unique needs, specific sessions were added to the planned training schedule. A feedback session was held on the last day to seek their responses on the content, delivery, and effectiveness of the sessions. Analysis of the feedback from the delegates enabled incorporation of necessary changes in the contents, approaches, techniques, and strategies for organising subsequent training programmes.

## **5. Areas of Improvement Identified through Training Programmes**

Weather prediction has improved considerably in recent times. The weather prediction models of the Indian Meteorological Department (IMD) were recognized for their technological advancement in plotting the likelihood of impending tropical cyclones. Modern science can even identify the possible track or path of the tropical cyclones and



expected landfall locations. On par, the effective way of communicating the identified risks still has several gaps. The following aspects on the gaps and recommendations were given based on the observations gathered during the training programmes.

### **5.1. Emergency Communication**

Communication plays a critical role throughout the different phases of a disaster such as pre-disaster, during and post-disaster emergencies. The gap in risk communications was witnessed to have occurred when the authorities failed to understand their audience. Communication has seen extensive improvements with the support of technology in modern urbanised areas and states within India. As rural communities were not homogenous entities, different sections of societies require different methods of communications. The performance of early warning systems and risk communications significantly differ with rural and sub-urban areas, and this is commonly observed across many states in India (Porathur, 1994). An effective risk communication shall include communicating the risk while monitoring the outcome. This not only ensures understanding of the community members about the hazard but also induces their participation once the received communication is understood properly. The training programmes also identified how a set of standard operating procedure (SOP) could benefit in the dissemination of communication or early warning system to manage any disaster. This further enabled the thought of observing the community response to such standard operating procedure in better escalation and disposal of resources.

### **5.2. Decision Making**

Decision-making is another important factor. Delayed evacuation may directly result in loss of lives. The primary mitigation action towards an approaching tropical cyclone is evacuation, followed by an escalation in the deployment of resources to the victims. Although this sounds like a straight forward action, execution and planning mass evacuation is a complex process. This implies that a dynamic understanding and assessment is needed to achieve successful evacuation before every event. A more transparent and explanatory evacuation plan, provision of continuous drills and training at regular intervals, and realistic communication of anticipated hazards can enhance public participation during evacuations.

### 5.3. Role Clarity

Understanding the roles and responsibilities to execute the contingency plan appropriately is the key to implement the response plan and related strategies. This is achievable when the interaction between the national, sub-national, and local response follows a horizontal linkage. Escalation of roles and responsibilities may sometimes be procedural, and this can become critical during emergencies, offsetting the primary focus of responding to emergency situations.

### 5.4. Horizontal Linkages Over Vertical During the Implementation of Response

Kapucu (2016) discusses the advantages of horizontal escalation of roles and responsibilities during emergencies. The suggestion as shown in Figure 2 was given based on the disadvantages identified in a vertical escalation with a hierarchical pattern, and with an assumption of possibly executing the key activities and sharing the responsibilities simultaneously.

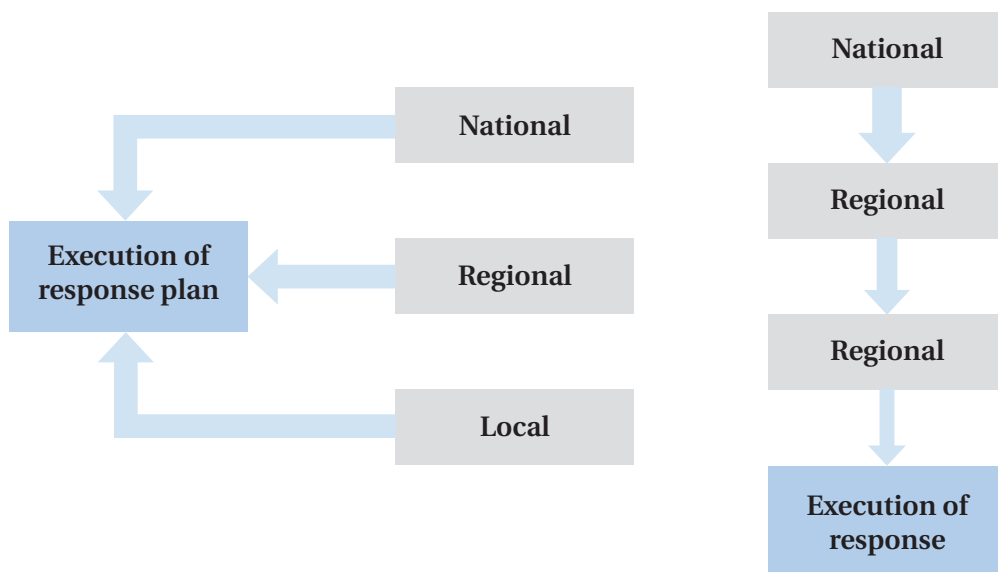


Figure 2: Recommendation on horizontal escalation (left) of responsibilities versus a vertical (right) approach.

### **5.5. Linking NGOs and Volunteers for Multi-level Networking**

The role of Non-Government Organizations (NGOs) during and post-impact periods was widely accepted and recognized (Verayanti, 2011). During cyclone Gaja (2018) in southern India, the first author was engaged in community-based disaster recovery (food and essential supplies through crowdfunding) using local youths during which it was observed that it took almost a week for the state government and corresponding administrators to reach the remote rural areas where youth volunteers and local NGOs were already functioning. A key comparative study identified how India lack in transparency in utilising the disaster management funds, especially at state and local-levels. The study also identified the challenges faced in mobilising, and various issues at preparedness phase which is one of the key phases that minimises the mortality rate (Shakeri, Vizvari, & Nazerian, 2021) These young volunteers, with the support of youth organisations and NGOs, have a competitive edge over the Government institutions while engaging with the local community. Their partnerships and collaborations with LGIs, CBOs and private organisations were laudable in most of the situations, especially during the recovery and extended recovery phases.

NGOs and volunteers were also observed to have the potential to support capacity building at greater levels by building community-level participation. This may be mainly due to their resources and flexibility to act locally and especially with the local-acting NGOs with the support of international NGOs. Although local NGOs have limited access than the local governments, their knowledge from various previous disasters can be greatly beneficial to communities. By adapting to a cross-sectoral partnership, the lack of risk knowledge could be reduced by working with trained volunteers or NGO functionaries operating in the field. Linking NGOs could be one of the most resourceful communication media strategies in the process of creating awareness in remote and rural as well as coastal areas of India.

### **5.6. National Disaster Database**

This is one of the key points observed. Establishing accurate death and damage statistics from disaster events are often critical for governments and their authorities (Guha-Sapir D, 2017). Guha-Sapir (2017) also describes how increased death or damage rate may expose the inefficiencies of the country's poor infrastructure or inadequate preparedness and responses to tropical cyclones. Inaccurate disaster data may further

lead to mis-calculation of socio-economic damage thereby resulting in underestimation of actual risk from tropical cyclones. As disaster damage data are vital to analysing the underlying risk, lack of data or inaccurate data can result in the underestimation of actual risk. Therefore, maintaining a disaster database with close-to-accurate data will support the analysis of risk assessment and can create awareness about the risks anticipated. This is a low-cost effort that helps in future analysis and return-period calculations.

### **5.7. Construction or Adaptation for 'Safe Community Zones'**

In low elevated coastal zones with high population densities and insufficient funding to adapt existing buildings, one option may be to develop and construct safe havens. This could be in the form of a Multi-Purpose Shelter (MPS) which may house *Anganawadi* (Child-care Centre), Health sub-centre, School, Public Distribution System outlet, Community Halls, etc. The MPS can be constructed on an elevated site or artificially raised site, for communities to retreat to safe havens during cyclones and floods. Some units in the MPS can work on a time-sharing basis as well during normal times, thus resulting in the use of minimum land for the creation of structures, reduced cost of construction, optimum utilisation of the infrastructure facilities, lesser transaction cost, etc.

### **5.8. Implementing Previous Lessons Learnt**

Lessons learnt from past events, especially from the most recent events, highlight the significant gaps such as lack of implementation of the lesson learnt and lack of investment in protective infrastructure and resilience measures. Education plays a key role in communicating and enhancing public participation. Properly educated and trained youth volunteers, under guidance and supervision, could be of great help in the recovery phase. These trained volunteers could be engaged in search and rescue operations with thrust on the provision of first aid, setting up emergency evacuation shelters and assisting in the evacuation of the local community.

### **5.9. Community Participation**

Lack of funded and organized community initiatives which creates public awareness was not observed in many rural and interior parts of India. Therefore, participation

of the community shall be encouraged, through continuous drills on accessing the evacuation routes, user-friendly risk maps to key locations, transportation modes and routes, etc. Community-partnered recovery efforts have proven to aid during quick recovery. Training programmes to kick-start the disaster readiness stage and exercises related to emergency kits and supply checklists should be practised among the communities. As an extension to the public awareness about the risk, schools and colleges shall incorporate disaster preparedness education as an essential element in the curriculum. Students shall be informed about hazards and risks. These measures are of special significance in states but vary considering the vulnerability of areas, points, and communities. Educating about disaster preparedness activities and evacuation drills in schools and colleges is recommended, involving students and their families. This approach will make the process of evacuation to the operational level and will avoid complications in carrying out evacuation during unforeseen situations. Initiation of capacity building programmes and developing community-based DRM initiatives for a future scenario is recommended to enhance public awareness.

### **5.10. Media Participation in Disaster Management**

The media's prominence not only ends with the tasks of boosting awareness but also supports the victims by gaining international attention (Dave) and drawing requests from the international humanitarian organization and their participation to instigate further relief funds. The use of diverse communications such as social media platforms shall be enhanced for countries whose land-based telecommunication infrastructure is limited. Many developed and developing countries consider social media as an emerging substitute for risk communication. The current COVID-19 pandemic in many countries is an example of how social media and diverse media communications have reached out to a large population and specific groups. Image/video sharing, threaded communications under a common hashtag has generated a new dimension in risk communication over the traditional practices by use of radios, telephones and teleprinters. New channels broadcasting disasters and live field situations have sustained in gaining public attention worldwide. Stakeholder participation from trusted news channels and other media sources shall be enhanced to support the increased focus of attention by the public.

## 6. Conclusion

It is important '*to know*' what is being done in the past and present to determine what '*to do*' for the future, and to fix the gap (Peffer & Sutton, 1999). It is necessary to understand the key factors affecting vulnerability assessment, resilience, and adaptive measurements for re-assessment of existing technology and new findings. Assessing the risk of a country to increase the adaptive capabilities and resiliency to weather events is strategically important not only to a country's government but also to all the stakeholders involved. The continuous migration of people and coastal investments within Low Elevated Coastal Zones (LECZ's) or cyclone-prone zones not only amplifies the vulnerability and risk of exposure but also necessitates continuous monitoring and re-assessment of risk. This also instigates how continuous assessment and analysis of strategies to mitigate future disaster risk in terms of cyclones and floods is crucial. To overpass these identified areas of improvement and to fill the gap, future training, and community-based disaster risk management with an in-depth understanding of the root causes that impeded the execution of DRM is essential. Combined community support has contributed towards the improvement of livelihoods, mental health, and well-being of the communities through enhanced public participation. With an effort to address the 'risk blind spots', the recommendations particularly emphasizing CBDRM were given to the identified areas of improvement. The suggested areas will act as an enabler to all its major participants including governments, organisations, institutions, industries, and community members to strengthen the current national disaster management plans in an effective and efficient manner.

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