THE CURRENT CONTEXT OF MULTI-HAZARD EARLY WARNING SYSTEMS (MHEWS) FOR COASTAL RESILIENCE AT NATIONAL LEVEL

MALDIVES.

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1. Executive Summary

Background

CABARET aims to build capacity for international and regional cooperation between Higher Education Institutes (HEIs) in Asia (region 6) and Europe, and among Asian HEIs themselves, to improve Multi Hazard Early Warning (MHEW) and increase disaster resilience among coastal communities. CABARET will address the cognitive and normative challenges in positioning early warning and preparedness in the wider trajectories of social change in societies and communities at risk. As part of CABARET project, this report presents the current context of multi-hazard early warning systems for coastal resilience at the national level in the Maldives.

Methodology

Data collection for the report was carried out in two parts. The first part consists of conducting a literature review for the available data sources on “natural disasters” and “multi-hazard early warning system” related to Maldives. The literature review was conducted using the data base, EBSCORE and also by referring to information on websites from National Disaster Management Centre, United Nation and Maldives Meteorological Service. In addition to web-based information, published articles related to Multi-Hazard Early Warning (MHEW) systems and disaster management in the Maldives were also reviewed. The publications were reviewed to gather information about current available policies and guidelines regarding MHEW at the national level, to identify challenges associated with MHEW in coastal resilience and to find out the role of the Higher Education Institutes (HEI) in the Maldives in improving MHEW in Coastal Resilience.

The second part of the data collection involved focus group interviews sessions with key personals involved in disaster management process and education sector. Each session lasted for about one and half hour during which, the responses given by the respondents were written and also the responses were recorded to mobile phone. To analyze the data, respondent’s answers were transcribed in English in written form. The data was analyzed by

coding key words and deriving themes from these coded words to find relationships and meaning.

Results.

From the data analysis it was found that, Maldives frequently experiences high frequency low impact events such as monsoonal flooding, coastal erosion and salt water intrusion. While cyclone hazards, wind storms and drought are more frequent in the northern region of the Maldives, rainfall hazards, swell waves and earthquakes are more frequent in the southern regions of the Maldives. Climate change is also a significant issue that needs urgent attention in the Maldives. Maldivian islands are very susceptible to coastal hazards such as costal cyclones, tidal and swell waves. Flood waves caused by a tidal wave could cause extensive damage to island communities.

In response to 2004 Indian Ocean Tsunami, a National Tsunami Warning Center (NTWC) was established under Maldives Meteorological Service to monitor earthquake activities in the Indian Ocean Region. Because of the geographic location of the Maldives, regular earthquake monitoring system is very crucial for Maldives. Even though Maldives has a well-equipped, up to date equipment to monitor multi hazards activities within the Indian ocean, the current MHEW system needs to be improved by introducing new mechanism like internet sirens system into the existing MHEW systems. At present the MHEW system can suffer from communication barriers if the internet is slow or unavailable. Deficiency of hardware equipment and lack of skilled people to work in the field of meteorology are also profound challenges Maldives need to overcome to establish effective MHEW systems in the Maldives.

Discussions

In the Maldives, very few reports are available on multi-hazard assessments. Conducting multi-hazards assessments across Maldives is very challenging due to limited human capacity and geographic isolation of the islands. In-addition, conducting multi-hazard assessments on a regular basis is expensive due to high transport cost and limited funding opportunities in the Maldives. Policy documents are very much needed in the Maldives to guide stakeholders to design and implement national and global frameworks. The current policy documents such

as Disaster Management Act and Maldives climate change policy framework have been very successful in-terms of raising people awareness and changing people perception about disaster management.

The CBDRR introduced by NDMC, offers a very effective approach to reduce local risks. The approach is a low coast approach that is easy to implement in the Maldives. Since the introduction of CBDRR framework in 2005, about 45 islands have strengthened their resilience against natural disasters. However, application of CBDRR approaches at the local level comes with some challenges such as, lack of full participation from the local communities to participate in CBDRR activities, lack of budget to run CBDRR activities and lack of support from the island councils and the local government to integrate CBDRR values in the island development plans.

For a country like Maldives with limited resources, regional cooperation is very much needed to successfully implement disaster management frameworks in the Maldives. The Sendai framework states the overall responsibility for reducing disaster risk is shared responsibility between Governments and relevant stakeholders. Cooperation between government and non-government organization and the local communities play an important role as enablers to successfully implement global frameworks at the national and regional levels. To ensure successful progress of projects such as CBDRR, it is essential to seek the assistance from civil societies and community-based organization to participate in collaboration with the government institutions to take part in the projects.

Conclusion.

The government of Maldives has established National Disaster Management Center (NDMC) with the mandate to carry out disaster management activities in collaboration with other relevant stakeholders throughout the Maldives. Progress is seen as more people in the general public are becoming aware about the need for hazard and risk management. However, at present, the role of Higher education institutes in disaster management is negligible in the Maldives. There are hardly any studies done specific to the role of Higher Education sector in disaster management in the Maldives.

The general public do not perceive disaster management as an important area to pursue a career. As a result, there is no demand for courses in this field in the Maldives. To overcome the barrier of lack of research in the field of Higher education and lack of demand by the public to pursue Higher Degrees in disaster management, the Higher Education Institutes can seek regional partnership to conduct research programs and awareness programme to shift public perception towards the importance of disaster preparedness and disaster management.

2. Introduction

CABARET aims to build capacity for international and regional cooperation between Higher Education Institutes (HEIs) in Asia (region 6) and Europe, and among Asian HEIs themselves, to improve Multi Hazard Early Warning (MHEW) and increase disaster resilience among coastal communities. In doing so, CABARET focuses on a subject area and a world region not sufficiently addressed by projects already being funded under previous schemes.

CABARET will address the cognitive and normative challenges in positioning early warning and preparedness in the wider trajectories of social change in societies and communities at risk. It is an imperative to take an integrated and holistic approach to early warnings for multiple hazards and risks tailored to user needs across sectors. In order to do this, first, partner institutions in each country will conduct a literature review at national level. The literature review mainly involves a review of current available policies, guidelines, national/local reports (e.g. White papers, if any), action plans, etc. to detail mainly the following:

- List of actions/initiatives, including, but not restricted to, policies, guidelines, national/local reports action plans, etc., for MHEW in coastal resilience taken at national/local level to improve MHEW and increase disaster resilience among coastal communities.
- Outcomes of the aforementioned actions/initiatives.
- Key stakeholders in MHEW in coastal resilience at national/local level in each country.
- Current enablers in MHEW in coastal resilience.
- Challenges associated with MHEW in coastal resilience.
- Role of the HEIs in the Country in improving MHEW in Coastal Resilience.

This report presents the current context of multi-hazard early warning systems for coastal resilience at the national level in Maldives.

3. Methodology

Data collection was carried out in two parts. The first part consists of conducting a literature review for the available data sources on “natural disasters” and “multi-hazard early warning system” related to Maldives. The literature review was conducted using Data base, EBSCORE and by reference to websites of National Disaster Management Centre, the UNDP and Maldives Meteorological Service.

Articles related to Multi-Hazard Early Warning (MHEW) systems and disaster management in the Maldives were reviewed. The publications were reviewed to gather information about current available policies, guidelines, national/local reports action plans, challenges associated with MHEW in coastal resilience in the context of Maldives and to find out the role of the Higher Education Institutes (HEI) in the Maldives in improving MHEW in Coastal Resilience.

The second part of data collection involved group interviews sessions with key personals involved in disaster management process and education sector. Officials from National Disaster Management Centre, Environment Ministry, Maldives Meteorological Office, Maldivian Red Crescent, Maldives Police Service, Tourism Ministry, International Union for Conservation of Nature, MAPS College and Maldives National University participated during stakeholder consultation workshop held in Maldives National University on 9th August 2017. A total of 12 participants participated in the discussions. The responses given by the respondents were written in the focus group interview guide and also the responses were recorded to mobile phone during the session. Each session lasted for about one and half hour.

To analyze the data, respondent’s answers were transcribed to English. The data was analyzed by coding key words and deriving themes from these coded words to find relationships and meaning.

Table 1: Participant Details

Participant Code	Level of experience in terms of involvement in MHEW in Coastal Resilience	Any other Remarks
MaGR1	Senior person responsible to coordinate disaster management, specially CBDRR programs in the Maldives.	National Disaster Management Centre of the Maldives.
MaGR2	Works as a forecaster officer at the Maldives Meteorological service. Her responsibility includes, predicting weather by obtaining information from Land, Sea and upper atmosphere. She is also responsible to issue weather alert, gives advice and warnings to media and concerned authorities.	Maldives Meteorological service.
MaGR3	Works as a forecaster officer at the Maldives Meteorological service. His main responsibility includes, predicting weather	Maldives Meteorological service.
MaGR 4	Coordinating officer from the Environment Ministry to work with Maldives Meteorological service and National Disaster Management Centre.	Environment Ministry.
MaGR 5	Works as disaster management Officer to take response action during a hazard event.	Red Crescent.
MaGR 6	Responsible to take part in relief actions during the event of hazard and provide rescue services to the general public.	Maldives police.
MaGR 7	Senior planning officer. She handles all the guidelines related to disaster in the Tourism industry. She is also the focal point from the Tourism Industry in alerting all the results, guesthouses regarding natural hazards and disease outbreak.	Ministry of Tourism. Disaster Management Unit.
MaGR 8 and MGR 9	Have experience in community development and community consultations for climate change and	International Union of Conservation of Nature.

	natural disaster events such as coral bleaching.	
MaGR 10	Programme manager of MAPS college, a private college in the Maldives specializing in business studies.	MAPS college.
MaGR 11	Responsible person in charge of Faculty of Science, of Maldives National University. Maldives National University is a leading university in the Maldives and it is the only higher education institute where environmental management programme is offered in the Maldives.	Maldives National University.

4. Background

Located in the Indian ocean, Maldives is a country consisting of 1,192 small coral islands that stretch 820 kilometers (510 miles) in length and 120 kilometers (75 miles) in width. (UNDP, 2006). The islands are geographically dispersed as shown in figure one. The average height of the Maldivian islands is 1.5 meters above mean sea level. The islands stretch from latitude 70 6'35''N, crossing the equator and extending up to 00 42'24''S and between longitudes 720 33'19''E and 730 46' 13'' E. Maldives enjoys a warm and humid tropical climate, with two monsoon periods known as the southwest monsoon (the wet period from May to November) and the northeast monsoon (the dry period from January to March). (UNDP,2006).

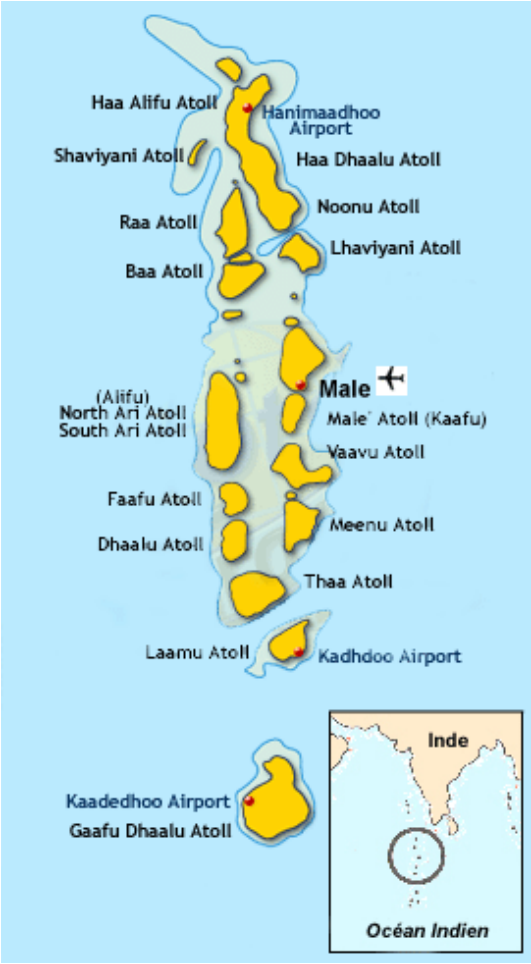

Figure 1: Map of the Maldives showing geographic dispersions of islands. (ONPAROU.COM, 2017)

The total population of Maldives is 338,434 people, excluding the expatriates living in the Maldives. (Ministry of Environment and Energy, 2016). The population is distributed within the country among administrative and non-administrative islands. There are 188 inhabited islands, 109 resorts and 128 industrial islands. (National Bureau of Statistics, 2015). Though there is no official categorization of urban and rural areas, the capital city Male', with a 38 percent of a residential population is widely referred to as urban center of the Maldives.

The main economic driver of the Maldives is the tourism sector. Tourism sector accounts for one third of the country's GDP. In addition, indirectly, the tourism sector also drives the construction, financial, manufacturing, food and entertainment sectors. Tourists choose Maldives to enjoy white sandy beaches and multicolored rich marine underwater coral reef ecosystems. The heavy dependency on the tourism for economic growth of the country places Maldives at a vulnerable position. Maldives is extremely vulnerable to the effects of climate change because of her geography and her dependency on natural resources. Extreme events such as wave swells, heavy rainfall, and windstorms, which cause damage through flooding, erosion, and other impacts is expected to increase in frequency and intensity in the future due to climate change. (Ministry of Tourism, 2015). In such events, tourism will be negatively affected and many people whose livelihood that directly and indirectly depend on tourism will suffer greatly.

5. Coastal Hazards

The Maldives frequently experiences high frequency low impact events such as monsoonal flooding, coastal erosion and salt water intrusion. According to (United Nation Development Programme (UNDP), 2008) There are four categories of natural hazards in the Maldives. They are geological hazards which involves earthquakes and coastal erosions, meteorological hazards which involves tropical cyclones and thunder storms, hydrological hazards which involves flooding and storm surges and climate related hazards which involves sea level rise and sea surface temperature rise. Among the categories mentioned, floods induced by tsunamis, abnormal swell waves, heavy rainfall, windstorms, droughts and earthquakes are considered as major natural hazards in the Maldives. (UNDP, 2008). Figure 1 shows the general patterns of the major natural hazards prevailing in the Maldives.

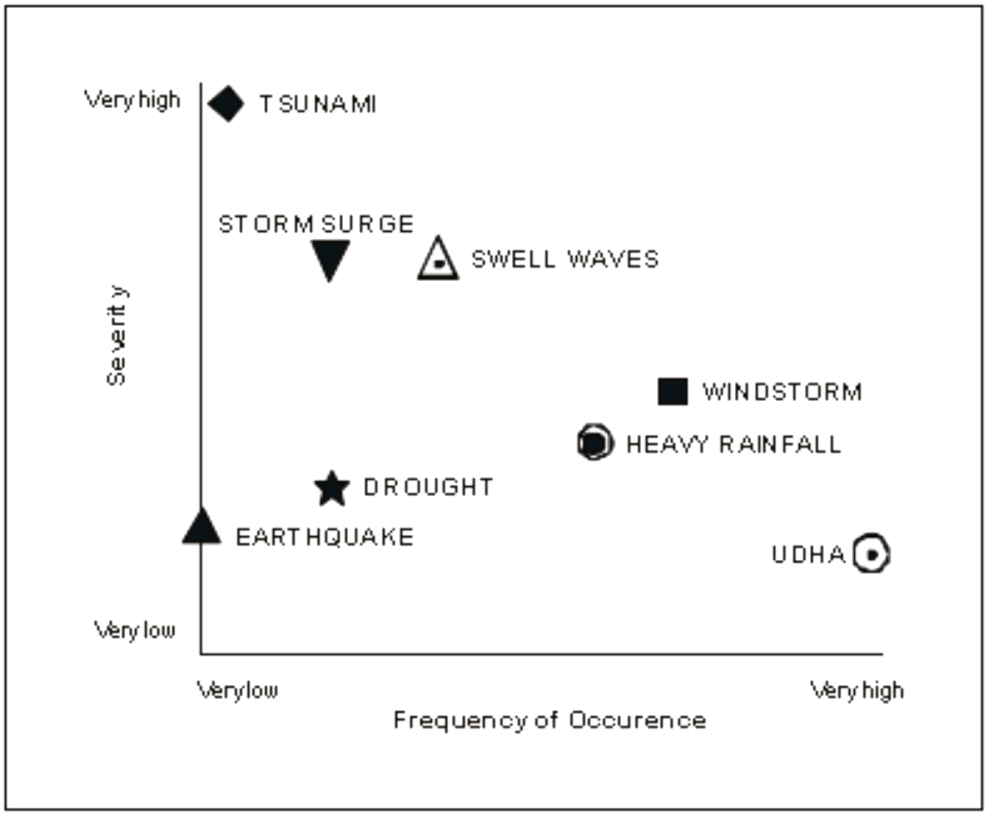

Figure 2: General patterns of the major natural hazards prevailing in the Maldives. (UNDP 2008, p.10, figure 1)

The distribution pattern of natural hazards is strictly controlled by their geophysical and climatic setting as shown in figure 2 and 3.

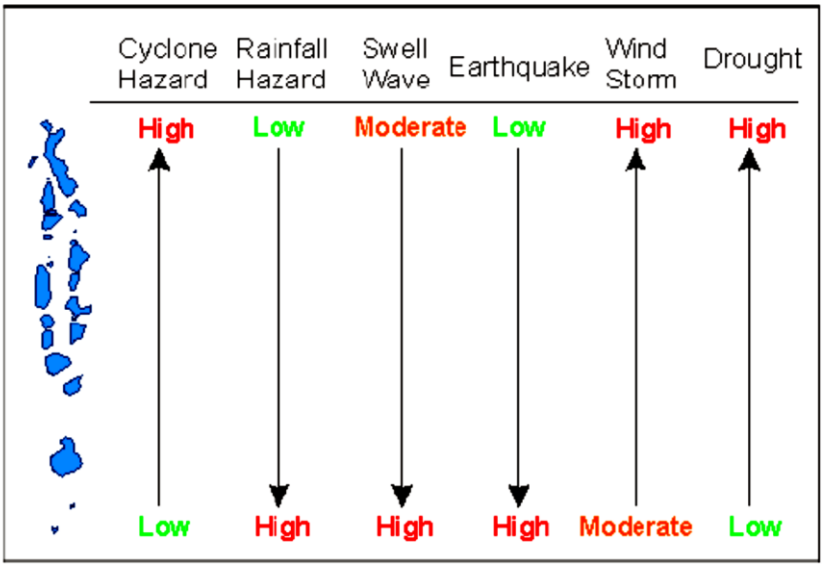

Figure 3: Latitudinal variations of major natural hazards across the Maldives. (UNDP 2008, p.11, figure 2)

According to figure 2, cyclone hazards, wind storms and drought are more frequent in the northern region of the Maldives, while rainfall hazards, swell waves and earthquakes are more frequent in the southern regions of the Maldives.

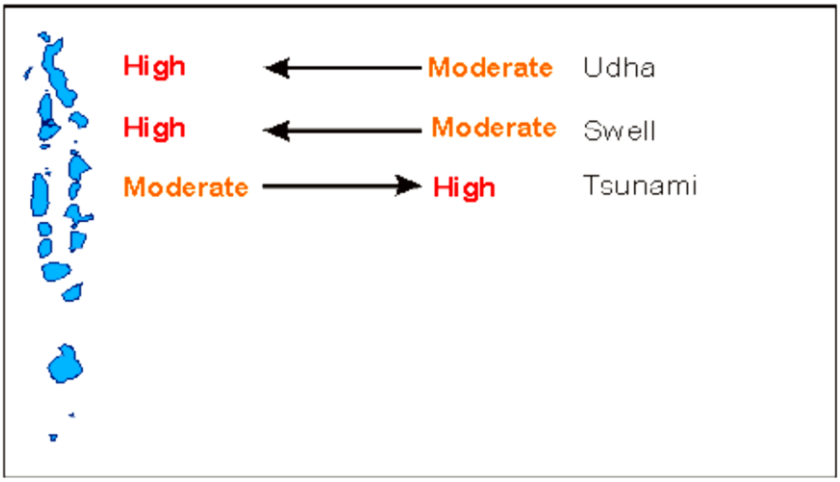

Figure 4: Longitudinal variations of major natural hazards across the Maldives. (UNDP 2008, p.12, figure 3)

Some hazard forms occur as a result of longitudinal differences in the Maldives as shown in figure 3. According to figure 3, the eastern rim islands are subjected to tsunamis and waves of higher intensity compared to islands in the western rim which are protected from high intensity waves. The island morphology and size also plays an important role in protection against coastal hazards. (UNDP, 2008).

According to (Ministry of Tourism, 2015) three major types of swells exist in the Maldives, they are 1) Udha waves, which are known as gravity waves caused by high tides and strong winds; 2) swell waves, which are known as tidal waves and 3) Tsunami waves, which are low frequency high impact waves caused by earthquakes. Wave swells can cause significant flooding that can damage key infrastructures such as homes, harbors, schools, mosques, and jetties in the islands. Other hazards such as monsoon strong winds can cause high tides, which can increase coastal flooding events. In 2008, strong surface winds, combined with heavy rainfall, caused significant damage to roofs and the uprooting of trees in many islands of the Maldives. (Ministry of Tourism, 2015).

Climate change is also a significant issue that needs urgent attention in the Maldives. The UN predicted maximum sea level rise of 59cm by 2100 is expected to make flooding incidents and coastal erosion events more frequent in the future. The projected increase in the sea surface temperature will threaten the survival of the coral reef ecosystem. (National Disaster Management Centre, 2014). Healthy coral reef ecosystem is a vital natural resource for tourism and fisheries industry. Damage to coral reefs such as coral bleaching due to increase in sea surface temperature will have negative impacts on tourism and fisheries industry Maldives heavily depends on for revenue.

Hazard Zone	Range of Probable Maximum Wave Height (centimeters)
1	less than 30
2	30-80
3	80-250
4	250-320
5	320-450

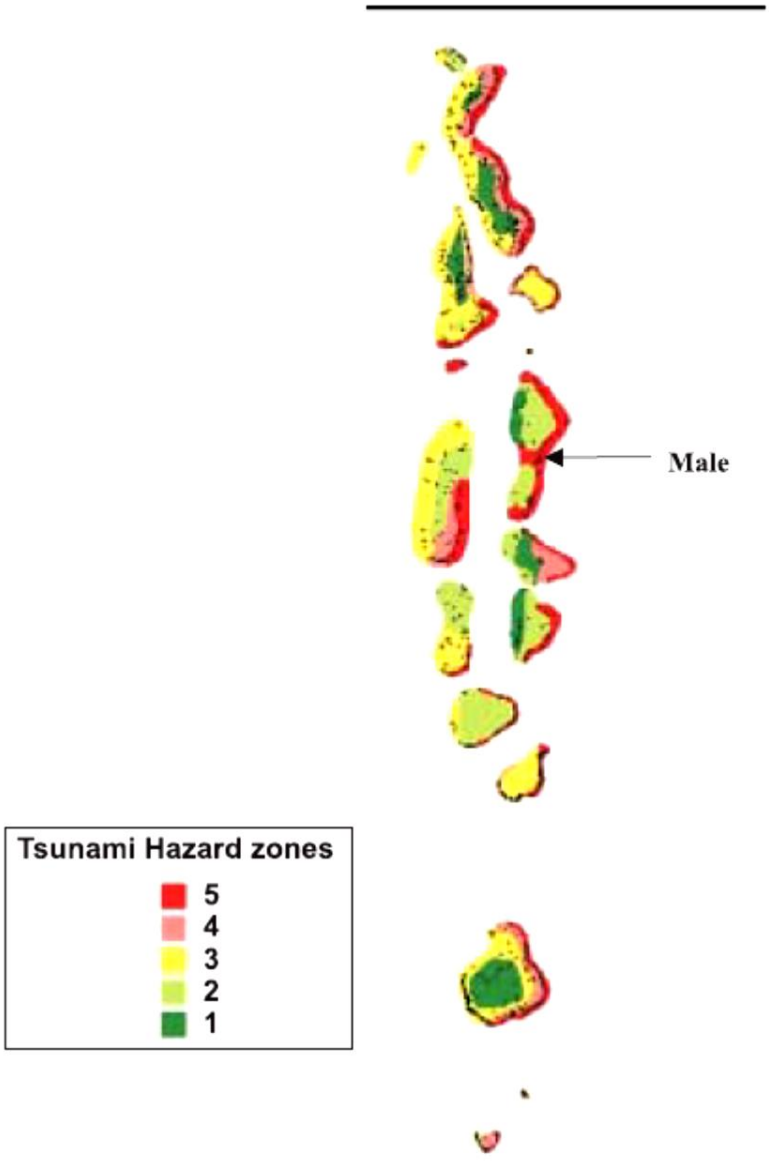

Figure 5: Tsunami Hazards zones in the Maldives. (UNDP 2008, p.14, figure 1)

5.1 Impact of the Coastal Hazards

5.1.1 Literature Review findings

Geographical dispersion, fragile ecosystems and heavy dependence on limited economic sectors make Maldives one of the most vulnerable countries in the world. Vulnerability of the country is further enhanced by natural disasters such as heavy rainfall, flooding, and tidal waves the country experiences from time to time. (UNDP, 2008).

According to a Disaster Risk Profile conducted in the Maldives by UNDP in 2006, flooding due to rainfalls, swells and tidal waves are the most frequent natural hazard experienced in the Maldives. Swell tides and tidal waves cause extensive damages to infrastructures, properties and household goods in island communities. In addition, swelling and tidal waves also cause salt water intrusion to ground water aquifer which results in the destruction of the fresh water lens of the islands, causing extensive damage to farmers and farming activities in the Maldives. (Ministry of Environment and Energy, 2016).

Even though earthquakes and Tsunamis are not frequent in the Maldives, the 2004 Indian Ocean Tsunami was the deadliest natural hazard recorded in the history of the Maldives. One third of the Maldivian population was directly hit by waves ranging from 1 to 4 meters. The waves crashed into the islands causing extensive damage to critical infrastructures such as homes, harbours, jetties and health posts. Severely impacted island communities were evacuated and re-located to safer locations. (Ibrahim & Hamood, 2006).

The Maldivian economy is based on Tourism and Fisheries industry, both of these industries heavily depend on the country's fragile ecosystem. The 2004 Indian Ocean Tsunami accounted for USD 266.2 million loss directly and USD 30 million loss indirectly. For a country with limited economic resources, this loss was a huge blow to the development of the country. (Ibrahim & Hamood, 2006).

5.1.2 Interview and Focus group findings

All the stakeholders who participated in the focus group interview session agreed that due to vast ocean surrounding the Maldives, Maldivian islands are very susceptible to coastal hazards such as costal cyclones, tidal and swell waves. Stakeholder (MGR1) pointed out that due to geographic isolations of the islands, their low-lying nature and the vast exposure to the ocean surrounding the islands, coastal hazards such as tidal waves often cause lot of damage to small island communities. Waves often sweep into the islands causing flooding and destroys infrastructures near the coastal areas.

Maldivian islands are very small in sizes, as a result due to scarcity of land, many critical infrastructures such as waste management centers, houses, restaurants and shops are built very close to the coast. Coastal hazards such as tidal waves and swell waves cause numerous damage to these infrastructures. In events of flooding the floods waters may reach a height of 2 to 4 meters and sweep into the houses, restaurants and shops near the coast, destroying equipment and furniture in the process. The salty flood waters may remain in the islands for one or two days before slowly sweeping into the underground.

Respondent MaGR1 also pointed out that a 2-meter-high flood caused by a tidal wave, or a swell wave may be negligible at the global scale due to their small size, but at national level, the damage caused by these events are very profound because salty flood waters that sinks to the island makes the freshwater lens of the island more saline. Many people in the island communities use the ground water for washing, bathing, cleaning and watering plants. When ground water becomes saline, the local communities find it difficult to use the ground water for their daily activities and in many cases small scale farming carried out at island level get affected because farmers cannot grow plant due to saline conditions of the ground water. Thus, the long-term consequences of flooding hinder the development of the islands very much.

Respondent MaGR2 have added that damage caused by coastal hazards can be reduced if there was proper planning at the national level. Appropriate planning should not only be

carried out as a response to disasters, but proper planning should be carried out before the event of a disaster. According to respondents MGR2:

> "All these things happen because disaster risk reduction is not integrated to local level development planning in the Maldives. This is really sad, because our disaster management cannot keep up with the country's development pace."

Most of the respondents felt that at present, the disaster management action plans are very isolated from the development that is taking place in the Maldives, therefore there is a dire need to incorporate disaster management and disaster risk management approaches to the current development plans to make disaster management more effective in the future.

5.2 Early Warning Systems available for Coastal Hazards

5.2.1 Literature Review findings

Attention to natural disasters such as tidal waves and tsunami was brought to the consideration of the Maldivian government by 1987 tidal wave and 2004 Indian Ocean Tsunami. (Asian Disaster Preparedness Centre, 2006). The 2004 Indian Ocean Tsunami was the deadliest natural disaster that hit the country in the entire known history of the Maldives. Following the devastating event, the German Government provided a grant worth US$ 1,300,000 to establish a disaster risk management programme in the Maldives. The key elements of the programme include development of the early warning systems, preparedness planning, disaster management policy development, emergency response capacity development, safe area development and vulnerability assessment development programmes in the Maldives. Since Early Warning System (EWS) is the main key to minimize damage in an event of a disaster, a national Tsunami warning system was established in the Maldives in response to 2004 Tsunami. (Asian Disaster Reduction Centre, 2005)

To facilitate the work of National Disaster Management, the government of Maldives established National Disaster Management Centre (NDMC) to carry out emergency response, relief and recovery effort in the Maldives. Over the past several years, the NDMC has carried our several capacity building programmes such as basic workshops on disaster risk management, community -based disaster preparedness planning exercises, first aid training programmes and island level evacuation exercises. (Asian Disaster Preparedness Centre, 2006)

In the case of a hazard, The National Meteorological Center (NMC) is responsible for monitor and inform the relevant authorities about the hazard. NMC gives warning about undersea and inland earthquakes, tsunami, tropical cyclones, heavy rain, tornados, gale force wind, storm surges and flood threats. In the Maldives three level of alert are used by NMC. Table 1 shows the criteria used in these alerts. (National Meteorological Center, 2015)

Table 1: Criteria used in issuing warning about natural hazards in the Maldives. Adopted from (National Meteorological Center, 2015)

Alert level	Description	Action
1 White	• Mean wind speed is expected to be over 23-30 mph. • Rain fall of more than 50 mm is expected to occur within 24 hours. • High tidal waves are expected.	• No immediate threat, only information about weather is provided.
2 Yellow	• Mean wind speed is expected to be over 30 to 40 mph. • Torrential rain is expected. • Severe thunderstorm is expected • Tropical cyclone is formed within effective areas of the Maldives. • Significant tidal or swell waves are expected or experienced.	• Concern authorities are advised to be ready to take action. Travel by the sea is not advisable.
3. Red	• Flash flood is expected. • A tropical cyclone is tracked to move closer or cross Maldives. • Destructive tidal waves or swell waves or storm surges are expected or observed.	• Evacuation of population from threatened areas to safer places. • Sea transport is prohibited.

3. Green	• The condition has improved.	• Cancel warning.

5.2.2 Interview and Focus group findings

In the Maldives, weather is predicted using Numerical weather predictable models. The models are web based. In case of a disaster such as earthquake or a tsunami, warning will come from Tsunami Regional Centers in India, Indonesia and Australia. According to respondent MGR1, at present all the information related to multi-hazards comes from internet, therefore, one disadvantage of this approach will be when the internet is down, there will be barriers in communicating with regional Tsunami Centers.

Respondent MGR 2 added that in the case of a Natural hazard such a Tsunami, earthquakes or cyclones, the Maldives Meteorological Service office will pass information to Natural Disaster Management Center. In case of a disaster, the Natural Disaster Management will alert the relevant authorities. Warnings are shared through tv, radio, news reports, and web-based information systems.

National Disaster Management Unit has three units. 1) Early warning and emergency operations, 2) Disaster Preparedness and Risk reduction and 3) Cooperate Affaires. The early warning and Emergency Operations serves as the central coordinating body responsible for carrying relief and recovery operations during emergencies.

From the focus group discussion, it was noticed that stakeholders from the National Disaster Management Centre and Maldives Meteorological Service are very familiar about the Multi-Hazard Early Warning Systems in the Maldives. However, the rest of the stakeholders were not familiar with the MHEWS in the Maldives and do not know how to relate the MHEWS with disaster management frameworks developed to strengthen disaster management in the Maldives. Hence communication gaps between key stakeholders who are responsible to act during disaster was one of the most serious issue emerged from the focus group discussion.

6. Multi Hazard Assessments

6.1.1 Literature Review findings

In the Maldives, a detail island risk assessment was carried out by UNDP in 2007, to assess the vulnerability of the Maldivian islands to hazards. According to the report major hazards Maldives experience are tsunamis, swell waves, wind storms, heavy rain falls, storm surges, Udha, droughts and earthquakes. In the context of the Maldives, Udha is referred to as annual events that occur during the south west monsoon, where low level of flooding, usually below 0.6 meters causes flooding in majority of islands during south west monsoon. On the other hand, swell waves and sea surges are linked to sever events such as windstorms. The report also highlights that vulnerably of the island from flooding depends on topographic factors such as shape and size of the island. For example, Island with low depressions without high ridge systems are more exposed to flood run-up due to the inward sloping gradient. (UNDP 2008)

In the past, hazard events such as flooding may have been a regular phenomenon in the Maldives, however, at that time, hazard events rarely destroy an island due to the protective natural barriers in the island such as the coastal vegetation, inland vegetation, the size of the water lens in the island and health of the marine ecosystem surrounding the island. (UNDP 2008), but today, due to development, most of these natural habitats are being destroyed or modified as a result, Maldivian islands are becoming more susceptible to to natural hazards.

According to disaster risk profile conducted by UNDP, Maldives faces tsunami threats largely from the east and relatively low threat from the north and south. Therefore, islands along the western fringe experiences a relatively low tsunami hazard compared to islands along the northern and southern fringes. (UNDP,2008)

Hazardous weather events which regularly affect Maldives include tropical cyclones and sever local storms. Tropical cyclones are considered destructive if they are associated with strong winds exceeding 150 Kilometers per hour with rain fall above 30 to 40 centimeters within a

24-hour period and storm tides exceed four to five meters. Northern atolls have a greater risk of cyclonic winds and storm surges compared to the southern atolls as shown in figure 6. However, the cyclones that affect northern islands of the country are weak cyclones that are formed in the southern part of the Bay of Bengal and the Arabian Sea.(UNDP, 2008)

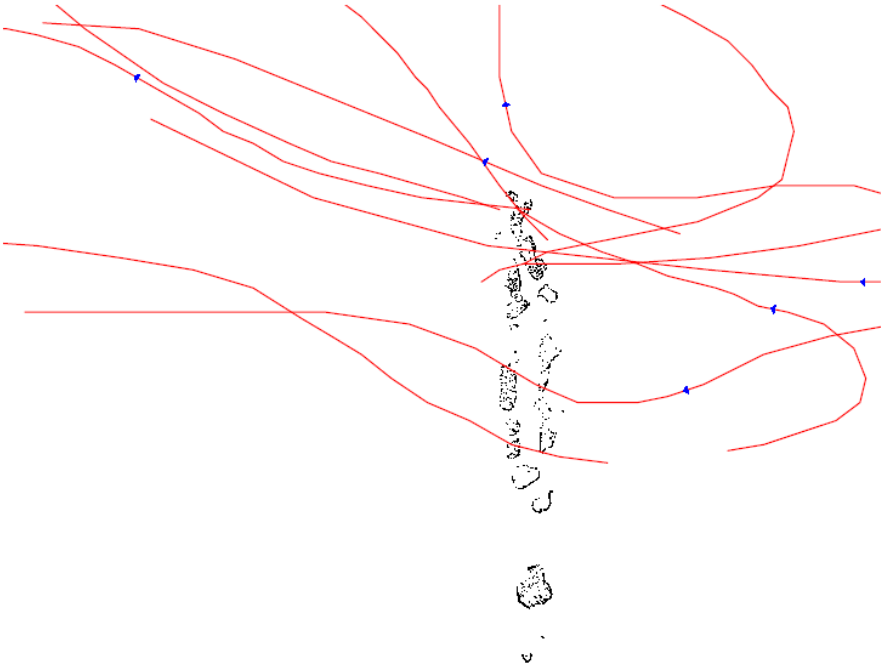

Figure 6: Cyclone tracks affecting Maldives during 1877 to 2004. (UNDP, 2008)

According to figure 6, islands located within close proximity to the equator, are largely free from storms. Figure 7 shows that northern region of the Maldives is more prone to wind hazards from cyclones compared to southern region of the Maldives. Strong winds can damage vegetation, houses, communication systems, roads, while heavy rainfall can cause flooding and cyclonic winds sometimes can cause sudden rise in the sea-level along the coast leading to storm surges. (UNDP, 2008)

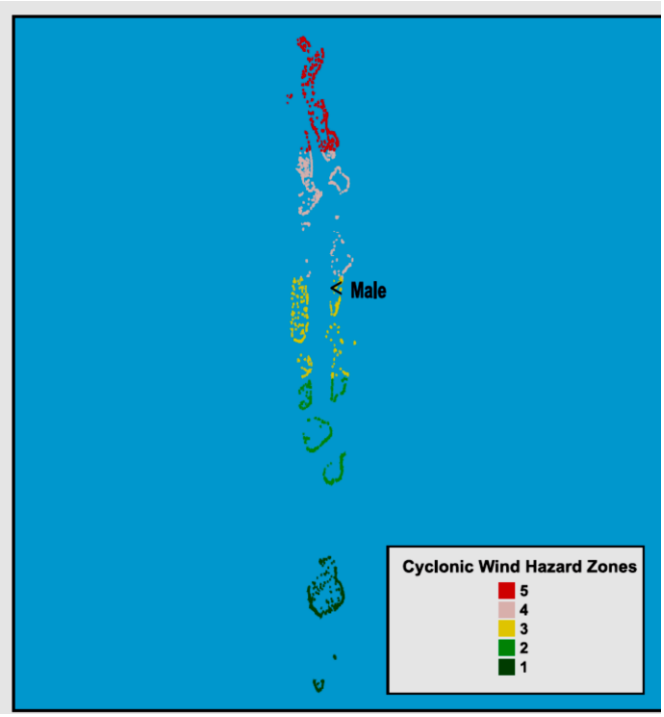

Figure 7: Cyclonic wind hazard map of the Maldives. (UNDP, 2008)

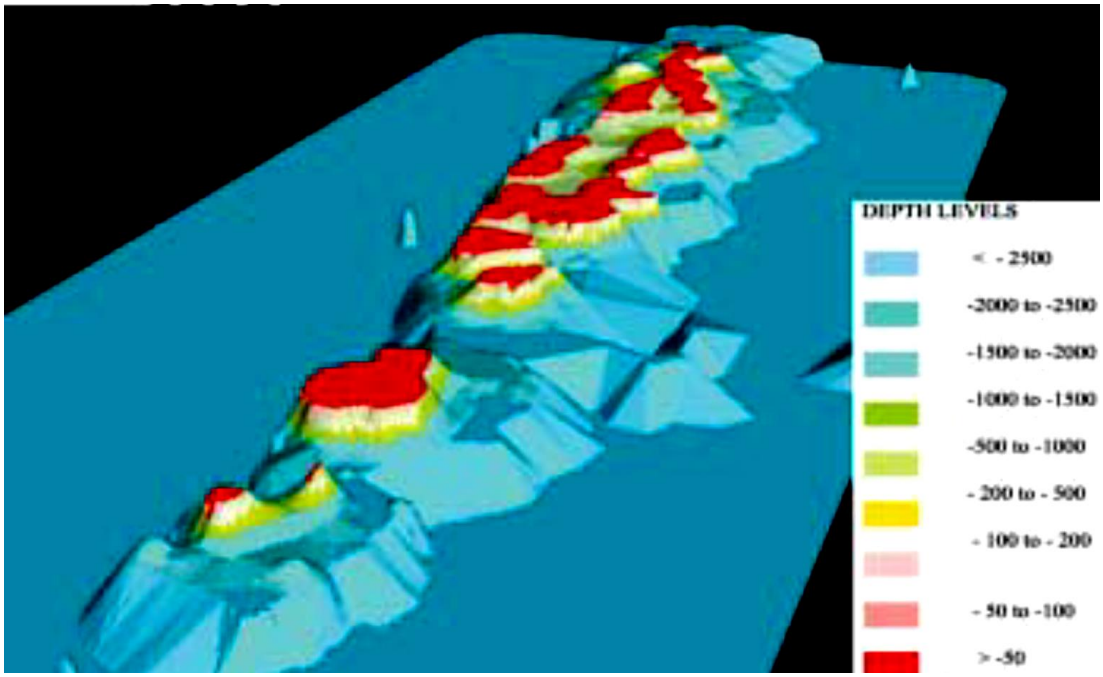

Figure 8: Three-Dimensional View of Bathymetry of Maldives (UNDP 2008)

Bathymetry around Maldives shows that the ocean slope close to east coast is steeper than the west coast. Figures 8 shows three-dimensional views of coastal bathymetry around Maldives. The hazard assessment conducted by UNDP reveals eastern islands of the Maldives

are more vulnerable to higher surge hazards compared to the western islands. Earth quake hazard is more common to the south while threats from sea level rise due to climate change is a uniform hazard throughout the country.

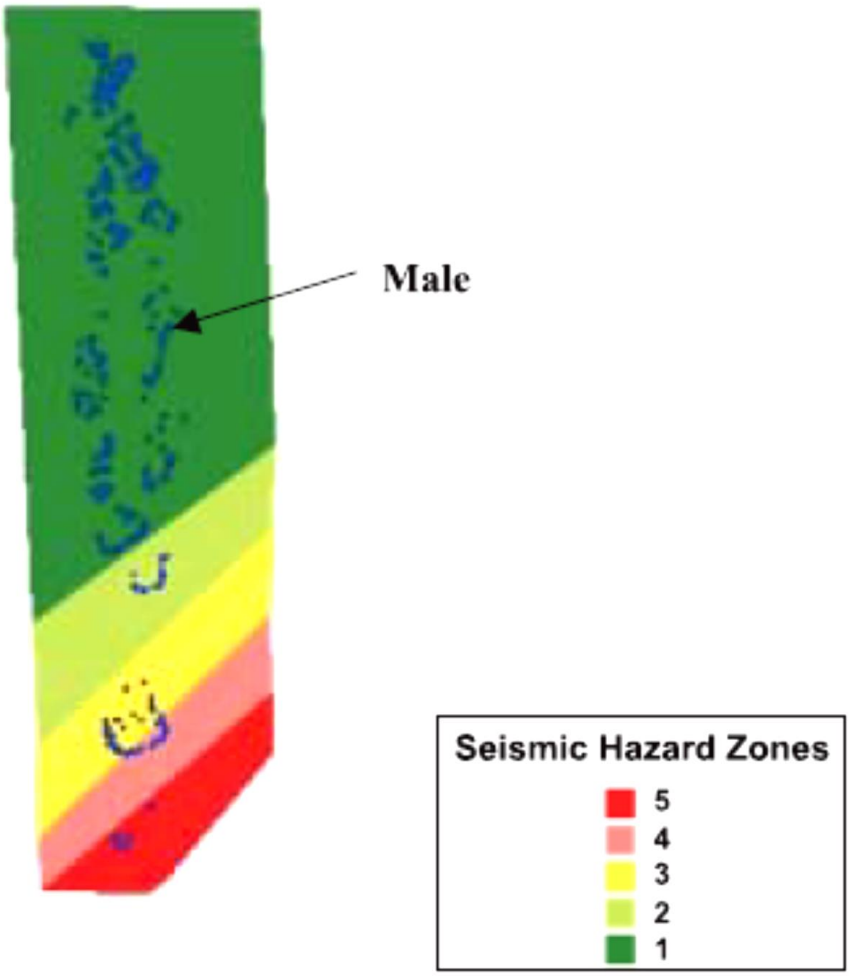

Figure 9: Maldives Seismic Hazard Zones (UNDP 2008)

6.1.2 Interview and Focus group findings

In the Maldives, very few reports are available on multi-hazard assessments. Conducting multi-hazards assessments across Maldives is very challenging due to limited human capacity and geographic isolation of the islands. In-addition, conducting multi-hazard assessments on a regular basis is expensive due to high transport cost and limited available funding in the Maldives. Nevertheless, Maldives has generated some reports on multi- hazard assessments in the country.

Respondents MGR 1 and MGR2 explained that after 2004 Tsunami, the government of Maldives recognized the need for Multi-Hazard Assessments throughout the country, as a result in collaboration with UNDP, in 2007 hazard assessments was carried out across the country. From this project, several assessments articles known as "Detail Island Risk Assessments" (DHIRAM) were produced. The reports are available from the National Disaster Management websites.

MGR3 also highlighted that since Maldives is a country vulnerable to climate change, Ministry of Environment has also conducted vulnerability assessments for Climate change in the Maldives. The reports from this projects are also available from National Disaster Management Centre website. The studies give comprehensive coverage of hazards that threaten Maldives, and also indicates the most vulnerable islands in the Maldives.

Even though some data in the form of hazard assessments are available in the Maldives, respondents MGR 5, MGR 6, MGR7 felt, there is urgent need for up to date assessments at National level. Current available data on hazard assessments are old data, therefore may not represent the current situations in the islands. MGR1 explained that in the context of the Maldives, development is taking place very rapidly as a result, natural habitats such as mangrove and coral reef ecosystems are being modified very rapidly. Large scale development projects often wipe out huge percentage of natural barriers such as coastal vegetation belts, coral reefs, and lagoons in the islands. In the absence of such natural defense mechanisms islands become more vulnerable to natural disasters. Such information

is needed to be incorporated into the current available hazard assessments to make the data more accurate.

7. Global Initiatives on Multi Hazard Early Warning (MHEW) Systems

7.1.1 Literature Review findings

On March 18, 2015, the Sendai Framework for Disaster Risk Reduction was adopted at the third UN world conference. The Sendai Framework for Disaster Risk Reduction 2015 to 2030 was developed on elements of the Hyogo Framework and introduces the concept of disaster risk management as one of the most important steps to take in disaster management. Sendai Framework outlines seven targets and four priorities for action to prevent and reduce risk. The main aim of the Sendai Framework is to achieve substantial reduction in the lives lost during disaster and to minimize livelihoods and health loss over the next 15 years. (UNISDR, 2015). Maldives is currently trying to implement Sendai Framework in the area of MHEW.

For Maldives, Sendai Framework is very important because the framework gives clear direction to prevent and reduce disaster risk at the national level and global level. Sendai Framework was officially introduced to Maldives on 9th March 2017 in a three-day workshop hosted by UNISDR and National Disaster Management Centre of the Maldives. The main aim of the workshop was to support better understanding of the concepts and global trends in disaster risk reduction related to climate change adaptation, capacity building, and future planning to align developmental strategies of the Maldives with the Sendai Framework. The workshop was the first step taken by the government to implement the Sendai Framework in the Maldives. (UNISDR, 2017)

7.1.2 Interview and Focus group findings

Making the link between Sendai Framework, the Sustainable development goals, and the Paris agreement on climate change is the key aspects that need to be considered when developing national strategies for disaster risk reduction in the Maldives. The main responsible bodies that work to implement global frameworks in the Maldives are 1) National Disaster Management Centre, 2) Maldives Meteorological Service, 3) Environment Ministry 4) Tourism Ministry and Local Government Authority. Respondents MaGR3 during the focus group interview session highlighted that in the Maldives, the National Disaster Management Centre looks after the Sendai Framework while the Environment Ministry looks after Sustainable Development Goals and the Paris agreement. Respondents MaGR 3 also added the biggest challenge for implementing the global frameworks in the Maldives is, lack of collaboration between the government ministries. According to MaGR1, since there is no single ministry to look after all the frameworks, collaborations between all the relevant ministries are very much needed but is not happening due to communication barriers.

All the stakeholders agreed that the apart from lack of cooperation among the Ministries, lack of human capacity is also another challenge Maldives face. Respondents MaGR 2 explained that due to lack of human capacity, Maldives do not have the capacity to give training or consultancy on hazard assessments to other countries. All the respondents pointed that even though global frameworks such as Sendai Frameworks exist in the Maldives, Maldivians are more likely to engage in post disaster activities rather than pre-disaster activities.

8. Current National efforts towards MHEW in Coastal Resilience

8.1.1 Literature Review findings

In the Maldives, the first meteorological office was established in the early 1940s to give basic weather prediction service to the Maldivians. By 2009, the meteorological office was converted to Maldives Meteorological Service (MMS) with the responsibility to monitor the seismological and meteorological services in the Maldives. Today there are 5 meteorological offices throughout the Maldives. The main MMS office is located in the Central region of the Maldives near the capital city Male'. Aviation synoptic observation done in the other stations are sent to the main MMS office via e-mail or fax. In addition to the weather stations, 20 automated weather stations and 3 tide gauges are installed across the country to provide real time data. Information provided by MMS include daily weather and aviation forecasts, weather warnings and marine forecasts. In the Maldives, MMS is responsible to deliver alerts regarding Indian Ocean Earth Quakes. (MMS, 2015)

In response to 2004 Indian Ocean Tsunami, a National Tsunami Warning Center (NTWC) was established under MMS to monitor earthquake activities in the Indian Ocean Region. California Integrated Seismic Network (CISN) was introduced and in 2008, Seismic P3 system was installed in the MMS for real time earth quake monitoring. The system is capable of automatically calculating earthquakes within a few minutes of time. Regular earthquake monitoring system is very crucial for the Maldives because of geographic location of the Maldives. Geologically Maldives is located near the Indian Ocean Ring where two main subduction zones, the plate boundaries near Sumatra in Indonesia and the Makran coast generates large magnitude earth quakes which can create Tsunamis. (MMS,2015)

8.1.2 Interview and Focus group findings

In the Maldives Daily and aviation forecasts, marine forecasts, tsunami warnings and earth quake information are issued from Maldives Meteorological Service (MMS). In the case of a disaster, the MMS collaborate with key government agencies to help in disaster relief activities. MMS also cooperate with key government agencies to develop risk maps and scenario building and modelling activities for Disaster Management plans.

Even though Maldives has a well-equipped, up to date equipment to monitor multi hazards activities within the Indian ocean, all the respondents who participated in the focus group discussion agreed that the current MHEW system needs to be improved by introducing new mechanism like internet sirens system into the current MHEW systems. At present the MHEW system can suffer from communication barriers if the internet is slow or unavailable.

Many respondents pointed out that MHEW systems can be improved by finding mechanisms that will address communication barriers such as use of mobile phone application to alert communities. Other challenges pointed out by the respondents were lack of hardware equipment to collect information needed for data base management such flash floods prediction across the Maldives and lack of skilled people to work in the field of meteorology.

In the Maldives, there is a shortage of skilled and competent meteorologists because tertiary education in meteorology is not available.

9. Policies to improve MHEW in Coastal Resilience

9.1.1 Literature Review findings

The National Disaster Management Center (NDMC) is mandated to organize and conduct awareness programs to prepare the public in the event of disaster. NDMC is also mandated to identify immediate response mechanisms and relief requirements in the event of a disaster and also to establish strong mechanisms with the government authorities and non-government authorities to ensure disaster risk reduction strategies remains a priority in the government and private sector. In order to facilitate NDMC to carry out their mandated activities by the government, the Government of Maldives rectified the Disaster Management Act on 6th September 2015. The purpose of the act is as follows:

Table 2: key purposes of Disaster Management Act.

• To protect the people from natural hazards and man-made disasters.
• To incorporate guidelines on disaster risk mitigation and preparedness.
• To reduce disaster risk and to adapt a preparatory national strategy.
• To identify responsible parties to manage disaster risk, and to identify their responsibilities.
• To provide assistance at emergency situations and to provide assistance on the relief efforts, to incorporate such guidelines to coordinate such assistance.
• To state the roles and responsibilities of the City Councils, Atoll Councils, and Island Councils in reducing disaster risk and mitigation in emergency situations.
• To create awareness among the people in reducing disaster risk and mitigation in emergency situations, and to incorporate guidelines to protect the people from such dangers and enhance coping capacity.
• To incorporate disaster risk reduction guidelines and policies within the sustainable National development projects.
• To make the people responsible and accountable towards disaster risk reduction and mitigation

To align with the Disaster management act, two policy guiding frameworks knows as Community Based Disaster Risk Management (CBDR) framework and National Internally Displaced People Framework were developed by NDMC.

Climate change is another area that Maldives need to take action. To address impacts of climate change in the Maldives, Maldives developed National Climate change policy framework to build resilience among the Maldivian communities. The policy goals define 5 thematic areas related to 1) Sustainable financing, 2) Low carbon emission, 3) Adaptation actions, 4) Climate change advocacy roles, and 5) Sustainable development. (Ministry of Environment, 2015)

Under adaptation theme, the policy encourages the government to build climate resilient infrastructures and to develop effective risk reduction responses by the relevant stakeholders.

9.1.2 Interview/Focus Group findings

Policy documents are very much needed in the Maldives to guide stakeholders to design and implement national and global frameworks. Respondents MGR1 and MGR 2 agreed that for successful implementation of disaster management and disaster risk strategies, policy documents are needed as guiding documents in the Maldives. Many respondents agreed that the current policy documents such as Disaster Management Act and Maldives climate change policy framework have been very successful in-terms of raising people awareness and changing people perception regarding disaster management. MGR8 explained that people's awareness regarding natural hazards have increased after 2004 Tsunami. Today most Maldivians will check weather reports before making travel arrangements. According to MGR 5:

> "People are more aware about weather information and they are informed about hazards compared to before. Nowadays, most Maldivian pay attention to see weather reports before travelling."

All the respondents agreed to make MHEW mechanisms in the Maldives more comprehensive, and decided that additional policy guiding documents are needed. However, in the case of Maldives, even to conduct a situation analysis to develop policies is very challenging due to lack of human capacity, lack of funding and geographic isolation of the islands and expensive transport costs.

10. Resilience Mechanisms

10.1.1 Literature Review findings

NDMC has developed several frameworks to make Maldives a disaster resilient country. One such framework is the Community-Based Disaster Risk Reduction (CBDR) framework which was developed to achieve disaster risk reduction at the community level by reducing local vulnerabilities and encouraging local communities to take responsibility for their own welfare. The CBDRR framework offers a very effective approach to reduce local risks. The approach is a low coast approach that is easy to implement in the Maldives. Since the introduction of CBDRR framework in 2005, about 45 islands have strengthened their resilience against natural hazards in the Maldives. (NDMC, 2014).

The second framework that was developed by NDMC to strengthen resilient in the Maldivian was the "National framework for managing internally displaced persons in the Maldives." The framework outlines actions that would guide local, national and international agencies when assisting Internally Displaced Persons (IDPs) in the Maldives during disaster. (NDMC, 2016)

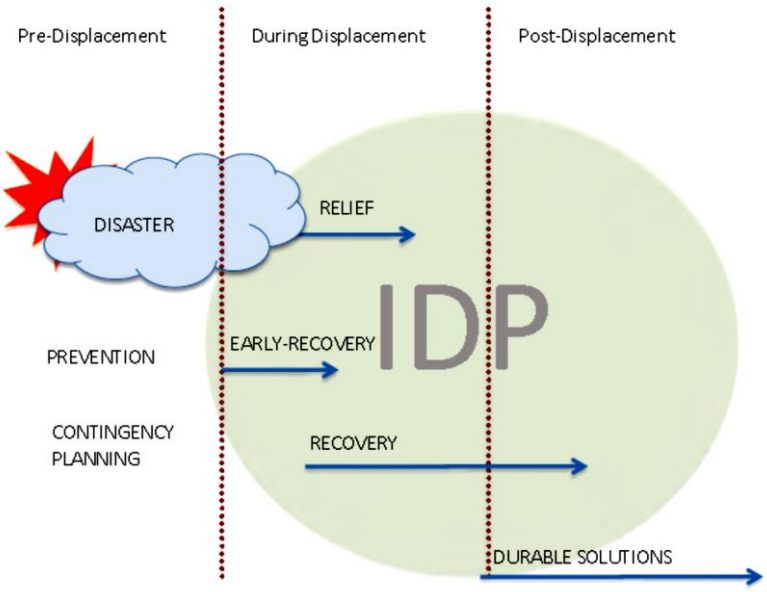

Figure 10: The cycle of displacement. (NDMC, 2016)

According to the figure 10, the three stages developed under the IDP framework are the pre-displacement phase, during displacement phase and post displacement phase. During the pre-displacement phase, the national authorities put all mechanisms in place to prevent the people from displacement. Contingency planning is a prerequisite during this phase. During displacement, the displaced people are provided with protection against the harsh conditions they might have to encounter during the displacement period. The post Displacement phase is considered when a durable solution is met by the displaced people and the displaced people no longer need to seek assistance from the authorities. (NDMC,2016)

10.1.2 Interview and Focus group findings

With the introduction of global frameworks such as the Sendai Framework and the Sustainable Development goals into the development context of the Maldives, the government of the Maldives recognizes the need to promote disaster risk management approaches to increase resilient among the Maldivian communities. All the respondents in the focus group interview sessions agreed that current resilience mechanisms are difficult to be established in the Maldives due to various challenges such as lack of human capacity and funding opportunities.

Respondent MGR 5 and MGR 6 pointed out, the size of the population is a challenge to implement resilience mechanisms in the Maldives. While some islands have a population exceeding 50000, other islands have population less than 500 people. Establishing hard resilient mechanisms to protect the island from natural hazards such as flooding and beach erosion, requires same cost regardless of the size of the population.

Respondent MGR 1 added that for a country like Maldives with limited resources, the best approach to develop resilience mechanism is through CBDRR approach because CBDRR approaches are low cost approaches which are very easy to implement at the local level to raise awareness among the local community regarding disaster. However, Respondents MGR 1 also mentioned that application of CBDRR approaches at the local level comes with some challenges like lack of full participation from the local communities to participate in CBDRR

activities, lack of budget to run CBDRR activities and lack of support from the island councils and the local government to integrate CBDRR values in the island development plans.

Many respondents also highlighted that soft resilience mechanisms like insurance mechanism are not popular among the locals even though such mechanism are developed by the National Disaster management Centre. MGR 3 stated that local communities do not take part in insurance mechanisms due to lack of awareness about the rationale behind such insurance policies.

11. Regional Cooperation

11.1.1 Literature Review findings

For a country like Maldives with limited resources, regional cooperation is very much needed to successfully implement disaster management frameworks in the Maldives. The biggest area in which regional assistance was given to Maldives was meteorological area by World Meteorological Organization (WMO). Maldives became a member of WMO in 1978 and ever since, WMO has played a key role in providing weather forecast based on Maldivian alert criteria. In addition, WMO also run weather models for different hazards scenarios for Maldives free of charge. (MMS, 2015)

Earthquake monitoring is done by Regional Tsunami Watch providers (RTWP) for the Indian Ocean Region. Meteorological data is also provided by Indonesian Tsunami Early warning system (Ina-TEWS), Indian Tsunami Early warning Centre (ITEWC) and Joint Australian Tsunami Warning Centre (JATWC). (MMS, 2015)

United Nation Development Programme (UNDP) and United Nation Office for Disaster Risk Reduction (UNISDR) are key organization in providing funding opportunities to run Disaster Risk Reduction projects in the Maldives. UNDP in collaboration with NDMC has conducted numerous disaster risk assessments across the Maldives after 2004 Tsunami. UNISDR is actively involved in the Maldives to raise awareness about the Sendai Framework and disaster risk reduction strategies applicable to Maldives. (NDMC, 2014)

11.1.2 Interview and Focus group findings

All the respondents agreed that Maldives lack the human capacity and financial resource to respond to disaster. As a result, the best way for Maldives is through regional cooperation to support effective MHEW in the Maldives. Maldives is highlighted in all the important frameworks developed at the regional level by the regional organization which is very important as being a small island, the challenges Maldives face is very different from the challenges other countries face in the region.

Respondents also highlighted that as Maldives is a country with limited resources in terms of human capacity, natural resources and funding, the biggest challenge for Maldives lies in obtaining funding opportunities to fill gaps in the area of capacity building for disaster management and meteorological service and to establish MHEW programs across Maldives. Therefore, to cater for this need, regional cooperation is very much needed in the Maldives.

12. Enablers associated with MHEW in Coastal Resilience

12.1.1 Literature Review findings

The Sendai framework states the overall responsibility for reducing disaster risk is a shared responsibility between Governments and relevant stakeholders. Cooperation between government and non-government organization and the local communities play an important role as enablers to successfully implement global frameworks at the national and regional levels. To ensure successful progress of projects such as CBDRR, it is essential to seek the assistance from civil societies and community based organization to participate in collaboration with the government institutions to take part in the projects. (NDMC, 2014)

The CBDRR program run in the Maldives is a low cost easy to implement programme, however, the success of the programme lies in the ability of the implementing agency to create an enabling environment to take place for the success of the project. According to several studies conducted by NDMC, even though the government has established laws and regulations to conduct national action plans related to disaster risk reduction at the community level, the lack of specific institutions and legal arrangements limit the opportunity to successfully implement CBDRR programme across the Maldives. In addition, the availability of the technical capacity to support CBDRR projects are very much limited in the Maldives. Specially the capacity to use scientific risk and warning information is quite limited in the islands communities. (NDMC, 2014).

Media can play a very important role in creating an enabling environment for CBDRR programs. If media takes active and inclusive role at the local and national level in contributing to raise awareness related to hazard information, the local gap in understanding information related to risk and hazards can be reduced.

12.1.2 Interview and Focus group findings

All the respondents agreed that biggest challenge in the context of disaster management lies in the area of collaborative work between all the stakeholders. At present due to communication barriers, collaborative work is very much hindered. To create an enabling environment, the stakeholders need to find ways to overcome the communication barriers they have. The second challenge all the stakeholders pointed out was lack of participation of community members when community based disaster risk reduction strategies are carried out by the government.

To create successful engagement of the local community, awareness sessions need to be held with the local community. Respondents also highlighted that media can play a very important role to create awareness among the local communities. Regular awareness programmes from tv and radio stations are very important to create an enabling environment for the successful engagement of the local community.

13. Role of Higher Education Institutes for an effective MHEW and Coastal Resilience

13.1.1 Higher Education in the Maldives.

In Maldives, there are both public and private Higher Education Institutions. The main universities in the Maldives are Maldives National University and Maldives Islamic University. There are several private collages who provide higher education in the Maldives. The leading private institutes are Villa College, Modern Academy for Professional Studies (MAPS), Clique college, and Cyryx College. Like any other small island country, the Maldivian Higher Education Institutes do not specialize in degree and post degree programs as they do in large countries. Instead most of the Higher Education Institutes offer courses and programs at pre-degree level, diploma level and degree level. Courses offered at postgraduate level are very limited and restricted to few specialized fields. (Aturupane, Fielden, Mikhail & Shojo, 2011).

In the Maldives, due to limited availability of specialized field at undergraduate level and postgraduate level, many Maldivians are compelled to seek their university education overseas in countries like Australia, England, Malaysia, New Zealand, Sri-Lanka and India. Students who study overseas are exposed to a rich and diverse societies and cultures. However, the major constraints for these students are the costly expenses the students have to bear while studying overseas, as a result, many Maldivians are unable to pursue higher education in the field of their interest. Deficiency of specialized fields and lack of professional to teach these fields are the most pressing concerns in the Higher Education sector of the Maldives. Since the country has very few professionals, the country is forced to rely on expatriate workers to work in professional fields such as medicine, engineering, banking, information technology and finance sector, which again is very costly and unsustainable as facilities such as infrastructure and equipment needed to teach these fields are also expensive and difficult to establish and maintain in the Maldives due to land scarcity, geographic isolation and lack of available resources. (Aturupane, Fielden, Mikhail & Shojo, 2011).

13.1.2 Education and awareness programme: Interview and Focus group findings

After 2004 Indian Ocean tsunami, special attention was given to develop disaster management programs across the country. The government of Maldives has established National Disaster Management Center (NDMC) with the mandate to carry out disaster management activities in collaboration with other relevant stakeholders throughout the Maldives. Progress is seen as more people in the general public are becoming aware about the need for hazard and risk management in the Maldives. However, at present, the role of Higher Education Institutes in disaster management is very minimal. Hardly any studies have been done specific to the role of higher education in disaster management. In some disaster risk reduction frameworks developed by NDMC and Environment Ministry possible roles for primary and secondary schools were mentioned, but specific roles of Higher Education sector were not mentioned.

From the focus group interviews conducted with the stakeholders it was found that there is no demand for disaster management courses in the Maldives. The general public do not perceive disaster management as an important area to pursue a career. As a result, there is no demand for courses in this field in the Maldives.

Since Higher Education Institutes cater for the need of the public when designing courses, the low demand by the public for disaster management field is seen as a risk by most Higher Education Institutes to develop courses in this field. As a result, there is hesitation within the Higher Education Institutes to introduced courses related to the field of disaster management in the Maldives.

To overcome the barrier of low demand for courses in disaster management, the Higher Education Institutes will need funding opportunities to conduct research and awareness programmes to shift public perception about career opportunities in disaster management arena in the future.

14. Conclusions.

The study presents the current context of multi-hazard early warning systems for coastal resilience at the national level in the Maldives. The Maldives frequently experiences high frequency low impact events such as monsoonal flooding, coastal erosion and salt water intrusion. While cyclone hazards, wind storms and drought are more frequent in the northern region of the Maldives, rainfall hazards, swell waves and earthquakes are more frequent in the southern regions of the Maldives. Climate change is also a significant issue that needs urgent attention in the Maldives. Maldivian islands are very susceptible to coastal hazards such as costal cyclones, tidal and swell waves. Flood waves caused by a tidal wave could cause extensive damage to island communities.

In response to 2004 Indian Ocean Tsunami, a National Tsunami Warning Center (NTWC) was established under MMS to monitor earthquake activities in the Indian Ocean Region. Regular earthquake monitoring system is very crucial for the Maldives because of geographic location of the Maldives. Even though Maldives has a well-equipped, up to date equipment to monitor Multi Hazards Activities within the Indian ocean, the current MHEW system needs to be improved by introducing new mechanism like internet sirens system into the existing MHEW systems. At present the MHEW system can suffer from communication barriers if the internet is slow or unavailable. Deficiency of hardware equipment and lack of skilled people to work in the field of meteorology are also profound challenges Maldives need to overcome to establish effective MHEW systems across the country.

In the Maldives, very few reports are available on Multi-Hazard Assessments. Conducting Multi-Hazards Assessments across Maldives is very challenging due to limited human capacity and geographic isolation of the islands. In-addition, conducting Multi-Hazard Assessments on a regular basis is expensive due to high transport cost and limited funding available in the Maldives.

Up to date policy documents are also very much needed in the Maldives to guide stakeholders to design and implement national and global frameworks. The current policy documents such as Disaster Management Act and Maldives climate change policy framework have been very

successful in-terms of raising people awareness and changing people perception about disaster management.

The CBDRR introduced by NDMC, offers a very effective approach to reduce local risks. The approach is a low coast approach that is easy to implement in the Maldives. Since the introduction of CBDRR framework in 2005, about 45 islands have strengthened their resilience against natural disasters. However, application of CBDRR approaches at the local level comes with some challenges like, lack of full participation from the local communities to participate in CBDRR activities, lack of budget to run CBDRR activities and lack of support from the island councils and the local government to integrate CBDRR values in the island development plans.

For a country like Maldives with limited resources, regional cooperation is very much needed to successfully implement disaster management frameworks in the Maldives. The Sendai framework states the overall responsibility for reducing disaster risk is shared a responsibility between Governments and relevant stakeholders. Cooperation between government and non-government organization and the local communities play an important role as enablers to successfully implement global frameworks at the national and regional levels. To ensure successful progress of projects such as CBDRR, it is essential to seek the assistance from civil societies and community based organization to participate in collaboration with the government institutions to take part in the projects.

The government of Maldives has established National Disaster Management Center (NDMC) with the mandate to carry out disaster management activities in collaboration with other relevant stakeholders throughout the Maldives. Progress is seen as more people in the general public are becoming aware about the need for hazard and risk management in the Maldives. However, at present, the role of Higher education institutes in disaster management is very minimal in the Maldives. Hardly any studies have been done specific to the role of Higher Education sector in disaster management in the Maldives. The general public do not perceive disaster management as an important area to pursue a career. As a result, there is no demand for courses in this field in the Maldives. To overcome the barrier of lack of research in the field of Higher Education and lack of demand by the public to pursue

Higher Degrees in disaster management, the Higher Education Institutes can seek regional partnership to conduct research programs and awareness programme to shift public perception about career opportunities in disaster management arena in the future.

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APPENDIX 1:

The following table lists all the policies, guidelines, national/local report available for MHEW in Coastal Resilience.

Name of the Document	Document Reference	Brief Description of the Document	Main initiatives/Actions highlighted in the Document	Key Informants (if given)
i.e. Policy, Guideline, National Report, etc.	**i.e. Author(s)/Institution Name, Year of Publication, Web Source (if online)**	**i.e. What is it about, it's main purpose, Why was it introduced, is the document aimed at at National Level/ Regional Level/ City Level/ Village Level/ any other, etc.**	**This can be in the form of bullet points and you have to highlight ONLY the main initiatives/actions stipulated in the document.**	**If there is a list of key people involved in the development of the document, you can list them here in (their name, position and contact number/e-mail. This will be helpful when you start your Interviews and/or focus groups.**
LITERATURE REVIEW FINDINGS				
	United Nation Development Programme. (2008). *Detailed island risk assessment in*	A comprehensive study conducted by UNDP to assess	The natural hazards prevailing in the Maldives	

Detailed Island Risk Assessment in Maldives: Natural hazards and physical vulnerability assessment report	*Maldives: Natural hazards and physical vulnerability assessment report.* Retrieved on 18th September 2017 from www.housing.gov.mv/v1/daaownload/129	the vulnerability of Maldives to disaster.	can be categorized as follows: • Geological hazards: Earthquakes and coastal erosion. • Meteorological hazards: Tropical cyclones, tropical storms (strong wind), thunder storms and waterspouts. • Hydrological hazards: Storm surges, swell waves, Udha, tsunamis, heavy rainfall and drought. • Climate change related hazards: Sea level rise, changes in precipitation, sea surface temperature rise, storm activity and swell waves.	
National Community Based Disaster Risk Reduction	National Disaster Management Centre. (2014). *National Community Based Disaster Risk Reduction (CBDRR) Framework*. Retrieved on 19th September 2017 from http://ndmc.gov.mv/assets/Uploads/National-CBDRR-Framework.pdf	This framework concisely outlines the enabling environment that is required to implement Community-Based Disaster Risk Reduction activities in the Maldivian communities.	The National CBDRR Framework will be an important tool that will be used in our communities to mainstream disaster risk reduction into their local development planning	

			process. The framework also focuses on strengthening the key elements that enable a conducive environment for large scale CBDRR activities. An important element is the strengthening of financial resources and budgetary allocation specifically for CBDRR at the local and national level.	
National Framework for Managing Internally Displaced Persons in the Maldives in case of a disaster/ crisis.	National Disaster Management Centre 2016, National *Framework for Managing Internally Displaced Persons in the Maldives in case of a disaster/ crisis*. Viewed 19th September 2017, http://ndmc.gov.mv/assets/Uploads/National-IDP-Framework.pdf	This framework outlines actions that would guide local, national and international agencies when assisting Internally Displaced Persons (IDPs) in the Maldives in any unfortunate case of a disaster.	Three stages developed under the IDP framework are the pre-displacement phase, during displacement phase and post displacement phase. During the pre-displacement phase, the national authorities put all mechanisms in place to prevent the people from displacement. Contingency planning is a prerequisite during this	

			phase. During displacement, the displaced people are provided with protection against the harsh conditions they might have to encounter during the displacement period. The post Displacement phase is considered when a durable solution is met by the displaced people and the displaced people no longer need to seek assistance from the authorities.	
Criteria for issuing weather alerts	Maldives Meteorological Service 2015, *Criteria for issuing weather alerts.* Viewed 19th September 2017 from , http://www.meteorology.gov.mv/alertcriteria	In the case of a hazard, The National Meteorological Center (NMC) is responsible for monitor and inform the relevant authorities about the hazard.	NMC gives warning about undersea and inland earthquakes, tsunami, tropical cyclones, heavy rain, tornados, gale force wind, storm surges and flood threats. Alert criteria are white, yellow and red.	

---- End of Report ----