

**Disaster Management & Community Based Early Warning System
(A Comparison between Pakistan & Japan)**



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ABSTRACT

Pakistan is exposed to numerous natural and manmade disasters and the communities living in remotely located rural areas are particularly prone to the hazards of such widespread disasters but with the help of modern technological methods of early warning system, the level of destruction of such disasters and hazards can be prevented or at least reduced. At community level, the technical and resource limitations often obstruct the efforts to tackle these issues effectively. The research on Disaster Management practices and policy in Japan and Pakistan along with Community Based Early Warning System (CBEWS) of two countries Japan provides opportunity to adopt possible methods and measures to overcome the problem that thwart the efficacy and help in understanding the issues that come between the early warning messages that are aim at benefiting the communities. The exposure of communities to various hazards can eventually be avoided through use of modern technology along with traditional methods. In this report, an attempt has been made to analyses the problem and understands the community based early warning system in Pakistan. The purpose of this study was to assess the vulnerability and threat in the early warning system of country. A comparative study has been carried out between practices and mechanism of community based early warning system in Pakistan and Japan.

Key words: Capacity building, Disaster, Disaster Risk Management, Early Warning, Hazard, Emergency Response, Mitigation Measures, Prevention Measures, Vulnerability.

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I hope this report will be useful for individuals and organizations working in the field of disaster management and especially for the Government of Pakistan and member countries of ADRC. The study enhanced my disaster management knowledge and experience, which would be utilized in more proactive manner in my home country.

LIST OF ACRONYMS

ADRC	Asian Disaster Reduction Center
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
CBDRM	Community Based Early Warning System
FEWS	Flood Early Warning System
GDP	Gross Domestic Product
HFA	Hyogo Framework for Action
IDNDR	International Decade for Natural Disaster Reduction
IFI	International Financial Institutions
ISDR	International Strategy for Disaster Reduction
NDMA	National Disaster Management Authority
PDMA	Provincial Disaster Management Authority
PMD	Pakistan Metrological Department
SPSS	Statistical Package for Social Science
UN	United Nations
UNDP	United Nation Development Program
UNEP	United Nation Environmental Program
UNICEF	United Nations Children’s Fund
UNISDR	United Nations International Strategy for Disaster Reduction
WHO	World Health Organization
WMO	World Meteorological Organization

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CHAPTER -1

1. Introduction

The disaster impacts increase when they are not properly managed and the community is the initial level that is immediately victimized due to the disaster impacts. During past few years, the communities living in the rural areas of Pakistan have witnessed a number of serious setbacks due to the devastations caused by the natural disasters. The lack of advanced early warning system particularly in remotely located rural areas where people lack access to various modern facilities and technology becomes one of the major reasons for extraordinary destruction of resources and loss of human life. The research on Japan's Community Based Early Warning System (CBEWS) and the methods that prior to occurrence of the disasters aware people about the possible threat and the damage that could happen due to natural disasters is highly important that exceptionally helps for realization of the shortcomings of Early Warning System particularly pertaining to the communities living in the rural areas.

The CBEWS has proved highly valuable for adopting effective measures that play a strong role in improving safety of men and material. It is one of the most effective measures for reducing negative impacts of threats and risks triggered by natural disastrous events since, the early warning system and other mitigation interventions are a cost effective way of disaster risk reduction. The Early Warning system aims at a critical assessment and discussion of successes, failures, potentials, and requirements for the effective use of early warning system disaster mitigation.

The advanced means of Early Warning System and the practices at the community level in Japan are could be very helpful for Pakistan to minimize the levels of the destruction during the disaster period. The technological equipment and the real-time measures used

in Japan can become a guiding point to adopt and lessen the level of losses. Moreover, Japan's combination of high technology and cultural adaptation to its natural setting makes tsunamis, floods and various other kinds of disaster detection systems. The early warning system and practices serve as a model for many countries in the world. The expectation about the benefits of this research are high due to the previous experiences of community based disaster management in Japan has proved extraordinary through demonstrating effectiveness of the capabilities in handling and controlling the disaster impacts during the Tsunamis and other disasters. The Early Warning System in Japan is a role model for both developed and developing nations of the world.

Through a research process that includes thorough review, study and analysis on Japan's CBEWS to work as capacity building tool and empower people at grassroots levels for facilitating the transparent interaction between government, civil societies and the vulnerability communities in the disaster prone areas. The activities that involve community awareness through various modes of communication in Japan provide as a resource for incorporation in the national level input for policy formulation pertaining to the early warning issues in Pakistan. The way of applying research results in Pakistan for Community Based Early Warning initiatives to enhance the risk assessment capability and information sharing methods and investing in the local capacity enhancement brings the losses at the minimum possible level.

1.1 Background

As depicted by the term, the early warning is a process of dissemination of the hazard and disaster information before its occurrence in order to assist decision makers to formulate suitable policies and perform certain actions to address the upcoming threats and managing such events to avoid the losses and worst consequences. Likewise, the Community Based Early Warning System (CBEWS) is a process of empowerment of the people at grassroots level through which they are enabled to prepare well to face any natural hazards and natural disasters.¹

To reduce the vulnerability of the communities, the early warning is considered to be major component of the disaster risk reduction measures that helps in saving lives and reduces the economic and material loss during the outbreak of the disasters.² Initially, the first ever organized practice of the early warning system was formed by the UN during 1984 and 1985 respectively to control the losses caused by famine in Sudan and Ethiopia. The international efforts for disaster risk reduction during 1990 to 1999 proved to be milestone in promotion of benefits of the early warning system. The World Conference on Natural Risk Reduction Early Warning System held in Yokohama, Japan in 23-27 May 1994 was a landmark in this regard. Following the Conference, Japan played role of a foremost country for promotion of global disaster awareness and reduction initiatives. Two other major World Conferences were held in Kobe in 2005 and in Sendai in 2015 respectively. The initiative led to the realization for UNISDR in 2000 to advocate the promotion of scientific means to enhance the accuracy of the early warning system, since then it also served as the coordinating body for the Second and Third World Conferences on Disaster Reduction of 2005 and 2015. The series of World Conference on Disaster

¹ Ismail Khan et al., "An Analysis of Community Based Flood Early Warning System in The State of Azad Jammu & Kashmir", *Procedia Engineering* 212 (2018): 792-800.

² V.V. Krzhizhanovskaya et al., "Flood Early Warning System: Design, Implementation and Computational Modules", *Procedia Computer Science* 4 (2011): 106-115.

Risk Reduction primarily aimed at tackling the issues of disasters and management of climatic risks in sustainable development context.³

The importance of community based early warning system is growing recognized in both developing and developed nations of the world. The importance of the empowerment of the community to tackle the disasters affects as an immediate responder greatly helps whole nation to avert growing losses of men and material. In developed nations, the utilization of modern technological equipment along with disaster resilience and repeated efforts of enhanced capacity building initiatives have proved with outstanding results that suggests that even facing the devastating disaster affects, those communities significantly recovered soon from the physical and psychological affects of the caused destruction.⁴ However, the case of developing or under developed nations is usually otherwise who cope with lacking resources and adequate disaster related knowledge that impedes their



disaster recovery and reduction efforts. The communities of the developing countries besides facing the shortage of technical equipment to forecast the occurrences of disasters and shun their huge destruction also lack the expertise in using those equipments.⁵

The community based early warning system comprises activities, measures, projects and programs that reduce disaster risks and are primarily designed for the people living in

³ Simon Butt, Luke Nottage and Hitoshi Nasu, *Asia-Pacific Disaster Management*, 1st ed. (Berlin, Heidelberg: Springer Berlin Heidelberg, 2014).

⁴ Maria Victoria G. Pineda, "Redefining Community Based Disaster Risk Management (CBDRM) Through Enhanced Early Warning Processes", *International Journal of Information and Education Technology* 5, no. 7 (2015): 543-548.

⁵ Gail Insko Wise, "Preparing for Disaster: A Way of Developing Community Relationships", *Disaster Management & Response* 5, no. 1 (2007): 14-17.

high risk communities, and are based on their urgent felt needs and capacities. There are certain characteristics of the community based disaster management practices that compose the features of participation of people as major factor to contribute towards the disaster risk reduction objectives. The priority is always given to the most vulnerable groups such as women, children, elderly, disabled persons and the people who lack access to the resources. It also takes into consideration, the enhancement of the existing survival capacity of the people. Since, the community based early warning systems are primarily community centric therefore, through a valid analysis of disaster risk capacity can provide communities with capabilities to avert or reduce their disaster exposure and vulnerability. The increased capacity enables communities to achieve goals of disaster resilience and building safer environment with the support of governments and the non-profit organizations.

Principally, the CBEWS is a content of participatory process and a response to the urgent needs of the community. The disaster management activities are interlinked in disaster management system during both pre and post disaster period. The disaster preparedness and prevention besides stress management are proactively involved in the community based disaster management capacities through ample structural and nonstructural short, medium and long-term countermeasures. The government and various other stakeholders play roles to impart the disaster management knowledge and provide the communities with required technological resources and expertise. The community based early warning disaster system also empowers the people to get better access to the social services by enabling them to confidently participate in the development endeavors. It also assists

communities to protect their interest and belongings and avail better opportunities for their development.⁶

The early warning system is pre-disaster phase and it increases the chances of effective response. The effective early warning system help reducing the economic losses and mitigate the number of injuries or deaths in case of any disaster, by providing information that allows individuals and communities to protect their lives and property. Such a process enables people to take action when disasters are very near to occur. If well integrated with risk assessment studies and communication and action plans, Early Warning Systems can lead to substantive benefits.

The vulnerable community focused communication methods exceptionally become productive since the majority of communities are located in rural areas and the sources for early warning system in such areas are mosque loudspeaker, community gatherings and the door-to-door campaign to aware the masses about possible hazards and disasters. The previous experiences of early warning measures reveal that in rural areas, the early warning system could not achieve tangible outcomes therefore; it needs auxiliary measures to adopt modern technological means and techniques to reduce the risk of disasters at maximum level.

In recent times, the Indian Ocean Tsunami of 2004 was one of the recent and most destructive disasters that claimed over 220,000 and many homeless. The tsunami consequently highlighted the need for early warning system since; if there was a proper early warning system it could prevent huge losses of men and material. The global realization for the effectiveness of the early warning system got attention towards already

⁶ Maria Victoria G. Pineda, "Redefining Community Based Disaster Risk Management (CBDRM) Through Enhanced Early Warning Processes", *International Journal of Information and Education Technology* 5, no. 7 (2015): 543-548.

initiated World Disaster Reduction Conference held in Hyogo, Japan in 2005 that adopted early warning system as one of the five themes of the Conference.⁷

⁷ Nobutomo Osanai, Hideaki Mizuno and Takahisa Mizuyama, "Design Standard of Control Structures Against Debris Flow in Japan", *Journal of Disaster Research* 5, no. 3 (2010): 307-314.

CHAPTER 2

2. Literature Review

The book Institutional Partnerships in Multi-Hazard Early Warning Systems, authored by Maryam Golnaraghi, comprises of various dimensions and discussions on disaster management and early warning conceptualization. It elaborates the scope of early warning as a multi-disciplinary term that is frequently used in many fields to describe the stipulation of information and knowledge that enables particular group of people to take the notice of alert and engage in appropriate countermeasure activities. In disaster situations, it raises the attentiveness amidst emerging dangerous circumstance where actions based upon real-time information help in reducing the involved risks. Today with the help of modern technological equipment, mankind has become self-sufficient enough with early warning systems available for natural disasters, geophysical and biological, industrial hazards, climatic changes and various other types of emergencies. Along with other disaster risk reduction interventions, the early warning systems assist in protecting lives and provide sustainable support for saving infrastructure, livelihood and various economic resources through early detection of threats of undesirable situations.

The communities can greatly benefit through implementation of a mechanism of early warning systems in their locality. The governments may often fail to take early warning measures into account while policy formulation related to disaster management that subsequently result in huge losses of men and material while causing huge cost to national infrastructures during the outbreak of disasters. The prior preparation for the disasters proves with remarkable dividends in turn merely through investing in early warning systems for comprehensive disaster risk management in order to avoided or

reduced the impact of disasters on human life, property, environment and the national economy.⁸

Koh Hock Lye, Philip L-F Liu and, Teh Su Yean in their edited work titled, *Tsunami Education, Protection and Preparedness* provides similar context on the CBEWS practices and policies. They term the early warning system as a powerful tool that can be set up to by the governments and the vulnerable people alike to avoid and reduce the high impact of hazards that include flood, flashfloods, landslides, storms, forest fires, tsunamis etc. The connotation of an effective early warning system merely lies in the identification of its benefits by the government as policies formulating authority and the members of particular communities that frequently experiences or risk the disaster threats. The early warning covering all methods and processes of communicating the early detection of the conclusions for decision making concerning the threats before they occur. The government and communities can take action based on well calculated scenario to deter whatever outcome of the disasters can result beyond their surviving capability to manage such events in a way to avoid worst case scenario amidst disasters.⁹

Ashbindu Singh and Zinta Zommers in their edited book, *Reducing Disaster: Early Warning Systems for Climate Change* elucidate the idea of CBEWS. The community based early warning system is a set of enhanced capacities of the community that is required to produce and disseminate timely and accurate threat warning to the threatened communities to properly arrange for evacuation places along with materials. To take such necessary preparedness measures and actions appropriately the sufficient time is required to reduce the exposure to the threat of harm and losses.¹⁰

⁸ Maryam Golnaraghi, *Institutional Partnerships In Multi-Hazard Early Warning Systems*, 2nd ed. (Berlin: Springer, 2012).

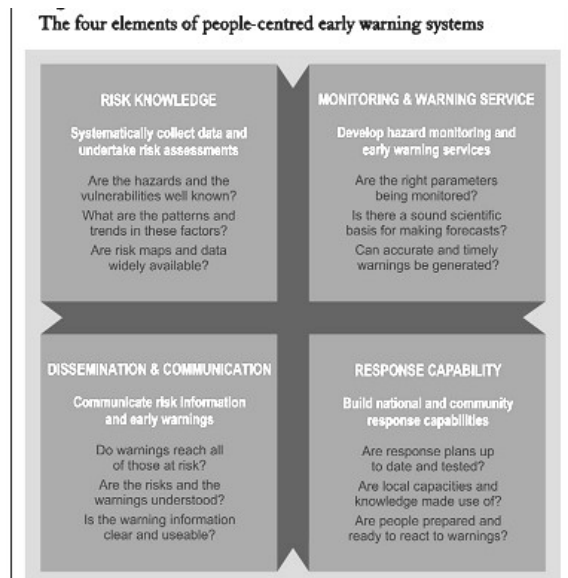
⁹ Koh Hock Lye, Philip L-F Liu and the Su Yean, *Tsunami Education, Protection and Preparedness*, 1st ed. (Pulau Pinang: Penerbit USM, 2011).

¹⁰ Ashbindu Singh and Zinta Zommers, *Reducing Disaster: Early Warning Systems for Climate Change*, 1st ed. (Dordrecht: Springer Netherlands, 2014).

The Early Warning measures particularly in rural areas of Pakistan could not achieve tangible outcomes; therefore, it needs exceptional measures to adopt real-time means and techniques to reduce the risk of disasters.

A people-centered Early Warning System essentially comprises four key elements:

1. Knowledge of the disaster risk
2. Monitoring / Access to information
3. Analysis and forecasting of the hazards
4. Communication or dissemination of alerts and warnings besides local capabilities to respond to the warnings received.



Moreover, the Community-Based Early

Warning Systems (CBEWS) are key practices that are managed by the communities to reduce the chances of threats that would cost them losses therefore; CBEWS allows them to better protect their assets and livelihood.

In real sense it is the empowerment of community and the society as a whole since, they become capable to protect themselves through protective measures by disaster resilience. The flood vulnerable communities can essentially monitor the downstream and upstream by observing and effectively operating their early warning systems. The heavy rainfall at upstream will definitely bring a direct impact on communities dwelling at the downstream places therefore, an early warning makes them to prepare for timely actions and evacuation plans based upon early warning information.¹¹

¹¹ Dwie Irmawaty Gultom, "Community-Based Disaster Communication: How Does It Become Trustworthy?", *Disaster Prevention and Management: An International Journal* 25, no. 4 (2016): 478-491.

The term Early Warning is used in many fields to describe the provision of information on an emerging dangerous circumstance where that information can enable action in advance to reduce the risks involved. Early Warning Systems exist for natural geophysical and biological hazards, complex socio-political emergencies, industrial hazards, personal health risks and many other related hazards. It is highly essential that the warnings must reach all those at risk including all vulnerable members of a community. The clarity of the messages containing simple, useful and understandable information are crucial to enable proper understanding of warnings and responses in order to safeguard lives and livelihoods. It should be taken into account that some community members might not be able to hear or see the information or to follow the instructions by themselves and appropriate measures and actions should be taken accordingly.¹²

The early warning system are long term investments and need commitment at grassroots level for self-sustainability. The local institutions such as community or peace councils, realizing direct benefits from the system will more likely incorporate the early warning system into their own strategies of behavior thus increasing the sustainability of the system. The early warning system is the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by hazards to take necessary preparedness measures and act appropriately in sufficient time to reduce the possibility of harms or losses. It means that Early warning system is the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals,

¹² Adenrele A Awotona, *Planning for Community-Based Disaster Resilience Worldwide*, 1st ed. (Abindon: Routledge, 2016).

communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss.¹³

Early action is non-specific term referring to either “preventative action” or “early response action”. Covering the processes of consultation, policy making, planning and action to reduce or avoid armed conflict (this could include diplomatic, military/ security, humanitarian and developmental/ economic activity). Early response is a category of proactive and reactive measures to reduce tensions and block conflict escalation. It involves both early prevention and early action.

The concept of CBEWS has been implemented through the Hyogo Framework of Actions since 2005. The main objective of disaster reduction activities under the framework for disaster resilience of the community level was emphasized. The risk community in various countries were progressively transformed as resilient community however, the practices varied with the issue that though the objective always remained same for ensuring the safety of the communities yet, the facilitation practices and the methods of the CBEWS frequently changed.¹⁴ Under various global disaster related initiatives, today almost all the nations in the world realize about the disastrous impacts of climate change that trigger hazards like earthquake, tsunami, flood, desertification etc. however, the levels of access to information and the technological means demand for an internationally accessible advanced and centralized early warning system. Several local and regional early warning accessories and applications are available but an effective international early warning institution related to disasters would become a benign asset for the mankind. The devastating Indian Ocean tsunami that killed 220,000 people in December

¹³ Matthew L. Collins and Naim Kapucu, "Early Warning Systems And Disaster Preparedness And Response In Local Government", *Disaster Prevention and Management: An International Journal* 17, no. 5 (2008): 587-600.

¹⁴ Ali A. Wangara, "Disaster Response Coordination Among Disaster Management Organizations in Modern Cities: The Case of Nairobi County, Kenya", *Prehospital and Disaster Medicine* 32, no. 1 (2017): 20-22.

2004 resulted in establishment of Inter-Governmental Oceanographic Commission (IOC) in the region that progressively facilitates for the cause of early warning in the region however, as a reality that still highlights for establishing an international early warning system.¹⁵

¹⁵ Masato Motosaka and Makoto Homma, "Earthquake Early Warning System Application for School Disaster Prevention", *Journal of Disaster Research* 4, no. 4 (2009): 557-564.

CHAPTER-3

3. Research Methodology

The research study is based on both qualitative and quantitative methods whereas, the primary and secondary resources on Community Based Early Warning Systems including field visits, expert discussions and lectures to analyze the practices and policies. The primary source including field visits and expert lectures have exceptionally proved helpful in this study. In addition, the real-time early warning expertise of the Government of Japan to cope with the hazards and disasters also proved helpful in exploring variety of aspects of CBEWS and assisted in getting accurate facts and figure that were essential for this research. The study is descriptive and analytical in nature. The data collection for CBEWS in context of Pakistan includes Pakistan's disaster management laws and policies. The discussions with various government officials and disaster management experts was conducted that along with field experiences proved as a great asset for learning and researching on community based disaster risk reduction and hazard risks strategies.

Strengths & limitations of the CBEWS approaches for disasters & other hazards		
Approach	Strength	Limitation
Qualitative	<ul style="list-style-type: none">- Quick to setup- Comparable numbers	<ul style="list-style-type: none">- High level of generalization- Misinterpretation of message
Quantitative	<ul style="list-style-type: none">- Contextual details- Long-term process	<ul style="list-style-type: none">- Time consuming- Hardly comparable
Participatory	<ul style="list-style-type: none">- Reflects individual views- Addresses actual local needs	<ul style="list-style-type: none">- Time consuming- Hardly comparable
Quantitative & participatory	<ul style="list-style-type: none">- Reflects individual views- Addresses actual local needs- Tangible to various stakeholders- Facilitates comparison	<ul style="list-style-type: none">- Highly dependent on facilitators skills

During this study it was observed that due to lack of disaster management awareness of the community and issues in using technological equipment that sometimes was highly sophisticated and needed particular expertise to operate such equipments became key impediment in the execution of community based early warning system in the Pakistan. As a purpose, this study was aimed at comparatively analyzing the Community Based Early Warning Systems and practices in Japan and Pakistan for minimizing disaster impacts however, it is empirically proved that due to some extends the level of damages/losses have been minimized/curtailed due to appropriate early warning system and practices at the community levels.

3.1 Statement of Problem

The lacking knowledge about disaster related issues and awareness about the management of its consequences along with some flaws of early warning system at community based practices leaving lesser room for ownership of the issue enhances the risk of loss during disasters. The obsolete methods and lack of adequate education to use technical and technological means further contributes in the shape of excessive destruction. The issues of education about usage of modern technological equipment, capacity building of communities and government officials at union council levels through proper coordination and mutual support are often ignored that results as a core problem of overcoming disaster management practices at the community levels.

3.2 Objectives of Research

The research study is focused on review and documenting the existing Early Warning System policies and practice at the national and community levels in Japan. In addition, as a comparative analysis it assesses the issues and vulnerabilities of Early Warning



System. As an objective, the research provides rationally possible solution and recommendations for enhancing the Community Based Early Warning System in Pakistan. The experiences learnt by community based disaster management practices in Japan are generally helpful in reducing adverse consequences of the disaster

hazards. The research aimed at reviewing and documenting the existing Early Warning System practiced at the national level in Japan. Through a comparative analysis, it was helpful in assessing the issues and vulnerabilities of Early Warning System. As an objective, through this research, various possible solution and recommendations have been proposed for enhancing Early Warning System.

3.3 Scope of the Research

Pakistan has been facing severely devastating disaster impacts. The national level disaster management policies and practices have exceptionally proved effective to save lives and livelihood however, the issues at the grassroots level particularly in the rural agricultural background has proved otherwise. There is widespread issue of ineffective and obsolete methods of disaster management that during last few years have proved unsatisfactory in terms of effectiveness. The scope of research study is highly valuable since it provides a variety of ways for adaptation of improved and modern disaster management practices and policies that while adopting serve as effective means for CBEWS that play a strong role in improving safety of men and material. It is one of the most efficient measures for reducing negative impacts of threats and risks triggered by natural disastrous events. The CBEWS and other mitigation interventions are a cost effective way of disaster risk

reduction. The Early Warning system aims at a critical assessment, management and discussion pertaining to the successes, failures, potentials, and requirements for the effective use of CBEWS for disaster mitigation.

CHAPTER-4

4. Effectiveness of Early Warning System for Communities

The early warning system can help nations to minimizing the disaster affects and even it can also prevent such affects if effective practiced. The community based early warning systems can serve as one of the most useful tool that ensure about the safety of the people and help in managing the disasters. The early information to the community through national or regional organizations



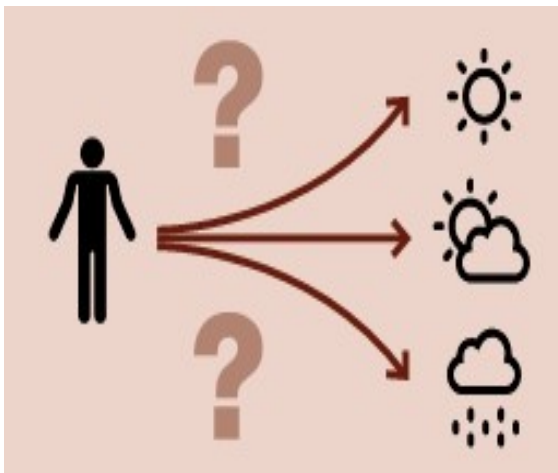
provides the individuals exposed to the disaster hazards to make necessary arrangements to cope with the approaching hazard.¹⁶

The aim is always set to save and reduce the losses incurring to the people and their belongings. The real-time disaster information is highly crucial to tackle such issues however, the lacking knowledge about disaster countermeasures and possible evacuation methods and ignorance would prove otherwise. In community based early warning process, the timely information of the disaster outbreak always holds the priority since without such information, the disaster preparedness of the communities may not be possible thus, the only point of lacking information can result in serious human and livelihood losses.¹⁷

¹⁶ Syamsu Rizal et al., "Natural Disaster Management-Based Model of Community Participation in Makassar", *International Journal of Academic Research* 6, no. 2 (2014): 211-216.

¹⁷ S.W.A. Gunn, "The Scientific Basis of Disaster Management", *Disaster Prevention and Management: An International Journal* 1, no. 3 (1992): 52-67.

The threat assessment is one of the crucial components of the early warning since, the message of the upcoming hazard may reach the responder however, it mainly depends how the individuals act to realize the scale of the hazard they are going to face. In some case, people often get emergency alerts but they usually ignore the level of the severity and remain at ease however, when the disaster affects reach them very close they found it very difficult to avoid higher losses. However, the disaster resilience is also an important means of capacity building for the communities to usually address the disaster risks, and follow appropriate disaster risk reduction process. The bulk of recent disasters are weather-related which are likely to grow as both climate change processes and intensity of weather events are on the rise.¹⁸



The natural hazards only turned into disasters when the communities are vulnerable and unprepared. Effective Early Warning Systems (EWS) have proved beyond doubt to save lives and reduce economic losses; however, they have not been significantly made an integral part of

the disaster management and risk reduction initiatives. The effective Early Warning Systems exceptionally contribute with early detection of uncertain disaster situations.¹⁹

As one of the key component of the disaster management and disaster preparedness at each level whether it may be national, provincial, district, and union council or community levels, the early and reliable information mobilizes towards the early actions.

¹⁸ S.H.M. Fakhruddin and Y. Chivakidakarn, "A Case Study for Early Warning and Disaster Management in Thailand", *International Journal of Disaster Risk Reduction* 9 (2014): 159-180.

¹⁹ Maria Victoria G. Pineda, "Redefining Community Based Disaster Risk Management (CBDRM) Through Enhanced Early Warning Processes", *International Journal of Information and Education Technology* 5, no. 7 (2015): 543-548.

The previous experiences of the disasters show that the timely disseminated warnings saved lives of people living in disaster prone areas. The communities in rural areas of Pakistan were able to evacuate to the safer places and take appropriate measures to safeguard their cattle and other belongings.²⁰ The early warning also provided the government a better opportunity to effectively reach the vulnerable people and initiate a process of immediate rescue operation and provision of necessary relief items.

4.1 Community Based Early Warning Equipment

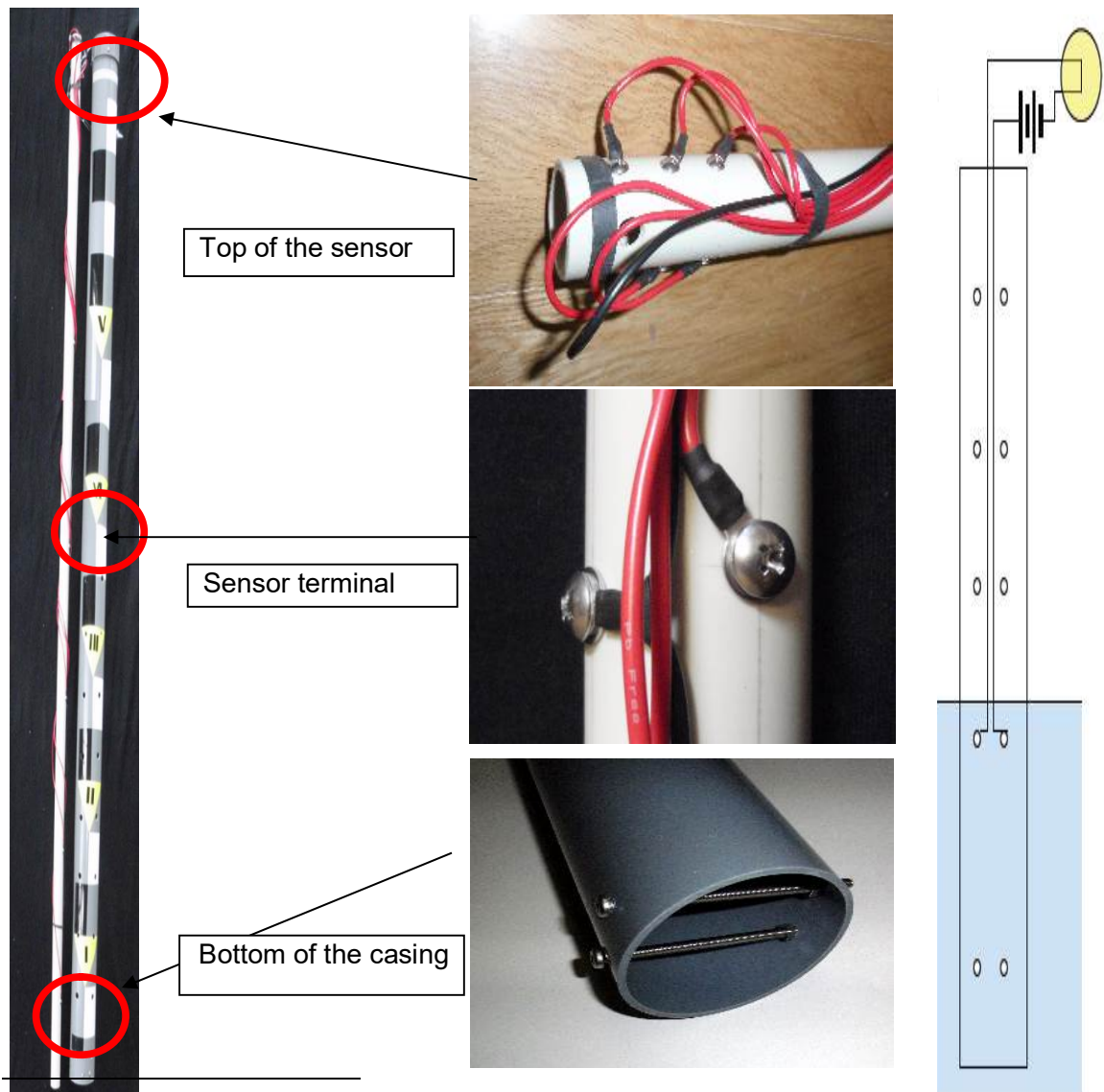
The international advocacy for the empowerment of the communities following the 1995 World Conference for Disaster Reduction in Japan that mainly emphasized for effectiveness of the Community Based Disaster Management and Early Warning System was pioneer in development of simplified technological equipments for the disaster reduction. The equipment was mainly community operated early warning, for instance such component for communities located in small steep river basins comprised of factors considering the floods/debris flows/landslides that occurred by localized heavy rainfall within the river basin where the communities were located. However, in most countries the national observation network was not so dense to cover all such basins. The floods/debris flows/landslides could occur shortly after heavy rainfall. Therefore, people should be warned immediately after rainfall. However, in most countries the national early warning system may not be so quick in operation. To meet such necessity water level equipment and rainfall equipment were developed in the Central America and the Caribbean.²¹

²⁰ S.S.L. Hettiarachchi and S. Weeresinghe, "Achieving Disaster Resilience Through the Sri Lankan Early Warning System: Good Practices of Disaster Risk Reduction and Management", *Procedia Economics and Finance* 18 (2014): 789-794.


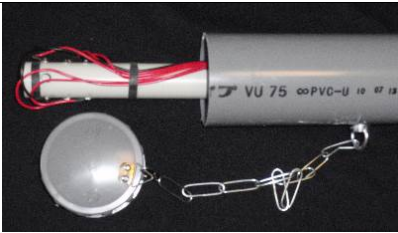


²¹ Masato Motosaka, "Special Issue On Early Warning for Natural Disaster Mitigation", *Journal of Disaster Research* 4, no. 4 (2009): 529-530.

4.1.1 Water Level Equipment

The water level equipment for the communities to monitor the level and the flow of water in order to avoid the threat of flood was developed by CONRED (Guatemala) after the Hurricane Mitch (1998) and has since been in use for COEW in Central America. The equipment has automatic alarm functions and can function as early warning systems for unattended, long-term monitoring of water level and flow. The advanced version of such equipment can be used in many environments, including wells, dams, streams, weirs, storm-water systems, and water or wastewater treatment plants.²²



²² Korem Shiwaku, "Innovative Usage of Disaster Reduction Technology Information", *Asian Journal of Environment and Disaster Management (AJEDM) - Focusing on Pro-Active Risk Reduction in Asia* 03, no. 01 (2011): 105-107.

		
Water Level Sensor (Equipment) Tube and Sensor pole(L:2m, φ:40mm)		
		
Head cover and connecting terminal	Bottom of casing tube	Sensor terminal

They are reliable regardless of salinity level, pollution level, or other harsh environmental conditions. The advanced and development versions of such equipment systems can communicate via GOES satellite, licensed-frequency radio, IP cell modems, spread-spectrum radio, and other methods.²³

4.1.2 Rainfall Equipment



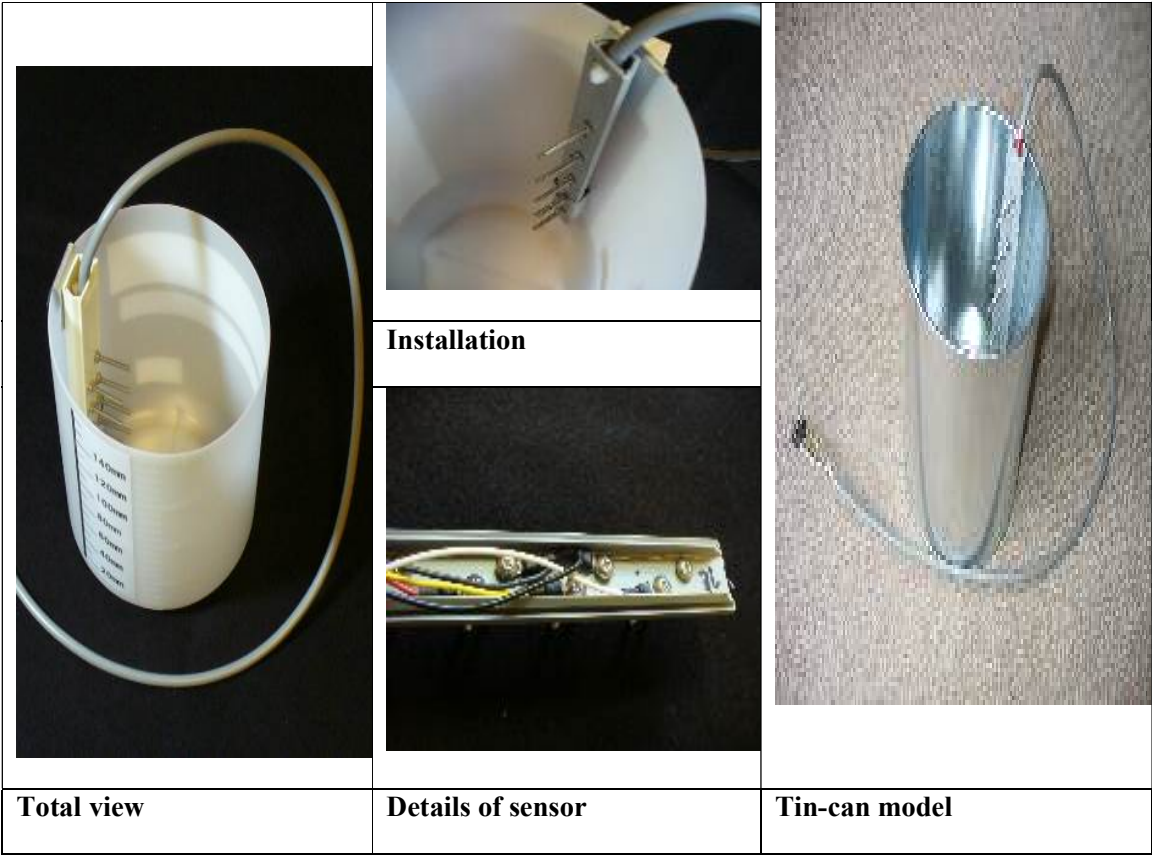
The Rainfall monitoring system with innovative technologies have provided the communities with means to monitor rainfall remotely for any location, track historical records and customize various types of alerts including text messages so that communities can become aware of the situation that when

²³ S.W.A. Gunn, "The Scientific Basis of Disaster Management", *Disaster Prevention and Management: An International Journal* 1, no. 3 (1992): 19-23.

the conditions change.

One of the easy to use equipment of similar type was developed by the University of West Indies (Trinidad & Tobago/CDERA/JICA) in 2004-2005. The equipment was distributed to Caribbean countries for community based early warning equipment to monitor the rainfall level. The equipment contains a bottle depending on the rainfall amount 2 to 3 liters. When it is necessary to measure a larger amount of rainfall than the capacity of the bottle, another small size bottle can be attached. The throw-in type equipment was developed for easier assembly and maintenance by the communities. In such equipment, the sensor is usually installed outside the premises that are connected through a cable to the monitoring apparatus and the connecting cable can be extended to more than 150 m.²⁴

Rainfall Sensor (Throw-in Type)



²⁴ Scott Gabriel Knowles, "Learning from Disaster: The History of Technology and The Future of Disaster Research", *Technology and Culture* 55, no. 4 (2014): 773-784.

Of various types of equipments being used for Community Based Early Warning System, such equipments are one of the suitable and user-friendly equipments. Such equipments are also being used by various international organizations for information sharing various vulnerable communities in the world.

4.2 Flood Early Warning System

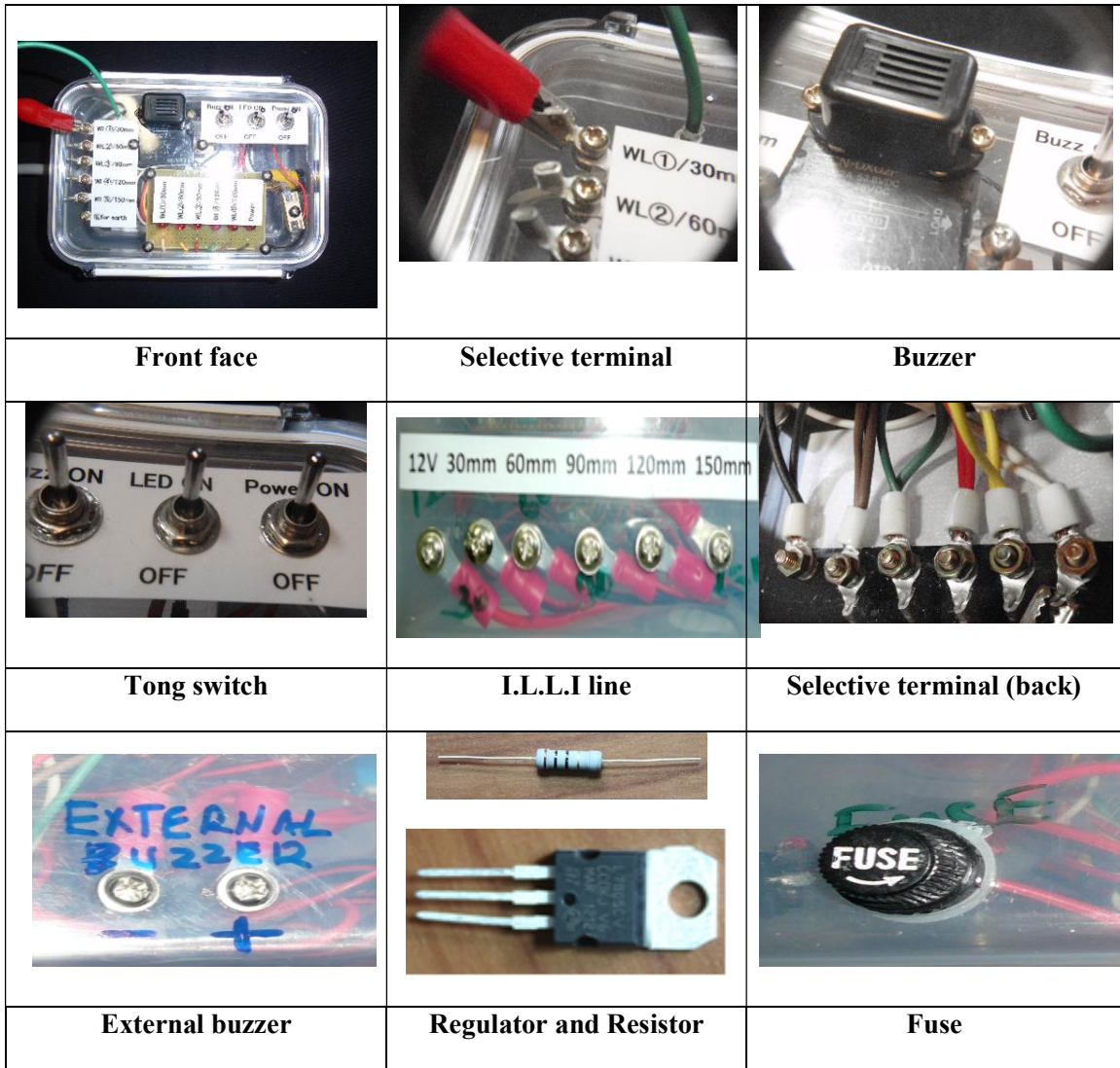
The system monitors sensor networks installed in flood defenses (dikes, dams, embankments, etc.), detects sensor signal abnormalities, calculates dike failure probability, and simulates possible scenarios of dike breaching and flood propagation. All the relevant information and simulation results are fed into an interactive decision support system that helps dike managers and city authorities to make informed decisions in case of emergency and in routine dike quality assessment.

Moreover, a Virtual Dike computational module has been developed for advanced research into dike stability and failure



mechanisms, and for training the artificial intelligence module on signal parameters induced by dike instabilities. The early warning system generic designs and functionality, the computational workflow, the individual modules, their integration are sources of Common Information Space middleware, and the first results of early warning system monitoring and performance benchmarks.²⁵

²⁵ S. Golian et al., "A Deterministic Framework for Selecting a Flood Forecasting and Warning System at Watershed Scale", *Journal of Flood Risk Management* 8, no. 4 (2014): 356-367.



Automated River Gauging Station



Manual River Gauging Station & monitor

Ganga Station		Water Measurement		Discharge Measurement	
Date	Time	Water Level (m)	Discharge (m³/s)	Area (m²)	Velocity (m/s)
11-22-17	19	1	10.22	10.22	
11-23-17	2	2	10.22	10.22	
11-24-17	3	3	10.22	10.22	
11-25-17	4	4	10.22	10.22	
11-26-17	5	5	10.22	10.22	
11-27-17	6	6	10.22	10.22	
11-28-17	7	7	10.22	10.22	
11-29-17	8	8	10.22	10.22	
11-30-17	9	9	10.22	10.22	
12-01-17	10	10	10.22	10.22	
12-02-17	11	11	10.22	10.22	
12-03-17	12	12	10.22	10.22	
12-04-17	13	13	10.22	10.22	
12-05-17	14	14	10.22	10.22	
12-06-17	15	15	10.22	10.22	
12-07-17	16	16	10.22	10.22	
12-08-17	17	17	10.22	10.22	
12-09-17	18	18	10.22	10.22	
12-10-17	19	19	10.22	10.22	
12-11-17	20	20	10.22	10.22	
12-12-17	21	21	10.22	10.22	
12-13-17	22	22	10.22	10.22	
12-14-17	23	23	10.22	10.22	
12-15-17	24	24	10.22	10.22	
12-16-17	25	25	10.22	10.22	
12-17-17	26	26	10.22	10.22	
12-18-17	27	27	10.22	10.22	
12-19-17	28	28	10.22	10.22	
12-20-17	29	29	10.22	10.22	
12-21-17	30	30	10.22	10.22	

← Record of data from RGS

CHAPTER-5

5. Country Profile and Disaster Issues in Pakistan

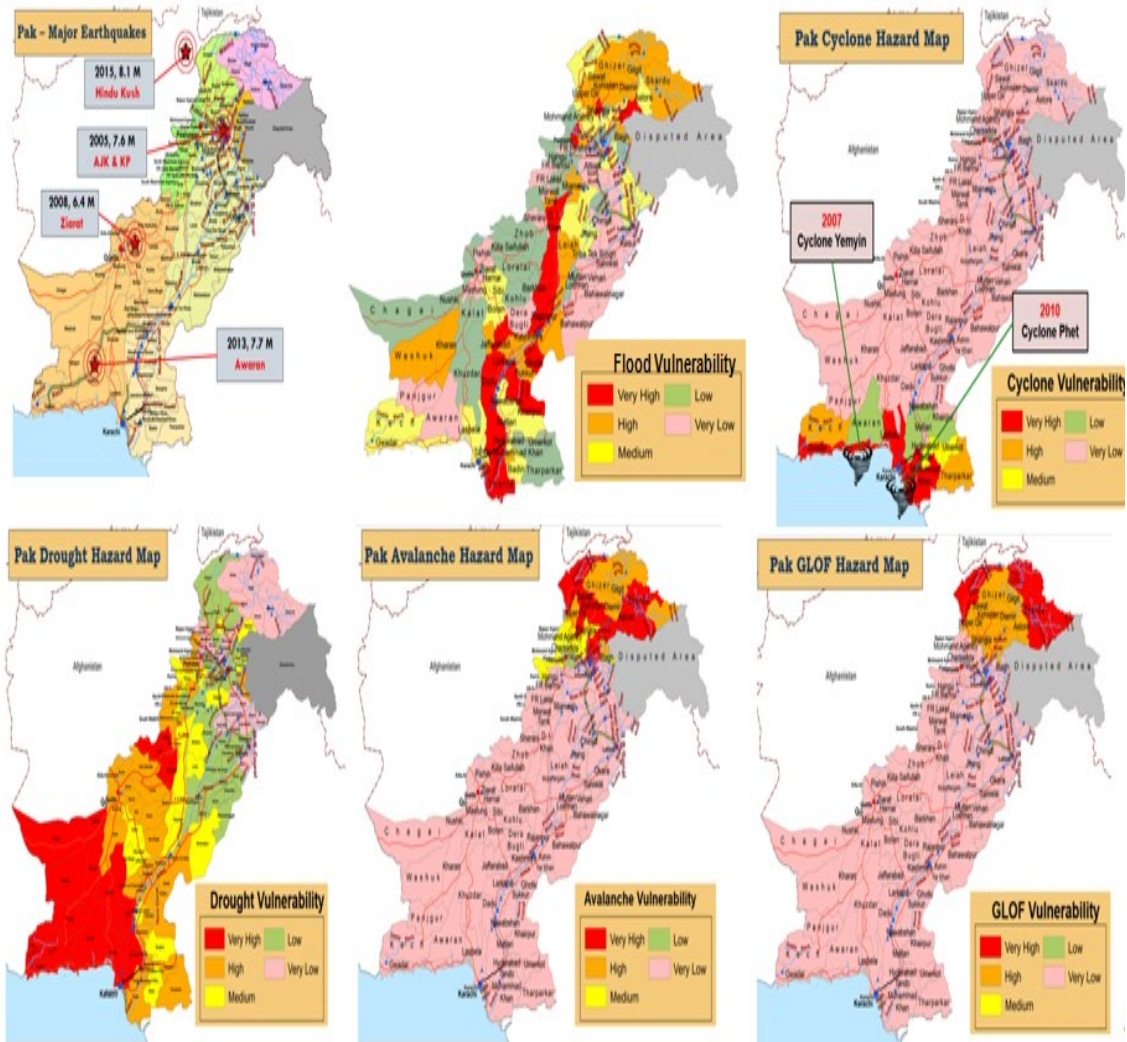
Pakistan with a total area of 796,095 sq km and lies between 24 and 37 degrees north and longitudes 62 and 75 degrees east. The country is highly prone to various hazards since the region wherein Pakistan lies is geographically bestowed with topographical and environmental extremes. Thus, the region hosts all types of terrains and climates, and barely manages extreme conditions. It comprises the four provinces of Punjab, Baluchistan, Khyber Pakhtunkhwa (KPK) and Sindh plus the Federal Capital (Islamabad), Gilgit-Baltistan region (GB) and Tribal Areas (FATA) under the federal administration, and Azad Jammu & Kashmir (AJK). There is a Parliamentary form of Government with a Prime Minister as the executive head and the President as the constitutional head. The National Language is Urdu. The country has a population of approximately 20 million people.²⁶

The country shares its borders with Iran to the west, India in the south-east, Afghanistan in the north-west, and China in the north. The Arabian Sea lies to its South and Pakistan shares total border length of 6,744 km with neighboring countries; with Afghanistan (2,430 km); with China (523 km); with India (2,912 km) and Iran (909 km). The coastal belt is about 1,046 km. Geographically Pakistan can be divided in five major portions included, Northern high mountain ranges (the Himalayas; the Karakorum and the Hindukush), the Balochistan Plateau along western bordering, the Indus River plains in the east, the Salt range across the northern portion of the Punjab province and the Deserts (Cholisthan in Punjab and Thar in Sindh province).²⁷

²⁶ Marc Audi and Amjad Ali, "Socio-Economic Development, Demographic Changes and Total Labor Productivity in Pakistan: A Co-Integrational and Decomposition Analysis", *Journal of Academy of Business and Economics* 17, no. 2 (2017): 7-24.

²⁷ Arshad Ali, Somana Riaz and Shahid Iqbal, "Deforestation and Its Impacts On Climate Change an Overview of Pakistan", *Papers on Global Change IGBP* 21, no. 1 (2014): 26-32.

The country faces severe challenges with continued disaster outbreaks particularly the continued floods, earthquakes, drought, cyclones, GLOF and issues of climatic change are of highly noticeable challenges.

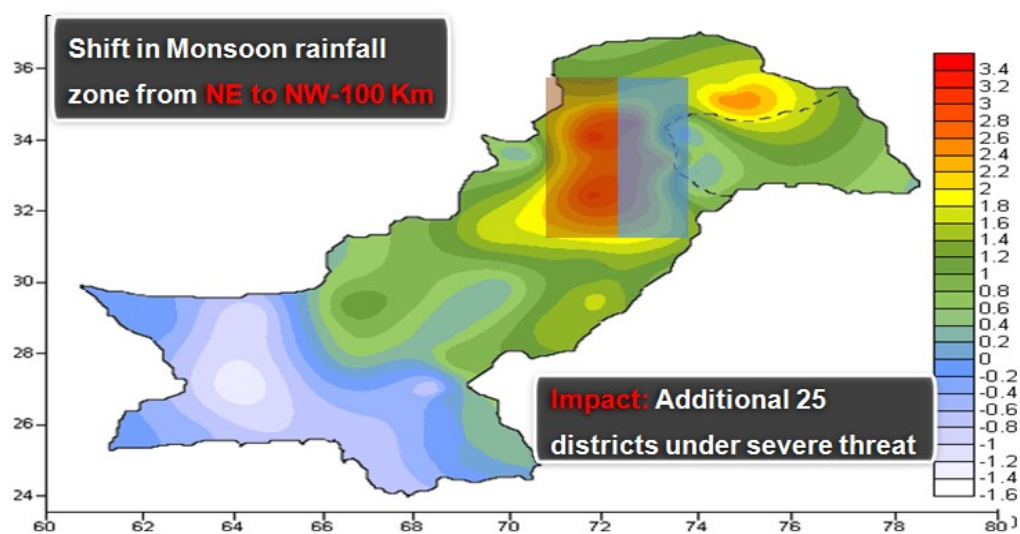


Source: NDMA Pakistan

The country has been heavily investing for the reason that national economy of Pakistan mainly relies over agricultural production however, the situation of continued floods has made in vulnerable to the disaster affects and economic losses. The increased Himalayan river flows mainly due to the climatic change have significantly increased during last two decades. The manmade reasons also have significant contribution in the worsening scenarios by building unnecessary embankments and improperly land use and river

diversion. The massive floods during 2010-11 were some of the greatest recorded disasters in the history of Pakistan. The floods affecting over 14 million people with an approximate loss of \$9.5 million to the economy of Pakistan that included the loss of agricultural production, livelihood, small and medium business and infrastructure of the country.²⁸

The climate of Pakistan varies with its topography but most consists of hot, dry desert, temperate in north-west and arctic in the north. About 60% of the total land area is classified as arid, which receives less than 200 mm annual rainfall. The southern slopes of the Himalayas and the sub mountainous tract receive higher rainfall ranging from 760 to 1270 mm annually. Some areas adjoining Kashmir receive more than 2000 mm precipitation per annum.²⁹



Pakistan has four well marked seasons namely spring, summer, Autumn & Winter. It's usually, cold from November to February; Pre-monsoon (Hot), from March to mid of June; Monsoon, from mid of June to mid of September and Post-monsoon, from mid of

²⁸ Razia Sharif, "Implications of Environmental Considerations for Floods in Pakistan", *IOSR Journal of Environmental Science, Toxicology and Food Technology* 6, no. 1 (2013): 32-35.

²⁹ Zareen Shahid and Awais Piracha, "Climate Change Impacts in Pakistan", *The International Journal of Climate Change: Impacts and Responses* 2, no. 1 (2010): 119-130.

September to October. Summer season is extremely hot and the relative humidity ranges from 25% to 50%. Day-time temperature in this season remains 40°C and beyond in plain areas. The average temperatures in winter range from 4°C to 20°C. Mercury sometimes falls well below freezing point in Northern parts of the country. Temperatures can be as low as - 27°C in the north (at Skardu) in winter and as high as 52°C in the southern parts during summer.³⁰

Increased Temperatures 2016 - 2035 (IPCC AR5)

Global versus Pakistan Decadal Mean Temperature Trends

Period	Global	Pakistan
1901-2000	0.06 °C	0.06°C
1956-2005	0.12 °C	0.16°C
1971-2005	0.15 °C	0.26°C
1981-2005	0.17 °C	0.39°C
1991-2005	0.33 °C	0.74°C
2010-2039	0.7°C*	1°C

***The mean temperature rise after 1950s over Pakistan is
twice as fast as the Global Mean Change***

Source: NDMA Pakistan

5.1 Disaster Context & Risk Profile of Pakistan

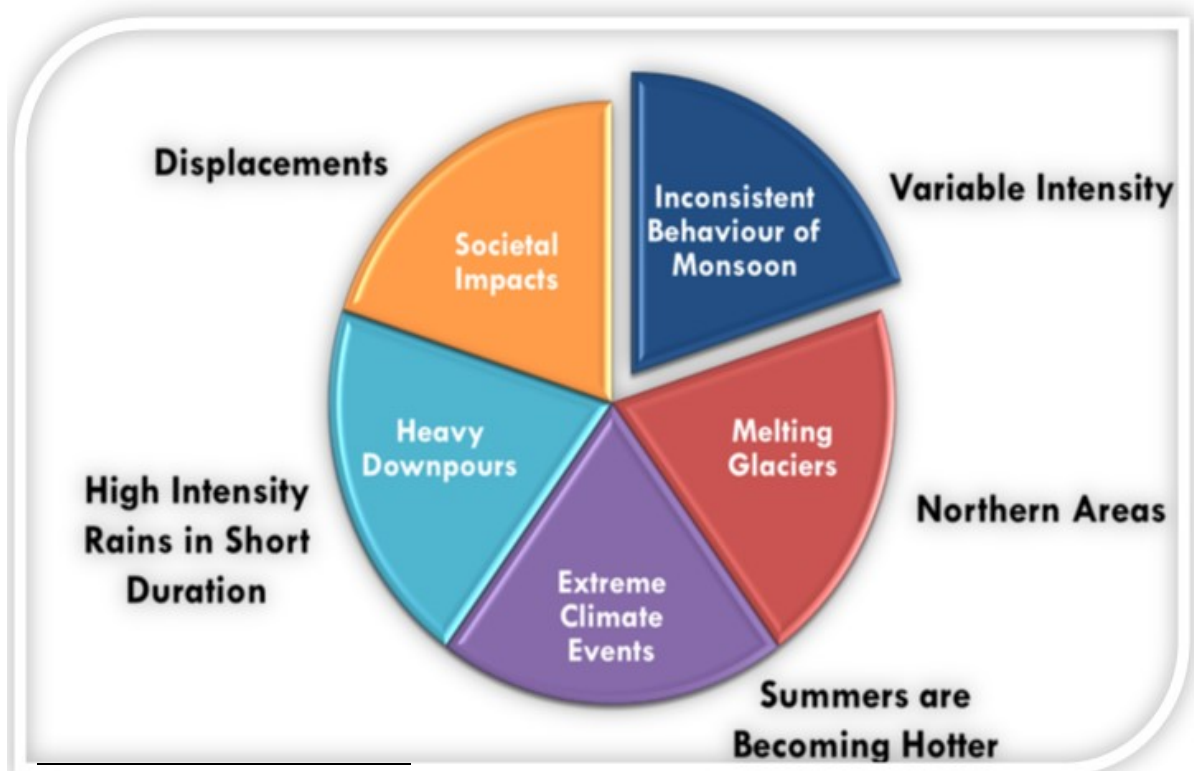
Pakistan frequently suffers from earthquakes. Northern and Western parts are particularly vulnerable to earthquakes. The Indus River is known as flood-prone area especially in July and August. High priority hazards in terms of their frequency and scale of impact

³⁰ Muhammad Abid, Uwe A. Schneider and Jürgen Scheffran, "Adaptation to Climate Change and Its Impacts On Food Productivity and Crop Income: Perspectives of Farmers in Rural Pakistan", *Journal of Rural Studies* 47 (2016): 254-266.

are: earthquakes, flooding, droughts, wind storms and landslides that have caused widespread damage and losses in the past.

Geo-physical conditions, climatic extremes, and high degrees of exposure and vulnerability, made Pakistan a disaster-prone country. Pakistan's exposure to natural hazards and disasters could be ranked between moderate to severe.³¹

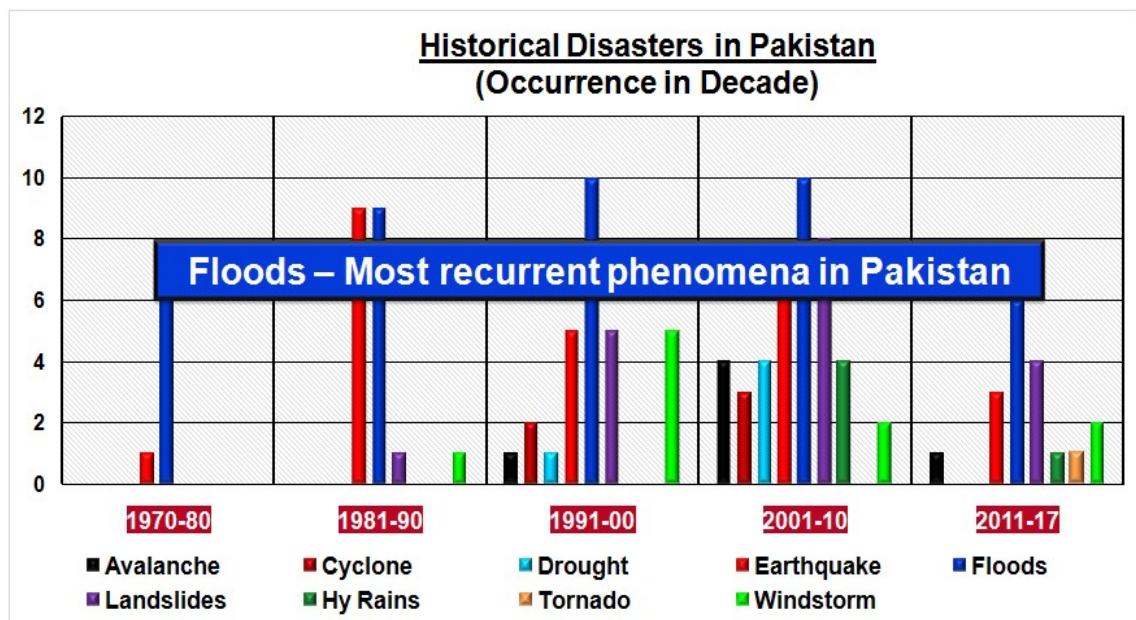
A range of hydro meteorological, geo-physical and biological hazards including earthquakes, floods, tsunamis, cyclones and storms, droughts, glacial lake outbursts, landslides, avalanches, pest attacks and epidemics pose risks to Pakistani society. Some of these hazards (e.g. floods, landslides etc.) are predominantly seasonal and occur on an annual basis, whereas other hazards such as earthquakes and tsunamis are rare events but potentially highly destructive.³²



³¹ Wahid Ullah, "Climate Change Vulnerability of Pakistan Towards Natural Disasters: A Review", *International Journal of Environmental Protection and Policy* 4, no. 5 (2016): 126-127.

³² Andrew Wilder, "Aid and Stability in Pakistan: Lessons from The 2005 Earthquake Response", *Disasters* 34 (2010): 406-426.

The historical overview of the statistics of the period from 1947 to 2017 lay out Pakistan’s disaster profile. One hundred and seventy-two natural disastrous events resulted in loss of 11 hundred thousand human lives, left near 9.5 million people homeless and cost an economic loss of more than 2.8 billion dollars. The pie chart given bellow describes a more detailed and clearer picture about the disaster history of Pakistan.³³



Source: NDMA Pakistan

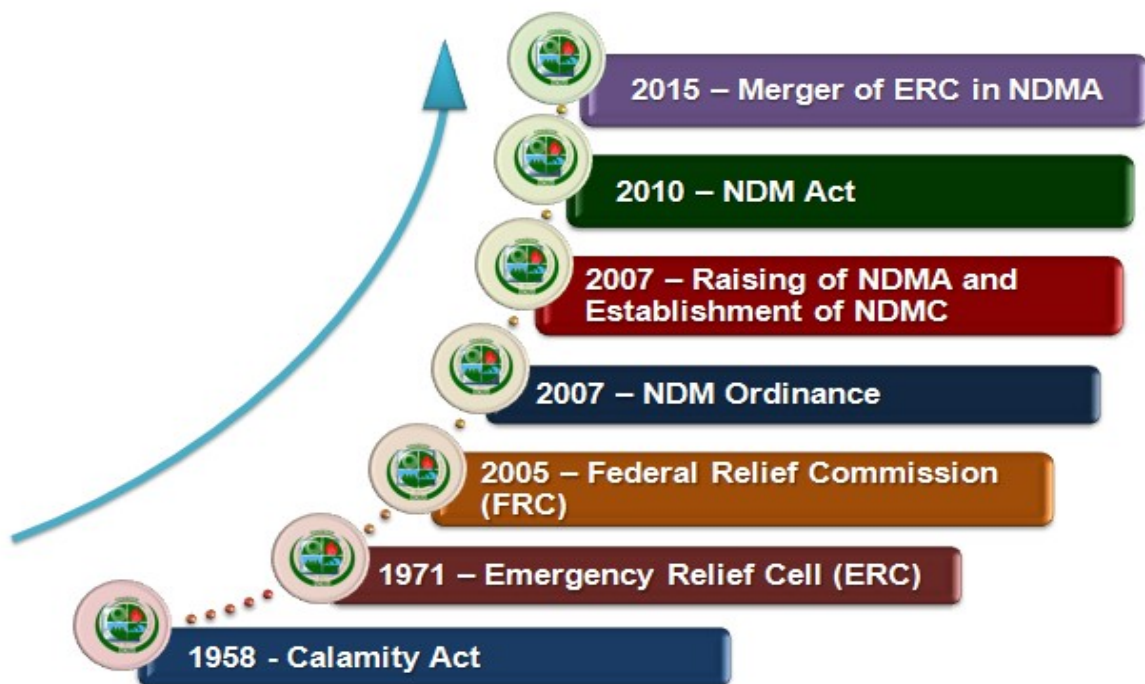
The country’s disaster context in terms of water management is high concerns that include impacts on various socio-economic sectors. The water variability in the river flow often causes loss of natural reservoirs, reduced yield of crops etc. likewise, the monsoon period, the country frequently experiences floods. Such disaster impacts also result into energy crisis with reduced availability of water for hydropower generation reduced

³³ Kashif Saeed Khan, Nadarajah Shanmugaratnam and Ingrid L.P. Nyborg, "Recovering from Disasters: A Study of Livelihoods in Post-Quake Villages in Northern Pakistan", *Disasters* 39, no. 2 (2017): 339-361.

thermal power plant efficiency at high temperatures, increased transmission and distribution / line losses and the increase in electricity demand. The energy crisis is severely hampering the economic growth of the country.

5.2 Disaster Management System in Pakistan

Prior to Earthquake 2005, the West Pakistan National Calamities Act of 1958 was the available legal remedy that regulated the maintenance and restoration of order in areas affected by calamities and relief against such events. An Emergency Relief Cell within the Cabinet Division has been serving since 1971 as an institutional disaster relief support at the national level. Similar institutional arrangements existed at the provincial level in the form of relief commissioners.³⁴



Source: NDMA Pakistan

The NDM Act of 2010 is comprehensive national DR policy guideline that elaborates following components of the system: -

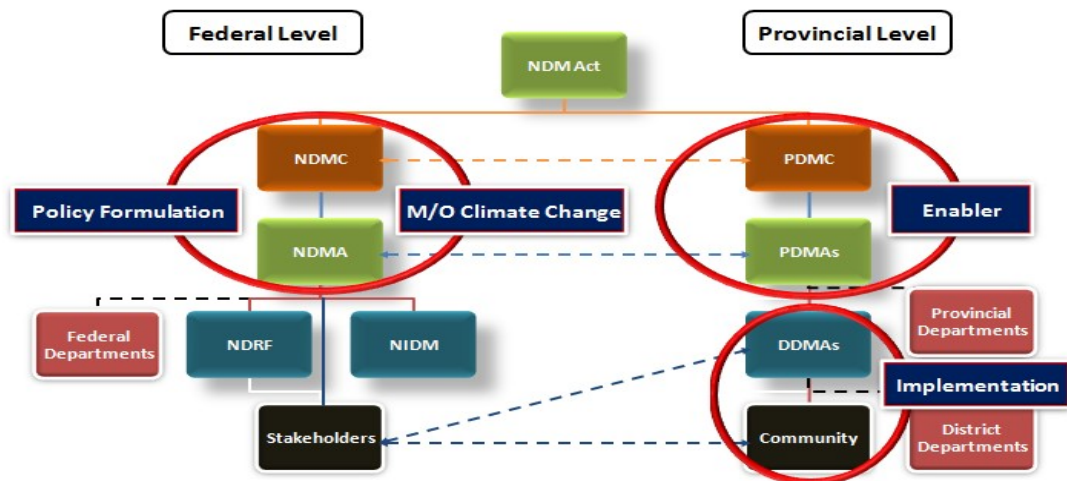
- a. National Disaster Management Commission (NDMC)
- b. National Disaster Management Authority (NDMA)

³⁴ Kamran Siddiqi, "The Pakistan Earthquake: A Personal Experience", *The Lancet* 367, no. 9515 (2006): 986.

- c. Provincial Disaster Commission(PDMC)
- d. Provincial Disaster Management Authorities(PDMAs)
- e. District Disaster Management Authorities(DDMAs)
- f. National Institute of Disaster Management(NIDM)
- g. Obligation of Federal and Provincial Governments in case of disaster.
- h. Establishment of National / Provincial Fund for Disaster Management (N/PDMF).

However, that government provided a reactive approach towards emergency response only. The occurrence of devastating earthquake of 2005, followed by global obligations has provided the required stimuli for the government to introduce a new Disaster Management System in the Country. Subsequently, the National Disaster Management (NDM) Ordinance was promulgated in December 2006 which became NDM Act with the approval of the Parliament in 2010. This Act serves as the primary law of the land in the field of disaster management and to implement the law, National Disaster Management Authority (NDMA) was created under National Disaster Management Commission (NDMC). Similar arrangements were enacted in the four provinces, FATA, GB and AJ&K. The creation of National Disaster Management Commission under stewardship of the Prime Minister, and its executive organ National Disaster Management Authority ushered an across the board transformation of the national perspective about the subject of DRM.

Disaster Management Structure of Pakistan



5.2.1 National Disaster Management Commission (NDMC)

The National Disaster Management Commission (NDMC) headed by prime minister has been established for the formulation of overall policies & guidelines etc. at national level while Provincial Disaster Management Commission (PDMC) headed by the chief minister of respective province at provincial level. Chairman NDMA and Director General PDMA will act secretary of the Commission at federal and provincial level respectively. The Key members of NDMC included:

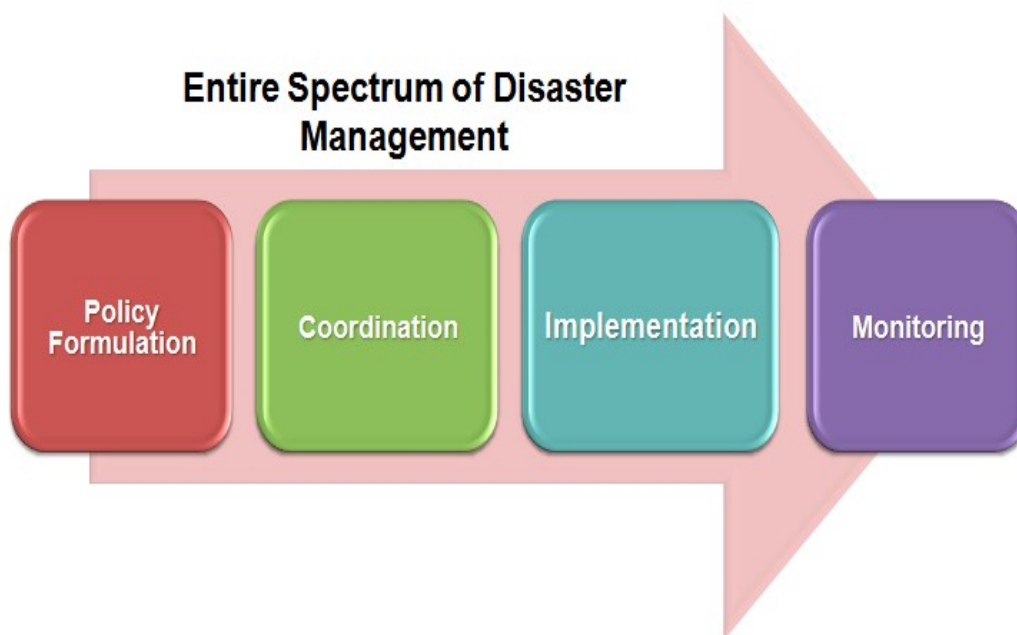
- a. The Prime Minister of Pakistan – Chair
- b. Leader of Opposition in the Senate & National Assembly
- c. Key Federal Ministers (Like Defense/interior/communications/ Health/ Finance etc.)
- d. Governor KPK (for FATA)
- e. Chief Ministers of all four Provinces
- f. Prime Minister, AJK & GB
- g. Chairman, JCSC or his nominee; and
- h. Civil Society and Co-opted Members.

The main powers and functions of the National Commission includes but not limited to: -

- a. Lay down the policies, plans and guidelines for disaster management.
- b. Approve the National Plan.
- c. Approve plans prepared by the Ministries or Divisions of the Federal Government in accordance with the National Plan.
- d. Arrange for, and oversee, the provision of funds for the purpose of mitigation measures, preparedness and response.
- e. Provide such support to other countries affected by major disasters as Federal Government may determine.

5.2.2 National Disaster Management Authority (NDMA)

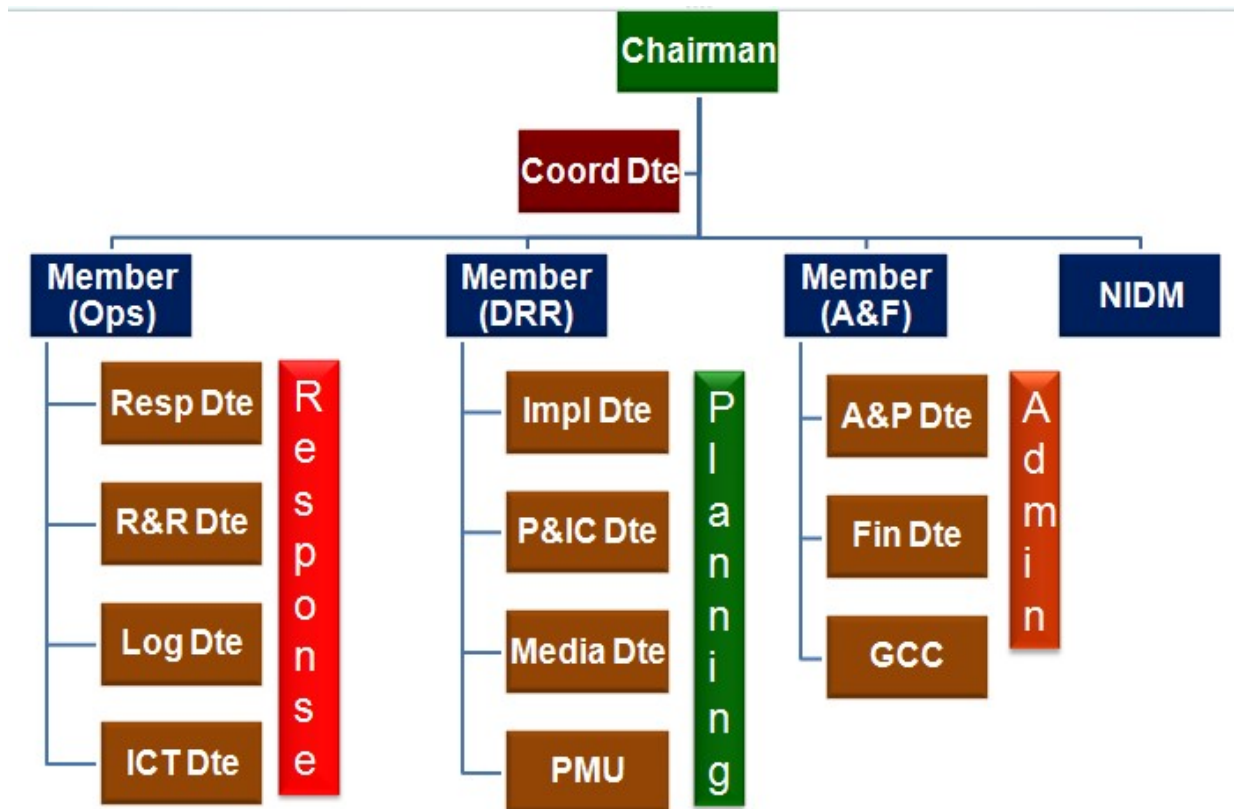
Sequel to the NDMO/ NDMA Act, National Disaster Management Authority (NDMA) at federal level was established in 2007. National Disaster Management Authority (NDMA) is the lead agency at the Federal level to deal with the whole spectrum of Disaster Management activities. It is the executive arm of the National Disaster Management Commission (NDMC) which has been established under the Chairmanship of the Prime Minister as the apex policy making body in the field of Disaster Management. In the event of a disaster, all stakeholders including Government Ministries / Departments / Organizations, Armed Forces, INGOs, NGOs, UN Agencies work through and form part of the NDMA to conduct one window operations.



It is established under the National Disaster Management Act – 2010 and functions under the supervision of National Disaster Management Commission (NDMC) which is headed by the Prime Minister of Islamic Republic of Pakistan. NDMA manages the whole Disaster Management Cycle (DMC) which includes Preparedness, Mitigation, Risk

Reduction, Relief and Rehabilitation. A National Disaster Management Plan (NDMP) is prepared and is followed towards provision of better services to the affected ones.

Organizational Structure of NDMA



Source: NDMA Pakistan

The power of the Authority includes but not limited to: -

- a. Act as the implementing, coordinating and monitoring body for disaster management;
- b. Prepare the National Plan to be approved by the National Commission;
- c. Implement coordinate and monitor the implementation of the National policy;
- d. Lay down guidelines for preparing disaster management plans by different Ministries or Departments and the Provincial Authorities;

- e. Provide necessary technical assistance to the Provincial Governments and the Provincial Authorities for preparing their disaster management plans in accordance with the guidelines laid down by the National Commission;
- f. Coordinate response in the event of any threatening disaster situation or disaster;
- g. Promote general education and awareness in relation to disaster management;
- h. Lay down guidelines for, or give directions to the concerned Ministries or Provincial Governments and the Provincial Authorities regarding measures to be taken by them in response to any threatening disaster situation or disaster.³⁵

³⁵ Atta-ur- Rahman, *Disaster Risk Reduction Approaches in Pakistan*, 1st ed. (Tokyo: Springer Verlag, JAPAN, 2016).

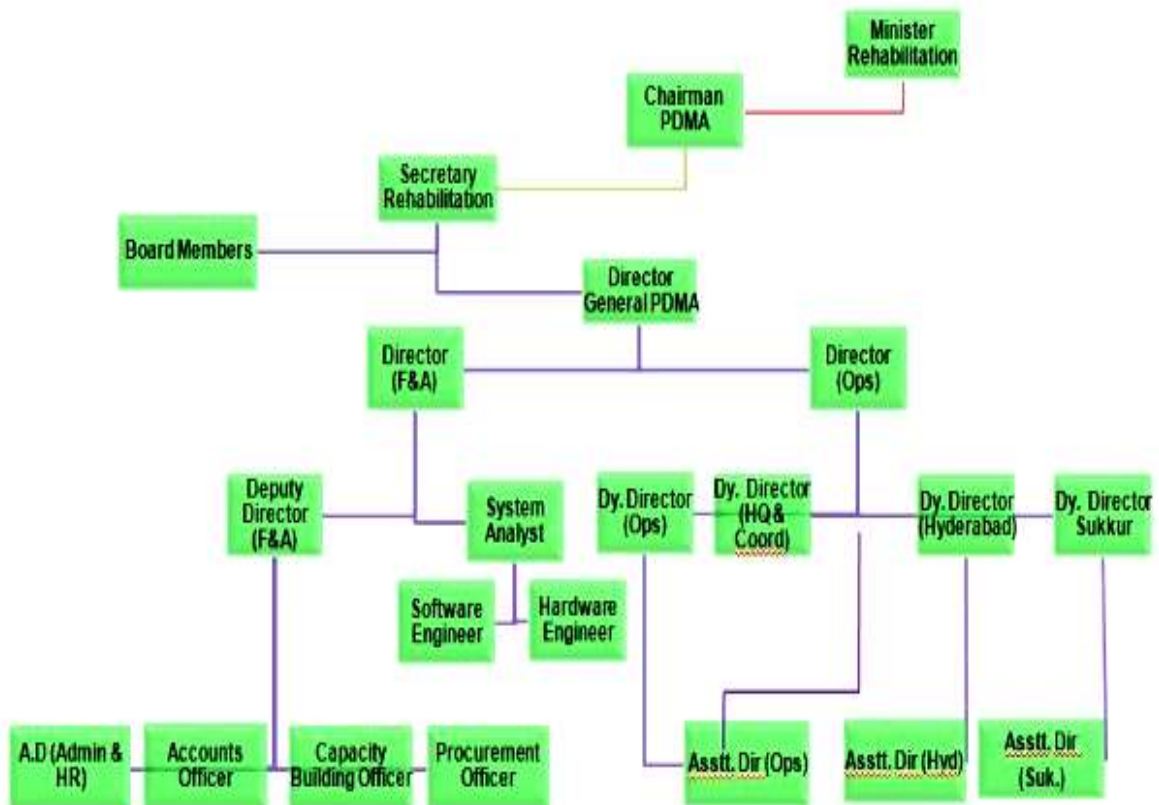
5.2.3 Provincial Disaster Management Authority (PDMA)

The Provincial Authority is established at each province including region of Gilgit–Baltistan and Azad Jammu & Kashmir. Key powers and functions of the Provincial Authorities includes: -

- a. Responsible for implementing policies and plans for disaster management in the Province.
- b. Formulate the provincial disaster management policy obtaining the approval of the Provincial Commission;
- c. Coordinate and monitor the implementation of the National Policy, National Plan and Provincial Plan.
- d. Examine the vulnerability of different parts of the Province to different disasters and specify prevention or mitigation measures.
- e. Lay down guidelines to be followed for preparation of disaster management plans by the Provincial Departments and District Authorities.
- f. Promote general education, awareness and community training.
- g. Ensure that communication systems are in order and disaster management drills are being carried out regularly;
- h. Coordinate response in the event of disaster;
- i. Evaluate preparedness at all governmental or non-governmental levels to respond to disaster and to enhance preparedness.
- j. Directions to any Provincial department or authority regarding actions to be taken in response to disaster;
- k. Provide necessary technical assistance or give advice to district authorities and local authorities for carrying out their functions effectively;

- l. Advise the Provincial Government regarding all financial matters in relation to disaster management;
- m. Examine the construction in the area and if it is of the opinion that the standards laid down have not been followed and it may direct the following same to secure compliance of such standards;
- n. Perform such other functions as may be assigned to it by the National or Provincial Authority.³⁶

Organizational Structure of PDMA



Source: PDMA Sindh

³⁶ Rajib Shaw, Juan M Pulhin and Joy J Pereira, *Climate Change Adaptation and Disaster Risk Reduction*, 1st ed. (Bingley, UK: Emerald, 2010).

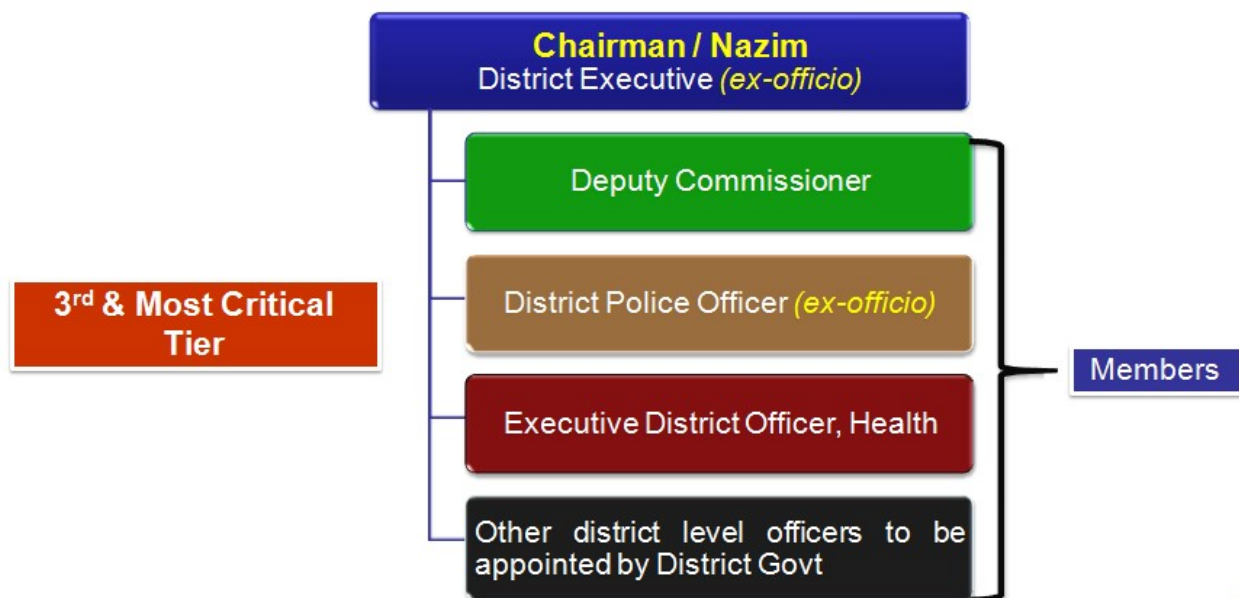
5.2.4 District Disaster Management Authority (DDMA)

As per NDM Act 2010, each Provincial Government shall establish a District Disaster Management Authority (DMA) for every district. The District Authority acts as the district planning; coordinating and implementing body for disaster management and take all measures for the purposes of disaster management in the district in accordance with the guidelines laid down by the National Authority and the Provincial Authority. The mandate of the District Authority includes but not limited to:

- a. Prepare a disaster management plan including district response plan for the district;
- b. Coordinate and monitor the implementation of the National Policy, Provincial Policy, National Plan, Provincial Plan and District Plan;
- c. Ensure that the areas in the district vulnerable to disasters are identified and measures for the prevention of disasters and the mitigation of its effects are undertaken by the departments of the Government at the district level as well as by the local authorities;
- d. Ensure that the guidelines for prevention, mitigation, preparedness and response measures as laid down by the National Authority and the Provincial Authority are followed by all departments of the Government at the district level and the local authorities in the district;
- e. Organize and coordinate specialized training programs for different levels of officers, employees and voluntary rescue workers in the district;
- f. Facilitate community training and awareness programs for prevention of disaster or mitigation with the support of local authorities, governmental and non-governmental organizations;

- g. Encourage the involvement of non-governmental organizations and voluntary social-welfare institutions working at the grassroots level in the district for disaster management set up, maintain, review and upgrade the mechanism for early warnings and dissemination of proper information to public;
- h. Identify buildings and places which could, in the event of disaster situation be used as relief centers or camps and make arrangements for water supply and sanitation in such buildings or places;
- i. Establish stockpiles of relief and rescue materials or ensure preparedness to make such materials available at a short notice.

Organizational Structure of PDMA



Source: NDMA Pakistan

The Act has also delegated additional powers to District Authorities for the purpose of assisting, protecting or providing relief to the community, in response to any disaster like:

- a. Give directions for the release and use of resources available with any department of the Government and the local authority in the district;

- b. Control and restrict vehicular traffic to, from and within, the vulnerable or affected area;
- c. Remove debris, conduct search and carry out rescue operations;
- d. Provide shelter, food, drinking water and essential provisions, healthcare and services;
- e. Establish emergency communication systems in the affected area;
- f. Procure exclusive or preferential use of amenities from any authority or person.³⁷

5.2.5 National Institute of Disaster Management (NIDM)

The Act allowed the Federal Government to establish an institute to be called the National Institute of Disaster Management (NIDM). Subject to the provisions of this Act, the National Institute of Disaster Management shall be responsible for planning and promoting training and research and developing core competencies in the area of disaster management.

The NIDM is a premier institute of training and capacity development programs for managing natural disasters occurring in Pakistan. It started functioning in 2008 but was not formally inaugurated till February 15 2010. Taking a ride through times when NIDM came into existence, Human Resource development and capacity building can be pointed as a building factor. Human resource not only involves the workforce of the institute but all the related organizations playing a part in preparedness, prevention, recovery and relief i.e. welfare agencies, NGO's, community development as well as general public.

The NIDM has following major objectives: -

- To develop curriculum on various facets of disaster management;

³⁷ Zubair Ahmed, "Disaster Risks and Disaster Management Policies and Practices in Pakistan: A Critical Analysis of Disaster Management Act 2010 Of Pakistan", *International Journal of Disaster Risk Reduction* 4, no. 3 (2013): 15-20.

- To undertake training, research and other related activities on disaster management;
- To develop linkages and build partnerships with national and international academic institutions;
- To develop network of disaster management professionals and master trainers working in various disciplines in the country and abroad;
- Publish newsletters, books, research journals, and audiovisuals to raise disaster risk awareness among general public;
- Liaison with the NIDM and NDMA alumni and engage them in different activities i.e. trainings, workshop and technical assistance;
- Establish and maintain database on disasters in the country and give regular updates through NIDM website.

The human resource development is an integral part of Disaster Risk Management (DRM). Structural and / or engineering interventions yield far less dividends if research, training and awareness components are undermined. In South Asia, DRM is relatively a new subject but owing to the region's exposure to a number of natural and human-induced threats, different countries have started taking a holistic approach by establishing dedicated institutes for public awareness and capacity building purposes. It reflects the significance of research and training for reducing disaster risks and lessening hazard impacts. It is widely argued by disaster experts that knowledge, information and training make a community more resilient against the consequences of hazards.

The Government of Pakistan is also striving to promote DRM as one of the priority development concerns. Its need was more crucial because of the consequent disasters which stressed upon the need of adopting a proactive approach by taking disaster risk reduction options to safe guard lives and properties. The creation of NDMA is an

example of landmark achievement. However, there was a growing realization that in the absence of a full-fledged academic institute dedicated for providing research and training services, it would have been difficult to achieve the objectives of DRM. On the other hand, the utility of existing training facilities had been marred over the years due to lack of resources, commitment, the quality of contents and delivery.

In this backdrop, National Institute of Disaster Management (NIDM) was established for effectively catering to research and training needs of the public and private sectors on DRM. The NIDM is empowered to: -

- a. Develop training modules, undertake research and documentation in disaster management and organize training programs;
- b. Formulate and implement a comprehensive human resource development plan covering all aspects of disaster management;
- c. Provide assistance in national level policy formulation;
- d. Provide required assistance to the training and research institutes for development of training and research programs for stakeholders including Government functionaries;
- e. Provide assistance to the Provincial Governments in the formulation of Provincial level policies, strategies, disaster management framework and any other assistance as may be required by the Provincial Governments for capacity-building of stakeholders, Government including its functionaries, civil society members, corporate sector and people's elected representatives;
- f. Develop educational materials for disaster management including academic and professional courses;

- g. Promote awareness among stakeholders including college or school teachers and students, technical personnel and others associated with multi-hazard mitigation, preparedness and response measures;

The Act also entrusted the Federal Governments to take all such measures as it deems necessary or expedient for the purpose of disaster management and shall include all such measures pertaining to: -

- a. Coordination of actions of the Ministries and Divisions of the Federal Government, Provincial Governments, National Authority, Provincial Authorities, governmental and non-governmental organizations in relation to disaster management;
- b. Cooperation and assistance to Provincial Governments, as requested by them or otherwise deemed appropriate by it;
- c. Requisition and deployment of armed forces, civil armed forces or any other civilian personnel or foreign contingents required for the purposes of this Act;
- d. Coordination with the United Nations agencies, international organizations and governments of foreign countries for the purposes of this Act;
- e. Establish institutions for research, training, and developmental programs in the field of disaster management.

The Federal Government may extend such support to other countries affected by major disaster as it may deem appropriate. Similarly, the Provincial Government, subject to the provisions of this Act, shall take all measures specified in the guidelines laid down by the National Authority and such further measures as it deems necessary or expedient, for the purpose of disaster management in their respective province.³⁸

³⁸ Zubair Ahmed, "Disaster Risks and Disaster Management Policies and Practices in Pakistan: A Critical Analysis of Disaster Management Act 2010 Of Pakistan", *International Journal of Disaster Risk Reduction* 4, no. 3 (2013): 15-20.

5.2.6 National / Provincial Funds for Disaster Management

The management of disasters, the resources always plays a key role. The Federal Government shall constitute a Fund to be called the National Disaster Management Funds for meeting any threatening disaster situation or disaster. The NDMF shall be administered by the National Authority towards meeting the expenses for emergency preparedness, response, mitigation, relief and reconstruction. The NDMF shall be financed from the following sources, namely: -

1. Grants made by the Federal Government;
2. Loans, aid and donations from the national or international agencies; and
3. Donations received from any other source.

5.2.7 Provincial Disaster Management Funds (PDMF)

Like, Provincial Disaster Management Fund shall be administered by the Provincial Authority towards meeting the expenses for emergency preparedness, response, mitigation, relief and reconstruction in the Province. The disaster management system is a well-articulated robust system, based on international good practices and local dynamics.

The system is growing, despite limited resources and disaster management capacities. The performance of the system witnessed appreciation not at national level but has also gained attention of international community during the past disasters.

The PDMF shall be financed from the following sources, namely: -

1. Grants made by the Federal Government or Provincial Governments; and
2. Loans, aid and donations from the national or international agencies provided in accordance with prescribed procedure. It may be highlighted that the Federal

Government and Provincial Governments shall, in their annual budgets, make provisions for funds for the purposes of carrying out the activities and programs set out in its disaster management plan.³⁹

³⁹ Shariq Riaz Khattak, "Standard Criteria Response Mechanism of Pakistan Disaster Management Authority (PDMA) And Asian Development Bank (ADB): Evidence from Pakistan", *Advances in Social Sciences Research Journal* 4, no. 10 (2017): 13-16.

CHAPTER-6

6. Pakistan Disaster Management & International Obligations

Establishment of “Safer and Resilient” societies is the most ever desire of every people centric government of the world. However, achieving resilient societies is a long journey and requires number of intervention from grassroots to state and international level. Among all these actions, the top ranked action would be promotion of disaster education and comprehensive awareness strategies at all sphere including community, state, national and global level. The country has been frequently facing hydro-metrological hazards therefore, to cope with such challenges it has been actively participating international organization cooperation to build a safer society.



Source: NDMA Pakistan

6.1 Pakistan's Participation in International Cooperation & Commitments

The international organizations along with regional and local collaborations can help focus the attention of national governments and policy makers on the importance of natural hazards awareness and disaster risk reduction education programs. International organizations have a key role to play with regard to long-term planning as they are decoupled from the shorter-term political mandates of national, local and local decision-makers. International efforts may also lead to the establishment of transnational platforms and networks aimed at developing a coherent cross-border approach to disaster risk management strategies and promoting a culture of safety in the long run.

6.1.1 Sendai Framework for Disaster Risk Reduction (SFDRR -2015-2030)

Sendai Framework for Disaster Risk Reduction-2015-2030 vide achievable actions under its Priority-1 has states “understanding disaster risk to build the knowledge of government officials at all levels, civil society, communities and volunteers, as well as the private sector, through sharing experiences, lessons learned, good practices and training and education on disaster risk reduction, including the use of existing training and education mechanisms and peer learning and promote national strategies to strengthen public education and awareness in disaster risk reduction, including disaster risk information and knowledge, through campaigns, social media and community mobilization, taking into account specific audiences and their needs.

6.1.2 The Hyogo Framework for Action (HFA)

Prior to the inception of Sendai Framework, the Hyogo Framework for Action (HFA) also highlighted the importance, role of education and public awareness in building the culture of safety and resilience at all levels. The Hyogo Framework for Action 2005-2015, has explicitly called for the “integration of disaster risk reduction as an intrinsic element of the United Nations Decade of Education for Sustainable Development (2005–2014).

Experience shows that impacts of disasters can be substantially reduced if communities are well prepared and ready to act and are equipped with the knowledge and capacities for effective disaster management and Effective public awareness and education activities help local communities acquire the skills and knowledge to make informed decisions on how to reduce their vulnerability to disasters, enhance their capacity and adapt their livelihoods to withstand current and future risks, as well as to demand greater action and accountability from those responsible.

6.1.3 The Global Platform for Disaster Risk Reduction (GPDRR)

During its various sessions for the safer future from disasters, the GPDRR has been stipulating, the role of public awareness and education in building community resilience.

It significantly focuses on:

- 1) Ensuring greater funding and action on safe education facilities, management and integration of DRR in formal and non-formal learning.
- 2) Agreement towards for a common global framework on Education for DRR.
- 3) Secure greater South to South collaboration on good practice and lessons learning for advancing DRR and Education.
- 4) The UNESCO supports countries to include DRR components into education policies and plans as well as school programs and curricula to increase the level of preparedness and protection of individual learners and entire communities. Disaster preparedness work is linked with efforts to integrate education for sustainable development (ESD), including climate change adaptation into the education system with the overall aim of building resilient and sustainable communities through education. UNESCO's work on DRR education refers to key dimensions of an integrated approach on School Safety which encompasses

structural safety, as well as school disaster management and disaster prevention education and curriculum development.

- 5) The DRR Education at global level has been coordinated, through the ISDR Thematic Platform on Knowledge and Education (TPKE), which includes UN agencies, International Organizations, International NGOs. TPKE platform, now called Global Alliance for DRR knowledge and education, promotes joint multi-stakeholder strategies for enhancing knowledge and education for disaster risk reduction as an intrinsic element of UN Decade of Education for Sustainable Development (DESD), 2005-2014.⁴⁰

6.1.4 The Red Cross Red Crescent National Societies

The Red Cross Red Crescent National Societies have a long tradition in working with communities on disaster risks, increasing safety and resilience through campaigns, informal education, participatory learning and formal school-based interventions. RCRC National Societies have developed a wide array of tools to support these activities and have carried out structured public-awareness and education activities on disaster reduction. Many of these activities are connected to children and schools.

6.1.5 International Federation of the Red Cross

The International Federation of the Red Cross produced a guide on public awareness and public education (PAPE) for DRR, as well as in 2012 key DRR messages to be used in PAPE activities.

As per NDM Act 2010, the National Disaster Management Authority (NDMA) has mandated to “promote general education and awareness in relation to disaster management” in the country. Similarly, the Provincial Disaster Management Authorities

⁴⁰ Elaine Enarson and P. G. Dhar Chakrabarti, *Women, Gender and Disaster*, 1st ed. (New Delhi: Sage Publications India Pvt, Ltd., 2015).

are also required to “promote general education, awareness and community training” at their respective provinces / regions.⁴¹

6.2 National DRR Policy Perspective

Under National Disaster Risk Reduction Policy (NDRRP), the Intervention No. 3.2.4 “Promoting risk awareness and knowledge through DRR education vide “Promoting DRR through public awareness campaigns” stipulates that “Reaching the wider public with DRR messages requires clearly targeted awareness campaigns with clear objectives, core target groups and appropriate methodologies that ensure messages reach men and women. The NIDM has an important role to play in advising on the design of such campaigns but also in creating capacity within NDMA, PDMA and DDMA to design, conduct and evaluate public awareness campaigns in the appropriate regional languages.



Source: NDMA Pakistan

⁴¹ Shahab e Saqib et al., "Factors Influencing Farmers' Adoption of Agricultural Credit as A Risk Management Strategy: The Case of Pakistan", *International Journal of Disaster Risk Reduction* 17, no. 5 (2016): 67-76.

The intervention calls for “Promoting DRR education in schools and colleges” stipulates that the integration of DRR into the education syllabus at all levels should focus upon creating awareness of priority hazards, mitigation or prevention options and building basic self-help and mutual-help capacities through school-based preparedness or safety plans (covering recovery of functionality in a post-disaster situation). School preparedness needs to be linked into wider community-based DRR plans and mechanisms as schools may serve as shelters and safe havens in disaster situations. For better coverage it is important that DRR education is also promoted in private and religious schools. Peer mechanisms are effective in reaching out of school children and youth.

Moreover, the intervention also emphasizes, “Promoting professional and technical education” stipulates that Professional and technical education in DRR needs to be enhanced through a range of activities including:

- i. The development of DRR as a professional discipline needs to be further promoted at national and provincial levels through high-quality academic programs while agreeing on common curricula standards.
- ii. The curricula of graduate and postgraduate courses in architecture, engineering, medicine, earth-, environmental and social sciences need to be further updated to incorporate the latest DRR knowledge and practices.
- iii. Everyday emergency responders (ambulance services, police, fire services require enhancement of their training and skills through dedicated DRR training.
- iv. Integrate DRR into curriculum of Civil Defense Training Institutions.
- v. At the local level training initiatives require support that target artisans such as builders and masons, and train them in hazard-resistant construction, focusing upon non-engineered buildings.

- vi. Vide Section 4.6 under “DRR Mainstreaming in Education System” stipulates that DRR agenda will remain inconclusive unless the national education system is made an integral part of it. Efforts are already underway to mainstream DRR in education curricula at all levels (school, college, university). However, the task at hand is to develop the DRR curricula in national and regional languages for subsequent mainstreaming. NDMA will facilitate the process of developing DRR curricula in consultation with relevant forums. Similarly, an appropriate mechanism will be devised to review with DRR lens the curricula of graduate and post-graduate level courses in architecture, engineering, and earth sciences, etc.⁴²

⁴² Atta-ur- Rahman, *Disaster Risk Reduction Approaches in Pakistan*, 1st ed. (Tokyo: Springer Verlag, JAPAN, 2016).

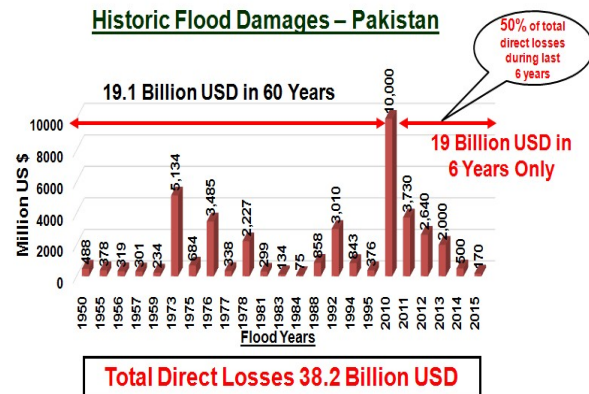
CHAPTER-7

7. Community Based Early Warning System in Pakistan

The community based early warning practices in disaster prone particularly in rural areas rely upon public awareness through mosque loudspeaker to inform entire community about evacuation and counter-measures to save lives and their belongings in case of any flood, earthquake and other hazard. The limitations of communication and the message dissemination further require for exceptional measures to avoid prototype warning methods of door to door knocking and the community gatherings.⁴³



In Pakistan, the bulk of recent disasters are weather-related and this proportion is likely to grow as climate change processes increase unpredictability and intensity of weather events. While natural hazards cannot be prevented, they only get turned into disasters when affected communities are vulnerable and unprepared. Community based Early Warning Systems (CBEWS) have proved beyond doubt to save lives and reduce economic losses; however, they have not yet been an integral part of the disaster management and risk reduction initiatives.



⁴³ Adenrele A Awotona, *Planning for Community-Based Disaster Resilience Worldwide*, 1st ed. (Abindon: Routledge, 2016).



People Gather around the notables of the community to learn about the disaster hazards and possible measures to avoid losses during the disasters. In villages, the notable person is usually an elder of the community or a religious scholar and or sometimes the educated people

belonging to the same community hold gathering of their community people to sensitize them about the disaster issues. The non-governmental organizations often support such activities with their limited capacities however, the need of usage of modern disaster forecast equipment requires significant expertise and such limitations frequently hamper the disaster reduction efforts of the community.

Earthquakes in Pakistan			
Earthquakes are the deadliest disaster in Pakistan			
Number of Modern Earthquakes			
Year	Magnitude	Deaths	Areas affected
August 24, 1931	7	–	Sharigh valley, Baluchistan
August 27, 1931	7.4	–	Mach, Baluchistan province
May 31, 1935	7.7	60,000	Districts of Baluchistan
November 27, 1945	7.9 or 8 (tsunami)	4,000	Makran-Sindh coastal areas
December 28, 1974	6.2	5,300	Districts of the Khyber province
October 8, 2005	7.8	80,000	Parts of Khyber and Azad Kashmir
October 29, 2008	6.4	216	Quetta, Baluchistan
January 18, 2011	7.2	2	Baluchistan

Source: pakistanweatherportal.com

The community early warning system in disaster prone and rural areas use public awareness through mosque loudspeaker to inform the entire community about counter-measures to save lives and their belongings in case of any flood, earthquake and any other hazard moreover, the limitations of communication and the message dissemination further requires for exceptional measure to use prototype warning methods of door to door knocking and the community gatherings. However, the Early warning systems contribute with early detection of undesirable situations. Early warning is the provision of timely and effective information, through identified institutions at national level that allows individuals exposed to hazard to take action to avoid or reduce their risk and prepare for effective response. This definition encompasses the range of factors necessary to achieve effective responses to warnings. A people-centered early warning system necessarily comprises four key elements: knowledge of the risks; monitoring, analysis and forecasting of the hazards; communication or dissemination of alerts and warnings; and local capabilities to respond to the warnings received. The expression end-to-end warning system is also used to emphasize that warning systems need to span all steps from hazard detection through to community response.

Trained Coastal Communities on Early warning & Emergency Evacuation



Since year 2000 and onwards, in socio-economic terms Pakistan has been greatly affected by impacts of natural disasters. The damage incurred as a consequence has severely impeded national progress and fulfillment of global commitments.

Prominent reasons of severe impact remained related to somewhat limited

early warning capability and partial or no community level outreach. However, with the help of modern technological methods of Early Warning System, the scale of destruction due to natural disasters could be reduced.

Pakistan is prone to many disasters. In disaster, response and recovery are time consuming and resources needed activities. In a country like Pakistan where resources are shrinking, population is increasing, changing priorities then it becomes very difficult to overcome these disasters. The earthquake of October 2005 not only killed 73,000 precious lives but also caused an estimated loss of US\$ 5.2 billion. Moreover, the flood in 2010 and 2011 brought thousands of casualties and displaced people. It estimated that the risk of the disasters will increase due to climatic changes.⁴⁴



In Pakistan before 2005 earthquake only federal flood commission provide information about flood. Rest there was no such a responsible institution to provide early warning for other hazards. Now we have national disaster management authority (NDMA) and the supporting bodies' provincial disaster management authorities (PDMA) and district disaster management authorities (DDMA) to provide early warning at national, provincial and district levels.

River Kabul and river swat are flowing in the study area. The level of water in river Kabul and river swat increase during the monsoon season and causes flood during this season. The community residing near Kabul and Swat River is at great risk due to flood.

⁴⁴ Margaret Macherera and Moses J. Chimbari, "A Review of Studies On Community Based Early Warning Systems", *Jambá: Journal of Disaster Risk Studies* 8, no. 1 (2016): 11-14.

Therefore, it is important that the existing early warning system should be efficient and improved in the study area.⁴⁵



Since, the term Early Warning is a measure that aims at the provision of information on an emerging dangerous circumstance where that information can enable action in advance to reduce the risks involved.

There are some community based disaster volunteer organizations working with limited resources however, there is need of proper

training of those volunteers about DRR issues so that prior to occurrence of disaster they would be educated about the prospective issue they could cope with during the disasters.

⁴⁵ Andrew Wilder, "Aid and Stability in Pakistan: Lessons from The 2005 Earthquake Response", *Disasters* 34, no. 9 (2010): 406-426.

7.1 Institutional Commitments for Community Capacity Building

7.1.1 The NDMP Perspective

The National Disaster Management Plan (NDMP) of Pakistan under the “Comprehensive Human Resource Development Plan” has chalk out a comprehensive human resource development Program that could serve the national cause of the disaster management amidst emergency periods.

The Human Resource Development Plan of NDMP under the Priority Actions and Programs for the Ten Years starting from 2012 to 2022 has pledged a number of initiatives vide following strategies on disaster education and awareness:



1. Vide Intervention- 5 - Promotion of Training, Education and Awareness in Relation to Disaster Management:

- a. Develop NIDM (National Institute of Disaster Management) to promote human resource development in the field of disaster management.
- b. Enhance the capacity of government agencies in charge of disaster management.
- c. Promote mainstreaming DRR through capacity enhancement of governmental officers.
- d. Develop the capacity of communities to cope with disasters.
- e. Raise people's awareness of disaster management

2. Vide Intervention-6- Strengthen Awareness Program on Disaster Risk Reduction at Local Level:

- a. Enhance knowledge on disasters management in the general public.

- b. Establish safe evacuation places in the case of disaster situation.
 - c. Implement and disseminate CBDRM activities.
 - d. Disseminate self-help and mutual help efforts in disaster management.
 - e. Establish disaster mitigation measures incorporated with existing development program.
3. Vide Out-put/ Activities on Education / Awareness highlights that NIDM will take initiative for improvement of human resources in the field of Disaster management through: -
- a. Setting up of organization of NIDM, construction of NIDM building complex, establishment of a library and Disaster Information Resource Center (DIRC) specialized for disaster management and promotion of research in the field of disaster management.
 - b. Capacity of governmental staff who are in charge of DRM to be enhanced through implementation of DRM training courses for F/G/S/PDMAs and DDMA staff, capacity enhancement of urban search and rescue teams, implementation of regular refresher trainings for district fire brigades and Implementation of DRM workshops for TMA staff.
 - c. Capacity of staff of government offices related to disaster management to be enhanced for mainstreaming DRR activities for their implementation including implementation of DRM workshops for relevant ministries, implementation of DRM workshops for relevant departments of provincial governments and state governments, implementation of DRM workshops for district governments, capacity of staff of government offices related to disaster management is enhanced for mainstreaming DRR activities for their implementation and Incorporation of DRM subjects into curriculum of government training institutes.

- d. Capacity of communities to be enhanced to cope with disasters through implementation of DRM workshops for community leaders and search and rescue trainings for members of community emergency response teams.
- e. Making Individuals Aware of DRM through implementation of awareness campaigns for the general public, promotion of disaster education at schools and implementation of DRM workshops for university students.⁴⁶

7.1.2 The NIDM Perspective

NDM Act- 2010 stipulates the responsibilities of NIDM as “NIDM shall be responsible for planning and promoting training and research and developing core competencies in the area of disaster management, documentation and development of national level information base relating to disaster management policies, prevention mechanisms and mitigation measures.” The activities are categorized into following four categories: -

1) Education:

- i. Incorporation of disaster management subjects into curriculum of governmental staff general training.
- ii. Promotion of disaster education in basic education.
- iii. Promotion of disaster education in higher education.

2) Awareness:

- i. Holding of national disaster management exhibition, seminars, workshops, conferences etc.
- ii. Awareness campaign through media.

3) Training:

- i. Training of NDMA staff
- ii. Training of F/G/S/PDMA staff

⁴⁶ Shaheen Ashraf Shah, "Gender and Building Homes in Disaster in Sindh, Pakistan", *Gender & Development* 20, no. 2 (2012): 249-264.

- iii. Training of DDMA staff
- iv. Training of TMA staff through DDMA
- v. Training of Staff of Federal Ministries
- vi. Training of university students

4) Promotion of Comprehensive HRD:

- a. Enhancement of coordination among organizations which conduct capacity building in the field of disaster management.
- b. Technical advisories and assistances for human resource development activities in the field of disaster management.⁴⁷

⁴⁷ Naim Kaput and Kuotsai Tom Liou, *Disaster and Development*, 1st ed. (Cham: Springer, 2016).

CHAPTER-8

8. Disaster Context & Warning System in Japan

The Japan as a developed country has outstanding mechanism for the early warning system for tsunamis, floods, volcanic eruptions and many other disasters. The early warning system essentially helps the communities to minimize the levels of damages and losses during disaster period. The early



warning-related Government Departments have only implemented limited measures. However, in addition to these measures new institution for early warning system, new modern technology, proper training of communities to sensitize them about the disaster issues and develop a mechanism to enable these communities to coordinate with the government and non-profit organization about the issues they cope with during and before the occurrence of disasters. The national government, local governments, and research organizations have installed seismometers, seismic intensity meters, and tsunami monitoring facilities throughout the country. The Japan Metrological Agency collects this observation data to monitor seismic activity and tsunamis. In Japan, to reduce disaster-related damage at initial level, it is considered highly important to make residents of at-risk areas aware of safe evacuation methods and nearby evacuation routes and sites ahead of time so that they can take appropriate actions based on early warning information.⁴⁸

⁴⁸ Tomohiro Tabata et al., "Environmental and Economic Evaluation of Pre-Disaster Plans for Disaster Waste Management: Case Study of Minami-Ise, Japan", *Waste Management* 61, no. 4 (2017): 386-396.

Japan has developed a system by which autonomous community disaster reduction organizations or community-based fire brigades at the local levels guide the evacuation process in the event of any risk of disaster. The public awareness is also considered as a high value objective and September 1 (the day of the 1923 Great Kanto Earthquake) has been designated Disaster Day in Japan. The week from August 30 to September 5 has been declared Disaster Week. During this time, many disaster reduction drills and outreach activities are conducted.⁴⁹

The Japan has developed early warning system to cater for almost all hazards in the country. Based on disaster understanding, Japan has improved early warning mechanism to make it the finest state of the art system and the reach covers nationwide service. JMA, FDMA, MLIT, Prefectural and Municipal governments are in the forefront in ensuring the dissemination of early warning to the Japanese households and residents. Using multiple methods and platforms for dissemination, the early warning mechanism triggers timely community response in Japan. Hazard maps, drills and exercises increase the level of responsiveness on what actions to be carried out when an early warning is issued. The Japan's early warning system encompasses a well organized mechanism to address the disaster relevant information that is based upon a series of institutional capacity to watch and disseminate real-time disaster information so that it may become useful for the risk prevention. The information helps the whole spectrum involved including individuals, communities and the organizations that may become prone to the disaster hazards.⁵⁰

The information also helps each of the stakeholders for prior preparation and proper reaction in advance so that the disaster risk and loss of life and resources may effectively be avoided.

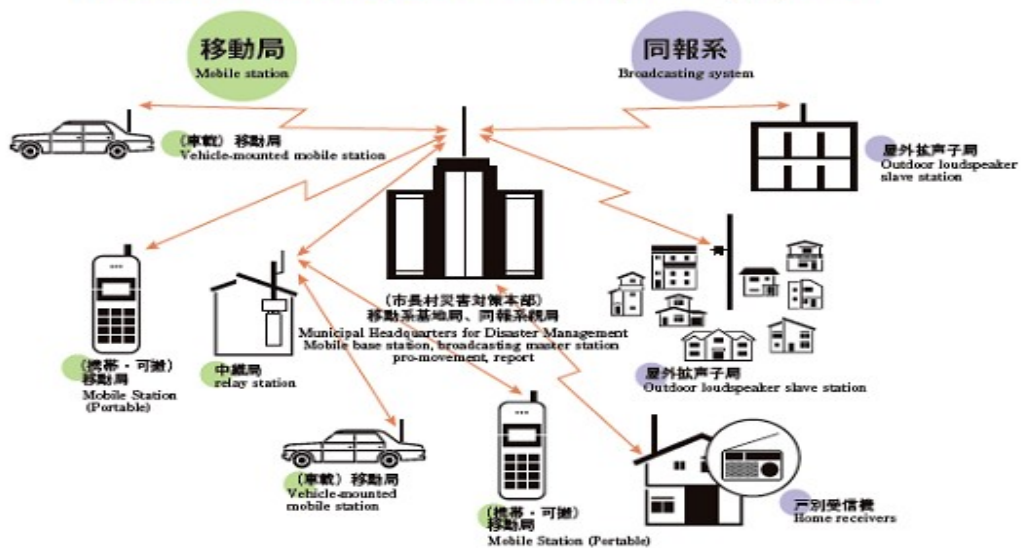
⁴⁹ Jeff Kingston, *Natural Disaster and Nuclear Crisis in Japan*, 1st ed. (Hoboken: Taylor & Francis, 2012).

⁵⁰ Itoko Suzuki and Yuko Kaneko, *Japan's Disaster Governance* (New York: Springer, 2013).

8.1 Early Warning System in Japan

Today Japan has become one of the leading countries in the world to effectively manage the disasters in pre and post occurrence scenarios. The country has development some most advanced versions of early warning equipment that are continuously being upgraded by time and again. The early warning information evacuation prior to the occurrence of a tsunami or any other disaster is well calculated and ensured the message should reach every concerned person and organization. The early warning about disasters during the disaster period is imminent information upon which propriety and life of people depend therefore, all means and resources including town level radio communication systems, J-Alert (a satellite based system that allows authorities to quickly broadcast alerts to local media and to citizens directly via system of speakers), television, mobile phones etc are utilized, and tsunami warnings are effectively delivered to the people.⁵¹

早期警戒体制の概念図 Outline of Early Warning Systems



Source: Japan Metrological Agency (Japan)

⁵¹ Paul Bacon, *Human Security and Japan's Triple Disaster*, 1st ed. (London: Routledge, 2014).

8.2 Japan Meteorological Agency (JMA)

The Japan Meteorological Agency (JMA) is the national organization that manages all the affairs related to the issuance of the disaster early warnings. The organization is mandated for the provision of accurate and real-time disaster and hazard information to the governmental organizations, prefecture governments, municipality and the residents for the purposes of avoiding the disaster affects. In its structural framework with the central government of Japan, the Japan Metrological Agency works as an extra-ministerial institution with Ministry of Land, Infrastructure, Transport and Tourism (MLIT). The organization with its own capability and also through joint venture with other national organizations, issues almost all the early warning messages about the hazards and disasters.

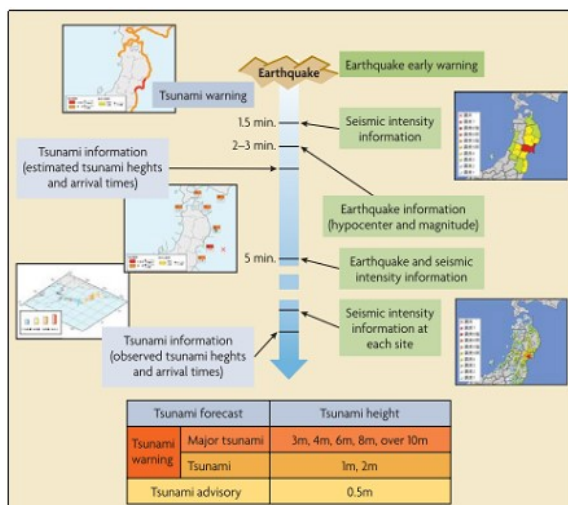
The Japan Metrological Agency for its part of the Disaster Response Mechanism provides apt and exact disaster information various disaster management authorities of Japan that aims at delivering such information to the masses through governmental organizations. Such disaster information effectively comprises of warnings, advisories that include:

- Warnings and advisories on weather, high tides, high waves and flooding;
- Earthquake Early Warnings;
- Tsunami Warnings and Advisories;
- Volcanic Warnings;
- Providing timely information about typhoons, heavy rain, tornadoes, earthquakes, tsunamis, volcanic eruptions etc.

The Japan Metrological Agency is also mandated with monitoring, forecasting and development of warnings for various kinds of risk and natural hazards like earthquakes and changing pattern of weather conditions. These forecasts also cover monitoring of

heavy rain, high snow and storm surges. The Japan Metrological Agency in collaboration with the River Bureau of Ministry of Land, Infrastructure, Transport and Tourism (MLIT) or prefectural governments also issues flood warnings during the flood hazard times.⁵²

The Japan Metrological Agency also manages the development of warning systems that cover weather situations including storm, snow-storm, heavy rain, heavy snow, storm surge, high waves and flood, volcanoes, tsunamis and earthquakes. Moreover, it also issues early warning alerts about extreme weather conditions. The organization in collaboration with Hydrological Services at national and municipal levels also manages collective reasonability about issuance of river flood warnings, sediment disaster alerts, with sediment control authorities at a municipal level. It has the mandate of cooperating with many other agencies for collecting and providing hazard/risk information in order to



support the national emergency planning process. The hazard risk information is usually obtained through effective early warning systems that are utilized for the facilitation of the early evacuation of the vulnerable people besides assisting for the activities of the various counterpart disaster management organizations.

Source: Japan Metrological Agency (Japan)

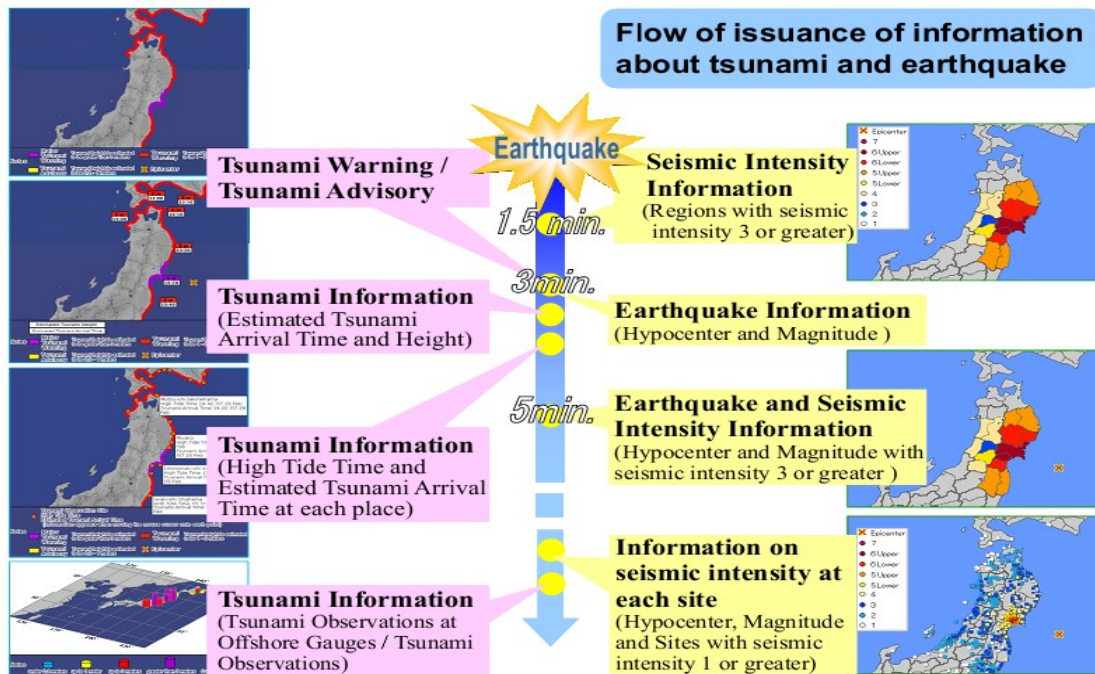
To monitor the various natural phenomena and weather conditions, the Japan Metrological Agency also operates 24/7 monitoring system that provides it with ability to

⁵² K. Lee Lerner and Brenda Wilmoth Lerner, *Environmental Issues*, 1st ed. (Detroit, Mich.: Thomson Gale, 2006).

generate forecasts and early warning information about the earthquake and possibly generation of tsunami and various other types of the severe weather conditions. It significantly incorporates the results of examining and forecasting the warning updates about the sediment disaster alerts for municipalities and the local governments. The process is operative in shared responsibility pattern through collaboration of organizations including the Japan Metrological Agency and prefectural governments and Hydrological Services for flood situation and warnings about designated rivers.⁵³

8.2.1 Tsunami Early Warning

During the outbreak of earthquakes, the Japan Metrological Agency through its capability estimates about the possible occurrence of the tsunami. The organization issues warnings and advisories to evacuate in case of the threat of tsunami. The Japan Metrological Agency in such a situation issues tsunami early warnings information and alerts shortly within a time of three minutes following an earthquake.



Source: Japan Metrological Agency (Japan)

⁵³ Sten Lennquist, *Medical Response to Major Incidents and Disasters*, 1st ed. (Heidelberg: Springer, 2012).

The Japan Metrological Agency along with Pacific Tsunami Warning Center (PTWC) also engages into the coordinated actions while origination of the tsunamis by seismic developments. The messages and early information disseminated through the warning system covers tsunami level and the expected time of its influx particularly in the coastal region.

8.2.2 Earthquake Early Warning System

The Japan Metrological Agency along with various national organizations working for the weather related issues has installed and maintaining seismometers for analysis of the epicenter location and the magnitude level of the earthquake and forecast about the possible tsunami. The seismic intensity meters installed at various places, measure the intensity according to the ground motion and constantly monitor the developments and the seismic activities.

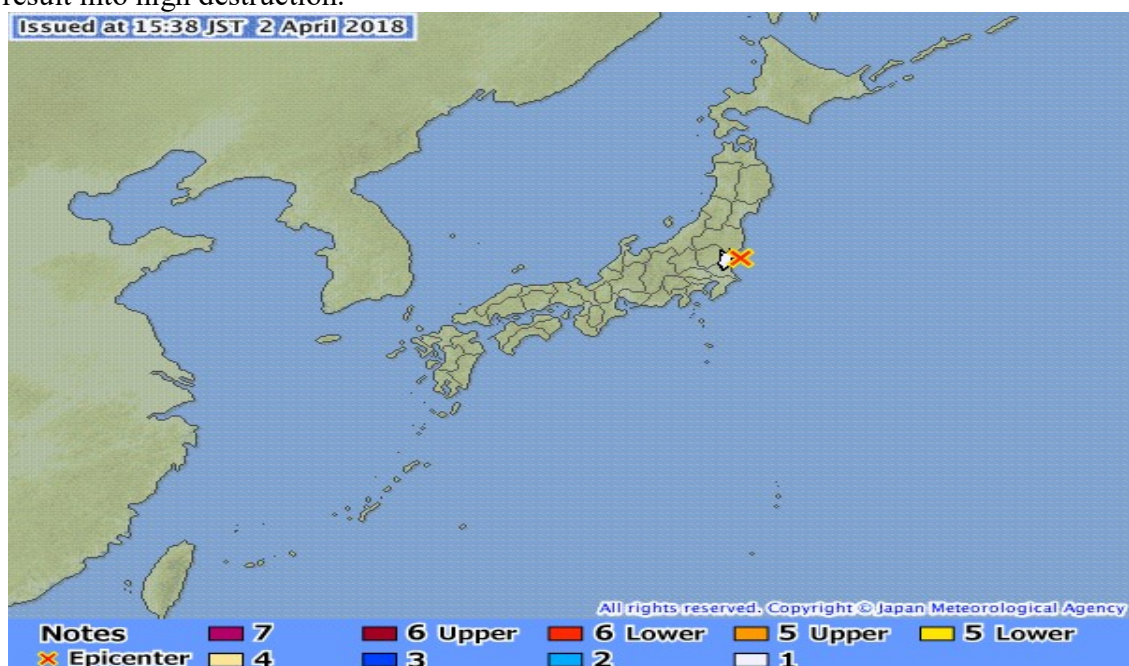


Source: Japan Metrological Agency (Japan)

The occurrence of the earthquake is shortly analyzed by the Japan Metrological Agency through its various installed seismometers and modern equipments. The Japan

Metrological Agency within a short period of almost 1.5 minutes becomes able to issue seismic intensity information report for earthquakes starting at the intensity level 3 or higher magnitude.⁵⁴ The organization within a time of around five minutes also provides an information report related to the earthquake that also indicate details about the epicenter and severity at various location including the earthquake’s seismic intensity and shock observation.

The Earthquake Early Warning (EEW) information is used for the announcements of the predictable hypocenter and magnitude of an earthquake as well as the possible reaching period the S-waves of any earthquake including the level of seismic intensity in the area. This accurate analysis based upon the calculated information through detecting the P-waves near the epicenter that follow a procedure of prompt data analysis keeping in view the speed differences of the P-waves that are comparatively quicker than the S-wave and result into high destruction.



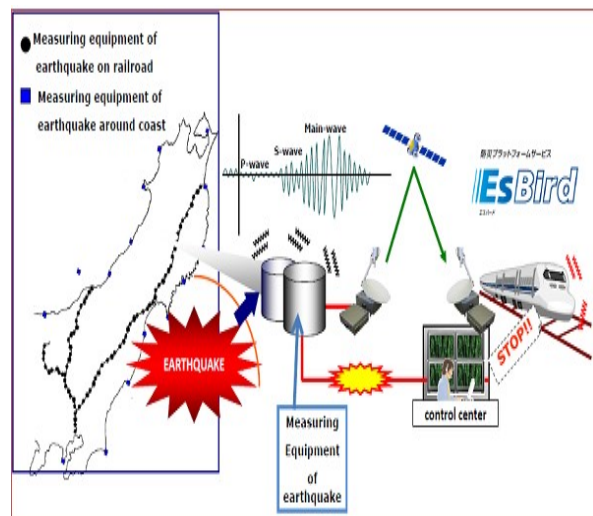
Source: Japan Metrological Agency (Japan)

⁵⁴ Koichi Shiwaku, Aiko Sakurai and Rajib Shaw, *Disaster Resilience of Education Systems*, 1st ed. (Tokyo: Springer, 2016).

Amidst scenarios of the large-scale ocean trench-type earthquakes, there can be a time lag of short to large timescale between the issuance of the earthquake early warning information that follow the scenario resulting in severe shaking nearly arrival of the S-waves. Such a scenario can be highly critical to decide and disseminate the information to avoid the damage by stopping trains and elevators, extinguishing flames, finding safer places and or crawling under the tables to avoid injury and loss.⁵⁵

The process of research and development is in vogue and continuously supported collectively by Japan Metrological Agency and various other stakeholders and organizations. The issuance of the earthquake early warning information to targeted entities such as railway companies is under practice since 2006. The earthquake, tsunami and various other disaster early warnings are immediately conveyed to central and prefectural governments, broadcast ring agencies, mobile service providers and other sources whereby the prefectural and local government administrations initiate the alarm system further to reach every nook and corner through sirens or microphones.⁵⁶

The Japan Metrological Agency earthquake warning systems are



Source: JMA (Japan)

effectively capable of issuing alerts a few seconds before the occurrence of the earthquake. The advanced technological means and efficient practices have enabled it to

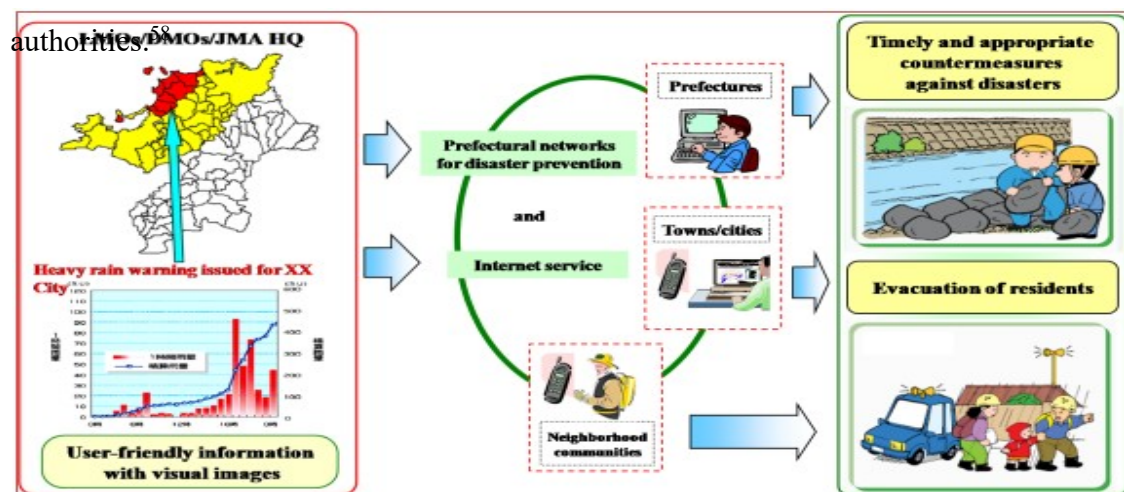
⁵⁵ Federica Ranghieri and Mikio Ishiwatari, *Learning from Mega disasters*, 1st ed. (Washington (DC): World Bank, 2014).

⁵⁶ Rajib Shaw, Juan M Pulhin and Joy J Pereira, *Climate Change Adaptation and Disaster Risk Management*, 1st ed. (Bingley: Emerald, 2010).

issue warnings that are transmitted through various sources of media including Radio, TV and other sources to ensure the prompt dissemination of the message and halting all the operations and slowing down trains, controlling elevators to avoid danger and enabling people to immediately evacuate to find a safer place to avoid disaster affects. Such early warning information are based upon analysis of the seismic intensity that help in deciding the prospective arrival time of major motion amidst the occurrence of the earthquakes.⁵⁷ The earthquake early warning information is generated from prompt data calculations obtained through national seismic networks.

8.2.3 Flood Early Warning System

The Japan Metrological Agency is also lead agency of Japan that effectively provides flood forecasting services. Such forecasts are generated in collaboration with central and prefectural river management offices. The flood early warning information includes warning about flood, evacuation and advisories that cover over 407 rivers throughout the country particularly those have been designated as sites of potential flood disasters by



Source: Japan Metrological Agency (Japan)

⁵⁷ Miki Ozeki and Kan Shimazaki, "Change in Disaster-Prevention Consciousness Brought by Serious Damage from A Large Scale Disaster: Studying The Kumamoto Earthquake in 2016", *Journal of Disaster Research* 13, no. 1 (2018): 199-204.

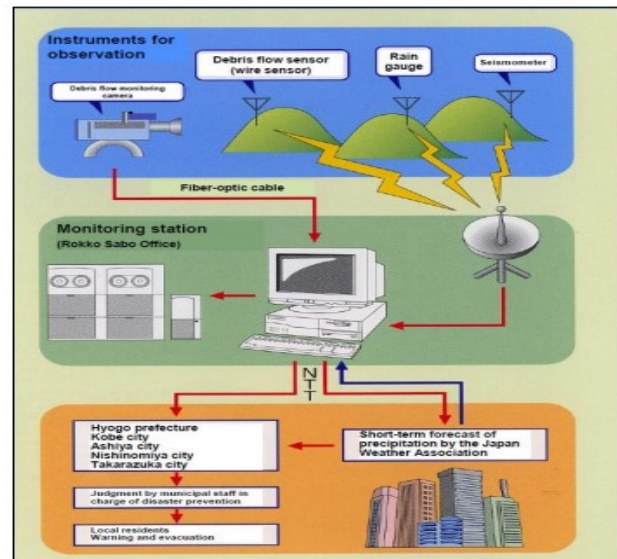
⁵⁸ Manabu Segawa, Kouzo Ito and Toshisuke Maruyama, "Flood Discharge Changes by Urbanization from Farmland Based On the Unit Flood Concept at The Kurabe River, Japan", *Open Journal of Modern Hydrology* 07, no. 03 (2017): 223-243.

The flood early warning system for 289 out of 407 rivers is jointly managed by the Japan Metrological Agency and the Ministry of Land, Infrastructure, Transport and Tourism whereas, rest of 118 rivers are managed collectively by the Japan Metrological Agency and prefectural governments in Japan. Moreover, the Japan Metrological Agency has arranged a mechanism of declared range of rivers that are flood Warning River sites and also including medium to small rivers under the responsibility of the local governments for management.⁵⁹

8.2.4 Sediment Disaster Warning

System

Like various other disaster early warning system, the Japan Metrological



Agency has also established a mechanism of sediment disaster alerts in collaboration with the prefectural governments. Such collaboration is comparable with hydrological services for flood warnings.

There is also set of measures by prefectural administrations that have soundly developed networks of precipitation measurements and topographical and geological information systems and hazard mapping.

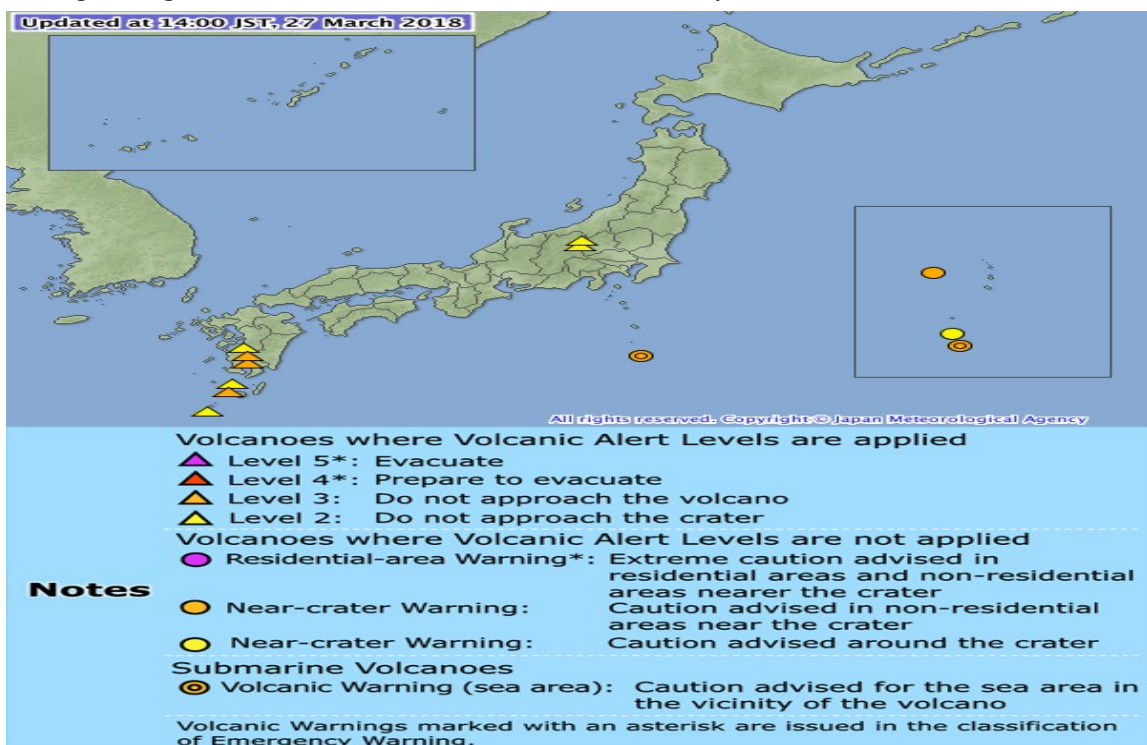
Together with the combination of all such sources, Japan Metrological Agency and prefectures issue collaborative sediment disaster alerts that specify cities, towns and villages affected by the sediment hazard. When a Heavy Rain Warning is issued, Sediment Disaster Alerts are issued jointly by Ministry of Land, Infrastructure, Transport

⁵⁹ Kumiko Fujita, Rajib Shaw and Yukiko Takeuchi, "Linking Mountain Community Practices to Sediment-Related Disaster Risk Reduction in Reihoku, Japan", *Asian Journal of Environment and Disaster Management (AJEDM) - Focusing on Pro-active Risk Reduction in Asia* 04, no. 02 (2012): 225.

and Tourism and prefectural government and the civil engineering bureaus when sediment-related damage caused by heavy rain is considered likely within the next few hours.

8.2.5 Volcanic Eruption Early Warning System

For monitoring the seismic and volcanic activity throughout the Japan, the Japan Metrological Agency is enthusiastically involved in operational activities and also issues important warnings and timely information to the community that exceptionally help in damage mitigation that can be caused by the earthquakes, tsunamis, volcanic eruptions and various other kinds of disasters. The Japan Metrological Agency has initiated the process of volcanic early warnings and forecasts since December 2007.⁶⁰ The system covers all active volcanic sites of Japan. The system has greatly contributed in the damage mitigation that could result from volcanic activity.



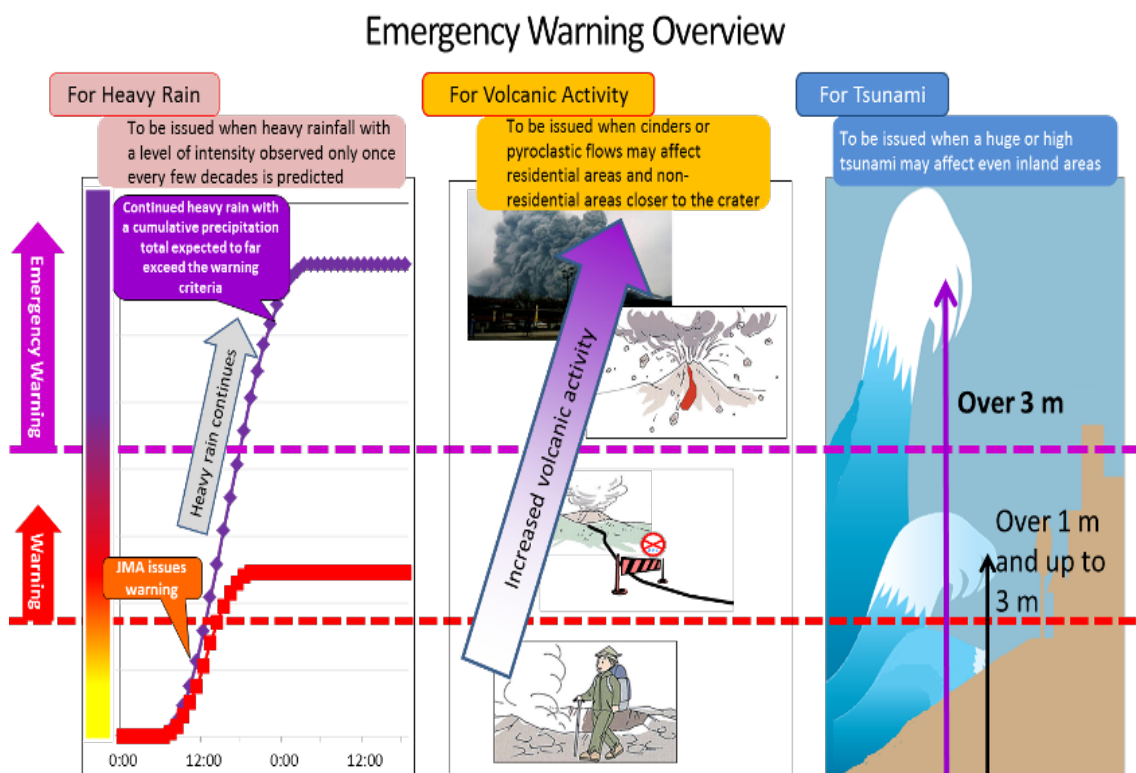
Source: Japan Metrological Agency (Japan)

⁶⁰ Youichiro Takada and Yo Fukushima, "Volcanic Subsidence Triggered by Megathrust Earthquakes", *Journal of Disaster Research* 9, no. 3 (2014): 373-380.

The early warning for volcanic eruption is issued in relatively likely volcanic disasters. It also imparts advisories to the community about evacuation of the people to safer places and necessary actions that should be taken by the people and local government.

8.2.6 Emergency Warning System

From 30 August 2013, the Japan Meteorological Agency has also launched an Emergency Warning System. The Emergency Warning is used to provide information about likelihood of catastrophes and other types of emergencies. The alert helps communities to take necessary measures and observe precautionary measures.



Source: Japan Meteorological Agency (Japan)

The initiatives like J-Alert are a process effective across the nation for emergency warnings. The J-Alert was launched in February 2007 in Japan. The process was designed to promptly notify communities about likelihood and actuality of various types

of threats.⁶¹ The development of such systems aims at early warnings that also help in speeding- up the evacuation process and assist in coordination of emergency response.

⁶¹ Susumu Kurahashi, "Tsunami-Generation Warning System Using Earthquake Early Warning", *International Journal of Geomate* 9, No. 13 (2015): 22-27.

9. CONCLUSION

The Early Warning Systems are an effective source of weather and disaster forecast that generate data by analysis that focuses on systematic data collection, investigation and provision of well estimated result based recommendations. The process of early warning also includes risk assessment and information dissemination based on qualitative and quantitative or a blend of both data sources. The early warning systems enhance the capacities of the governments that in actuality mean a mechanism of investing in local competence. The effective means of early warning systems effective serve as capacity building resource that empower people at grassroots levels and also facilitate a process of transparent interaction between government, civil societies and the vulnerability communities of disaster prone areas.

The empowerment and sensitization of the community is highly effective in overcoming disaster affects. The governments who focus on community based capacity building experience lesser losses. The ownership and the realization is also a necessary question that should be prioritized by both i.e. governments and the community.

In Japan, organizations involved in disaster reduction, especially the Japan Meteorological Agency (JMA), Ministry of Land, Infrastructure and Transport (MLIT) including prefectural authorities use 24/7 hazard vigilance systems that provide careful monitoring of various natural phenomena and weather conditions. In addition, the news and broadcasting system in Japan is effectively utilized as one of the major sources for distribution of early warning information to communities. The national government and local government organizations have significantly concluded agreements with the Japan Broadcasting Corporation (NHK) and other broadcasting and FM radio stations that disseminate the disaster updates and warning information through their broadcasting.

Such a collaborative structure helps communities to work for the establishment of supportive systems for disaster management.

As a comparative analysis, there is wide gap between disaster preparedness and community based early warning practices in Japan and Pakistan. The advanced technological means and utilization of state institutions is highly supportive for the cause. Apart from the post disaster scenario, the broadcasting system and the mobile network services can be highly helpful to reach communities in every nook and corner and mitigate the disaster affects.

In Japan, the use of technological means and information provided by many organizations including news broadcasters, prefecture governments, central government and various research institutes helps communities to better arrange for disaster preparedness. In case of Pakistan, the similar level of information at the governmental level is available however; the interpretation of the information is key obstacle in disaster preparedness of communities. To overcome, this issue, there is high need of capacity building, educating people about DRR issues, usage of various tools and first aid equipment and arranging mock drills.

10. RECOMMENDATIONS

- The participation of the community is highly beneficial since, the CBDM activities aim at development disaster management capability of the community and effective risk management therefore, it is highly essential the authorities should take communities on board so that they may become able to prepare disaster readiness plan.
- The disaster information is one of the important factor of the disaster management activates therefore, the timely information would help communities to anticipate the disaster risks and assess their hazard vulnerability thus avail the chance to make necessary arrangements, take appropriate preparedness and countermeasures support of authorities.
- Although access to relevant information is essential for adequately disaster preparedness, it is not sufficient. Community capacities must be developed up to the level that they may become self-sufficient to prepare and initiate effective disaster risk reduction strategies in a timely way.
- To achieve the disaster mitigation goals, it is crucial to enhance capacity of communities through mock exercises and other participatory forums with particular focus to communities living in the flood and earthquake prone areas.
- The local government at districts levels (as being practiced in Japan at prefectural levels) can assist communities to develop and manage community level disaster management plans, mapping and evacuation places. These plans will provide a road map according to which communities will be able to implement key disaster preparedness and response actions.
- The key components of the community disaster preparedness plans should focus on land and resource use planning. Such measures would enable community to

evaluate existing loopholes and verify how resources are affected by weather patterns and thus develop relevant initiatives that can reduce the potential negative impact of disasters on their lives and livelihoods.

- Individual motivation for the cause of disaster preparedness can mobilize whole nation to manage the disasters effectively and collectively.

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