EARLY WARNING SYSTEM AND COMMUNITY BASED EMERGENCY RESPONSE MECHANISM

By:

Captain Mohamed Inayath

Director, Programs

National Disaster Management Authority (NDMA)

Republic of Maldives

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Cover Photo

(Source: Prime Minister's Office and Fire and Disaster Management Agency)

An angel's voice

A woman on the municipal staff in Minamisanriku City was urging residents over the radio to evacuate to higher ground. Although tinged with fear and apprehension, her voice gave people courage and helped save countless lives. She continued broadcasting to the very end before being engulfed by the tsunami. She never returned home. She had planned to be married in September 2011. In all, 39 staff members were declared dead or missing. The 12- meter- high building was located in a risk area that was submerged by 2.4 meters of water during the 1960 Chilean Tsunami.

The cover photo shows the Disaster Management Headquarters of Minamisanriku City where the late lady Staff kept providing early warning about the impending disaster to the community until her own location engulfed and submerged by the gigantic tsunami. She sacrificed her life to others. It was an act of bravery and heroism. She was a true hero and a selfless humanitarian.

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ABSTRACT

Natural disasters pose significant threats and challenges to many parts of the world. Extreme weather events and climate change are causing extensive damage and loss to life and livelihood of millions of people in urban cities, rural areas and low elevated coastal areas especially small island states. Maldives is one of the most threatened countries by disasters induced by climate risks.

Reliable disaster early warning is a prerequisite and a vital component of disaster response. It is particularly important for the local community and households to receive early warning in case of sudden onset disasters such as earthquakes, tsunami, volcanic eruption, flash flood, landslide, cyclones and storms etc. EW also serves as the trigger point for evacuation order and timely response initiation decision by the individuals and local governments which could result in saving numerous lives and property.

Although, Maldives has an established national level early warning system, rural atolls and island communities hardly receive any of the early warning messages on time. Therefore, this research would be addressing on how to establish a community based early warning system for small islands and how to integrate this system into an effective and efficient disaster response and relief operations at the individual island community level in the Maldives.

Keywords: Disaster Risk Management, Disaster Risk Reduction, Disaster Management System, Early Warning System and Emergency Response Mechanism.

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CHAPTER 1
INTRODUCTION

1.1   Background

Loss of lives and livelihood from disasters whether it is slow onset or sudden onset is a huge global concern irrespective of the country's location, size and economic status. Some nations are luckier while many states continuously fight to minimize the impact from various disasters that they face throughout but yet no country is 100 percent safe and disaster risks free. The uncertainty of the nature calls for better preparedness planning and disaster counter measures. Prediction of many natural and manmade disasters and extreme events with multi-hazards is possible to a great extent today with the help of advanced science and technology.

Reliable disaster early warning is a prerequisite and a vital component of preparedness for disaster response. It is particularly important for the local community and households to receive EW in case of sudden onset disasters such as earthquakes, tsunami, volcanic eruption, flash flood, landslide, cyclones and storms etc. EW also serves as the trigger point for evacuation order and timely response initiation decision by the individuals and local government which could result in saving numerous lives and property. The absence or inadequate EW may lead an avoidable circumstance into a catastrophe. The death toll of Indian Ocean Tsunami in 2004 is a vivid example of this because majority of victims did not have access or receive any EW although many of the countries have huge lead time for action. Thus, establishing a multi-hazard disaster EWS should be a priority in preparedness for an effective response at all levels.

Maldives is one of the most threatened countries by the natural disasters, extreme weather events and other climate risks. Being one of the smallest and low elevated countries in the world has a threat of existence from the effects of climate change and sea level rise in the long run. Given the vulnerable situation of the country and based on the past disaster history, it is utmost important for Maldives to take immediate actions to establish an EWS which is able to disseminate and deliver timely, accurate and reliable warning messages to the most remote island communities and to set up an emergency first response mechanism within the local island communities to make the atoll islands safe, secure and protected from disasters.

Japanese concept of disaster risk reduction, live with risk environment and attitude provide valuable takeaways for other countries. Maldives as a developing country it is very important to take the advantage of lessons learned from mega disasters in Japan especially GHAE and GEJE, and the disaster mitigation, preparedness, response, recovery and reconstruction efforts, and DRM approach as a whole in Japan as global public goods for future development of the nation.

1.2 Statement of the Problems and Significance of the Research

Disasters affect the countries irrespective of size and geographical location but it is the small and poor countries that are most severely impacted. This hinders the development and creates extra burden economically and socially to achieve the desired prosperity of many developing and underdeveloped communities. In fact, this is absolutely true particularly for the small island states like Maldives. For example, the Indian Ocean tsunami on 26 December 2004 caused severe damage to the physical infrastructure of many islands and set back the high levels of social progress and prosperity achieved in recent years. Total damages are estimated to be US$470 million, 62% of GDP (World Bank, 2005).

In any disaster situation, the most important first responders are the affected local community. It is them who perform first aid, search and rescue, protection and manage evacuation shelters until the public assistance and support arrives at the scene. The central government, national response force and other response efforts require and take time to take the control of the situation. The time is critical and immense important in saving lives during disasters, especially the golden 72 hours which should not be given up in waiting for the public support. In the Great Hanshin Awaji Earthquake in 1995, more than 80% of the rescued works were done by the neighborhood and community people themselves. Therefore, empowering the local community with maximum response capacity is a must that every community should be adhered to. The best resources and manpower is the local community for a better early evacuation and response in protecting the citizens from negative impacts of disasters.

Given the vulnerability, geophysical characteristics and the wide dispersal of the island communities of Maldives apart in the deep ocean currently lacks a robust, redundant and reliable EWS. However, Maldives has established and maintains a multi-hazard national EWS in the country. The critical issue here is the lack of infrastructure, the limitations of timely access and dissemination of EW down to the last mile and grass root level in the remote island communities. Thus, it exists the gap and dire need for a comprehensive community based multi-hazard early warning system to be established and maintained 24/7 in every inhabited island locality in order to provide an effective emergency response by the island communities.

Since, most of the island communities in the Maldives are physically isolated societies from one another; a disaster with devastating magnitude could result a total isolation, loss of communication and cut off from external support for several hours, days or may be for weeks. Hence, preparing and equipping the Island Emergency Response Teams (IERT), commonly referred as Community Emergency Response Team (CERT) could be one of the best options for the local governments, Island/Atoll and City Councils. These teams are based in islands on volunteerism and consist of volunteers who could act and be a part of larger Local Emergency

Response Force (LERF) in an Atoll or a City. At present, a handful of islands have IERTs and they are inadequately equipped and very limited in capacity.

1.3 Objectives of the Research

The overall objective of this study is to understand the importance and role of multi-hazard early warning system and the community based emergency response mechanism for the small islands of Maldives. The specific objectives of this research are:

> To learn and understand about the early warning systems, procedures and protocols in Japan and in the Maldives;
>
> To identify how early warning initiates emergency response in the context of Japanese local communities;
>
> To identify and understand the community volunteer based emergency first response and relief mechanism in Japan; and
>
> To recommend a model to establish Island Emergency Response Teams and integrate them into the emergency response and relief operations and disaster preparedness at the community level in the islands.

1.4 Expected Results

Upon completion of the ADRC's Visiting Researcher Program FY2015B, the researcher intends to produce the research paper consisting of the following outcomes;

> ➢ Recommend a mechanism to establish community based early warning system in the islands.
> ➢ Lessons learnt and recommendation for the DRR and the development of Community Emergency Response Teams (CERT) at the local community level in the islands.

1.5 Scope and Delimitations of the Study

The scope of this research is very much focused on the various components of disaster early warning systems and the disaster response and relief part of the disaster risk reduction and management in the Maldives and in Japan. However, the importance of disaster preparedness phase is highlighted to some extent. More emphasis is given to the Japanese context of disaster management in quoting examples, lessons learnt and past experiences because the primary information and data gathered for the research are solely from Japan but it is not limited to the good practices and case studies from other parts of the world as well.

In order to achieve the research objectives and outcome mentioned before, the approach of fitting the most relevant and applicable options and solutions to the small island communities of Maldives were used and adopted by keeping the vast differences in geophysical

characteristics, economy, social and technological environment, risk profile and governance structure between the Japan and Maldives.

Furthermore, various disaster risk reduction concepts and approaches of Japan were streamlined and narrowed down in the conclusion and recommendations for Maldives to develop a comprehensive multi-hazard early warning system and a community based disaster first response set up in the remote island communities. However, some of the hazards and risks like inland earthquake, landslides, volcanic eruptions and other sediment disasters were not discussed since those are not applicable in Maldives.

The challenges and few limitations of this research include the language barrier, majority of the literature available on DRR are in Japanese, presentations and discussions required translation to a great extent. Finally, the limitation of time available may be insufficient to produce a comprehensive analysis for this research work.

CHAPTER 2
LITERATURE REVIEW

2.1   Disaster Impact

Disasters affect millions of people and cause damage cost in billions of dollars every year around the globe. This trend keeps growing and increasing. The following figures show the occurrence and economic damage of recent disasters. The increasing intensity and frequency with which disasters are being experienced worldwide demonstrate the critical need to enhance disaster risk management. Indeed, high-profile, large-scale disasters are increasing global consciousness of the need to strengthen national and regional capacities to mitigate, respond to and manage such events.
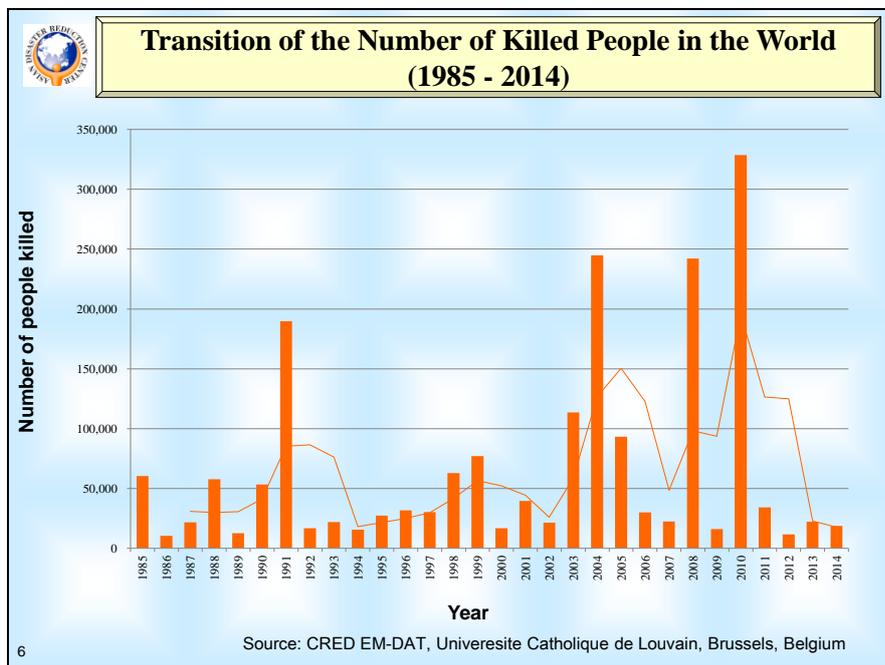
Figure 2.1 Number of People Died in the World (1985 - 2014)
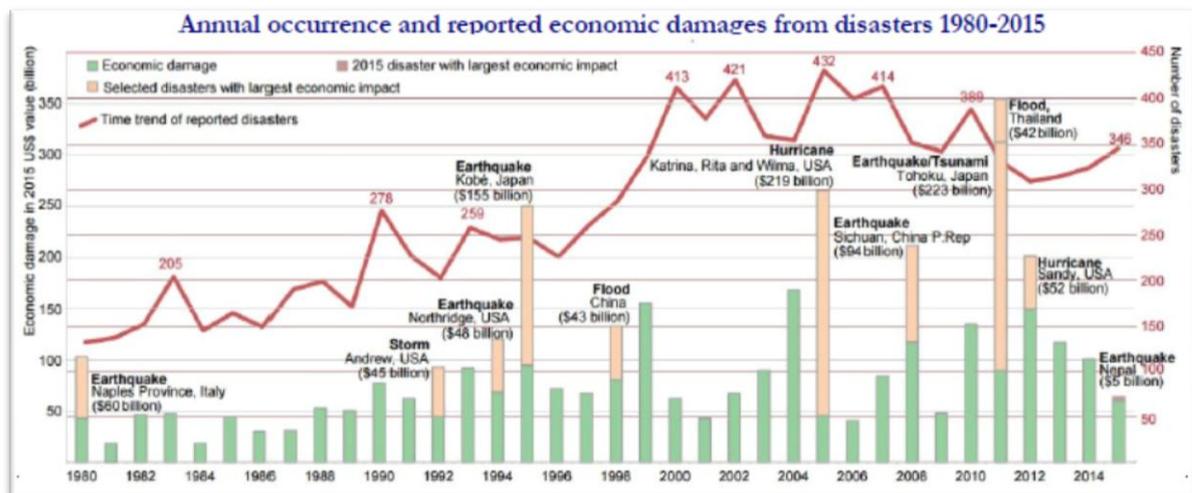
Figure 2.2 Disaster occurrence and loss (1980 to 2015)

Disaster risk reduction, and early warning, early action in particular, are essential in achieving sustainable development. Furthermore to reduce the loss and damage from disasters, preparedness for response is necessary. The above figures show the number of lives lost from past disasters. This is evident that firm and proactive measures are required to combat disasters. It's time to switch from managing disasters to risk reduction.

2.2 Disaster Risk Management (DRM)

Disasters put development achievements at risk in many societies. Often, disasters hurt the most vulnerable and poor communities who live multi-hazard prone areas. However, disasters may not spare the developed world from recurring. The Great East Japan Earthquake and the subsequent Tsunami caused widespread damage and extreme devastation five years ago on March 11, 2011 is a powerful remainder to the world that even the best prepared country will face exceptional disasters (World Bank, 2014).

Most of the developmental gains achieved in the past can be destroyed in a matter of seconds with disasters if not prepared and responded to disasters effectively and efficiently. Adaptation and risk reduction are the most common and the best options to prepare for future climate risks and disasters. Mainstreaming and integrating Disaster Risk Reduction (DRR) and DRM in development planning could help lower the impact of disasters, protect and save lives and property. Furthermore, disaster preparedness and effective countermeasures enhance the coping capacity of the people leading to more resilient communities and nations around the globe.

UNISDR disaster terminology defines DRM as the systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster. This term is an extension of the more general term "risk management" to address the specific issue of disaster risks. Disaster risk management aims to avoid, lessen or transfer the adverse effects of hazards through activities and measures for prevention, mitigation and preparedness.

DRR (Disaster Risk Reduction) is the concept and practice of reducing disaster risks through analysis and management of the causal factors of disasters. It leads to reduced exposure to hazards, lessening of vulnerability of people and assets, effective management of land and the environment and improved preparedness for adverse events (UNISDR, 2009). Disaster risk reduction is an effective means to achieve resilience through prevention, mitigation and preparedness to enable nations and communities and absorb damage and loss, minimize impacts and bounce forward and build back better to link disaster risk management with sustainable development.

The ultimate goal of DRM is to build disaster resilient societies and keep achieving sustainable development. Hence, DRM put stronger focus on risk prevention, risk reduction and resilience building in post disaster recovery and reconstruction by supporting principles and practice of 'Building Back Better' and safer as well as learning from past disasters. DRM also ensures effective preparedness for communities to respond rapidly, recover better and remain resilient, including to new and deteriorating emergencies.

2.3   International Mechanism and Platforms for DRR

Disaster risk is a global challenge. In many countries, economic and social exposure to natural hazards is increasing. Thus, reducing the risk of disasters requires an all-states and all-stakeholders effort. International mechanism helps to create an enabling environment for the nations to achieve disaster resilience with global partnership, much-needed risk-sensitive investment and sustainable development.

Unlike the traditional response and relief centric approach, more proactive and community based approach of Disaster Risk Reduction (DRR) is popular and preferable by many nations and communities. Lots of initiatives have been taken up to now by the international, regional, national platforms and the local communities to reduce the risk and impact from disastrous events. DRR is a top priority in the development agendas, global forums and platforms. The purpose of these initiatives is to build resilience of nations and communities to future disasters and reduce the disaster loss.

The United Nations International Strategy for Disaster Reduction (UNISDR) system provides a vehicle for cooperation among the international community, Governments, organizations and civil society actors to assist in the formation, adaptation and implementation of the International DRR Frameworks. Furthermore, regional platforms play a vital role in promoting DRR and capacity building in their respective regional countries. Being a member of the Asian Disaster Reduction Center (ADRC) and SAARC Disaster Management Center (SDMC), Maldives receives many opportunities and benefits in the field of DRR and related efforts to make a resilient Maldives.

A comprehensive approach to reduce disaster risks is set out in the most recent two United Nations-endorsed Frameworks for Action, adopted in 2005 and in 2015 respectively. National Platforms in the countries support better national DRR governance efforts and help to build stronger and more effective national coordination mechanism with the relevant stakeholders.

2.3.1   Hyogo Framework for Action (HFA)

The Hyogo Framework for Action 2005-2015, which aimed at building the resilience of nations and communities to disasters, was adopted by the governments and organizations at the World Conference on Disaster Risk Reduction in Kobe City, in the Hyogo Prefecture of Japan in January 2005. The conference outcome is known as the Hyogo Framework. Its goal

was stated as "the substantial reduction of disaster losses, in lives and in the social, economic and environmental assets of communities and countries" and it set out five Priorities for Action to achieve this, namely:

1) Ensure that disaster risk reduction (DRR) is a national and local priority with a strong institutional basis for implementation.
2) Identify, assess and monitor disaster risks and enhance early warning.
3) Use knowledge, innovation & education to build a culture of safety & resilience at all levels.
4) Reduce the underlying risk factors.
5) Strengthen disaster preparedness for effective response at all levels.

2.3.2 Sendai Framework for DRR (2015 – 2030)

The Framework was adopted at the Third UN World Conference on Disaster Risk Reduction in Sendai, Japan, on March 18, 2015. The predecessor to the HFA, also refer as the post-2015 framework for disaster risk reduction offers an important opportunity to renew a broad-based commitment to building resilience and to support coherence across the post-2015 development agenda and the Sustainable Development Goals (UNISDR, 2015). Currently, Sendai Framework for Disaster Risk Reduction 2015-2030 is the international guideline for DRR.

The SFDRR aims to achieve the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries over the next 15 years. It has four priorities for action to prevent new and reduce existing disaster risks as follows:

(i) Understanding disaster risk;
(ii) Strengthening disaster risk governance to manage disaster risk;
(iii) Investing in disaster reduction for resilience and;
(iv) Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction.

2.4 Community Based Disaster Risk Reduction (CBDRR)

In the context of disaster risk management, a community can be defined as people living in one geographical area, who are exposed to common hazards due to their location. They may have common experience in responding to hazards and disasters. However, they may have different perceptions of and exposure to risk. Groups within the locality will have a stake in risk reduction measures.

Community-Based Disaster Risk Reduction (CBDRR) is an approach and process of disaster risk management in which communities at risk are actively engaged in the identification, analysis, treatment, monitoring and evaluation of disaster risks in order to reduce their

vulnerabilities and enhance their capacities to prevent and withstand damaging effects of hazards (ADPC, 2004). CBDRR contributes to progressive realization of safety, disaster resilience and development of all. Simply put, the aim of CBDRR is to reduce vulnerabilities and strengthen people's capacity to cope with hazards. This means that the people are at the heart of decision making and implementation of disaster risk management activities.

2.4.1 Why is Community Based Approach is Important?

Over the last two decades, the community-focus on disaster risk reduction has increasingly been recognized as an essential component of a comprehensive national disaster risk management system, for the following reasons:

➢ The community is the first responder in any disaster.

➢ In many cases, top-down approaches may fail to address the specific local needs of vulnerable communities, ignore the potential of local resources and capacities and in some cases may even increase people's vulnerability.

➢ Nobody can understand local opportunities and constraints better than the local communities themselves.

➢ CBDRR brings together the local communities and other stakeholders for disaster risk management to expand its resource base.

At the time of need, locals become the best readily available resource for the rescue of the community. Therefore, it is believed that the most successful and sustainable approach of DRM is to empower the local community through the Community Based Disaster Risk Management (CBDRM), and it is often the local residents who suffer or get affected by disasters.

Figure 2.3 Roles of the Communities in CBDRM

Recognizing the role of communities and providing them with central and local government support is critical in order to maintaining and strengthening important community based functions. Community based disaster risk management (CBDRM) programs have also provided a critical vehicle for strengthening preparedness. Most CBDRM activities usually have a strong component of raising local awareness of risks. However, while many programs are short-lived, there are numerous examples of CBDRM programs successfully leading to enhanced preparedness and response capability in the communities.

From the past disaster experience, Maldives has learned the importance of risk reduction before disasters and the enhancement of local level preparedness at the island communities. Given the geophysical nature and the dispersion of the islands, the most effective approach to address the disasters in the Maldives is to prepare each and every island community for the multiple hazards they are exposed to. Hence, the main focus is given to empower the islanders through the community based disaster risk reduction. This certainly would help to reduce the vulnerabilities, strengthen people's capacities to cope with multi-hazards and finally, improving the disaster resiliency of the island communities.

2.5 DRM Cycle

When a disaster strikes, emergency response and relief are taken, then recovery and reconstruction work follows. Society learns lessons from the disaster and takes countermeasures for future disasters to prevent and mitigate possible loss and damages. Then, preparedness is carried out for future disasters. This cycle is called as the "disaster management cycle" (JICA, 2014). The figure below shows a four phased DRM cycle.

Preparedness -- activities prior to a disaster.
Examples: preparedness plans; emergency exercises/training; warning systems.

Response -- activities during a disaster.
Examples: public warning systems; emergency operations; search and rescue.

Recovery -- activities following a disaster.
Examples: temporary housing; claims processing and grants; long-term medical care and counseling.

Mitigation - activities that reduce the effects of disasters.
**Examples:** building codes and zoning; vulnerability analyses; public education.

Figure 2.4 Four Phased Disaster Management Cycle

2.5.1 Disaster Preparedness for Response

Preparedness has been defined as "the capacities and knowledge developed by governments, professional response organizations, communities and individuals to anticipate and respond effectively to the impact of likely, imminent or current hazards or conditions" (UNISDR, 2009b).

In order to lower the impacts of natural disaster, it is desirable to make damage itself as small as possible by preventive measures. However, it is impossible to protect all areas from all disasters, and also there is a budget limitation to do so. For these reasons, in order to protect lives from a natural disaster, it is important to response with better preparedness immediately before and after the occurrence of the disaster event. Response with better preparedness means to forecast the occurrence of natural disasters in early stage, quickly disseminate the forecast and warning information, appropriately alerts or evacuate people in accordance with the information and once a disaster occurs, immediately provide relief to victims and suffered areas (lifesaving, medical care and relief supplies (JICA, 2014).

Preparedness has been central to all the international frameworks for disaster risk reduction since the IDNDR and was included in Priority for Action 5 of the HFA and Priority for Action 4 of the SFDRR. Thus, preparedness for response has been the main focus of the disaster risk management sector in many countries. Many success stories during the HFA are associated with improvements in preparedness, often combined with more effective early warning.

Preparedness activities are a critical part of corrective disaster risk management in that certain risks, particularly those associated with mortality and morbidity can be reduced through anticipation and response. Put simply, if a prepared population is able to evacuate an area before a major flood, lives will be saved and mortality and morbidity risk will therefore be lower. At the same time, preparedness is part of compensatory risk management and helps strengthen resilience. Well-organized emergency assistance based on contingency plans can help households and communities to buffer disaster losses, recover more quickly and avoid the translation of loss into broader impacts

Strengthening early warning systems, disaster preparedness and response capacities is vital to minimize the human losses and damages to the property, livelihood assets and critical infrastructure of the communities. The basic requirements for a prepared community are:

a. Alert, informed and active community members;
b. Effective community organizations with identified and constructive roles in local emergency management arrangements;

c. Local governments which acknowledge their roles in community safety issues and which have well established, widely understood and practiced arrangements for discharging their community safety responsibilities; and

d. Organizations and communities being able to work together to respond to the emergency, save lives and property, and assist the community to recover.

Increased awareness on vulnerability and disaster risk to the island settlements is very important to make proactive disaster preparedness culture in the mindsets of the local island community people. Conducting and promoting regular disaster preparedness exercises, including evacuation drills, with a view to ensuring rapid and effective disaster response is a crucial part of disaster preparedness.

Preparing to respond to, and mitigate the impact of, disasters as well as delivering assistance during and after the incident comprise the 'preparedness and response' aspect of dealing with disasters. Activities included under this umbrella are the activities of government at all levels, as well as of the private sector, communities, individuals, volunteers, and non-governmental organizations.

Most of the developmental gains achieved in the past can be destroyed in a matter of seconds with disasters if not prepared and responded to disasters effectively and efficiently. Emergency Response is a set of activities implemented soon after a hazard event, designed to save lives, reduce suffering and promote speedy recovery, utilizing any remaining capacities of the community. Effective response depends on integration of the whole community and all partners executing their roles and responsibilities.

Local communities play a key role in preparing for disastrous events and are normally the first responders to take action. During GEJE on March 11, 2011, community based organizations were very active in the disaster response and saved countless human lives. The foundation for effective disaster preparedness and response is laid at the local level. Well prepared local communities can often significantly reduce their disaster losses, even if national level emergency management structures collapse or fail to respond. In contrast, even the best organized disaster management at the national level may be ineffective if local preparedness capacities are weak or non-existent.

2.6 Early Warning Systems

Early Warning is the provision of timely hazard threat information to individual citizens. Individual citizens based on their respective exposure to a hazard would take action for their safety. An early warning system, hereinafter referred to as EWS, is made of a set of procedures, policies, and Information Technology put together for an effective and efficient dissemination of timely hazardous event and risk information to the public. An effective early

warning system encompasses the early action and earlier response as its main element. EWS has a core objective to save lives and minimize damage and losses to properties.

UNISDR, 2009 defines EWS as "the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, 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." This definition encompasses the range of factors necessary to achieve effective responses to warnings.

A people-centered EWS necessarily comprises of 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. Timely and effective hazard forecasting, and early warning to the vulnerable community can save lives and prevent a hazard from turning into a disaster. There are numerous examples when early information of impending disaster has saved valuable lives.

Developments in sophisticated technology, improvements in risk monitoring and forecasting, satellite data quality and increasing computer power and connectivity have resulted in a transformation of early warning across the globe. Moreover, the improved accuracy and lead time of predictions of high-impact weather events have made a major contribution to timely provision of early warning. In fact, the development and implementation of early warning systems is one of the areas where the countries have achieved most progress (GAR, 2015).

For EWS to be effective and efficient, it needs to monitor and analyze hazards in real time and also communicate and disseminate early warning to the vulnerable communities and response agencies in a most efficient and timely manner. Advancement in Information and Communication Technology (ICT) has made not only forecast of the hazards possible but also made it easy to mobilize response and communicate early warning to the vulnerable communities thereby minimizing deadly impact of worst disasters.

Despite much progress in the EWS, several gaps still remain for improvement. Integration of comprehensive risk information into hazard warning information is still weak in many countries, and it is still rare for alerts to provide information on the level of risk and possible actions beyond evacuation alerts. Success stories from Bangladesh, Chile, India, the Philippines and other countries show that timely and effective warning and communication coupled with risk information and a prepared population significantly reduces mortality (ibid.).

Japan relied heavily on formal early warning systems, evacuation plans, and alerts to limit loss of life. Indeed, Japan does have in place an extensive warning system for disasters like earthquakes and tsunamis. in order to be effective, early warnings not only have to forecast a

hazard but need to include value-added information with respect to the risks that can be expected and the actions that can be taken. Even while warnings can now be issued directly via SMS, which overcomes the communication barriers at the last mile, it is still rare for alerts to provide information on the level of risk

2.6.1 Community Based Early Warning Systems

HFA progress reports highlight success in developing early warning systems that correspond more closely to local needs. For example, Australia reports that every state and territory now has the ability to tailor core messages to fit local conditions and evacuation plans. In Sri Lanka, a people-centered early warning system was established that includes teams of volunteers using local communication methods. In Thailand, volunteers have been trained at the village level to monitor hazards and transmit early warnings in a timely manner. However, early warning information empowers only to the extent that households and communities are able to act on that information.

Warning systems can save people's lives and reduce economic damages from natural disasters such as floods, tsunamis, earthquakes, landslides, and other events. Start with low-cost systems. Warning systems can start with simple methods. Low-cost equipment, such as fire bells and sirens, were widely utilized as warning tools during the GEJE. EWS should be linked with community-based activities in order to trigger efficient response. Actions at the community level are crucial as demonstrated by the volunteer fire corps that issued warnings and saved lives on March 11, 2011 in Japan. Warning systems and other measures organized by communities may be particularly relevant in developing countries where government capacity and resources are limited.

Since warning systems are meant to benefit communities on the ground and to inform their actions, the responsible organizations should understand how local people cope with and respond to disasters. Community members decide on their own when, where, and how to escape or evacuate during a tsunami for example. The organizations should tailor the contents of warning messages to the users' needs and points of view. Such messages need to be simple, timely, and encourage early action. Establishing end-to-end EWS ensure that warnings reach the communities at risk. Multiple communication channels should be established so that information keeps flowing in case of power and communication failures. Since natural events can happen at any time, the organizations concerned are required to function around the clock 24 hours a day, 7 days a week.

2.7 Emergency Response Mechanism

By constantly dealing with an ever growing hazards, the developing world has learned that a prompt, well-coordinated and effective response mounted in the aftermath of disasters not only minimizes loss of life and property but also facilitates early recovery are the most

effective way. Countries will continue to require a dedicated disaster management system to prepare for and respond to disasters and emergencies. The important ingredients of an effective response system are;

    a. Integrated all level institutional arrangements,

    b. Multi-hazard end-to-end early warning systems,

    c. Failsafe communication system,

    d. Rapid evacuation of threatened communities,

    e. Quick deployment of specialized response forces and coordination and synergy among various agencies at various levels in dealing with any disaster.

    f. Most importantly, all agencies and their functionaries must clearly understand their roles and responsibilities and they specific actions they have to take for responding to disaster or threatening disaster situations.

Disaster response mechanism requires the establishment of full support by the national government and empowerment of local authorities and administrators. Empowerment of local governments, communities and stakeholders in rural and urban areas is a prerequisite for the success of disaster risk reduction and resilience building. This is why local government leaders, with the support of other actors such as community based institutions, private sector, academia and experts, can use local disaster risk reduction information and strategies to save lives and reduce losses.

In an ideal emergency response system, local governments have primary responsibility for emergency management under the laws. This includes preparedness, response, recovery, mitigation and prevention. Disaster Management legislation has assigned this responsibility to local governments. Communities identify local hazards, and set out a response plan. Prefectural and municipal mandates give the Governor and the Mayor authority to request support from their central government if they believe a hazard has overwhelmed the community's capacity to respond.

2.7.1 Community Based Emergency Response Teams

According to the World Disaster Report 2015, local actors are the key to humanitarian effectiveness and local communities are always the first to respond to emergencies and disasters. In Japan's case, we learned how communities can play a critical role in preparing for and coping with natural disasters. Communities can help prevent damage from spreading, maintain social order, and provide support to the vulnerable.

At the Great Hanshin-Awaji Earthquake Disaster in 1995, the number of building collapse or heavily damaged is around 250,000 and the number of people captured in the buildings is around 35,000. After the earthquake happened, in the situation that telephone didn't work and there was a heavy traffic on the road, 27,000 people were rescued by neighbors and 80% of

them were alive. However, 8,000 people were rescued by Army, Police or Fire Fighters and less than 50% of them were alive. This fact gives us a lesson that the activity of local community is the key to mitigate earthquake disaster.

During GEJE and Tsunami, the community-level response (and community- based warnings) was the key that saved countless human lives. The volunteer fire corps are community-based organizations (CBOs) trained in disaster management used various tools such as handheld loud speakers, fire bells, sirens, and fire engine loudspeakers to warn communities throughout the affected areas. Thus, disaster risk communication must be practiced regularly, so that people are able to better understand the information, and messages and agencies can better understand the mechanisms that local people use to cope with disasters (GEJE, 2014)

2.7.1.1 Community Emergency Response Team (CERT)

The Community Emergency Response Team (CERT) is a program that is rapidly gaining in importance as the need for trained civilians, often the first responders to their own local disasters, becomes more vital in an effort to make disaster management as effective and safe as possible for survivors and rescuers alike. These are corps of trained volunteers who would activate themselves immediately after a disaster to assist their families, neighbors, and communities until first responders can reach affected areas. The most important mission of CERT is to provide a rapid, effective and efficient emergency response in times of disasters.

CERT Organization:

When a disaster occurs, natural or man-made, an immediate response is needed. In order to avoid chaos and maintain communication when providing an effective disaster response, CERTs use the Incident Command System (ICS) to organize their relief efforts and to establish an effective span of control.

The ICS is a "management system designed to enable effective and efficient domestic incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure". Professional responders utilize the ICS because it provides a universal structure that can expand or contract depending on the needs of a particular crisis or disaster. It also provides a universal language that anyone can understand, so that responders, whether professional or volunteer, can cooperate together without vital communication being lost or misunderstood in the miasma of jargon that is often utilized by a wide variety of first responders.

The ICS is normally structured into five functional areas including: Command, Operations, Planning, Logistics, and Finance/Administration. When applied to CERTs, the ICS operates in the usual framework, with the command function being filled by the first CERT Team Leader to respond to the disaster scene. The ICS functions within CERTs by organizing

volunteers/personnel into specialized functional groups based on acquired skills, or ones that were already present. ICS functions in the following ways:

- Management, or Command, (the CERT Team Leader) is responsible for deciding what is to be done.
- Operations is responsible for how it gets done.
- Logistics is responsible for how it gets supported.
- Planning is responsible for determining what is going on and how the information gets communicated and/or displayed.
- Finance/Administration is responsible for how everything gets documented.

The ICS can also, as it is utilized by professional personnel, expand and contract based on the needs of the disaster situation. As a disaster situation grows graver, and personnel from a state or national level begin to arrive, the simpler ICS structure that fit the needs of just the CERT team can grow to meet the needs of the expanding disaster relief efforts.

Roles of CERT

CERTs take on many active roles within a community. They seek to alleviate suffering not only during a disaster, but also before and after as well. That is, through training, CERT members are prepared to serve their community not only in disaster response, but in disaster preparedness, mitigation, and recovery as well. This section of the paper will attempt to illustrate the importance of CERTs within a community before, during, and after a disaster

Before a Disaster: Instead of simply alleviating conditions and providing assistance post disasters, CERTs can provide a means of preparing their communities for disasters. By learning preventive measures, a community can ensure that their families are safe as well as work to minimize potential damage. CERTs can be utilized before a disaster occurs in a variety of ways, for example:

- Distribute preparedness materials and conduct preparedness demonstrations.
- Ensure that community members have up-to-date knowledge and information of local first responders.
- Demonstrate how to properly install smoke detectors and other household monitoring devices.
- Verify and update a list of special needs residents who may have already registered with local emergency responders. Make sure these residents are properly prepared for disasters and that they will be accounted for in the face of a disaster.
- Distributing information, and teaching people how to about disaster kits.
- Teaching hazard mitigation procedures (e.g. eliminating hazardous material from home, ensuring electrical outlets are not overloaded, etc.).

During a Disaster: When a disaster is occurring widespread damage can take place and create more needs than can be immediately met by professional emergency responders. At

times, these emergency responders may be delayed due to infrastructure damage or other causes. When such situations occur, CERTs can assist their local communities until professional responders are able to arrive. CERTs can contribute to disaster response in a number of ways, such as:

• Conducting light search and rescue operations.

• Documenting damage and relaying important information to emergency personnel.

• Conducting triage on disaster survivors before emergency responders arrive.

• Providing basic first aid to disaster survivors.

• Assisting with crowd control and providing updated information to residents.

• Helping lost individuals and those with special needs.

After a Disaster: As soon as the critical phase of a disaster has passed the process of regaining control and normalizing the affected area can begin. During this recovery process CERTs might fill the following roles:

• Helping survivors, first responders, and other CERT members cope with trauma induced from the disaster.

• Keeping up-to-date information for citizens on recovery efforts.

• Delivering food and other supplies to survivors and emergency responders.

• Directing traffic and helping to maintain security around affected or high damage areas.

• Helping to staff and set up shelters and medical centers.

CHAPTER 3
METHODOLOGY

3.1 Type of Research

This research is descriptive in nature and mostly qualitative. The data and information gathered by primary and secondary means were used to understand the early warning systems and disaster emergency response mechanism and preparedness of the nation and the local communities as a whole in Japan in order to learn lessons to recommend a possible EWS and a community based response mechanism to adopt in the islands of Maldives.

3.2 Data Collection Methods

The primary data collection was done in some of the Prefectures, Cities and Municipalities of Japan which have experienced mega disasters in the past history. Few of the disasters include Great East Japan Earthquake in 2011, Great Hanshin Awaji Earthquake in 1995, Mt. Unzen-Fugen Volcanic Eruption Disaster and Pyroclastic flow in the years 1990 to 1993, Nakashima River Flood in 1982 in Nagasaki, and Kamenose Landslide induced flood in Osaka and Nara. Information sessions were provided by the Cabinet Office, JMA Regional Office Osaka, disaster management units of MLIT, Prefectural Governments, Japan Police, Cities and Municipalities, Fire Departments and Towns. Quite a lot of the data is from the Hyogo Prefecture and Kobe City. This research has used both primary and secondary data to understand the early warning setup and the disaster response mechanism at different levels in Japan.

3.2.1 Secondary Data Collection

Most of the secondary data were collected from the relevant authorities, departments and Bosai Units. Published and unpublished researches and other related data about EW, DRR and Community Based Disaster Response have been gathered for the study. The secondary data sources include books, journal articles, papers, research reports, NGO reports, documents and reports. In addition, several internet websites were found to be very useful in providing secondary data. ADRC's web portal and Research Bank made numerous English translated documents and readings available. Senior Researchers and Researchers at ADRC also provided lots of Japanese Bosai materials and resources to this research.

3.2.2 Primary Data Collection

Primary data were gathered mainly from the institutional presentations, tours and field visits and observations. In addition to this, interactive presentation and discussion sessions with Subject Matter Experts during the site visits provided firsthand information and insight into the specific disaster mitigation and countermeasures. The observations made by participating

community awareness programs, disaster drills and anniversary commemoration of past tragic events by interacting with local people were very useful and enabled to know more about the Japanese disaster history, their culture of safety and protection, community participation and delivery methods to create prepared communities for disasters.

3.2.2.1 Briefings and Presentations

The table below shows the various briefings and presentations delivered to the researchers which were used to gather knowledge about the Japanese DRR in detail.

#	Title and Topic	Organization	Date
1	Disaster Management in Japan	Cabinet Office	10 Feb 2016
2		JMA, Osaka	
3	International Disaster Risk Alliance Forum (DRA Forum 2016)	DRA Members, Kobe	20 Jan 2016
4	International recovery Forum 2016 Sending the message of Building Back Better from Hyogo, Japan Post-event: Open Dialogue Session	IRP, Cabinet Office, Hyogo Prefectural Government, ADRC, UNISDR	26 - 27 Jan 2016
5	Kobe City's Voluntary Disaster Reduction Organization Disaster Safe Welfare Community – BOKOMI	JICA, Kobe City Fire Bureau	22 Jan 2016
6	Earthquake and Tsunami in Japan and the GEJE on 11.3.2011	Tohuku University	02 Feb 2016
7	Impact on Minamisanriku City by the GEJE	Minamisanriku Recovery Office	03 Feb 2016
8	Mainstreaming DRM in Developing Countries	Japan-World Bank DRM Hub	9 Feb 2016
9	Operation and Functions of Wide Area Disaster Management Base and Headquarters	Tokyo Rinkai Disaster Prevention Park	10 Feb 2016
10	Early Warning System and Mechanism in Japan	Osaka Regional Headquarters of JMA	17 Feb 2016
11	International Recovery Platform (IRP) activities and Build Back Better (BBB) concept in disaster recovery	ADRC, JICA and IRP, Kobe	18 Feb 2016
12	Mt. Unzen-Fugen Volcanic Eruption	Unzen Recovery	23 Feb 2016

		Office, Kyushu Regional Development Bureau, MLIT	
13	Hyogo Prefecture Disaster Management	ADRC, Kobe	26 Feb 2016
14	Kamenose Landslide Counter Measures and Data Reference Center		02 Mar 2016
15	Waste Water Treatment System at Higashinada Sewage Treatment Plant	Higashi Water Environment Center, Kobe City	08 Mar 2016
16	Building Standard Law (Building Code) of Japan	DRI and ADRC, Kobe	15 Mar 2016
17	Rokko Sabo Office		16 Mar 2016
18	Japanese Disaster Management	ADRC	Many Classes

3.2.2.2 Field Visits and Observations

During the research period, several field visits were conducted and site observations were made to get in depth knowledge about the effects of past disasters, recovery and reconstruction efforts of recent disasters like Great East Japan Earthquake and Tsunami, various counter measures and disaster prevention and mitigation for sediment disasters, volcanic hazards, landslides, debris flows, storm surge, tsunami and flooding. The following table provides a summary of field visits and observed locations and facilities.

#	Field Visit	Location	Observations
1	Nojima Fault Preservation Museum	Awaji Island	Active Fault and Land dislocation by GHAE
2	Kobe City Fire Department Control Room	Kobe	Functions of Command and Communication facility
3	Town Watching and Hazard Mapping	Nada Ward	
4	Tsunami Affected Sites	Minamisanriku City, Iwanuma city, Natori City, Yamamoto Town and Yuriage Area	Tsunami devastation and ongoing recovery and reconstruction efforts
5	Sendai Area Tour with a Disaster Story Teller	Arahama Elementary School, Yuriage Area	Tsunami Damage to Coastal Areas

6	Tokyo Rinkai Disaster Prevention Park		Wide Area Disaster management Base, Emergency operations Room and Disaster Prevention Experience Learning Facility
7	Miki Emergency Management Base, and Hyogo Prefecture Emergency Management and Training Center	Miki, Hyogo Prefecture	Wide area disaster preparedness and flow of emergency actions
8	Atomic Bombing and Peace Park	Nagasaki	Destruction created by Atomic Bombing and rebuilding of Nagasaki City
9	Onokoba Sabo Observatory, Mt. Unzen Disaster Memorial Hall	Shimabara, Nagasaki	Sabo recovery work, affected sites of volcanic eruption and sediment disaster prevention and mitigation works.
10	Nakashima River and Urban Flood Affected Areas in 1982	Nagasaki	Urban Flood Mitigation and Counter Measures. Flood Diversion Channels.
11	Hyogo Prefecture Police	Police HQ, Hyogo	Role and functions of Command and Communication Center, and Traffic Management Center.
12	Kamenose Landslide Counter Measures and Data Centre, and Kamenose Landslide Area Library	Kamenose Area	Landslide Mitigation and Counter Measures
13	Higashinada Sewage Treatment Plant	Higashi Water Environment Center, Kobe City	Waste Water Treatment and Sewerage System
14	Osaka Tsunami and Storm Surge Prevention Station	Nishi Osaka Flood Control Office	Management and Control of seawalls and tide gates to prevent tsunami and storm surges
15	Rokko Sabo Office	Sumiyoshi	Sumiyoshi River Management, Green Belt Project, Slope Counter Measures and Kentani Dai-yon Dam Construction

3.2.2.3 Community Disaster Awareness Programs

Japan provides perhaps one of the best environments to witness and participate in the community disaster awareness programs and events. Researchers were allowed to look, observe, feel and experience lot of events and programs organized by Prefectures, Municipals, Cities, NGOs and other CBOs to the public and communities. The table below shows the few and most important events that provided vital information for this research.

#	Event / Program	Organization/Location	Remarks
1	Great Hanshin-Awaji Earthquake Memorial and Museum	DRI, Kobe	Museum Visit and watching earthquake disaster videos
2	17.1 Memorial Walk and Disaster Drill to commemorate GHAE	Kobe	2 km evacuation walk followed by visiting and observing booths/stalls and drill exercises by various stakeholders
3	Kaeru Caravan – Community Disaster Awareness Program	JICA, Kobe	Participated in some events
4	Honjo Bosaikan - Honjo Life Safety Learning Center	Tokyo Fire Department	Multi-hazard awareness and disaster experiencing
5	Disaster Prevention Experience Learning Facility	Tokyo Rinkai Disaster Prevention Park	Earthquake Disaster Experiencing and Learning
6	Disaster Evacuation Drill for disabled and people requiring special assistance	Nada Ward, Kobe City	Participated in the Drill and Debriefing (After Action Review)
7	Mount Unzen Disaster Memorial Hall	Shimabara, Nagasaki	Awareness raising on volcanic disasters and simulated displays
8	"Prepare and Feel DRR" – Hyogo Prefecture River and Flood Mitigation Bus Tour	Hyogo Prefecture	Aono Dam, Horaikyo Sabo Dam, River Bank Facility and Embankment Work
9	Kyoto Bosai 2016	Kyoto Prefecture	Disaster Prevention Learning and Experiencing

CHAPTER 4
DISATER RISK PROFILE OF JAPAN AND MALDIVES

4.1 Disaster Risk Profile of Japan

Due to its natural conditions, Japan is prone to virtually every type of natural disaster. A variety of natural disasters occurred in the past. Historically, destructive natural disasters have posed the greatest challenge for Japanese society. Unfavorable geographical, topographical and meteorological conditions of the country have made it one of the most disaster prone countries in the world. Although its territory accounts merely for the 0,25 % of the planet's land area, Japan is subject to about 20,5 % earthquakes with the magnitude 6 or more and 7 % the world's active volcanoes is located on its territory.

The most frequent natural hazards in Japan are earthquakes, tsunamis, typhoons, volcano eruptions, floods and landslides. Occasional torrential rains and heavy snows are another challenge for the country. The high number of earthquakes, tsunamis and active volcanoes are the conditioned by the fact that territory of Japan forms the part Circum-Pacific Seismic Belt which is sometimes called as Pacific Ring of Fire.
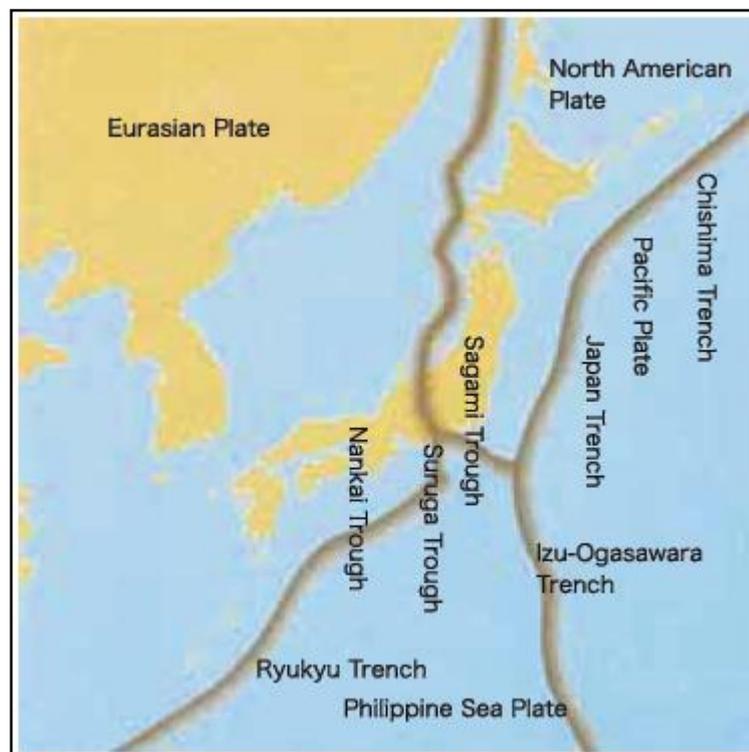
Figure 4.1 Junction of Four Tectonic Plates

As it is described in the Figure 4.1 Japan is located at the junction of 4 tectonic plates – Eurasian Plate, North American Plate, Pacific Plate and Philippine Sea –which is the cause of high seismicity of its territory. Tsunamis are triggered by strong earthquakes at ocean bottom or huge landslides in the vicinity of the coast.

Typhoons and rain front are the main causes of storm and flood disasters in Japan. About 10 typhoons hit Japan causing storm, tidal wave and high tides mainly during the period between May and October with August and September. 1959 year is considered to be turning point in fighting with typhoons – in that after Isewan typhoon which caused to the death of more than 5000. Since then as a result of set of measures taken and application new technological advancements by Japan Meteorological Agency (JMA) number of dead or missing peoples in the result of typhoons sharply decreased.

Fire vulnerability and risk in Japan is high. This is mainly due to large forest areas which cover about 70% of its total area, highly developed chemical and high-technology industries and close proximity of buildings in densely populated areas. Wildfires in Japan occur usually in dry seasons, mainly in summer. Moreover, tsunamis and earthquakes are also likely to entail large-scale fires in its immediate aftermath. About 7000 fire cases occurred in immediate aftermath of the Great Hanshin-Awaji earthquake in 1995.

Rivers in Japan are short and steep and flow rapidly and violently. Moreover, ratio between normal volume of flow and that during a storm is extremely great. A great amount of rain falls on the Japanese archipelago during the rainy season (heavy rains of June and July) and typhoon seasons; and during periods of intensive rainfall, even a small stream that usually runs low may become a raging torrent. Moreover, combination of such factors as steep mountains, fast-flowing rivers, unstable and soft ground, rainy climate and frequent earthquakes often lead to such sediment disasters as debris flows, landslides and slope failures. Charts and maps below explain situation in Japan with regard floods and sediment disasters.

4.2 Recent Disasters

4.2.1 Great Hanshin-Awaji Earthquake (January 1995)

On 17 January 1995, an earthquake with a 7.3 on the Richter scale occurred at Awaji island of Hyogo Prefecture in Western Japan. It killed 6,434 people, injured 43,792 people, destroyed 104,906 houses, half destroyed 144,274 houses, and partially destroyed 390,506 houses. By the fires broke out along with the earthquake, the area of 835,858 square meters was burnt down.

4.2.2 Mid Niigata Prefecture Earthquake (October 2004)

On 23 October 2004, the Mid Niigata Prefecture was affected by an earthquake with a 6.8 on the Richter scale. Landslides and destruction of buildings and houses caused 68 dead, and 4,805 injured. 3,175 houses were totally destroyed, 13,810 houses were half destroyed, and 105,573 houses were partially destroyed.

4.2.3 The Great East Japan Earthquake (March 2011)

A magnitude 9.0 earthquake hit the northeastern Japan on 11 March 2011, recording the largest earthquake hit in Japan. Its epicenter was located in the coast of Sanriku and its epicentral area stretched from the coasts of Iwate Prefecture to Ibaraki Prefecture. Massive shakes were observed particularly in eastern Japan including Japanese intensity scale of 7 registered in the north of Miyagi Prefecture. Furthermore, this earthquake, a trench-type earthquake occurred near the boundary of the Pacific Plate and the plate beneath Tohoku area, triggered seafloor movements and generated massive tsunami. According to the National Police Agency, this earthquake and tsunami have left unprecedented human suffering: 15,870 people death, 2,814 people missing and 6,114 people injured, as well as property damage: 129,472 totally collapsed buildings, 255,977 half collapsed buildings and 702,928 partially collapsed buildings. Furthermore, the value of the destruction of the social infrastructure, housing, and corporate facilities was estimated at 16.9 trillion yen and it had a great impact on Japanese economy.

4.3 Disaster Risk Profile of Maldives

The Maldives is a small island country lies between latitude 7° 6' 35" N, crossing the equator and extending up to 0° 42' 24" S and between longitudes 72° 33' 19" E to 73° 46' 13" E in the south-west of Sri Lanka and India. Maldives is comprised of 20 administrative atolls encompassing 1,192 small low-lying coral islands, of which 188 are inhabited and more than 100 islands are exclusive tourist resorts. The tiny islands stretch 820 km north to south and 120 km east to west. Total area is about 115,300 sq. km of which about 99% is water and total land area is about 298 square kilometers. The population of the Maldives is 344,023 (Census, 2014), of which 38 percent live in Male' City, the Capital of Maldives. Tourism is the backbone of the economy; fishing and agriculture also significantly contribute to the livelihood of the people. Two seasons; dry season (from December to April, northwest monsoon) and rainy season (from May to November, southwest monsoon) dominate the Maldives' weather. Maldives is one of the most vulnerable countries in the world. Being the most flat and the lowest elevated nation with average height of 1.5 meters, Maldives faces multi-hazard risks and threats from the global warming and climate change induced sea level rise and extreme weather events.

The country's geographic location, physical and geo-climatic features of its islands near the equator in the Indian Ocean exposes the country to different natural hazards from earthquakes (particularly the Southern region), tropical cyclones, storms, thunderstorms, heavy rainfall, drought, floods induced by heavy rainfall to storm surges, swell waves and tsunami. It regularly experiences extensive risks in terms of high frequency, low impact events such as monsoonal flooding, sea surges and other chronic phenomena including coastal erosion, saltwater intrusion and other climate risks. In addition, many islands of the Maldives

experience fresh water shortage during the dry season because of increased salinity and contamination of the ground water since the 2004 Indian Ocean Tsunami. Government spends several millions to supply emergency drinking water to the affected island communities every year.

Geologically, Maldives is located on the Indian tectonic plate which makes Indian Ocean ring as the main area of concern. There are two main subduction zones in this ring, the plate boundaries near Sumatra, Indonesia and the Makran coast. Large magnitude earthquakes in subduction zones tend to create Tsunamis, hence these areas are given a special importance.

In addition to the subduction zones mentioned, we experience earthquakes in the Carlsberg Ridge which is located on the south west of Maldives islands. Even though this fault does not cause a Tsunami, it can cause other damages depending on the magnitude of the event. The earthquake occurred on 15th of July 2013 which was recorded 7.6 in Richter scale, caused some damages to the Addu City infrastructure.

Maldives is one of the fewer countries which do not have any natural higher grounds. Not a single piece of land is higher than three meters above mean sea level. Generally, urban or rural, all the islands are coastal communities. All the human settlements, industries and critical infrastructure are located near the shoreline. Airports, hospitals, schools, power plants and more than 40 per cent of houses lie less than 100 meters from the sea. Due to the close proximity to the coastline, several households are prone to severe climate hazards.

4.4   Recent Disasters

4.4.1   Addu City Flood Crisis (24-25 November 2015)

Addu Atoll in the south of the Maldives has been hit by severe flooding after several hours of torrential rainfall. Homes and businesses in Addu City have been inundated by floodwaters and the storm damage has been described as the worst in 40 years. The City experienced 228.4 mm rainfall between 8am Tuesday to 8am Wednesday and was the highest recorded in the country history in 24 hours. It also experienced an alarmingly high rainfall in an hour with 54.9mm. The islands of Feydhoo, Maradhoofeydhoo and Maradhoo households were severely affected. About 297 houses got flooded and loss is estimated at US$0.3 million.

4.4.2   Male Water Crisis (4 December 2014)

A serious fire broke out on 4 December 2014 inside the Maldives Water and Sewerage Company (MWSC)'s Generator Unit and has disrupted Male' City's water supply. The water supply was suspended across the capital city as MWSC is the sole provider of clean desalinated water in the capital and the unit was severely damaged in the fire. A national crisis was declared by the government of Maldives and an operation to distribute safe drinking water in the Male' City started. Maldives National Defense Force (MNDF) and the

Maldives Police Service (MPS) are being tasked to manage the distribution of safe drinking water. Meanwhile, the Maldives Red Crescent and various private sector companies have been supporting and deployed to assist in the wider delivery of clean water to the households. The loss and the cost of relief operation were estimated to be US$20 million and lasted for 10 days.

4.4.3 Cyclone Nilam (October-November 2012)

Tropical cyclone that originated from the Bay of Bengal hit Maldives late October and continued until the first few days of November flooding 51 islands. 28 islands were severely flooded, and 4 islands were in a critical state. The cyclone affected 33,826 people and caused an estimated US$ 133,090 in damage.

4.4.4 Surge Waves (15-17 May 2007)

On 15-17 May 2007, a series of swells, between 10 - 15 feet, hit an estimated 68 islands in 16 Atolls across the Maldives, causing the inundation of up to 600 meters from the coastline. The most affected atolls were Gaafu Dhaalu, Dhaalu, Thaa and Laamu, which include over 24 islands. There were no human fatalities from the coastal flooding. However, 1649 people were evacuated from their homes. A total of 579 housing units were damaged by the high tide floods. 33 islands were affected by salt water intrusions that caused significant damage to crops, agriculture farms, home gardens and vegetation, which most people depend upon for livelihood and food supplies. The wave surges also caused minor damage to harbors and jetties in 17 islands and 58 out of the 68 islands inundated have reported to have significant area of the coastlines eroded.

4.4.5 Indian Ocean Tsunami (December 2004)

Indian Ocean Tsunami occurred off the Sumatra Island on 26 December 2004 devastated the Maldives, causing 82 people killed, 26 people missing and more than 27,214 people affected. The total economic loss was approx. US$ 470 million, about 62% GDP. Total (World Bank, 2005).

CHAPTER 5
DISASTER MANAGEMENT SYSTEM IN JAPAN AND MALDIVES

This chapter highlights and identifies the disaster management system in two countries with respect to legal framework, institutional mechanism and disaster management plans.

5.1   DM System in Japan

It is a national priority to protect national land as well as citizens' lives, livelihoods, and property from natural disasters. The turning point for strengthening the disaster management system came into effect in response to the immense damage caused by the Typhoon Ise-wan in 1959, and led to the enactment of the Disaster Countermeasures Basic Act in 1961, which formulates a comprehensive and strategic disaster management system. Thereafter, the disaster management system has been continuously reviewed and revised following the lessons learned from large-scale disasters such as the Great Hanshin-Awaji Earthquake in 1995 and the Great East Japan Earthquake and Tsunami in 2011 and the nuclear disaster (CAO, 2015). Response mechanisms to emergencies are specified in the Basic law on Natural Disasters as well as in a series of contingency-related laws.

Figure 5.1 Outline of the Disaster Management System in Japan

At the national level Central Disaster Management Council, the apex body for DM in Japan is housed within the Cabinet Office headed by the Prime Minister. Along with a series of reforms of the central government system in 2001, the post of Minister of State for DM was newly established to integrate and coordinate disaster reduction policies and measures of ministries and agencies. In the Cabinet Office, which is responsible for securing cooperation and collaboration among related government organizations in the wide-razing issues, the Director-General of Disaster Management is mandated to undertake the planning of basic disaster management policies and response to large-scale disasters, as well as conduct overall coordination.

5.1.1 Legal

It was major disasters in the Japanese history that triggered the introduction of disaster management Acts and Laws which enabled to form a comprehensive disaster management system in Japan. Japan's legislation for disaster management system, including the Disaster Countermeasures Basic Act, addresses all of the disaster phases of prevention, mitigation and preparedness, emergency response as well as recovery and reconstruction with roles and responsibilities among the national and local governments clearly defined, it is stipulated that the relevant entities of the public and private sectors are to cooperate in implementing various disaster countermeasures.

In Japan, the DM system has been developed and strengthened following the bitter experience of large-scale natural disasters and accidents over the years. The country has 7 basic acts, 18 disaster prevention and preparedness legislations, 3 legislations governing disaster emergency response and 23 disaster recovery and reconstruction and financial measures acts. The first act for the disaster response i.e. Disaster Relief Act dates back to 1947, passed after the 1946 Nankai earthquake. Thereafter every disaster led to learning and experience and it led to passing of new legislation. There is almost a separate legislation for each disaster and separate legislation for every aspect of disasters such as prevention, preparedness, response, rehabilitation and recovery, building standard, financial measures, earthquake insurance, etc.

The most notable piece of legislation is the Act passed in 2002 namely 'Act on Special Measures for Promotion of Tonankai and Nankai Earthquake Disaster Management'. The country is expecting mega earthquakes which may arise out of Tonankai and Nankai troughs and this legislation aims at reducing possible impact from these earthquakes and preparing the country to face them.

The Disaster Countermeasures Basic Act has constantly been reviewed and amended since its first enactment, and with lessons learned from the Great East Japan Earthquake, provisions were added including enhancement of the measures concerning support activities mutually done by local governments in 2012 and the measures for ensuring smooth and safe evacuation

of residents and improving protection of affected people in 2013. In 2014, provisions were added for strengthening measures against unattended cars in order to promptly clear them from the roads for emergency vehicles.

5.1.2 Institutional

The highest and the supreme body for the disaster management in Japan is the Cabinet Office (CAO). Along with a series of reforms of the central government system in 2001, the post of Minister of State for Disaster Management was newly established to integrate and coordinate disaster risk management policies and measures of ministries and agencies. In the Cabinet Office, which is responsible for securing cooperation and collaboration among related government organizations in wide-ranging issues, the Director-General for Disaster Management is mandated to undertake the planning of basic disaster management policies and response to large-scale disasters, as well as conduct overall coordination.

In the event of a large-scale disaster, the Cabinet Office is engaged in collection and dissemination of accurate information, reporting to the Prime Minister, establishment of the emergency activities system including the Government's Disaster Management Headquarters, overall wide area coordination concerning disaster response measures.
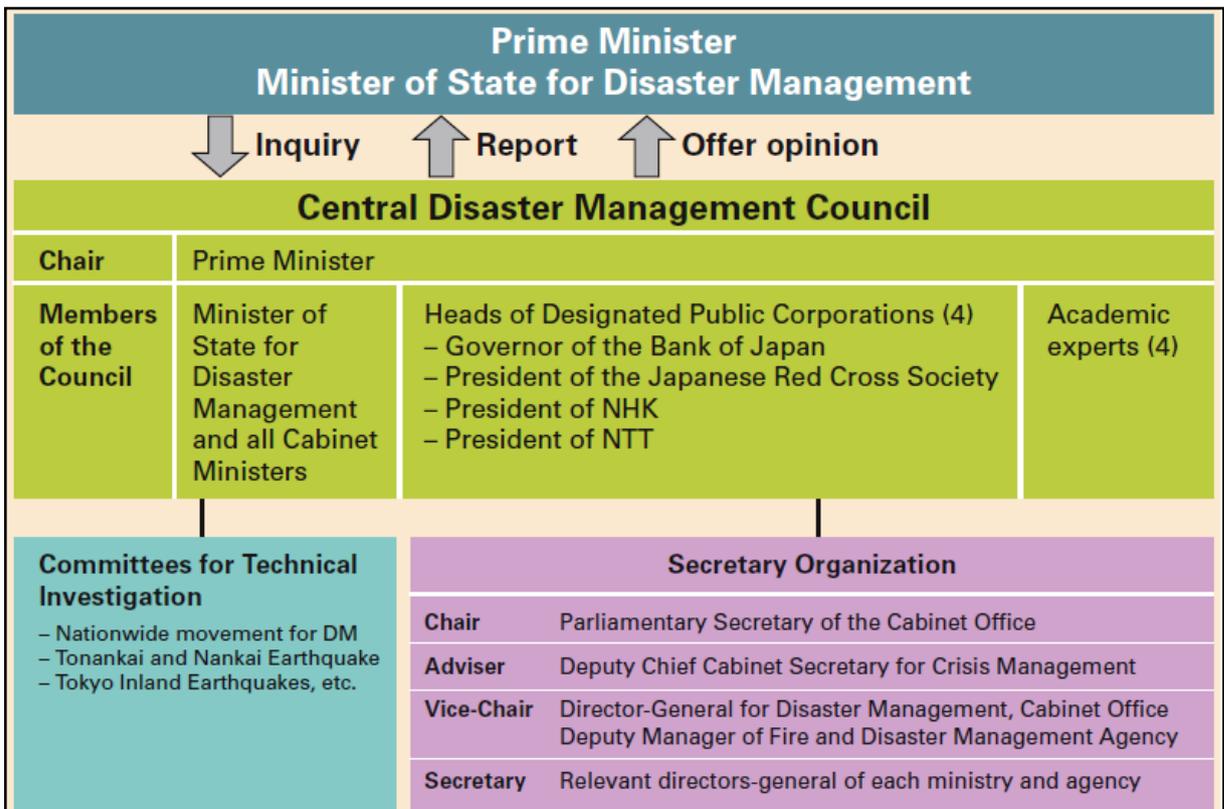

Figure 5.2 Structure of the Central Disaster Management Council

5.1.2.1 Central Disaster Management Council (CDMC)

To prepare for disasters, the Central Disaster Management Council decides the national government's disaster management policies. Such decisions are carried out by respective ministries and agencies, accordingly. The Central Disaster Management Council is one of the councils that deal with crucial policies of the Cabinet, and is established in the Cabinet Office based on the Disaster Countermeasures Basic Act.

The Council consists of the Prime Minister as the chairperson, all members of the Cabinet, heads of major public corporations and experts. The Council develops the Basic Disaster Management Plan and establishes basic disaster management policies, and plays a role of promoting comprehensive disaster countermeasures including deliberating important issues on disaster management upon requests from the Prime Minister or Minister of State for Disaster Management. The duties of the Central Disaster Management Council are to:

➤ Formulate and promote implementation of the Basic Disaster Management Plan and Earthquake Countermeasures Plans;

➤ Formulate and promote implementation of the urgent measures plan for major disasters;

➤ Deliberate on important disaster reduction issues, in response to requests from the Prime Minister or Minister of State for Disaster Management (basic disaster management policies, overall coordination of disaster countermeasures and declaration of state of disaster emergency);

➤ Offer opinions regarding important disaster reduction issues to the Prime Minister and Minister of State for Disaster Management.

5.1.3 Disaster Management Plans

In Japan Disaster Management Planning is done at three levels namely:-

5.1.3.1 Disaster Management Planning System

Basic Disaster Management Plan: This plan is the highest-level plan and constitutes the basis for disaster management activities prepared by the Central Disaster Management Council based on the Disaster Countermeasures Basic Act.

Disaster Management Operation Plan: This is a plan made by each designated government organization and designated public corporation based on the Basic Disaster Management Plan.

Local Disaster Management Plan: This is a plan made by each Prefectural and Municipal Disaster Management Council, subject to local circumstances and based on the Basic Disaster Management Plan.

Community Disaster Management Plan: This is a disaster management activities plan at the community level which is established by residents and businesses jointly on a voluntary basis.

5.1.3.2 Basic Disaster Management Plan

The Basic Disaster Management Plan is a comprehensive and long term disaster management plan forming a foundation for the Disaster Management Operations Plan and Local Disaster Management Plan. It is the most over-arching plan and stipulates provisions for the establishment of the disaster management system, promotion of disaster management measures, acceleration of post disaster recovery and reconstruction measures, and promotion of scientific and technological research on disaster management.
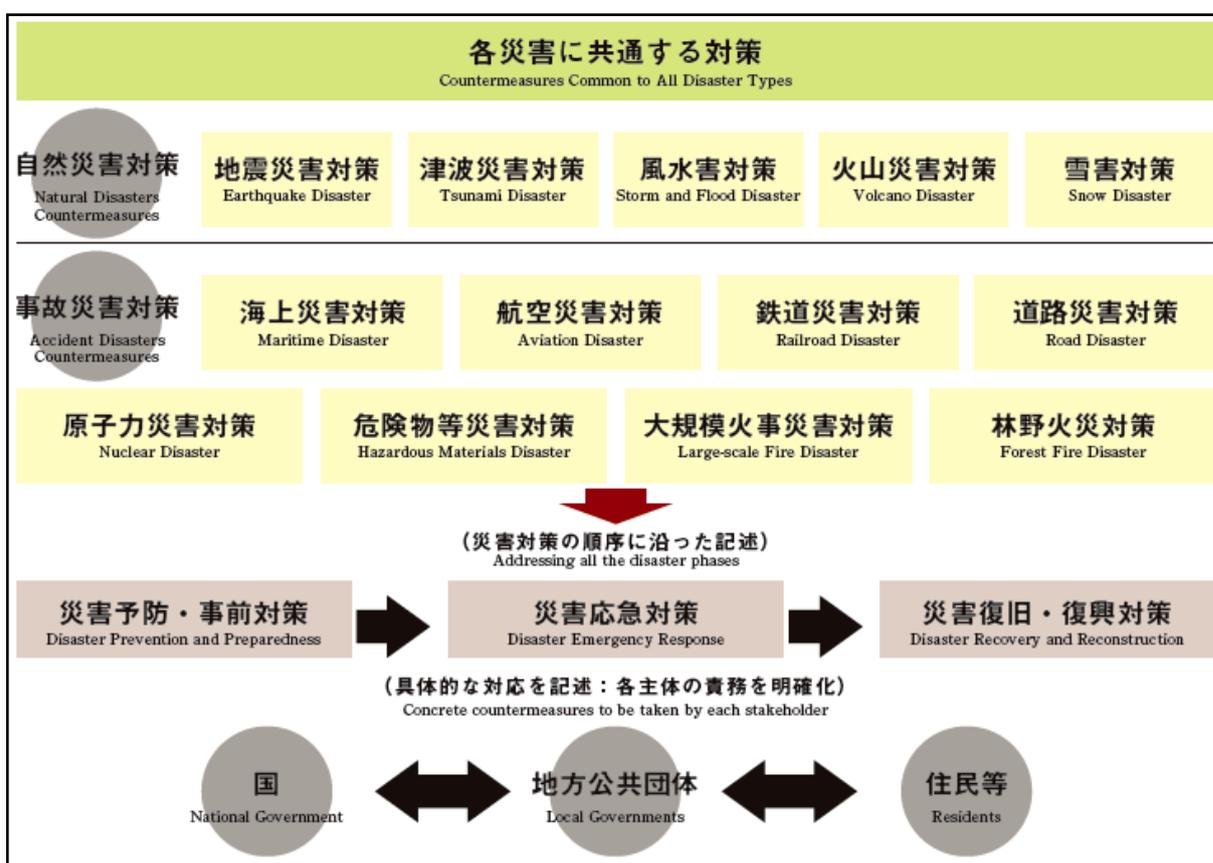

Figure 5.3 Structure of Basic Disaster Management Plan

The plan was revised entirely in 1995 based on the experiences of the Great Hanshin-Awaji Earthquake. It defines responsibilities of each entity such as the national and local governments, public corporations and other entities. It consists of various plans for each type of disaster, where specific countermeasures to be taken by each entity are described according to the disaster management phases of prevention and preparedness, emergency response, as well as recovery and reconstruction.

Further, based on the lessons learned from the Great East Japan Earthquake, a new chapter was created in December 2011, for Tsunami Disaster Countermeasures and changes were

made in September 2012 and January 2014, reflecting amendment of the Disaster Countermeasures Basic Act and reflecting the study results by the Nuclear Regulation Authority (NRA) respectively. In November 2014, another change was made to reinforce the measures for removing unattended cars in case of emergency. A further change was made in March 2015, to enhance the nuclear disaster management system.

5.1.3.3 Department/Organizational Level:

Disaster Management Operation Plan: This is a plan made by each designated government organization and designated public corporation based on the Basic Disaster Management Plan. They are responsible for the formulation and promoting implementation of the Disaster Management Operation Plan

5.1.3.4 Prefectural / Municipal Level:

Local Disaster Management Plan: This is a plan made by each prefectural and municipal disaster management council, subject to local circumstances and based on the Basic Disaster Management Plan.

Prefectural and municipal Disaster Management Councils are established in prefectures and local municipalities, with membership comprised of representatives of local government organizations, including police and fire management departments, and designated local public corporations. Implementation of disaster risk management measures is based on the Local Disaster Management Plans drafted by the Councils. These Disaster Management Councils and Disaster Management Plans, at each level from central government to local municipalities, are prescribed in the Disaster Countermeasures Basic Act. This Act requires the Disaster Management Council at each level to review its Disaster Management Plan every year and amend it in order to ensure that the capacities of all early warning system stakeholders are utilized in the most effective and efficient manner. Each Disaster Management Council should communicate developments and/or amendments of their Disaster Management Plan to the Prime Minister, governors of prefectures and local municipalities.

The plans at all levels have been prepared and regularly revised and updated incorporating the lessons learnt and changes made in the Basic DMP prepared at the national level. DMP is the main document which is referred to for disaster management and emergency response in Japan.

5.2 DM System in Maldives

A presidential decree established the National Disaster Management Centre (NDMC) soon after the 2004 Indian Ocean Tsunami. Initially, its mandate was to coordinate the recovery process for the tsunami response and relief effort. However, as things progressed, the government handed the mandate of disaster preparedness and risk reduction as well to the

NDMC. With the Disaster Management Act 28/2015 the National Disaster Management Authority (NDMA) was created. This is considered the greatest achievement in the history of disaster management in the country.

Following the 2004 Indian Ocean Tsunami there is a strong focus on developing disaster preparedness at the national level. Each year December 26 is marked as National Unity Day to commemorate the 2004 Tsunami. National institutions and civil organizations use the day to advocate for better disaster preparedness in the country.

5.2.1 Legal

The following Acts and Ordinances provide the legal basis for the respective institutions and organizations carryout and engage disaster risk reduction and emergency response activities in the Maldives.

5.2.1.1 Disaster Management Act 28/2015

The Disaster Management Act 28/2015, which was published in the government gazette on 6 September 2015, stipulates the basic tenets and principles that govern the disaster management in the Maldives. The Act states the policies, rules and guidelines that need to be formulated to realize the purposes specified by this Act; to save and protect the Maldives' geographical area, the Maldivian people, the property of the Maldivian people, and the natural and urban environment from hazards and disasters of natural and other causes; and to reduce the disaster risk from various hazards considering the vulnerability; and to be prepared for and safe from disasters, in the event of such an incident or state of emergency. This Act seeks to provide a framework and a platform at all levels to address all the Phases of disaster mitigation, preparedness, response, and recovery.

5.2.1.2 Decentralization Act (2010)

Article 24 of the Decentralization Act 2010 asserts the island councils mandate with the responsibility to establish a mechanism to provide effective response in case of a disaster.

5.2.1.3 Armed Forces Act (1/2008)

The responsibilities in article 7 (d) of the Armed Forces Act gives mandate to the Armed Forces to lead and coordinate with the relevant government agencies and work to save the lives of people and property in case of hazards and disasters. Article 7 (e) refers to freighting and saving lives of people and property in case of fires. Article (f) refers to helping the lives of people facing maritime incidents and saving the lives of people and property in case of land or maritime hazards and disasters.

5.2.1.4 Police Act (5/2008)

Article 6 (11) of the Police Act observes the responsibilities of Police in case of hazards or disasters. Police are mandated to save the lives of people, households and property in case of a natural disasters or other type of disasters. Also help the victims of hazards and disasters and assist in maritime incidents and other emergencies.

5.2.1.5 Maldives Red Crescent Act (7/2009)

Under the objectives of the Maldives Red Crescent Act, article 3 (a) asserts the primary objective is to provide humanitarian aid, prevent and alleviate human suffering.

5.2.2 Institutional

In Maldives, an atoll is an administrative division or a region in the government system. An atoll consists of many islands. Number of islands and its sizes vary from atoll to atoll. Individual atolls have received their mandates from the Act on Decentralization of the Administrative Divisions of the Maldives. Atoll Councils are responsible for the developmental programs and projects conduct at various islands within the particular atoll. Local Government Authority is a national institution created to monitor the work and activities and coordinate the work of the councils under the Act on Decentralization of the Administrative Divisions of the Maldives.

National Level	City / Atoll Level	Island Level
- National Disaster management Council - National Disaster Steering Committee - National Disaster Management Authority - Maldives National Defence Force - Maldives Police Service - Maldives Red Crescent Society - Maldives Meteorological Service - Public Media Service	- City / Atoll Council - City / Atoll Disaster Management Committee - City / Atoll Disaster Management Unit - MNDF Area Commands - Police Divisions / City / Atoll Police - MRC Branches	- Island Council - Island Disaster Management Committee - Island Disaster Management Unit - MNDF Posts / Unit - Island Police Station - MRC Unit - Community Based Organizations

Figure 5.4 Disaster Management Structure of Maldives

Currently, the NDMA serves as the national authority and institution with the mandate to lead disaster management and disaster risk reduction in the country. It also serves as the national platform to coordinate multi-sectorial disaster management activities in the Maldives and leads government commitment to protecting its people and the implementation of international standards such the HFA (2005-2015) and moving forward with SFA (2015-2030). At present, NDMC is under the Ministry of Defense and National Security.

5.2.3 Disaster Management Plans

The National Disaster Management Plan (NDMP) and the National Operation Plan (NEOP) would be providing the necessary guidance and direction for disaster mitigation, prevention, Preparedness, response, recovery, rehabilitation, and the crisis management in the Maldives. Disaster Management Act compels to produce and maintain these two plans. However, the work to formulate national disaster management plan (NDMP) is underway and the national emergency operational plan (NEOP) is in the final draft stage

In addition, the Strategic National Action Plan (SNAP) for Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) aims to promote collaboration among policy makers, experts and practitioners of disaster risk reduction and climate change adaptation throughout the country in order to develop a comprehensive risk management approach. Other plans include the establishment national early warning system, commissioning of disaster management plan for tourism sector, development of Safe Island Strategy and integration and mainstreaming of climate change adaptation and disaster risk reduction into the resilient island development planning of the Maldives.

Moreover, under national DRR efforts, some important national frameworks, guidelines and local level plans have been developed. They include the National Framework for Community Based Disaster Risk Management, National Framework for Managing Internally Displaced People, Guide for School Emergency Operation Plan, Island Disaster Management Plans, Public Health Emergency Plan and Island Development Plans.

CHAPTER 6
EARLY WARNING SYSTEMS

EWS is "the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, 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". This definition given by the UNISDR encompasses the range of factors necessary to achieve effective responses to warnings.

6.1   Early Warning System in Japan

Japan has one of the most sophisticated and hi-tech EWS in the world for multi-hazards. As evacuation information when a tsunami is impending is information upon which lives depend, every possible tool including local disaster management 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, radio, mobile phones, 1-Seg (a mobile terrestrial digital audio/video and data broadcasting service), etc should be utilized, and tsunami warnings must be delivered to governments and residents without fail – Committee report
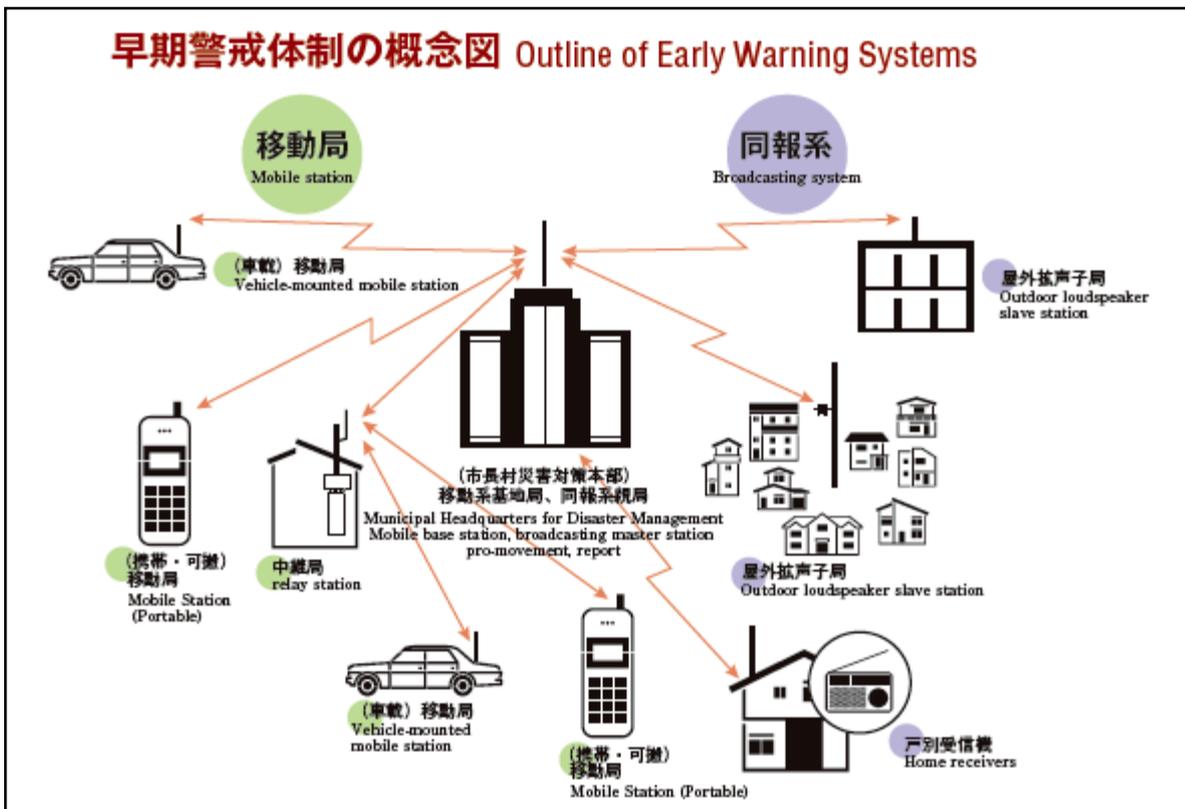

Figure 6.1 Outline of Early Warning System in Japan

6.2 Japan Meteorological Agency (JMA)

Japan Meteorological Agency (JMA) is the national authority responsible for issuing disaster early warning and is required to provide reliable and timely information to governmental agencies, local governments and residents for the purposes of natural disaster prevention and mitigation. Within the structural framework of Japan's central government, the JMA is placed as an extra-ministerial bureau of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). In Japan, all warnings for hazards are issued by JMA either solely or jointly with other authorities.

As part of the Disaster Response Mechanism, the JMA provides timely and accurate 'Disaster Information' to central and local disaster management authorities, in order to supply such information to the public through these authorities. This 'Disaster Information' consists of following warnings, advisories and information:

- Warnings and advisories on weather, high tides, high waves and flooding;
- Earthquake Early Warnings;
- Tsunami Warnings and Advisories;
- Volcanic Warnings;
- Information regarding typhoons, heavy rain, tornadoes, earthquakes, tsunamis and volcanic activities.

JMA has the mandate for monitoring, forecasting and development of warnings for various kinds of high risk natural hazards such as earthquakes and severe weather conditions, including heavy rain, heavy snow and storm surge. JMA also has responsibility for issuing flood warnings, in collaboration with the River Bureau of MLIT or prefectural governments.

JMA is responsible for the development of Warnings in relation to weather (i.e. storm, snow-storm, heavy rain, heavy snow, storm surge, high waves and flood), volcanoes, tsunamis and earthquakes. In addition, JMA issues early warning information for extreme weather. JMA also has a joint or shared responsibility for issuing River Flood Warnings, in collaboration with Hydrological Services at national and municipal levels, and for Sediment Disaster Alerts, with sediment control authorities at a municipal level.

JMA also provides hazard/risk information and contributes to the production of hazard/risk information by other agencies in order to support emergency planning. Hazard risk information obtained through early warning systems is utilized in supporting the early evacuation of residents and the response activities of disaster management organizations. JMA operates 24- hourly systems to monitor various natural phenomena and weather conditions and it issues a wide range of forecasts and advisories regarding earthquake-generated tsunami and severe weather events such as heavy rain. JMA incorporates the results of monitoring and forecasting into warning messages including, for example, sediment

disaster alerts for municipalities, collaboratively issued by JMA and prefectural governments, and flood warnings for designated rivers, collaboratively issued by JMA and Hydrological Services/prefectural governments.

6.3   Hazard Specific EW and Alerts

6.3.1   Tsunami EW

In case of an earthquake, JMA estimates the possibility of a tsunami. If a damaging tsunami is expected, JMA issues tsunami warnings and advisories three minutes after the earthquake. In case tsunamis are originated by seismic events far from Japan, JMA takes a coordinated action with the Pacific Tsunami Warning Center (PTWC). Information provided by the warning system includes tsunami height and arrival times for affected locations in coastal areas.
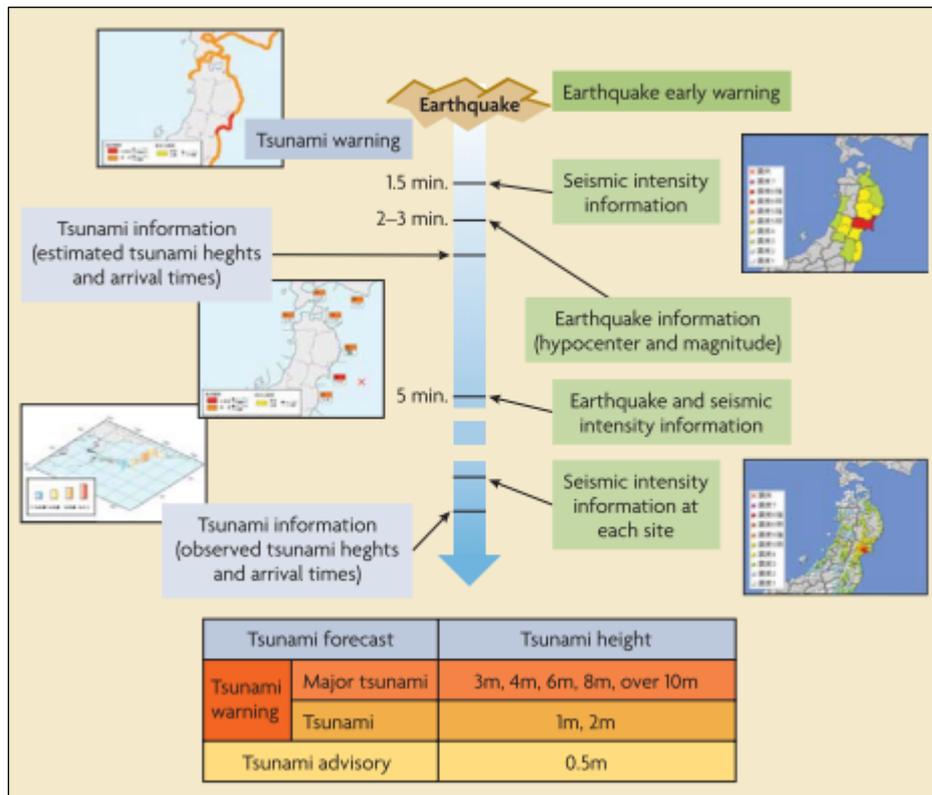

**Figure 6.2 Timeline and Criteria for Tsunami Advisory and Tsunami Warning**

Figure 10.1 Information flow in the tsunami-warning system

Source: Japan Meteorological Agency (JMA).

Local governments

Loudspeakers, sirens

Police, fire officers

Residents in coastal areas at risk

Dedicated telephone line

JMA

Central government

TV broadcasting

Radio stations, etc.

On TV Screen
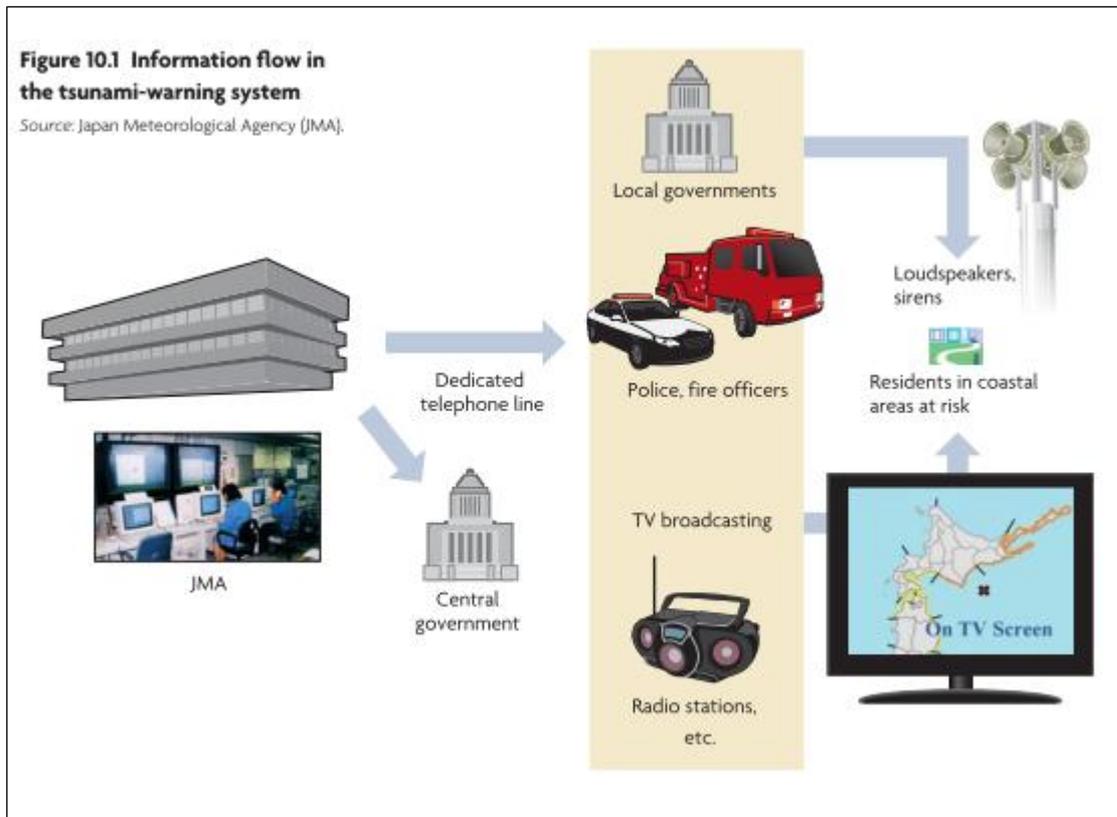
Figure 6.3 Tsunami Early Warning Dissemination by JMA

6.3.2   EEW

In order to constantly monitor seismic activity, the JMA and other relevant organizations install and maintain seismometers that are used for estimating the location of the epicenter and magnitude of an earthquake as well as for tsunami forecasts, and seismic intensity meters that measure the intensity of ground motion, in numerous places nationwide. As soon as an earthquake occurs in or around Japan, the JMA analyzes the data from various seismometers and seismic intensity meters. Within about ninety seconds (1.5 minutes), it issues a seismic intensity information report for earthquakes of intensity 3 or greater, and within about five minutes issues an earthquake information report indicating the epicenter and magnitude of the earthquake and the seismic intensity in the municipalities where strong shaking was observed.
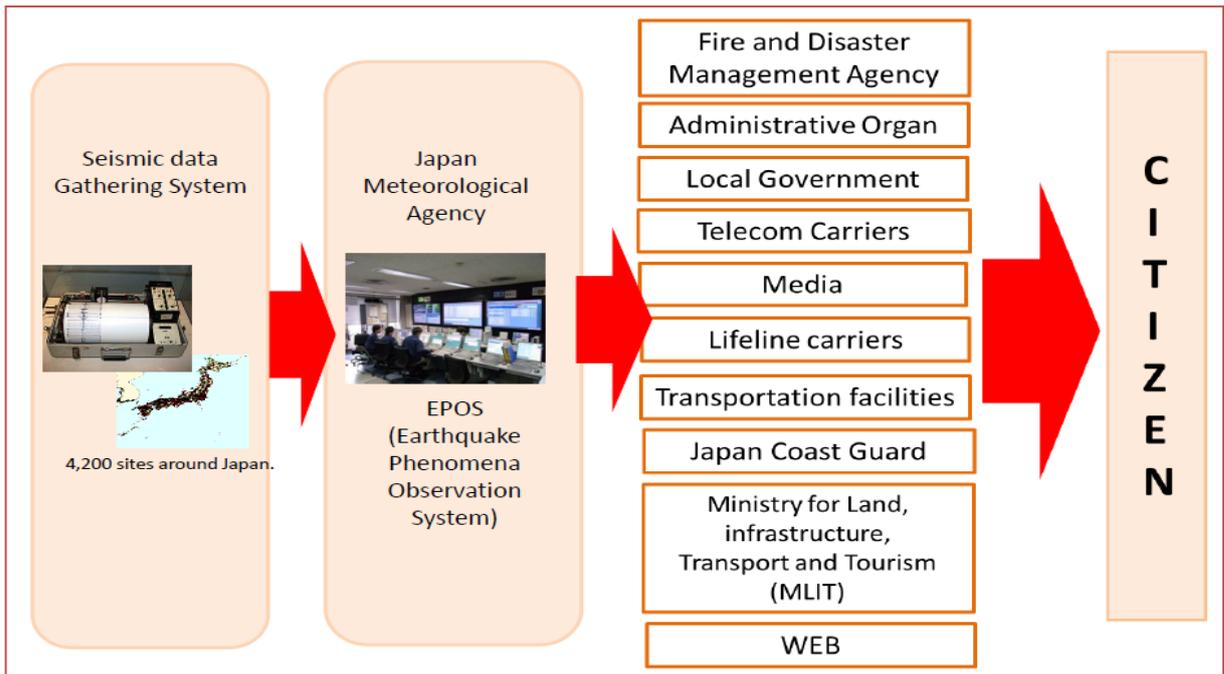
6.3.2.1 Utilization of Earthquake Early Warning Information

Earthquake Early Warning (EEW) information announces the estimated hypocenter and magnitude of an earthquake as well as the estimated arrival time of the S-wave of the earthquake and seismic intensity in each area. This information is made possible by detecting the P-wave near the epicenter and immediately processing the data since there is a difference in the speed of the P-wave, which arrives faster, and the S-wave, which arrives later and causes more severely destructive phenomena.

In the case of a large-scale ocean trench-type earthquake, there may be a time lag (several seconds to several tens of seconds) between the issuance of the EEW information and the start of severe shaking (when the S-wave arrives). This can be a critical time to be used for mitigating damage by stopping trains and elevators, extinguishing flames or crawling under tables. Research and development has been promoted by the JMA in cooperation with related organizations, and the provision of the EEW information to specific entities such as railway companies began in 2006. Earthquake or tsunami warnings are instantly delivered to central & local governments, broadcasters, telecom carriers. After receiving these warning, local governments deliver alarm through their sirens or microphones.

The JMA earthquake warning system issues alerts a few seconds or tens of seconds before an earthquake. Since October 2007, the warnings are transmitted through media like TV and radio and are used for other applications such as promptly slowing down trains, controlling elevators to avoid danger and enabling people to quickly protect by themselves. The warnings include information on the estimated seismic intensity and the expected arrival time of

principal motion when an earthquake occurs. This information is derived from prompt analysis of the data obtained from Japan's seismic network.
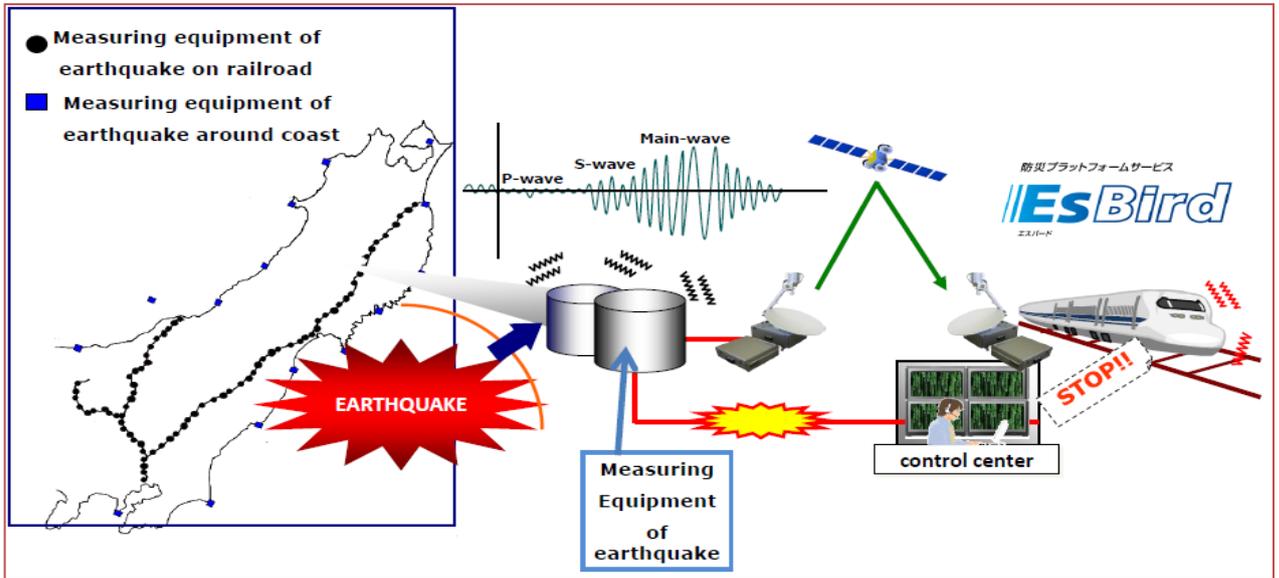

Figure 6.4 Outline of Earthquake Early Warning Information Used to Stop High Speed Trains

6.3.3   Meteorological Warnings and Advisories of JMA

When a hazardous weather condition is expected, JMA delivers various plain language messages including Warnings, Advisories and Bulletins to the general public and disaster prevention authorities so that appropriate measures can be taken to mitigate possible hazards. Warnings are issued when weather conditions are expected to be catastrophic and meet warning criteria. Advisories are issued when weather conditions meet advisory criteria but are expected to remain below the warning criteria. Bulletins provide information to supplement the Warnings and Advisories. These messages are issued by Local Meteorological Observatories (LMOs) for each of the sub-divisions in their respective prefectures. JMA issues 7 warnings and 16 advisories for hydro meteorological hazards as follows;

Figure 6.5 Meteorological Warnings and Advisories by JMA
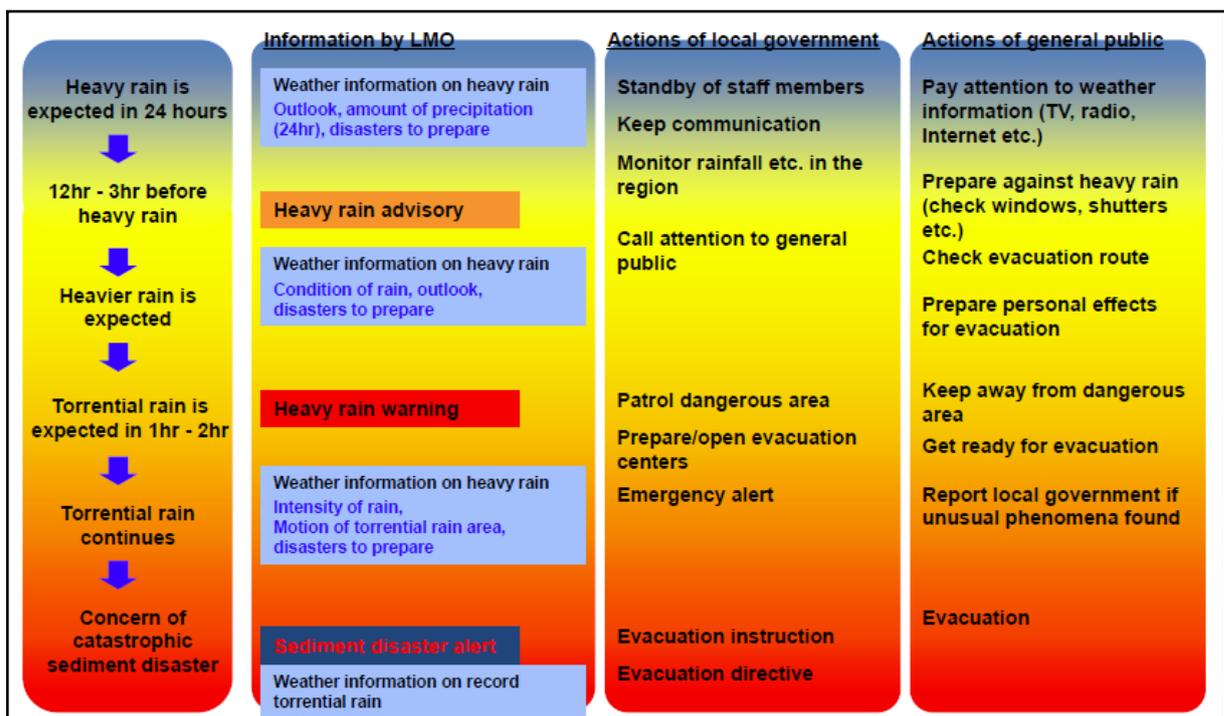

Figure 6.6 Timeline and Required Actions for Heavy Rain

6.3.4 Flood Early Warning

JMA issues flood warnings in collaboration with the Hydrological Service. JMA collects weather information and predicts the weather situation while the Hydrological Service has its own observation network of rain gauges and water level recorders for keeping an eye on the river situation.
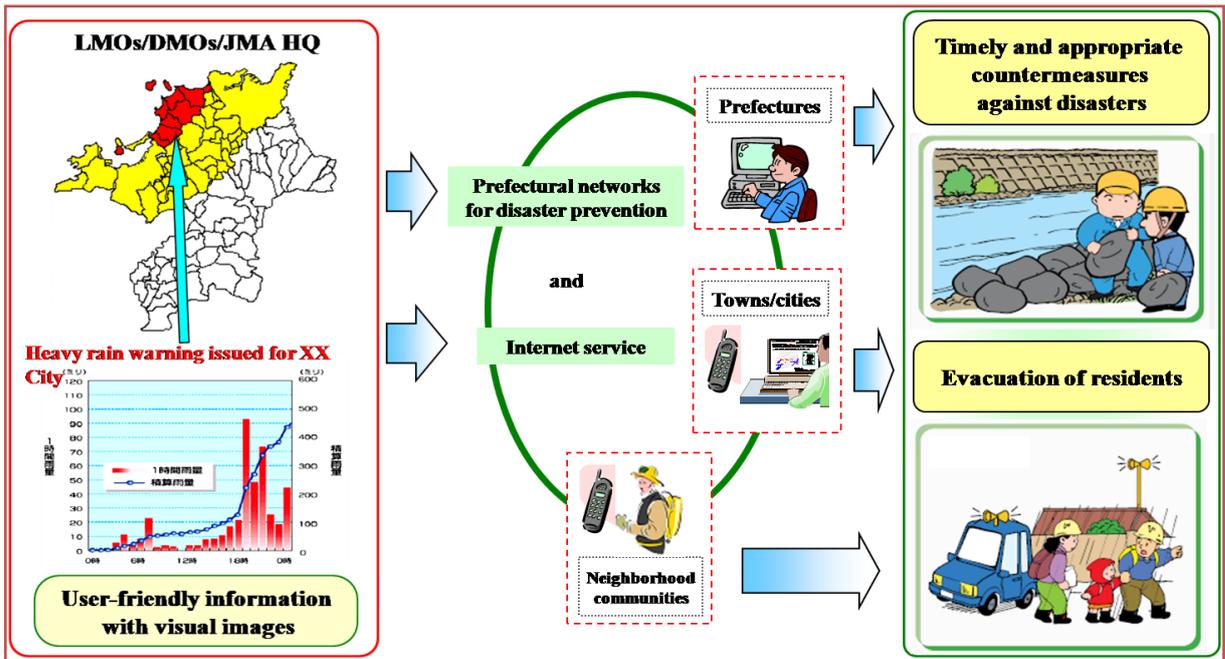
Figure 6.7 Flood Early Warning Communication

JMA is also responsible for providing flood forecasting services in collaboration with central and local river management authorities. These services include flood warnings and advisories covering 407 rivers (as of March 2011) throughout the country that have been designated by these authorities as sites of potential flood disasters. Flood forecasting systems for 289 of the 407 rivers are managed jointly by JMA and the MLIT, and the other 118 are managed jointly by JMA and prefectural governments. Furthermore, JMA has extended the range of rivers for which flood warnings are issued by including medium to small rivers that are managed by local governments.

6.3.5   Sediment Disaster Warnings

JMA has an established partnership with prefectures for issuing of sediment disaster alerts. This partnership is very similar to that with hydrological services for flood warnings. Prefectures have their local networks of precipitation measurements and topographical and geological information including hazard maps.
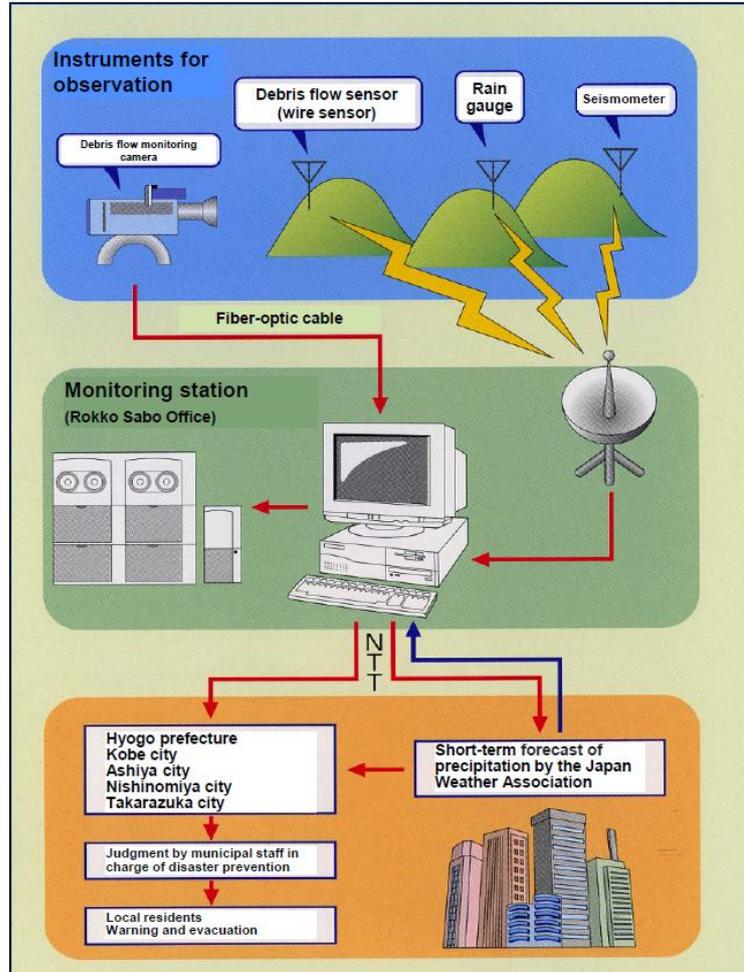
Figure 6.8 Sediment Disaster Early Warning System at Rokko Sabo Office

By combining these sources, JMA 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 MLIT and prefectural government civil engineering bureaus when sediment-related damage caused by heavy rain is considered likely within the next few hours.

6.3.6 Volcanic Eruptions

JMA operationally monitors seismic and volcanic activity throughout the country and issues relevant warnings and information to mitigate damage caused by disasters related to earthquakes, tsunamis and volcanic eruptions. JMA began issuing volcanic warnings and volcanic forecasts for each active volcano in Japan on Dec 1, 2007 to mitigate damage from volcanic activity. Volcanic warnings are issued in relation to expected volcanic disasters, and specify the municipalities where people need to take action. Volcanic forecasts are issued for less active volcanoes or those that become so.

Figure 6.9 Volcanic Hazard Warnings Levels and Required Actions

6.3.7 Emergency Warning System

JMA launched the Emergency Warning System on 30 August 2013. Emergency Warnings are issued to alert people to the significant likelihood of catastrophes in association with natural phenomena of extraordinary magnitude observed only once every few decades.
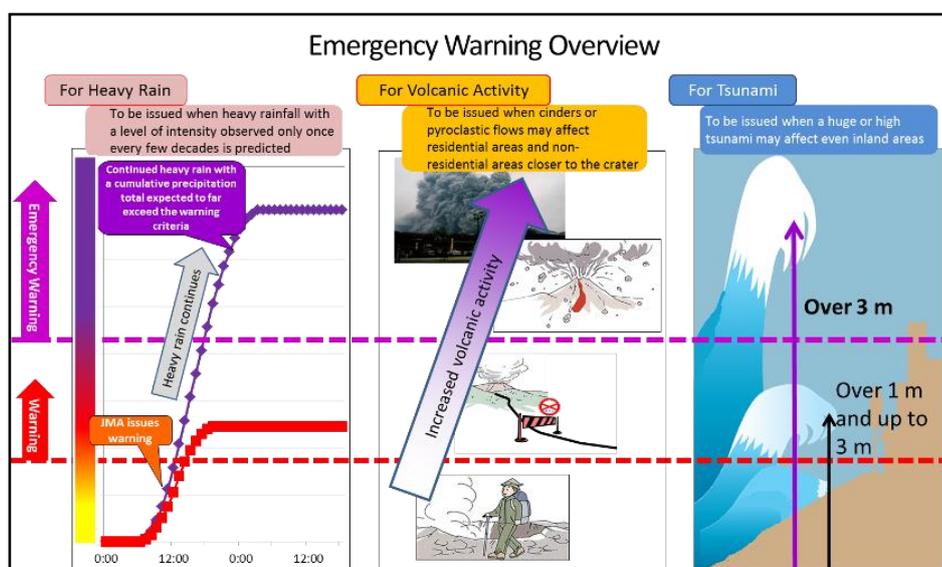
6.10 Emergency Warning System

6.4 Dissemination of Forecast and Early Warning

In order to prevent and mitigate damage caused by natural disasters and support prompt disaster prevention activities, JMA disseminates weather information and warnings via various channels to government disaster prevention agencies, local governments, the mass media and the public. An outline of early warning provision in Japan is given in Figure 6.11. For this purpose, the Agency maintains direct communication links with meteorological offices and central/local governments. Strong communication with municipal governments

that play direct roles in disaster management and mitigation in affected areas is essential. Such communication is ensured via various channels for information dissemination, such as prefectural governments, NTT (Nippon Telegraph and Telephone Corporation), J-ALERT (an instant information broadcasting system introduced by the Fire and Disaster Management Agency (FDMA) and the Internet.
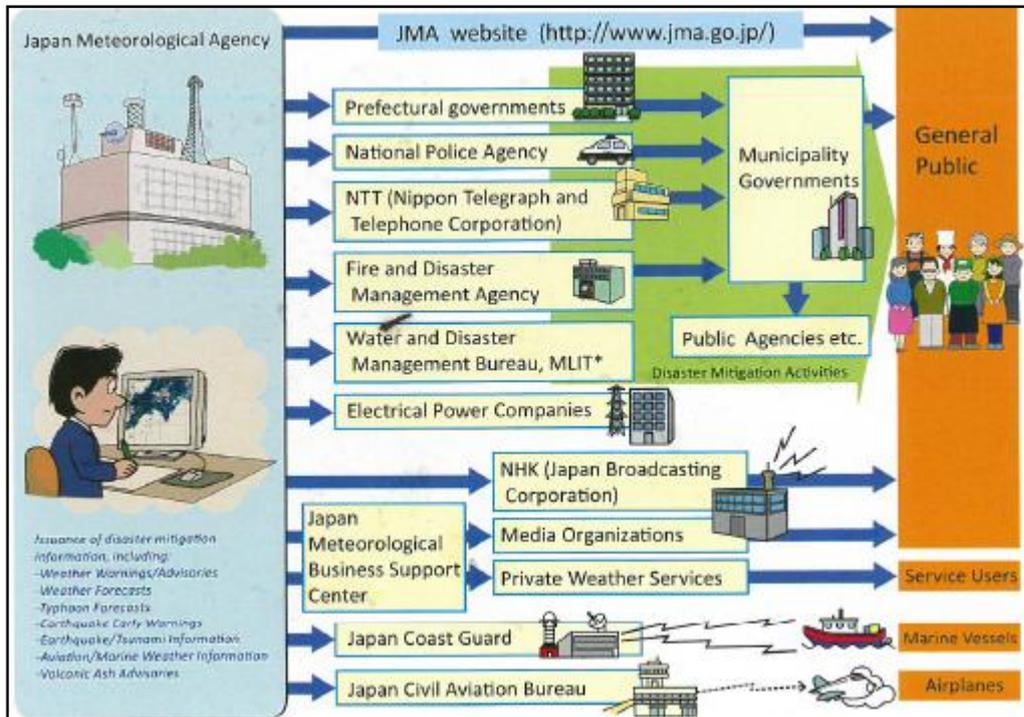
Figure 6.11 Provision of Hazard Information to the General Public

Reliable and redundant communication systems are essential for the effective dissemination of early warning information. JMA has an on-line system linking JMA and various users including disaster management organizations of the national and local governments and media organizations. The Central Disaster Management Radio Communications System (CDMRCS) connects national organizations and is composed of a telephone and facsimile hotline between designated government bodies and public corporations, an image transmission circuit for transmitting pictures of disaster situations from helicopters in realtime, and a satellite communications system as a backup. The Fire and Disaster Management Agency Radio Communications System connects firefighting organizations across the country. Prefectural and municipal disaster management radio communications systems connect local disaster management organizations and residents. Local governments use simultaneous wireless communications systems including outdoor loudspeakers and indoor radio receivers to disseminate disaster information to residents. Tsunami and severe weather warnings are also widely disseminated to citizens via TV and radio broadcasts.

To support prompt disaster mitigation activities by local governments, the Agency has introduced a new information provision system called the Information Network for Disaster

Prevention (INDiP), which enables effective and rapid dissemination of data in both text and graphic form. INDiP connects disaster prevention agencies and local governments with JMA headquarters via the Internet and provides detailed weather information and warnings tailored to individual municipalities. Information for maritime users is transmitted via the JMH radio facsimile broadcast service operated by JMA and fishery radio communications services. Such information is also disseminated within the framework of the Global Maritime Distress and Safety System (GMDSS), i.e. via the NAVTEX broadcast service of the Japan Coast Guard for seas in the vicinity of Japan, and via the Safety-Net broadcast service for ships in the high seas via the maritime satellite INMARSAT. Nowadays, the Internet plays a vital role for JMA in the public dissemination of a wide range of meteorological information not only on forecasts but also on historical and current observation data.
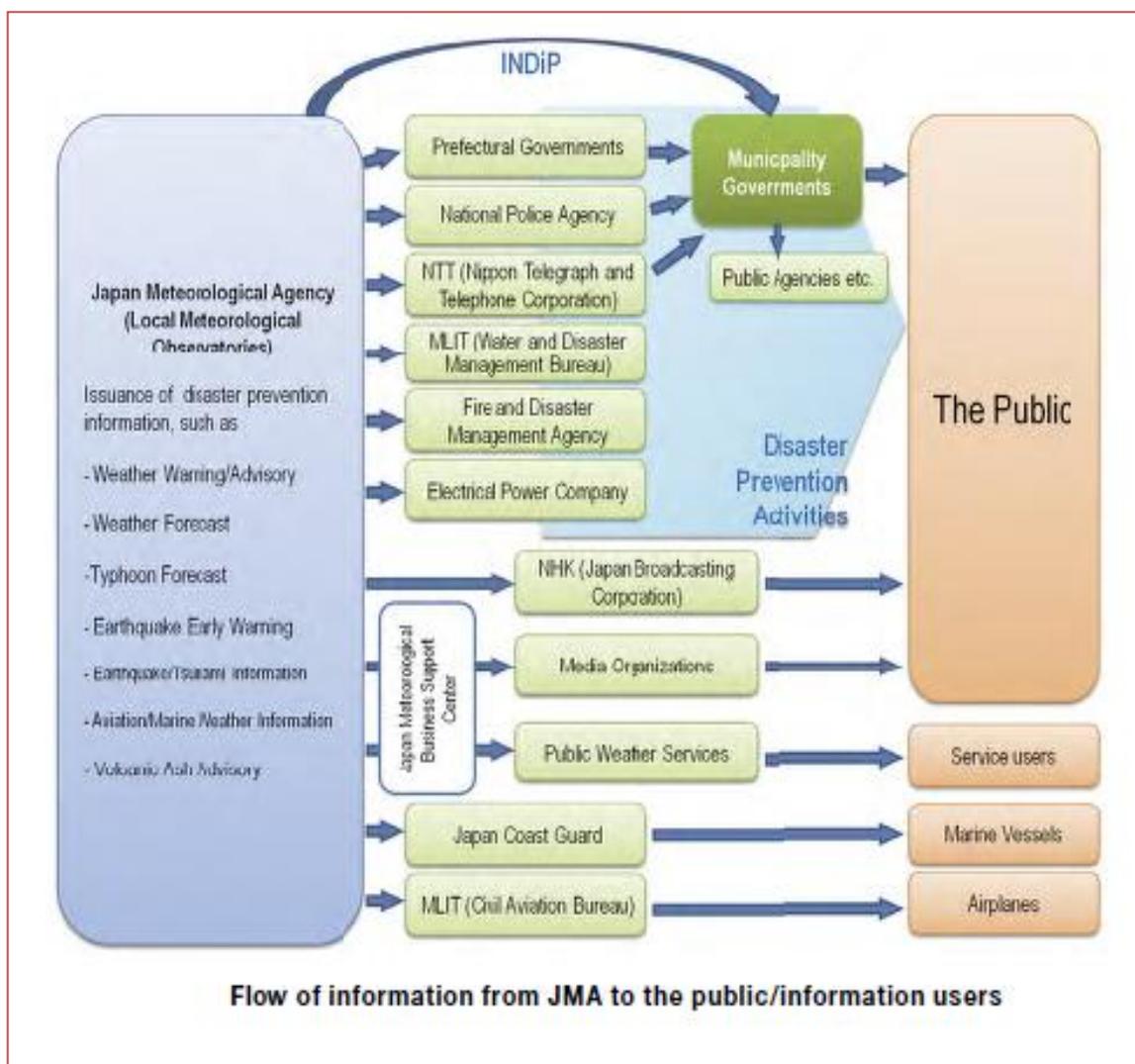
Figure 6.12 INDiP Network (Source: JMA)

6.4.1   J-Alert System

J-Alert is the system to immediately transmit emergency information such as Emergency Earthquake information, tsunami warning, information of ballistic missiles, which people have no enough time to deal with, is transmitted to the municipalities by using satellite (via the Fire and Disaster Management Agency, the Cabinet Secretariat, and JMA). It became operational on 09 February 2007 and on 01 October 2007 started sending the emergency earthquake information. As of first March 2010, 344 municipalities have introduced this system. Among them, automatic activation system of radio broadcasting and community FM has been introduced to 282 municipalities. The J-Alert framework has been given in figure 6.11.
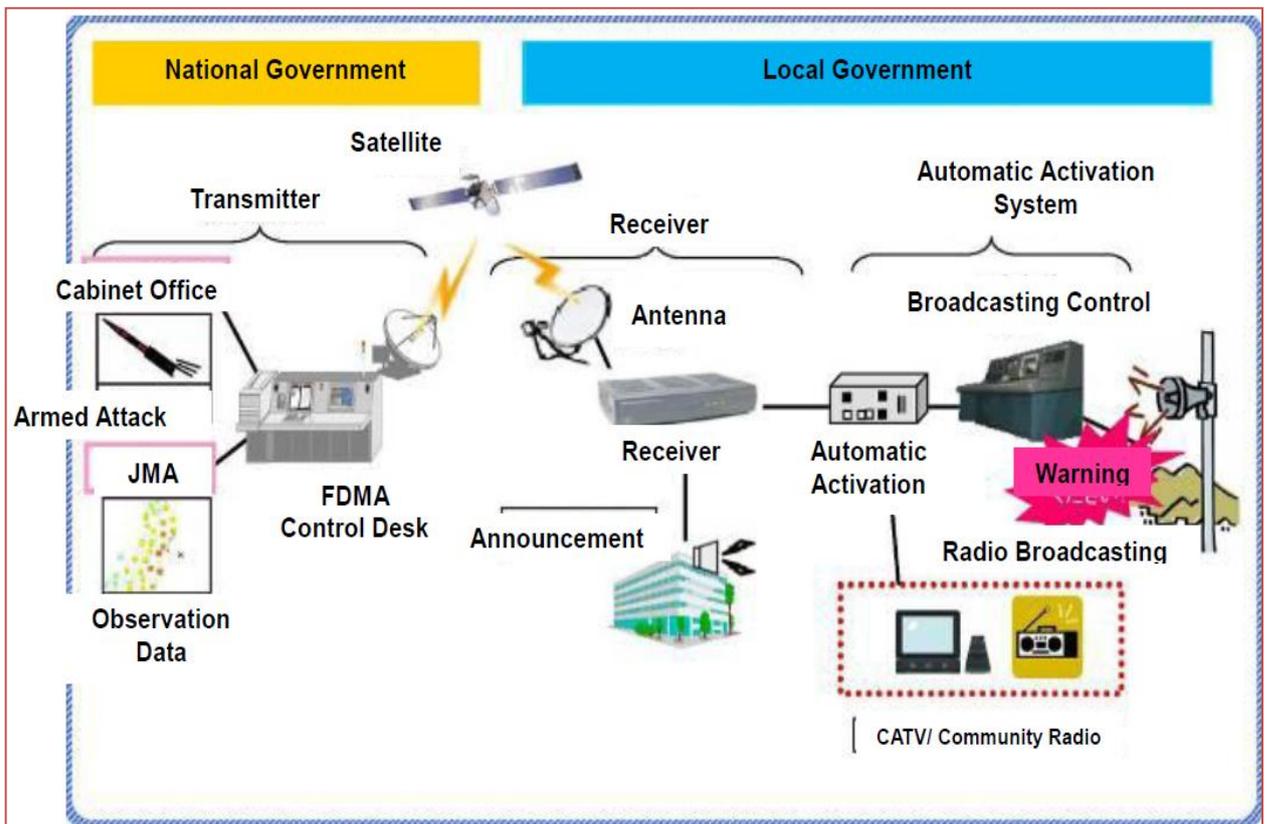
Figure 6.13 Framework of J-Alert System

Using warning systems to trigger timely community response is the key to disaster management. No matter how advanced technology becomes, the guiding principle is that people should take the initiative to escape from a tsunami on their own as soon as they feel any quakes. Inaccurate or inappropriate information in a tsunami warning could mislead, delay evacuation, and increase the loss of lives. Multiple methods of information sharing must be secured. Inaccurate or inappropriate information in a tsunami warning could mislead, delay evacuation, and increase the loss of lives. It was difficult to provide people

with revised information during the evacuation because of power and communication system failures.

6.4.2   L-Alert

L-Alert is a disaster information sharing system where prefectures use a shared platform for sending out local disaster information all at once via multiple media. The Ministry of Internal Affairs and Communications (MIC) has been working on the dissemination of L-Alert throughout Japan for the collective and quick transmission of disaster-related information transmitted by municipalities, including evacuation instructions, to a variety of media.

Local governments can also use emergency alert emails and prefectural / municipal disaster management radio communication system which delivers early warning information to the receivers installed in households.

Figure 6.14 Outline of an Area Mail Distribution Service

6.5   Early Warning System in the Maldives

The importance of Early Warning was realized in Maldives only after the Tsunami in 2004. Before, it was just the weather forecast intended for sea transportation and fishermen. Since then Maldives has put tremendous effort to establish an EW setup. As a result, a national early warning system was commissioned and in place at the Maldives Meteorological Services. The Disaster Management Act issues responsibility to Maldives Meteorological Services to maintain an updated multi-hazard early warning system to gather/seek information regarding impending disasters in the Maldivian territory.   Since 2010, National Multi-Hazard Early Warning Centre (NMHEWC) is based within the Maldives Meteorological Services and has been entrusted with the task of monitoring the Meteorological, Geological and Oceanographic hazards and informs the concerned authorities. The NMHEWC collects information from local, regional and international centers. All necessary information about tropical cyclone, tidal wave, earthquake and tsunami will be disseminated to concerned authorities and general public.

6.5.1 Maldives Meteorological Service (MMS)

Maldives Meteorological Service is the national prime agency mandated for providing hydro meteorological, geological and oceanographic hazard information to the public in coordination with other related stakeholders. Today, MMS is responsible for the seismological and meteorological services in Maldives.

The vision of MMS is to provide accurate, timely and reliable meteorological information to minimize the impact on life and property while supporting sustainable socio-economic development of the Maldives. The mission of MMS is as follows;

- Timely dissemination of alerts and advisories on all natural disasters.

- Expansion and maintenance of weather observation net-work in accordance with international standards and best practices with well trained professionals.

- Enable easy access of high quality historical meteorological data to the user community for Sustainable National Socio-Economic Development.

- Develop meteorological services and capacity building for the national requirement, and contribute to regional and international community.

There are 5 Meteorological offices under MMS, the station in Hulhule' being the main office. Aviation and synoptic observations done in the other four stations are sent to the Hulhule station on their respective time via email or fax. Each of these stations is now working on 24/7. In addition to these stations, there are 20 automated weather stations and 3 tide gauges installed across the country which provides real time data to MMS.

6.5.2 MMS Criteria and Color Codes for EW Alerts

6.5.2.1 Criteria for Issuing Weather Alerts and Proposed Actions

Alert Level	Description	Action
1 White	- Mean wind speed is expected or prevail between 20-30 mph - Rainfall of more than 50mm is expected to occur within 24 hours - High tidal waves are expected	Weather information, but no immediate threat
2 Yellow	- Mean wind speed is expected or prevail between 30-40 mph - Torrential rain is expected and if heavy rain occurs for more than 2 hours - A severe thunderstorm is expected or experienced - Tropical cyclone is formed within effective areas of Maldives - Significant tidal or swell waves are expected or experienced	Concern authorities and people living in the area to be on alert and ready to take action. Travel by sea is not advisable

Alert Level	Description	Action
3 Red	• Flash flood is expected • A tropical cyclone is tracked to move closer or cross Maldives islands • Destructive tidal or swell waves or storm surge is expected or observed	Evacuation of population from threatened areas to safer places. Prohibition of sea transport
4 Green	• The condition has improved	Cancel Warning

6.5.2.2 Criteria for issuing Alerts and Warnings for the Earthquake and Tsunami

Alert Level	Description	Action
1 White	• An earthquake with magnitude of 7.0 or higher in Richter scale, occurred in the Indian Ocean ring but there is no immediate threat from the event	Earthquake information
2 Yellow	• An earthquake occurred with magnitude of 8.0 or higher in Richter scale over the Indian Ocean region. The earthquake has the potential to generate a widely destructive regional tsunami in the Indian Ocean	Earthquake and Tsunami advisory, concerned authorities and public are advised to be on alert and be ready to move safer areas and high rise buildings
3 Red	• An earthquake of 8.0 or higher in Richter scale, occurred in the Indian Ocean ring and confirmation of an ocean wide destructive tsunami originated from the epicenter	Tsunami warning. People at risk to be evacuated from the danger zones
4 Green	• The condition has improved	Cancellation message, MMS assumes that the tsunami threat does not exist to Maldives

6.5.2.3 Recommended Actions by the Public for Earth Quake and Tsunami Alerts

Level 1 – White Alert

This is issued for earthquakes with magnitude >7.0 in the Indian Ocean ring. This is issued as an advisory. Make sure to check if it's an ocean wide tsunami or a local tsunami.

Level 2 – Yellow Alert

This is issued for earthquakes with a possibility of an ocean wide tsunami.

If a yellow alert is issued, keep checking on the local news and our social media, the latest news will be always updated on them by Maldives Meteorological Service.

• Make sure to have a first aid kit ready with snacks and water

- Gather a few clothes and a blanket

- Keep your identity cards and some cash with you

- Senior citizens and children ready for the emergency situation

Level 3 – Red Alert

Red alert will be issued for a confirmed ocean wide tsunami in the Indian Ocean ring and will affect the Maldives islands. MMS will inform the tsunami travel time to the public via public media and social networks. Take all the safety precautions and evacuate disaster prone islands if possible.

The box below shows important safety measurements to be taken during a tsunami warning:

- Do NOT panic

- Go to a high, strong concrete building with your safety kit (first aid kit, snacks, water and few clothes)

- Leave the first two floors empty

- If there are no high buildings, move in to the ocean on boats and wait till the warning is cancelled or tsunami approaches.

- Priority is your own safety; do not carry house hold items with you

- Special attention is given to senior citizens, children and women

- If you are in school, follow the advice given by the school management

- Stay away from the beaches until the warning is cancelled by MMS

- If you are in the open sea and gets the tsunami warning, remain in the open sea, DO NOT return to the lagoon, the ideal depth of the water at which the boat stays should be about 400m.

- It's also dangerous to take your boats out to the sea when it is closer to the tsunami arrival time

- Tsunami Arrival

- Seek advice from relevant authorities

- When the water in the harbor is sucked in to the ocean, that is the final warning given before the first tsunami wave

- National Disaster Management Centre, MNDF, Police, MRC and Local Councils, will aid you in every possible way, please corporate with them.

6.5.3 EW Dissemination in the Maldives

MMS communicates impending hazard information to the assigned authorities and organizations and public via telephone, facsimile, SMS to selected mobile phones and through internet in their website and social media. The NMHEWC has hotline established between itself and National Disaster Management Centre (NDMC), Maldives Police Service (MPS), Maldives National Defense Force (MNDF), Voice of Maldives (VOM), Television Maldives (TVM), Maldives Red Crescent (MRC) and Tourism Disaster Management Centre (TDMC). Any available information that may be beneficial to the public to prepare themselves for a natural disaster will be provided to the NDMC without any delay.
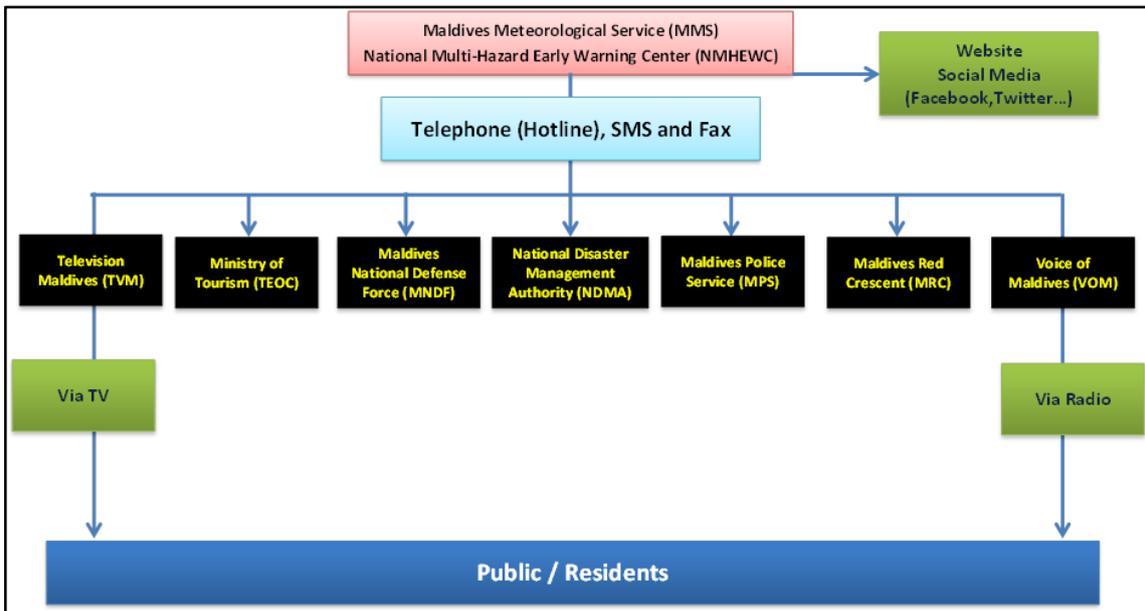
Figure 6.15 Early Warning Dissemination System in Maldives
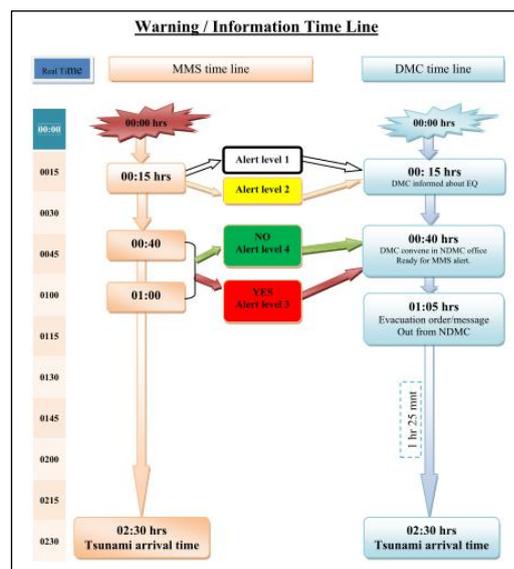
Figure 6.16 Earth Quake and Tsunami EW Timeline

6.6   Summary

The most important element in enhancing disaster preparedness for effective response at all levels is the reliable, timely and accurate early warning. EW leads early response action. Past disaster experience shows that well delivered warning messages saved at risk communities from various hazards. It enables local communities conduct planned evacuations if required, safeguard property and livelihood assets, and first responders to prepare and standby for search and rescue emergency operations.

Japan has developed EWS to cater for almost all hazards in the country. Based on disaster understanding, Japan has improved EW 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 EW to the Japanese households and residents. Using multiple methods and platforms for dissemination, EW 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 EW is issued.

Maldives has established a national multi-hazard early warning center at its meteorological service. MMS communicates warning and advisories to pre-assigned concerned authorities by means of telephone lines, fax, SMS, website and social media. However, MMS lacks required capacity and the infrastructure to disseminate early warning up to the grass-root level in the last mile of the remote island communities. Therefore, it is paramount important to establish people centered end-to-end community based early warning mechanism at the island level in each and every inhabited island.

CHAPTER 7
DISASTER RESPONSE AND RELIEF MECHANISM

7.1 Japan

Since Japan disaster management system consists of four layers (national level, prefectural level, municipal level and residents level), disaster response mechanism too follows the same four tiers. The basic level begins within the affected community by its residents. The Pillar of the Japanese system of emergency response at the community level is the "Self Help, Mutual Help and Public Help" concept.
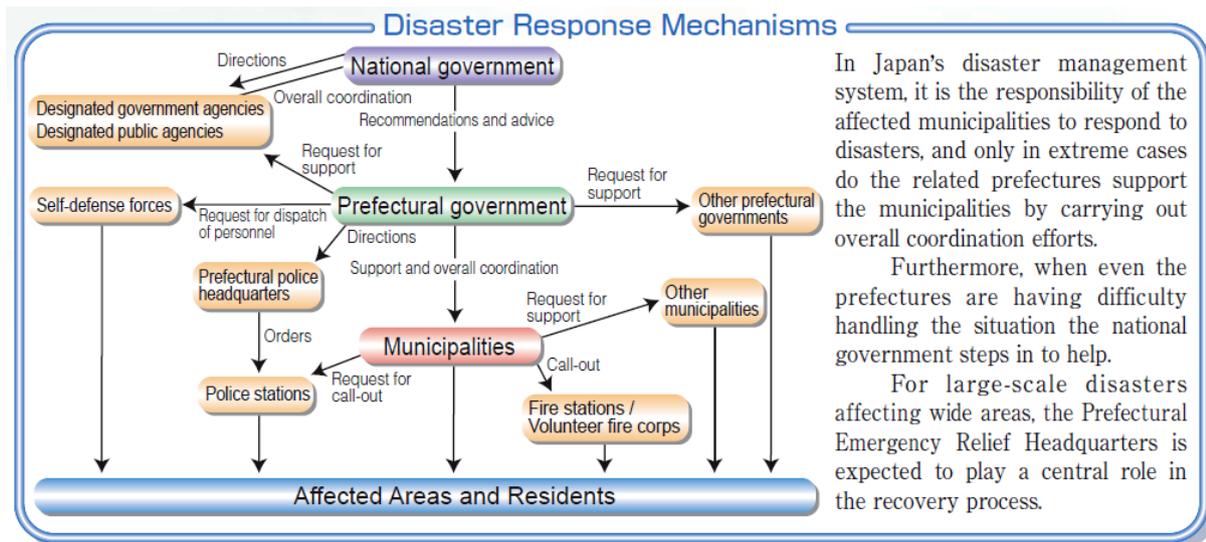
Figure 7.1 Disaster Response Mechanism

7.2 National Level

The national government collects disaster information at the Cabinet Information Collection Center 24 hours a day. When a large-scale disaster strikes, an emergency team composed of the director-generals of the respective ministries and agencies gathers immediately at the Crisis Management Center in the Prime Minister's Official Residence to grasp and analyze the disaster situation, and report the results to the Prime Minister. Disaster Management meetings at the ministerial or high-ranking senior official level are held, as necessary. According to the level of damage, the government may establish the Headquarters for Major Disaster Management (headed by the Minister of State for Disaster Management) or the Extreme Disaster Management Headquarters (headed by the Prime Minister), to establish the policies for the disaster countermeasures, and to coordinate various emergency measures to be taken by various organizations.

Further, in order to grasp the situation in the disaster area, a government investigation team headed by the Minister of State for Disaster Management may be dispatched, or if quick and swift actions are needed to be taken with overall coordination of emergency activities on site, the government may establish the onsite headquarters for disaster management.

7.2.1 Wide- Area Support System

In case of large-scale disasters that exceed the response capabilities of the affected local government, various wide-area support mechanisms are mobilized by the National Police Agency (Disaster Response Units), Fire and Disaster Management Agency (Emergency Fire Rescue Team), and Japan Coast Guard. Furthermore, the Self-Defense Forces can be dispatched

for emergency response activities upon request from the governor of the affected prefecture. Also, the Disaster Medical Assistance Teams (DMATs) are dispatched to provide wide-area medical services. These teams transport severely injured persons via Self-Defense Forces vehicles and aircrafts to hospitals outside the disaster stricken zone.

於：内閣府
Cabinet Office

災害情報の受信・連絡
Disaster information collection and transmission
● 24時間体制
24-hour system
● 非常参集要員及び各省庁に一斉連絡
Simultaneous assembly call to the designated emergency response teams, ministries and agencies

災害発生
Large-scale Disaster

於：官邸
Prime Minister's Office

情報収集（被害状況、対応状況）
Collect information (disaster situation, response operations)
● 関係省庁、公共機関の情報収集・集約
Collection and compilation of information from government and public organizations
● 政府内の情報配信・共有
Information distribution and sharing within government organizations
● 情報先遣チーム派遣
Dispatch of initial emergency survey team

要員参集
Assemble emergency response team

緊急参集チームによる事態把握、初動対処集約・調整等
Analysis of damage situation, coordination of emergency response measures

被害状況、対応状況等の情報収集・集約
（内閣官房及び関係省庁連絡員と協力して）
Collect and analyze information regarding damage and response operations
(cooperate with Cabinet Secretariat and relevant ministries and agencies)

概括的な被害情報として Comprehensive damage information:
・地震防災情報システム（DIS）（内閣府）
Disaster Information System (DIS) (Cabinet Office)
・画像情報（ヘリコプター等）
Visual information (helicopters, etc.)
・関係省庁、公共機関の第一次情報 等
Initial information from related ministries and agencies and public organizations

当面、本部設置は必要ない状況
No immediate need to establish headquarters

被害規模の把握
Analysis of scale of damage

本部設置を協議すべき状況
Need to discuss for establishing headquarters

関係閣僚緊急協議による対処方針協議
Consultation by related cabinet members

臨時の閣議による災害緊急事態の布告・本部設置・政府対処方針決定等
Declaration of Disaster Emergency and Setting up Headquarters by the Extraordinary Cabinet Meeting Decision on the Counter-measure Policies by the Government, etc.

情報集約及び応急対策調整
Information collection and emergency operations coordination
● 関係省庁災害対策会議の開催
Inter-ministerial meeting
● 各省庁応急対策の調整
Coordination of emergency operations by each ministry
● 政府調査団派遣の調整
Dispatch of government investigation team
● 現地災害対策室の運営 等
Administration of on-site disaster management office

非常災害対策本部設置
Establishment of Major Disaster Management Headquarters
本部長：防災担当大臣
Chief Minister of State for Disaster Management
設置場所：内閣府
Location: Cabinet Office
事務局：内閣府
Secretariat: Cabinet Office
本部の運営
Management of headquarters
・各省庁の対策とりまとめ、総合調整
Coordination of emergency operations by each ministry
・政府調査団派遣の調整
Dispatch of government investigation team
・現地対策本部の運営 等
Administration of on-site disaster management headquarters etc.

緊急災害対策本部設置
Establishment of Extreme Disaster Management Headquarters
本部長：内閣総理大臣
Chief Prime Minister
設置場所：官邸
Location: Prime Minister's Office
事務局：官邸及び内閣府
Secretariat: Prime Minister's Office and Cabinet Office
本部の運営
Management of headquarters
・各省庁の対策とりまとめ、総合調整
Coordination of emergency operations by each ministry
・政府調査団派遣の調整
Dispatch of government investigation team
・現地対策本部の運営 等
Administration of on-site disaster management headquarters etc.

Figure 7.2 Prime Minister's Office and Cabinet Office Disaster Response Mechanism

7.2.2　Disaster Response Coordination Mechanism

In the event of a disaster occurring, municipalities will primarily be engaged in emergency countermeasures as they are the closest to residents. Prefectural administration will get involved when the comprehensive wider-area measures are necessary. In the event of a large-scale disaster beyond the capability of local public entities struck by the disaster, national government will step in to support the local entity and coordinate mutual support among the local entities.

At the national level, the Extreme Disaster Management Headquarters or the Major Disaster Management Headquarters is set up to promptly collect the disaster information from relevant ministries and local public entities struck by the disaster, and overall coordination is provided for rescue, first aid, medical and emergency supplies as necessary and appropriate. Also, an on-site disaster management headquarters may be set up to promptly coordinates among the affected

local entities and collect information and requests from relevant prefectures and to properly conduct the emergency response activities in consideration to the needs for the affected people.
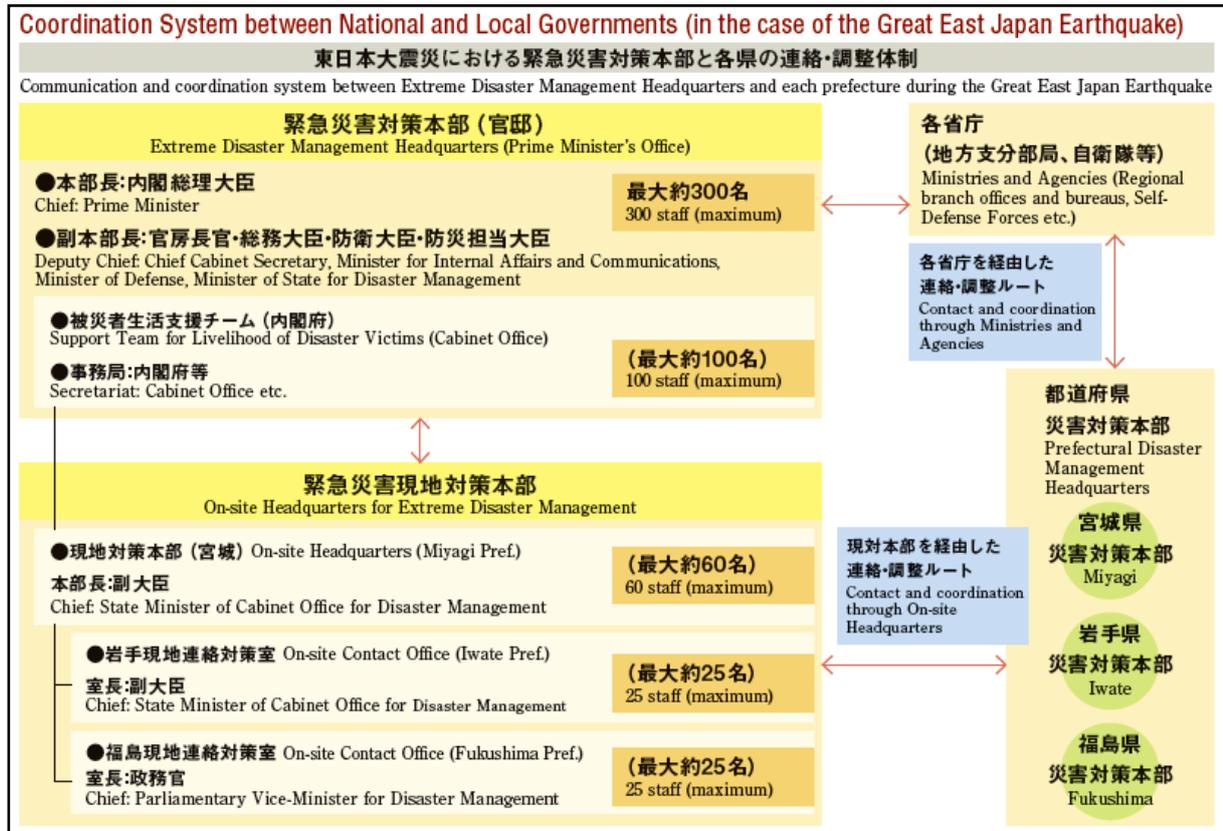

Figure 7.3 Response Coordination System between National and Local Governments

Through joint meetings held in collaboration with the disaster response headquarters organized by the local entities in the affected areas, the national government and the local entities coordinate based on their shared awareness to serve as the government's closest one-stop contact point for requests from the affected local entities. As such, the role of the on-site disaster management headquarters is increasing its importance.

7.2.3 Japan Self Defense Forces (SDF)

The SDF disaster relief role is defined in Article 83 of the Self-Defense Forces Law of 1954, requiring units to respond to calls for assistance from prefectural governors to aid in firefighting, earthquake disasters, searches for missing persons, rescues, and reinforcement of embankments and levees in the event of flooding. The SDF conducts a variety of disaster relief operations in collaboration with municipal governments when disasters such as natural disasters occur in any part of the country, by engaging in the search and rescue of disaster victims or missing ships or aircraft, controlling floods, offering medical treatment, preventing epidemics, supplying water, and transporting personnel and goods. In particular, over 100,000 SDF personnel were dispatched at a peak time for relief operations for the large-scale earthquake and nuclear disaster based on the Great East Japan Earthquake in March 2011.

SDF are deployed only upon the request of prefectural governor. Municipal mayors can ask prefectural governors to request a disaster relief dispatch by the SDF. In the event that mayors are unable to make such a request to the prefectural governor, they can inform the Minister of Defense, or those designated by the Minister of the disaster conditions. After receiving such requests from governors, the Minister of Defense or other personnel designated by the Minister

can immediately dispatch units as necessary according to the disaster situation. Under circumstances of particular urgency when there is no time to wait for a request, the Minister of Defense or those designated by the Minister may authorize an exceptional dispatch (discretionary dispatch).

7.2.4 Fire and Disaster Management Agency (FDMA)

Fire and Disaster Management Agency formulates various measures to prevent disasters, such as fire, earthquake, storm, or flood damage, and to develop the necessary legal basis and improve armaments consisting of the materials and equipment necessary to minimize damage when a disaster occurs. To this end, FDMA provides municipalities with advice, guidance and recommendations concerning their fire service organizations and activities. It also functions as a contact center between local fire-defense related organizations and government and coordination body during the large scale disasters and accidents. Utilizing the available facilities and human resources, fire services must achieve the following tasks:

(1) to protect people's lives and property from fire, and

(2) to take precautions against disasters such as storms, floods, fires and earthquakes and to mitigate the damage resulting from these.

Moreover, in the case of large-scale disasters when firefighting organizations cannot cope alone, elite emergency rescue teams of the FDMA, known as, Emergency Fire Response Teams assist them. Emergency Fire Response Teams was founded in 1995, after the Great Hanshin-Awaji Earthquake and institutionalized by the Fire Defense Organization Law as amended in 2003. Officially, EFRT founded in 2004.

Leader of the municipal teams supervise municipal teams and manage their activities whereas the Leader of the Command Support Group deploys teams swiftly to disaster areas using helicopters and other vehicles in order to gain a better understanding of disaster conditions, contacting and liaising with the Fire and Disaster Management Agency, and providing instructions and support to local firefighting teams. Since 2004, the Commissioner of the Fire and Disaster Management Agency has the authority to mobilize and control firefighting teams in the event of a large-scale disaster or accident. The FDMA controls all aspects of management, from obtaining real-time information on the disaster to instructing Emergency Fire Response Teams to mobilize.

7.2.5 National Police Agency (NPA)

Japan is a risk prone country to many natural disasters. Therefore, the NPA promotes various measures to respond to all types of natural disasters and accidents. In the event of a disaster, the NPA instructs and coordinates relevant police headquarters on victims rescue, search for the missing, traffic control and other relief measures. NAP carries out several emergency response functions other the normal mandatory responsibilities including evacuation guidance, search and rescue for victims, searches for the missing autopsies and identification of bodies, securing of emergency traffic routes, victim support, guard/patrol activities and crackdowns on crimes etc.

Based on the lessons learned from the Great East Japan Earthquake, the police have established special units around the nation that will be sent to affected areas in the event of a major disaster. In 2014, many people were killed or went missing due to natural disasters, including landslides caused by torrential rains in Hiroshima and the Mt. Ontake eruption. In the wake of these disasters, the Inter-Prefectural Emergency Rescue Unit (IERU), the units specializing in disaster relief operations, and other units were swiftly sent for the rescue of survivors and the search for the missing.

7.2.6 Japan Coast Guard

Japan Coast Guard (JCG) is an external organ of the MLIT. The main responsibilities of JCG include:

- Maintaining maritime order
- Guarding territorial seas and EEZ
- Protecting the marine environment
- Taking marine disaster preparedness measures
- Exploring the territorial waters
- Ensuring Maritime Traffic Safety

It is the responsibility of JCG to conduct maritime search and rescue operation in disasters and maritime incidents or accidents. The JCG works to raise awareness and educate people about the dangers of the sea and the principles of self-rescue. It also makes every effort when accidents do occur to respond promptly and save lives. The JCG also works together with other public and private rescue organizations including police and fire departments to cover the vast areas of sea that surround Japan. It is important that the JCG be notified as soon as possible when trouble occurs in seas far from land. For that reason, the JCG operates a maritime accident reporting service 24 hours a day by radio based on the Global Maritime Distress and Safety System (GMDSS). Reports of incidents and accidents and requests for help can also quickly be made to the JCG when the need arises by dialing 118 on a mobile or onboard phone. Calls from landline are received by the respective regional centers, whereas, the calls from onboard phones are directed to headquarters.

To respond to such maritime disasters as large-scale oil spills, the discharge of hazardous and noxious substances, and shipboard fires, the JCG has stationed fire-fighting ships and disaster mitigation equipment around the country. This provides the JCG with a system that is always ready to mobilize and is also useful for such tasks as predicting how an oil spill will spread and drift in order to allow its effective removal.

The JCG also works for maritime disaster prevention by conducting exercises with private-sector disaster prevention organizations in Japan and overseas. The JCG makes every effort to keep its systems in good order and conducts drills so that when a major natural disaster occurs it is ready to quickly carry out such emergency relief operations as rescuing disaster victims, providing emergency transportation for personnel and relief supplies, and conducting surveys of stricken areas.

7.2.7 Disaster Medical Assistance Teams (DMAT)

Disaster Medical Assistance Teams are specialized and trained medical aid teams which operate during large-scale disasters. DMAT system was established in 2005 based on the lessons of Great Hanshin Awaji Earthquake.. The guidelines for the deployment of DMATs are based on the results of research funded by a Health and Labour Sciences research grant from the, the Ministry of Health Labour and Welfare (MHLW). In these guidelines, DMATs are defined as "mobile, trained medical teams that can be rapidly deployed during the acute phase of a disaster (within 48 hours). "DMAT Team Member Training Course" is conducted at the National Hospital Organization's Disaster Medical Center (an independent administrative agency) for certification of DMAT personnel. DMAT member are specialized to render medical assistance and treatment during the acute phases of disasters as well as transferring casualties to safe areas.

Functioning of DMAT are based on the agreements between prefectural governments and medical establishments and DMATs are deployed only upon the request of government of

disaster affected prefecture unless the one following conditions is not the case: an earthquake of Japanese seismic intensity 5 occurring within any of the 23 wards of Tokyo; an earthquake of Japanese seismic intensity of nearly 6 or greater occurring in any other area (outside of the 23 wards of Tokyo); a tsunami alert is issued; an earthquake alert is issued for the Tokai region; or large-scale aircraft crash occurs.

7.2.8 Technical Emergency Control Force (TEC-FORCE)

The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) established TEC-FORCE in 2008. The TEC-FORCE is a specialized group made up of ministry staff that helps disaster-affected municipalities to quickly assess damages, identify measures to prevent additional damage, and provide technical assistance for rehabilitation and emergency response activities.

7.2.9 Japanese Red Cross Society (JRCS)

The JRCS is listed as a "Designated Public Corporation" under the Disaster Countermeasures Basic Act. According to the Disaster Relief Act, the JRCS has the obligation to cooperate with the national and prefectural governments in the provision of relief assistance, the details of which are laid out in the agreement signed by the Minister of Health, Labour and Welfare and the President of the JRCS. Based on this, the JRCS is developing disaster relief responses according to relief regulations and disaster management plans. Additionally, as a member of the Central Disaster Management Council headed by the Prime Minister, and in collaboration with other organizations, the JRCS is responsible for a part of the country's overall disaster management.

In times of emergency, the JRCS carries out the following activities to support disaster victims.

   a. Medical Relief
   b. Stockpiling and Distribution of Relief Supplies
   c. Provision of Blood Products
   d. Collection of Donations
   e. Disaster Volunteer Activities
   f. Psychological Care

7.2.10 NHK

As the sole public broadcaster of Japan where earthquakes, volcanic eruptions, typhoons, and other natural disasters are all too common, NHK is expected to play a twofold role in emergency situations. In its usual capacity as a source of information, NHK reports on the damage caused and the state of the disaster affected area. But it is also regarded as part of the infrastructure of disaster prevention and crisis management. This perception is stipulated in the Disaster Countermeasures Basic Act. By the law NHK is designated as 'public institution' to contribute, through its broadcast, to the prevention of the disaster. NHK must broadcast warnings of tsunami or other dangerous weather conditions in order to promote precautionary measures and the mitigation of damage. Small quakes detected by the JMA before strong earthquake occurs, automatically redirected to NHK is what enables it to issue public alert promptly and provide necessary information regarding the magnitude and precise location of the earthquake as well as tsunami information nationwide.

JMA's Emergency Warning System (EWS) utilized in collaboration the NHK is carried out only in special emergency cases such as large-scale tsunami and earthquake warnings or based on the request of governors and mayors. In striving to alert as many people as possible, the system switches on television sets and radios (4 TV channels and 3 radio channels belong to NHK)

automatically. The test transmission is conducted every month and emergency drills held every day by NHK.

To ensure quick and live broadcasting from disaster hit areas NHK owns several helicopters which are equipped with necessary devices for live broadcasting. Moreover, NHK has remote controlled cameras installed countrywide. In addition, the official web-page of NHK also provides disaster and weather information and enables watching two channels (General TV and NHK World TV) online.

7.2.11 Japan Meteorological Agency (JMA)

The Disaster Management Operation Plan of the JMA prescribes the following measures to be taken by the JMA in support of disaster preparedness and emergency response:

Disaster Preparedness
- Implementing meteorological services for disaster preparedness;
- Implementing a cooperation scheme with national disaster authorities, prefectures and mass media;
- Conducting drills and training for disaster mitigation;
- Conducting surveys and research on disaster management and providing knowledge to the public.

Emergency Response
- Establishing an emergency response scheme and activities;
- Setting priorities for services during emergency response;
- Cooperating with national disaster authorities, prefectures and mass media;
- Reporting results of surveys after disasters.
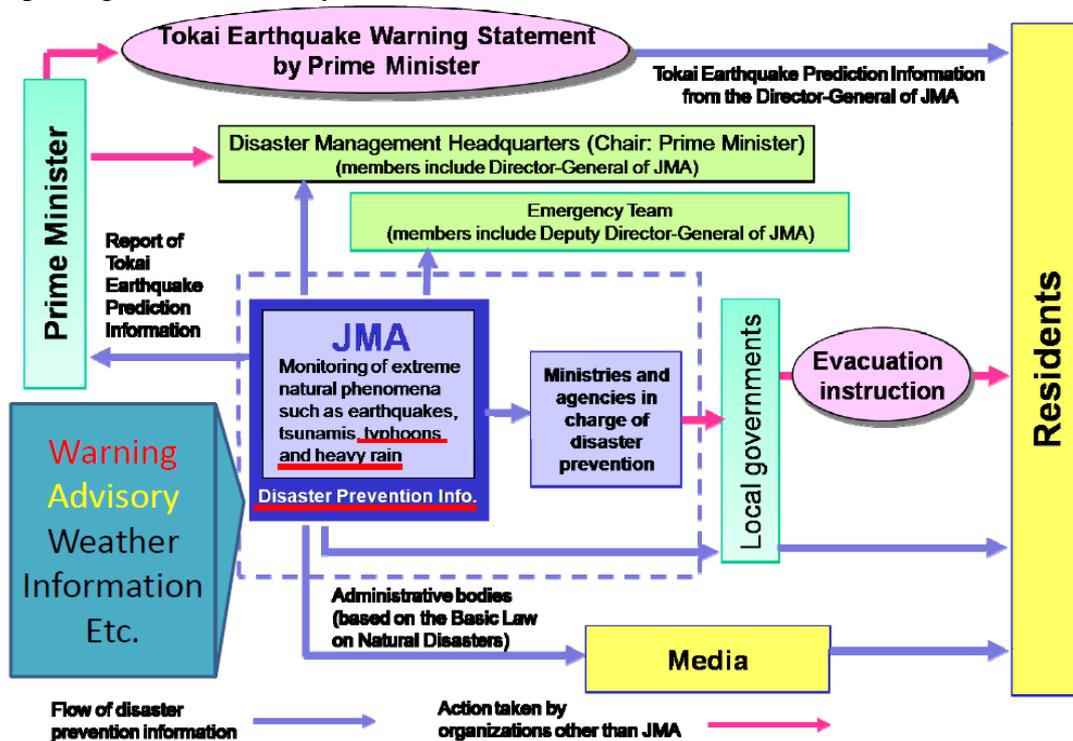
Figure 7.4 Role of JMA in Disaster Response

7.2.12 Prefectural Level

The local governments need to collect and disseminate disaster and damage information quickly and to have secure communications so that they can carry out effective disaster emergency activities such as search and rescue and medical operations. Based on such information, local governments set up a disaster response headquarters (headed by mayors of the cities and/or governors of the prefectures concerned) while related organizations establish their own operations mechanisms.

The public safety and welfare of a prefecture's residents are the fundamental responsibilities of every governor. The governor coordinates prefecture resources and provides the strategic guidance for response to all types of incidents. This includes supporting local governments as needed and coordinating assistance with other prefectures and the national government. A governor also:

- Establish HQ to coordinate large scale disasters.
- Communicates to the public, in an accessible manner (e.g., effective communications to address all members of the whole community), and helps people, businesses, and organizations cope with the consequences of any type of incident
- Requests assistance from Self Defense Force, Fire and Disaster Management Agency, Japan Coast Guard and DMAT. Prefecture Police is also on Governor's disposal to utilize in the response operations.
- Coordinates assistance from other states through interstate mutual aid and assistance agreements, inter prefectural agreements.


Figure 7.5 TMG Crisis Management System
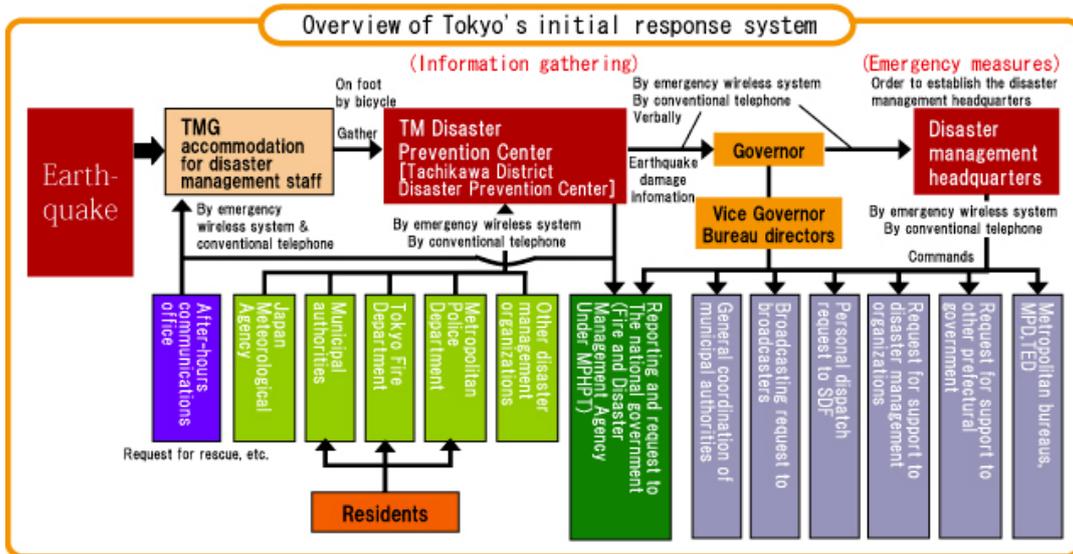
**Figure 7.6 Tokyo Prefecture Initial Response System**
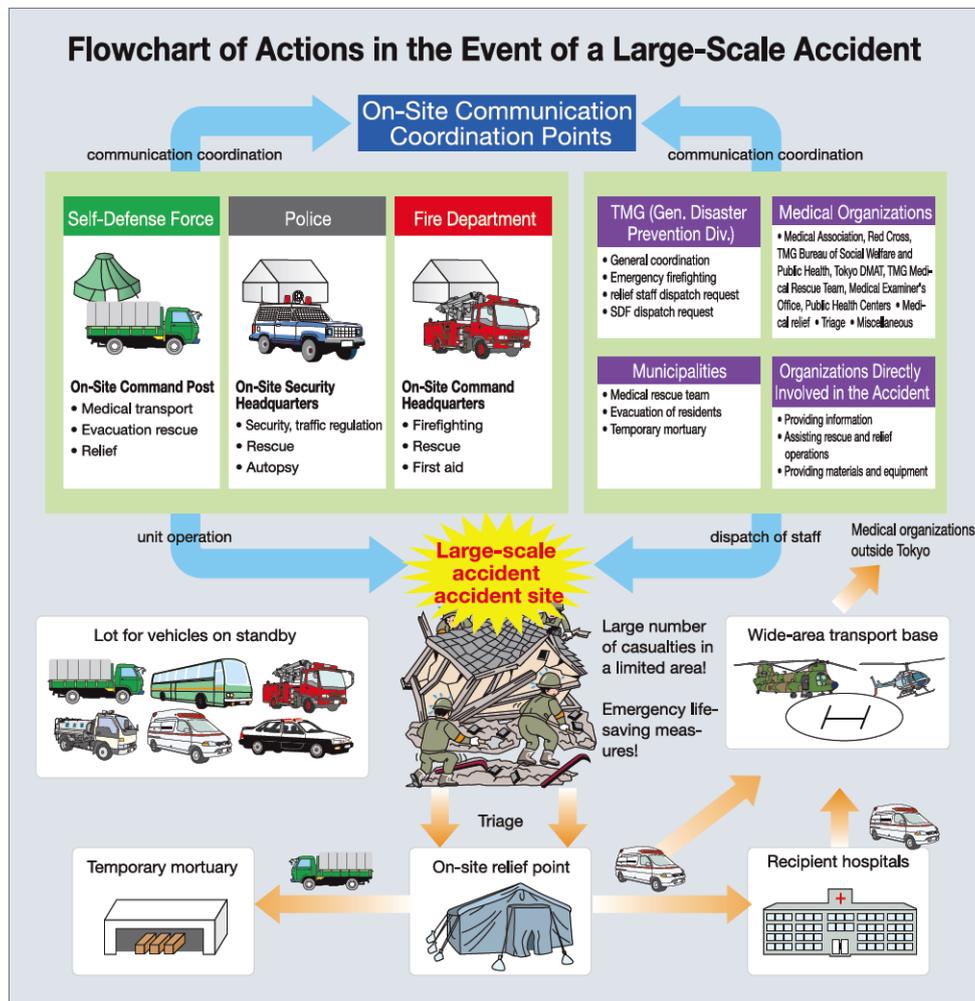
Figure 7.7 Tokyo Prefecture Response Actions to a Large Scale Incident

7.2.13 The Hyogo Emergency Net (E-Net)

The Hyogo E-Net is a system designed to utilize current trends in mobile and wireless information technology in order to supplement conventional systems for disaster management, such as radio and loudspeaker vans, which directly supplies local citizens with emergency information (on earthquakes, tsunamis, weather warnings), evacuation information and other vital information via e-mail on mobile phones and websites.

Each municipality in Hyogo Prefecture has its own website. In the event of emergencies and disasters, this system will expedite the transmission of vital information to local citizens in the most immediate manner possible. For everyday affairs, this site serves as a regular mobile phone homepage, providing local citizens with information on upcoming events and useful information on daily-life including pictures. The Hyogo E-Net was designed based on the lessons learned through the experiences of the Great Hanshin-Awaji Earthquake. We believe that this network will help us create safer and more secure communities in Hyogo.

7.3   City/Municipal/Town/Village Level

In Japan, the municipalities are obliged to fully carry out the fire services in their areas. They implement the actual fire service affairs such as firefighting and rescue and ambulance services. However, for such reasons as finances, if it is deemed more efficient and rational to handle such affairs jointly with other municipalities, some municipalities are doing so by establishing "municipal corporations" or "area associations." The following figure shows the roles of Chuo City in a disaster,
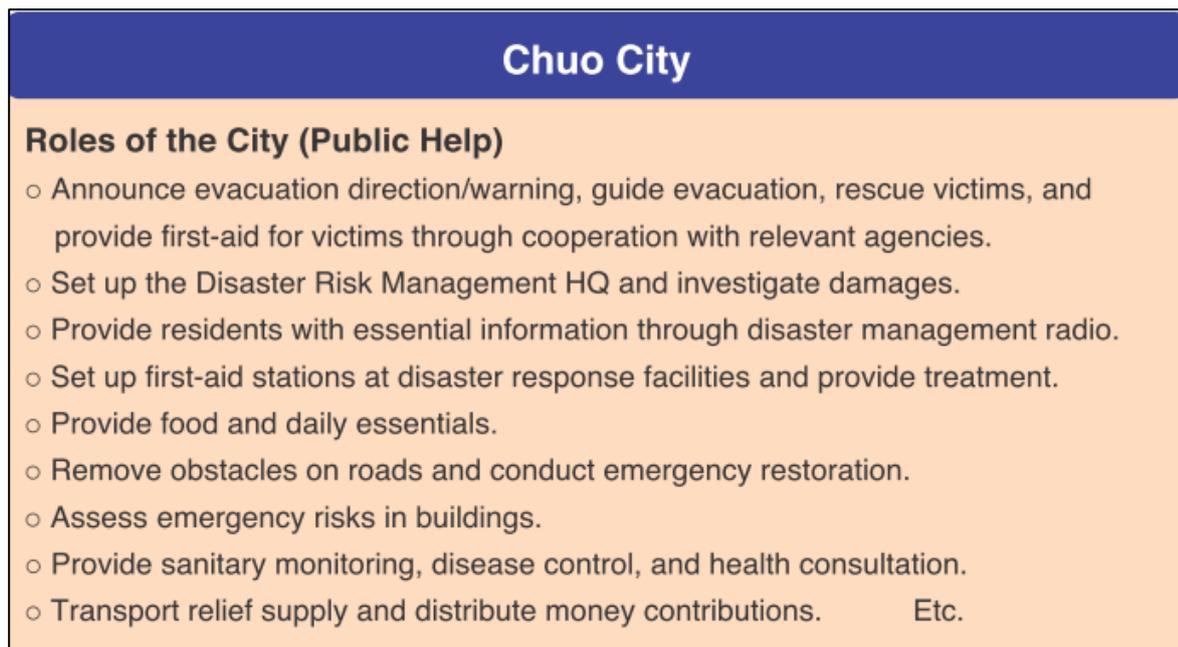
Figure 7.8 Role of Chuo City in Disaster Response

The organizations for handling the fire services consist of fire departments, fire stations and volunteer fire corps. The municipalities are required to organize some or all of these organizations. Main affairs handled by the municipalities are:

- Establishment, management and operation of fire service organizations.
- Fire prevention, firefighting, rescue and ambulance services, and response to earthquake, storm and flood damage

- Formulation of municipal disaster prevention plans and implementation of comprehensive disaster countermeasures.

7.4   Community Level

Local communities have been responding to disasters for centuries. According to (GEJE, 2012) before the creation of Japan's formal state system, local communities carried out disaster- related activities as volunteers; community based organizations (CBOs) have existed for centuries. They include: Suibo- dan for flood risk dating from the 17th century, Syobo- dan for firefighting from the 18th century, and Jisyubo for earthquake disasters from the 1970s. In addition, various nongovernmental organizations (NGOs) and non-profit organizations (NPOs) are involved in disaster risk management (DRM) activities at the community level. Many of them collaborate with neighborhood associations (Jichikai) and local governments, and sometimes with local academic institutions.

Residents and enterprises at the community level are encouraged and supported to formulate, promote and implement Community Based Disaster Management Plan. Main theme at the localities is the concept of self-help, mutual help and public help where individuals first try to protect the self and family and then assists others in the scene mutually until the public support arrives. Since the "limits of public help" following a large-scale natural disaster is clear, and initiatives based on self-help and mutual help are very important, a Community Disaster Management Planning System has been established to support voluntary DRR activities by community residents.

7.4.1   Community Based Volunteers

Community-based preparedness planning allows us all to prepare for and respond to anticipated disruptions and potential hazards following a disaster. As individuals, we can prepare our homes and families to cope during that critical period. Through prevent planning, neighborhoods and worksites can also work together to help reduce injuries, loss of lives, and property damage. Neighborhood preparedness will enhance the ability of individuals and neighborhoods to reduce their emergency needs and to manage their existing resources until professional assistance becomes available.

Large scale disasters can severely restrict or overwhelm our response resources, communications, transportation, and utilities and leave many individuals and neighborhoods cut off from outside support. Damaged roads and disrupted communications systems may restrict the access of emergency response agencies into critically affected areas. Thus, for the initial period immediately following a disaster, often up to 3 days or longer; individuals, households, and neighborhoods may need to rely on their own resources for food, water, first aid and shelter.

7.4.1.1   Voluntary Firefighting Corps

The courageous act of these volunteers to fight against disaster is based solely on their resolution to protect their communities on their own and their sense of responsibility to live up to people's trust in them. Members of Volunteer Fire Corps are working for communities to protect people's lives and property through firefighting activities when a fire occurs, lifesaving and rescue activity, patrolling and guidance for evacuation in a natural disaster, such as an earthquake, storm, or flood, fully utilizing their knowledge of and skills in firefighting and disaster preventing activities acquired as members of Volunteer Fire Corps. They shoulder a variety of roles including the organization of first aid classes, fire prevention instruction to residents, special lookout patrols, and public relations activities.

The mobility of Volunteer Fire Corps members, who are familiar with the geography and individual residents of the area, has made a great contribution in many a serious disasters, preventing further disaster and saving local residents. Volunteer Fire Corps are increasing their importance under improving cooperation between them and fire departments as well as other autonomous disaster preventing organizations led by local residents. To support such activities conducted by Volunteer Fire Corps, Fire and Disaster Management Agency is providing people with disaster prevention education using the Internet and acting to encourage people to participate in Volunteer Fire Corps through PR in mail magazines, in addition to the promotion of improvement in activity environments and machinery and equipment of Volunteer Fire Corps.

7.4.1.2 Suibo-Dan – Voluntary Flood Fighting Teams

Voluntary flood fighting teams, known as "suibo-dan" play important role in flood fighting system of Japan. These teams are usually established within the municipalities in the vicinity areas of rivers. The members of "suibo-dan" normally engaged in different jobs but are also involved in patrolling, watching out and levee protection works in close coordination with river administrators and other related organizations during floods. During periods without flooding, they still conduct patrols and inspection of levees, provisions for flood fighting warehouses and for communication facilities, drills and other activities in preparation for a flood. As of 2009 there were about 900 000 voluntary flood fighters nationwide.

7.4.1.3 Bokomi

BOKOMIs are community based - elementary school district based disaster prevention organizations. Since 1995, based on the lessons learned from the Great East Hanshin-Awaji Earthquake, all of the districts of Kobe city – 191 districts have established BOKOMIs. To establish BOKOMI, firstly, it is discussed and decided on by local government organizations including the local city office and the local fire station, together with leader of local residents associations, women's associations, elderly associations, voluntary fire corps and etc.

The equipment and materials needed for the activities are provided by the local government and storehouses installed in local parks, in preparation for emergencies. Schools in Japan also serve as evacuation sites during emergencies. In normal times BOKOMI conducts various emergency drill programs such as on how to use the provided equipment and materials (for ex. Water fire extinguishers, powder fire extinguishers), rescue drills, evacuation drills, information transmission drills, flood control drills and etc. In addition, BOKOMI also conduct welfare activities (such as keeping in touch with and holding lunch gatherings for the elderly people who live alone) as an effort to cover both community welfare activities and community disaster prevention activities.

7.5 Maldives

The dispersed nature of the inhabited islands makes responding to emergencies a logistical challenge and a nightmare for concerned agencies and it is extremely difficult for the authorities to deliver immediate first-response and emergency relief services to the people residing in remote rural islands. The national priority in disaster risk management is to establish a sustainable model for risk reduction and response that is also efficient in providing relief and assistance to affected communities in the shortest time.

The community based approach is a proven model for a sustainable approach to disaster management. Apart from bringing down costs, it has the fastest response time, empowers the community and gives ownership of the disaster response activities to the community.

Organization at the community level that enables the community to identify problems, establish priorities and act is a feature of a resilient community.

The institutional setup and structure for the community level decentralized management of disaster management activities has been established through the Disaster Management Units that are being established at the Island Councils. The next step is to establish a mechanism for establishing a human resource base that would support the DM Units in preparing for and responding to disasters.

7.5.1 National Emergency Response Force

Disasters response in the Maldives also has three levels. They are national level, city/atoll level and island level. Table below displays response tools established at different levels to ensure effective and efficient emergency response. Each has different roles and responsibilities at different levels of emergencies.

	National	Atoll/City	Island/Local Level
Decision Making/Strategic	Disaster Management Council Disaster Management Steering Committee National Disaster Management Authority	Atoll/City Disaster Management Committee	Island Disaster Management Committee
Emergency Management / Operational	National Emergency Operations Centre/EOC	Atoll/City Disaster Management Unit	Island Disaster Management Unit
Field Level First Responders/ Field Operations	National Emergency Response Force (NERF)	City/Atoll Response Team	Local Emergency Response Force (LERF)

Figure 7.9 Emergency Response Mechanism

National Emergency Response Force consists of the following organizations and elements.

> a. Maldives National Defence Force
>
> (Fire and Rescue Service and Coast Guard)
>
> b. Maldives Police Service
>
> c. Emergency Health Service Providers
>
> d. Maldives Red Crescent

The legal mandate and responsibility of various response actors at different levels are;

- Article 24 of the Maldives Act on Decentralization of the Administrative Divisions of the Maldives (7/2010) asserts the island councils mandate with the responsibility to establish a mechanism to provide effective response in case of a disaster.

- The responsibilities in article 7 (d) of the Armed Forces Act (1/2008) gives mandate to the Armed Forces to lead and coordinate with the relevant government agencies and work to save the lives of people and property in case of hazards and disasters. Article 7 (e) refers to

freighting and saving lives of people and property in case of fires. Article (f) refers to helping the lives of people facing maritime incidents and saving the lives of people and property in case of land or maritime hazards and disasters.

- Article 6 (11) of the Police Act (5/2008) observes the responsibilities of Police in case of hazards or disasters. Police are mandated to save the lives of people, households and property in case of a natural disasters or other type of disasters. Also help the victims of hazards and disasters and assist in maritime incidents and other emergencies.

- Under the objectives of the Maldives Red Crescent Act (5/2009), article 3 (a) asserts the primary objective is to provide humanitarian aid, prevent and alleviate human suffering.

7.5.2 National emergency Operational Plan (NEOP)

The National Emergency Operations Plan (NEOP) is a multi-hazard plan that establishes a single, comprehensive framework for the management of emergencies and disasters within Maldives. The plan is implemented upon such emergency and disaster, when it becomes necessary to mobilize the resources of the identified departments and agencies to save lives, and protect property and infrastructure. The plan assigns major roles and responsibilities to departments and agencies. The plan requires planning, training, and exercising prior to a real event in order to respond effectively.
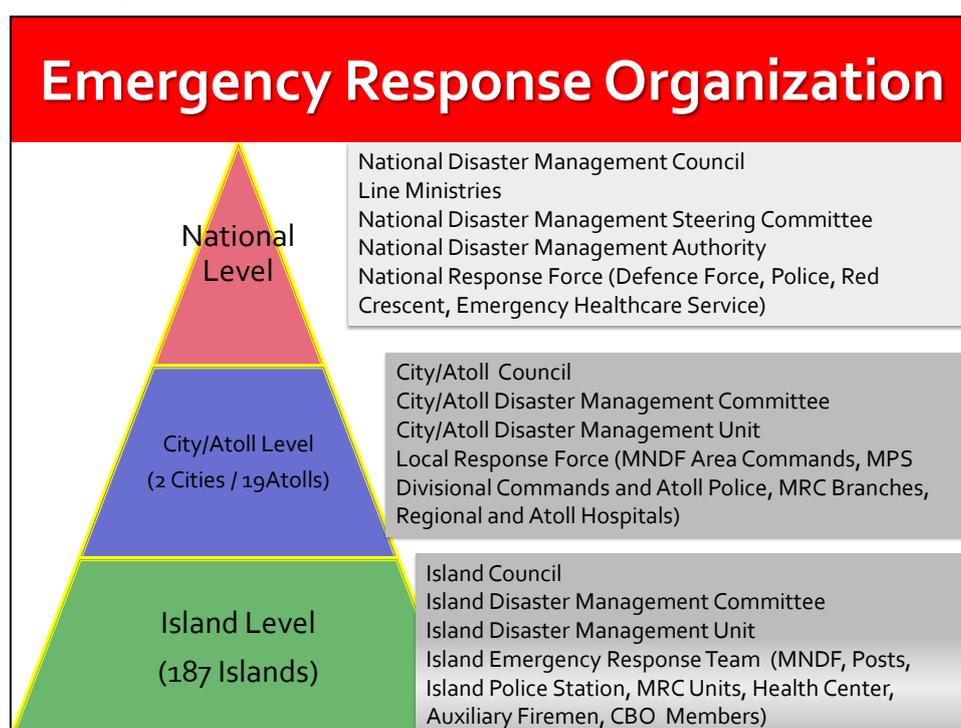

Figure 7.10 Various Levels of Emergency Operations

7.5.3 Atoll and Island Level

At present, level of disaster preparedness within the atoll and island context is very low. There is no established disaster response official mechanism to be followed. The Atoll Council and Island Councils together with other stakeholders need to focus more in terms disaster response, search and rescue and community based emergency management plans.

Currently, disaster response activities are carried out through sub components of National Emergency Response Force. Maldives National Defence Force has its Area Commands and

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Posts; Maldives Police Service has Divisional Commands, Atoll Police and Island Police Stations; Maldives Red Crescent has Branches and Units; Emergency Healthcare Service has Regional Hospitals and Atoll Hospitals established in different parts of the country. When NDMA, Atolls Council and Island Councils request for emergency assistance, all these agencies quickly provide emergency first response and relief depending on their capacity and mandate.

However, lack of resources and training keeps the islanders more dependent on military or police to respond incidents and emergencies. Often island communities wait for police force or Defence force to attend disaster events. Islands lack emergency response plans and mechanism within the community level. The coordination of response in an ad-hoc manner delays the search and rescue and had cost few lives in the recent past due to the late responses.

Nevertheless, some few islands have Community Emergency Response Teams (CERT) formed and are operational. Their most important mission is to provide a rapid, effective and efficient emergency response in times of disasters in the local community until public assistance reaches to the scene. The handful of islands that have CERT are inadequately equipped and very limited in capacity. The islands without any first response unit, the Island Council and the local community have to manage the incident for as long as they receive support from their neighboring island, Atoll Council or the national government.

CHAPTER 8
LESSONS LEARNT FROM JAPAN, RECOMMENDATIONS AND CONCLUSION

In this last chapter of the study comprises of the lessons learnt from Japan and recommendations for community based early warning system and better preparedness for response in the small island communities of the Maldives.

8.1   Lessons Learnt From Japan

Believing it important to take the advantage of lessons learned from the past disasters and the recovery, reconstruction and rebuilding efforts in Japan as global public goods for future integration of DRR in the resilient island development planning, many good and applicable practices were identified. Out of several experiences and learning, the following lessons represent only few examples related to early warning systems and emergency response mechanism in Japan.

According to the Hyogo Prefecture Governor, "we cannot stop natural disasters from occurring. What we can do though is try to prepare for disasters, mitigate the damage as much as possible, and achieve quick relief and recovery even if we have been hit by them. In this context, sharing our experiences and the lessons we learned with the next generation and preparing for future disasters is more important than anything else".

8.1.1   Self Help, Mutual Help and Public Help

This is the backbone and bread and butter of the disaster preparedness and response in the Japanese society. This concept puts enormous emphasis on individual and household preparedness for disasters. People are encouraged to protect and safeguard the self and family first. Then to assist other neighbors and community by mutually supporting until the public help arrives to the affected area.
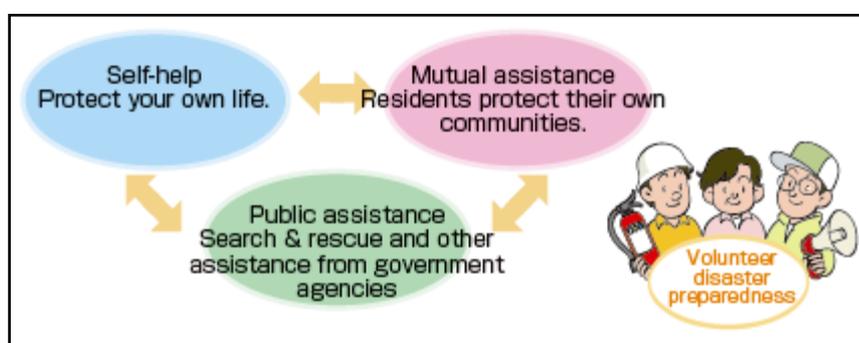

Figure 8.1 Tripod Disaster Response Concept

The limitations of the various levels of public disaster response activities in every disaster, the importance of "mutual-help" in collaboration with local municipalities becomes apparent in affected communities. Self-help, mutual assistance, and public assistance are very important for improving the ability of community to respond and cooperate in the event of a disaster in order to minimize the disaster damage.

8.1.2   Multi-hazard Early Warning System

Japan has developed one of the most sophisticated hi-tech end-to-end multi-hazard early warning systems in the world. All of Japan's national territory is covered by early warning systems for storms, torrential rains, heavy snow, sediment disasters, tsunami, tidal waves, high surf, inundation and floods. This enables everyone living in Japan to receive early warning allowing

taking early actions. As a result, the loss of life and damage to property has been significantly reduced. During the GEJE on March 11, the community level response and community based warnings was the key that saved countless human lives.

8.1.3 Wide Area Support System

National governments as well as the local governments have established wide area support system to function as alternate operational and logistics hub in responding large scale disasters. These multi-functional and multi-purpose Bases can be used as locations for extreme disaster management headquarters and on site local disaster management headquarters. Furthermore, it also serve as base camp for wide area support forces, coordinate response, relief and emergency medical support during disasters. During normal times, it is used to emergency stockpiling, provide training and conduct drills, and create public awareness and disaster risk reduction activities.

8.1.4 Volunteerism and Community based Organizations

In Japan, a country prone to natural disasters, community organizations such as volunteer fire corps, flood-fighting organizations and many CBOs have assumed a crucial role in preventing disasters and assisting response and early relief activities in the event of disasters. The role of communities in DRM is formally recognized and supported by local and national authorities through linkages with local institutions. Japanese society values the vital role of volunteers to a great extent.

After the Great East Japan Earthquake and Tsunami, to encourage volunteer activities by university students, the Ministry of Education informed universities that they would provide credit for volunteering in affected areas. Under corporate social responsibility, companies also created new systems such as "volunteer leave" for employees.

Most people saved from major disasters are rescued by relatives and neighbors within the first 24 hours before professional responders can get there. Statistics show that in the 1995 Kobe earthquake, 80 percent of those rescued were saved by their neighbors. So, while local and national authorities have key responsibilities for civil protection in hazard events, communities are always the first responders and should be empowered in that role. This fact gives us a lesson that the activity of local community is the key to mitigate earthquake disaster.

The government has designated each January 17 as "Disaster Reduction and Volunteer Day, and the week from January 15 to January 21 as "Disaster Reduction and Volunteer Week." During this one-week period, seminars, lectures, exhibitions and other events are held to promote the volunteer and autonomous disaster reduction activities when disasters occur. These events take place throughout Japan, with the close cooperation of national and local governments, local public corporations and other relevant entities. Thus, volunteer culture has become firmly entrenched in Japan societies.

8.1.5 Emergency Kit Bag

Very strong emphasis is given to aware people to prepare for disasters by stockpiling emergency supplies and making ready grab-and-go bag. While emergency services personnel are the best trained and equipped to handle emergencies, they may not be immediately available in a catastrophic disaster. In such a situation, members of the community may be on their own for several days or longer. They may have to rely on their own resources for food, water, first aid,

and shelter, and neighbors or coworkers may have to provide immediate assistance to those who are hurt or need other help. Such a bag would definitely serve the best when in need after a disaster.

8.1.6 Disaster Drills and Exercises

Throughout the Japan, at all levels from national to local and community participates, conducts and organizes disaster evacuation and response drills, coordination exercises multiple times during a year. Whole community including local governments, public and private organizations, NGOs, schools, CBOs and vulnerable groups are trained thoroughly and have been doing disaster prevention drills regularly. Japan has a culture of preparedness, where training and evacuation drills are systematically practiced at the local and community levels and in schools and workplaces.

The basic policy for disaster management drills that are conducted by national and local governments, as well as an overview of the drills that are carried out at the national level, are determined every year by the Central Disaster Management Council in the Comprehensive Disaster Management Drill Framework. The government also conducts several programs to educate the people about the basic immediate response in the event of an earthquake or tsunami.

8.1.7 Disaster Prevention Awareness

In Japan, other countries can learn how communities can play a critical role in preparing for and coping with natural disasters. Communities can help prevent damage from spreading, assist local authority, and provide support to the vulnerable. As disaster prone and frequent country, high priority is given to raise public awareness on risks and disaster prevention. To make disaster preparedness a second nature and inculcate the culture of safety in the citizens' mind, disaster prevention awareness plays the most important role. Japan is doing it in every possible way.

Furthermore, to pass the lessons learned from the disasters to future generations, lots of me approaches and modalities are being used. Making and preservation of monuments, disaster prevention learning centers, museums, DRR promotion events and festivals can be observed throughout the Japanese communities. Many preserved sites of disasters have attracted large number of visitors. By actually seeing these sites, the horror of disasters and preparedness messages can be learned.

8.2 Recommendations

   a. Empower and promote the island communities to take the ownership of the safety and security of themselves and to safeguard their assets and island's critical infrastructure from disasters. If there is large scale disaster like a tsunami or devastating storm affecting the entire stretch of atolls, immediate response from national level can take few to several days. It requires self and community preparation for survival and to reduce the impact. Develop specific programs such as BOKOMI, CERT and auxiliary firemen to engage the active participation and ownership of relevant stakeholders, including communities, in disaster risk reduction, in particular building on the spirit of volunteerism in islands.

   b. Establish community based early warning system in all the inhabited islands. Develop protocols to make receiving early warning an official and a duty of an assigned or selected person or team as an additional task if that person is an employee. Organizations and different stakeholders in the island can be used for this. The available or established facilities and services which operate 24/7 (Power House, Health Center, Police station etc.) are the most ideal locations to set up the early warning receiving system. So that,

whenever the operations centers at national level or atoll level could pass the message, the focal point would be able to receive it and pass to the relevant DM unit head or identified person as per the protocol and SOPs. Out of several means, the most reliable but cost effective option can be opted such as telephone, mobile phones, HF/VHF radios, email alert or satellite phones etc. In the worst case scenario when everything fails, as a last resort as a messenger, the EW can be passed to the relevant body.
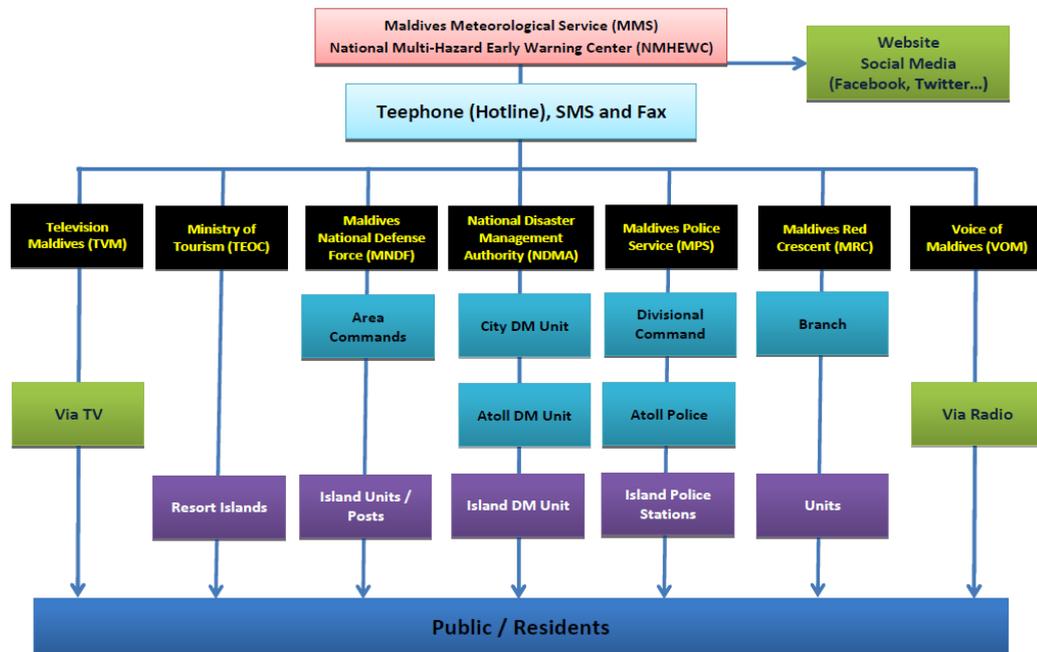
c. Establish and create community emergency response teams (CERT) in all inhabited island communities. Provide them required training and skills to function as first responders role. These teams will then be available to provide first response during emergencies. Give priority to those who are in permanent jobs at work places within the island to ensure the availability. Aim to provide them the basic equipment and gear based on the capacity of the local government. Support CERT to organize meetings and trainings by providing island council's resources. The operational mechanism of BOKOMI in Kobe, Japan and more popular CERT system as in US cities and counties may be considered as a model to establish and operate in island communities of Maldives.

d. Prepare, implement and maintain emergency response plan for every island community with whole community participation. Make CERT the primary response force of that island. With the emergency management skills, training and community resources, they can operate upon receiving early warning from MMS or NDMA.

e. Arrange and conduct drills and emergency exercises at all levels involving all the sectors and stakeholders. Include the most vulnerable people in evacuation drills and prioritize testing early warning system and dissemination mechanism.

f. Teach disaster prevention skills for survival. This would inculcate lifelong lifesaving skills in the island community members. Swimming and sea survival, basic first aid and maintaining emergency kit with some protective and safety gears can be very handy during disasters and surprised extreme weather events such as wind storms and sea surges. Since, Maldivians are frequently exposed to rough weather conditions often due to the extensive use of requirement of sea transportation.

g. Make DRM a learning module and a practical component at schools. Schools in Maldives provide the finest environment for disaster prevention and risk reduction as a common platform where the whole community can be involved and engaged. Public schools can lead and be a model for others since schools become evacuation centers or emergency shelters once a disaster strikes the island.

h. Develop wide area support hubs in other parts of the country. Depend on capital Male' for supplying of relief items and other logistics or technical support proves impractical and costly. This was evident in Indian Ocean Tsunami 2004, cyclone Nilam in 2012 and severe flooding events in the past. During harsh weather conditions, it may take several hours and days to deliver a barrel of chlorine to the affected island if it is from Male' only. Therefore to enhance the disaster relief and humanitarian supplies uninterrupted, concept of wide area support center is very ideal and important for a much dispersed island country like Maldives. Operational and maintenance responsibility could be given to one of the first responding agency from Maldives National Defence Force, Maldives Police Service or Maldives Red Crescent considering their establishment and interest in the intended possible Atolls.

8.3   Challenges

Lack of dedicated resources for disaster risk reduction at all levels. Most of the island communities already lack the minimum equipment and other logistical support required for an effective first response. Limited transportation within the atolls hinders disaster response and relief delivery to a great extent. Some recurring threats could have been resolved with basic and small-scale mitigation interventions, yet no resources are allocated for mitigation actions and vulnerability reduction efforts at community levels.

Geographically dispersed islands and sparse populations provide a major challenge for DRR. The country's unique geographical make often challenges effective response actions in times of emergencies and disasters. It also is a factor for increasing vulnerability due to lack of timely access to basic services or it hampers or delays delivery of basic services from central levels.

Meteorological information in particular has become increasingly pervasive through global media and the Internet. There is less and less dependence on official channels for hazard forecasts, although this has created new issues around the accuracy of warning information, particularly when conflicting information is available from apparently credible sources. Satellite television channels and social media break the news of distant earthquake and tsunami far ahead of local early warning creates chaos and panic in the public.

Local governance and decentralization still requires more familiarization in the country. There still remains much to be done in terms of developing capacities of local councils on local government management, local development planning, delivery of basic services, performance of their duties and responsibilities and efficient dispensation of local mandate and authority. These are important requisites if disaster risk reduction and management are to be fully mainstreamed in the local development processes and should be inclusive of all groups and women. In addition, fiscal decentralization and national budgetary support to local development processes are primordial to effect meaningful decentralization.

8.4   Conclusion

Japanese concept of disaster risk reduction, living with risk environment and attitude disaster provide valuable takeaways for other countries. Maldives as a developing country it is very important to take the advantage of lessons learned from mega disasters in Japan especially

GHAE and GEJE, the disaster mitigation, preparedness, response, recovery and reconstruction efforts, and DRM approach as a whole in Japan as global public goods for future development of the nation.

Achieving and maintaining effective individual and community preparedness is the first line of defense against disasters and can reduce the immediate stress on response organizations. This level of preparedness requires continual public awareness and education to ensure residents and businesses take precautions to reduce their emergency vulnerability, especially during and immediately after disaster impact.

Therefore, reliable disaster early warning is a prerequisite and a vital component of disaster response. It is particularly important for the local community and households to receive EW in case of sudden onset disasters such as earthquakes, tsunami, volcanic eruption, flash flood, landslide, cyclones and storms etc. EW also serves as the trigger point for evacuation order and timely response initiation decision by the individuals and local government which could result in saving numerous lives and property damage. The absence or inadequate EW may lead an avoidable circumstance into a catastrophe.

Since, most of the island communities in the Maldives are physically isolated societies from one another; a disaster with devastating magnitude could result a total isolation, loss of communication and cut off from external support for several hours, days or may be for weeks. Hence, preparing and equipping the Island Emergency Response Teams (IERT), commonly referred as Community Emergency Response Team (CERT) could be one of the best options for the local governments, Island/Atoll and City Councils. These teams are based in islands on volunteerism and consist of volunteers who could act and be a part of larger Local Emergency Response Force (LERF) in an Atoll or a City.

> **"Acting for the common good is a frequent theme in Japanese culture and it infuses the country's approach to disaster preparedness and risk reduction. The rest of the world has much to learn from Japan, if we are to make progress on saving lives and livelihoods, and reducing disaster losses"**
>
> Banki Moon, UN Secretary-General

Taking the above statement in a positive manner, there are ample rooms to improve the existing early warning system and the emergency response mechanism of the Maldives. The gaps that hinder the effectiveness and efficiency in our DRR approach and emergency mechanism can be filled with good practices and lessons learnt from Japan depending on the situation, adaptability and feasibility. Physical components of risk reduction and management may not be possible to achieve as in developed country. However, social components, human behavior and attitude can be approached and have more chance of success in a developing country like Maldives.