DISASTER MANAGEMENT IN JAPAN: A COMPARATIVE STUDY OF THE 1995 AND THE 2011 EARTHQUAKES

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ROMEN OINAM

JAPANESE STUDIES DIVISION
CENTRE FOR EAST ASIAN STUDIES
SCHOOL OF INTERNATIONAL STUDIES
JAWAHARLAL NEHRU UNIVERSITY
NEW DELHI – 110067
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जवाहरलाल नेहरू विश्वविद्यालय
CENTRE FOR EAST ASIAN STUDIES
SCHOOL OF INTERNATIONAL STUDIES
JAWAHARLAL NEHRU UNIVERSITY
NEW DELHI- 110 067 (INDIA)

Phone : 91-11-2670 4346
FAX : 91-11-2670 4346

Date: July 27, 2015

DECLARATION

I declare that the dissertation entitled **"Disaster Management in Japan: A Comparative Study of the 1995 and the 2011 Earthquakes"**, submitted by me in partial fulfillment of the requirements for the award of the degree of **Master of Philosophy** of Jawaharlal Nehru University is my own work. The dissertation has not been previously submitted for any other degree of this or any other University.

Romen Oinam

CERTIFICATE

We recommend that this dissertation may be placed before the examiners for evaluation.

27/7

Dr. D. Varaprasad Sekhar

(Chairperson, CEAS)

Chairperson
Centre for East Asian Studies
School of International Studies
Jawaharlal Nehru University
New Delhi-110067

Dr. H.S. Prabhakar

(Supervisor)

Supervisor
Centre for East Asian Studies
School of International Studies
Jawaharlal Nehru University
New Delhi - 110067

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I own the responsibility for all the errors or omissions in this work.

JNU, New Delhi

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Abbreviations

ADPC Asian Disaster Preparedness Center

ADRC Asian Disaster Reduction Center

AGI American Geological Institute

CDMC Central Disaster Management Council

CRED Centre for Research on Epidemiology of Disasters

DCBA Disaster Countermeasures Basic Act

DMAT Disaster Medical Assistance Team

EEWS Earthquake Early Warning System

EFRT Emergency Fire Response Team

EPOS Earthquake Phenomenon Observation Satellite

FDMA Fire and Disaster Management Agency

FEMA Federal Emergency Management Agency

FREESIA Fundamental Research on Earthquakes and Earth's Interior Anomalies

GDP Gross Domestic Product

GEJE Great East Japan Earthquake

GFDRR Global Facility for Disaster Risk Reduction

GSI Geospatial Institute of Japan

HERP Headquarter for Earthquake Research Promotion

HFA Hyogo Framework for Action 2005-2015

HuMA Humanitarian Medical Assistance

IAEA International Atomic Energy Agency

ICS	Incident Command System
IDNDR	International Decade for Natural Disaster Reduction
INES	International Nuclear and Radiological Event Scale
INGOs	International Non-Governmental Organizations
JANIC	Japan NGO Center for International Co-operation
JCG	Japan Coast Guard
JMA	Japan Meteorological Agency
JNTO	Japan National Tourism Organization
JOCS	Japan Overseas Christian Medical Co-operative Societies
JPY	Japanese Yen
JR	Japan Railway
JRCS	Japanese Red Cross Society
JST	Japan Standard Time
METI	Ministry of Economy, Trade and Industry
MEXT	Ministry of Education, Culture, Sports, Science and Technology
MICA	Ministry of Internal Affairs and Communications
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MOFA	Ministry of Foreign Affairs
NGOs	Non-Governmental Organizations
NHK	Nippon Hoso Kyokai (Japan Broadcasting Corporation)
NPA	National Police Agency
NPOs	Non-Profit Organizations
NTT	Nippon Telegraph and Telephone

NRC	Nuclear Regulatory Commission
NOTAM	Notice to Airmen
NVN	Nishinomiya Volunteer Network
OCHA	Office for the Coordination of Humanitarian Affairs
PBV	Peace Boat Volunteer
RDC	Reconstruction Design Council
SAR	Search and Rescue
SDF	Self Defense Forces
SPEEDI	System for Prediction of Environment Emergency Dose Information
TEC-Force	Technical Emergency Control Force
UNCHS	United Nations Commission on Human Settlements
UNDRO	United Nations Disaster Relief Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction
UrEDAS	Urgent Earthquake Detection and Alarm System
USGS	United States Geological Survey
WB	World Bank

Chapter 1
Introduction

Disasters[1] are as old as nature. Mankind has survived and lived with natural disasters from the days of the mythical universal deluge. Disasters may come in the forms of earthquakes, floods, droughts, fires, famines, etc. and caused tremendous death and destruction to life and property. It may be both natural as well as man-made, in the sense that in some parts of a country, floods are coming due to the construction of check dams and embankments on the rivers while some regions in high seismic belt areas are prone to natural disasters. Despite the progress made by mankind in science and technology since the dawn of human civilization, men have not yet been able to control and master nature. The more the mankind has progressed and developed, the more it has become vulnerable to the blows of disaster. Natural disasters will continue to be an integral part of mankind as our earth is a living planet.

Natural disasters are global phenomenon and no country is immune to disasters irrespective of their geo-climatic location, although they may vary in terms of intensity and magnitude. The massive death and destruction suffered during the Indian Ocean tsunami (2004), Hurricane Katrina (2005) in US, and devastating earthquakes in central Chile (2010), Haiti (2010), and Sichuan province of China (2008) is a reminder to the dangers of natural disasters. However, disasters have greater adverse impact on developing and under-developed countries due to various factors like poverty, poor physical infrastructure, institutional weakness etc. (UNFCCC 2007). In the year 2011, 332 reported natural disasters claimed the lives of 30,770 people, made 244.7 million victims[2] besides causing damage of around US$ 366.1 billion worldwide (Guha-Sapir *et al.* 2012:1). The devastation caused by the 2011 Great East Japan Earthquake was mainly responsible for the large number of victims.[3] A total of 330 natural disasters were

[1] The definition of *'Disaster'* owes its origin to the French word *'Desastre'* which is a combination of two terms *'des'* meaning *'bad or evil'* and *'astre'* meaning *'star'*. So the term 'disaster' means 'bad or evil star'. In the past, disasters were regarded to be inevitable outcomes of some unfavorable alignment of stars.
[2] It is the total aggregate of killed and affected.
[3] As the 2011 Great East Japan Earthquake caused the death of 15892 people.

reported in the year 2013 causing the death of 21610 people besides inflicting damages to the tune of US $118.6 billion and making 96.5 million victims (Guha-Sapir *et al*. 2014:13).

Table 1.1 Natural Disasters Occurrence and Impacts: Regional Figures (2013)

(1) Number of Natural Disasters in the Year 2013

No. of Natural Disasters	Africa	Americas	Asia	Europe	Oceania	Global
Climatological	4	15	6	4	4	33
Geophysical	0	4	25	1	2	32
Hydrological	34	32	75	16	2	159
Meteorological	6	23	50	24	3	106
Total	44	74	156	45	11	330

(*Source*: Annual Data Statistical Review 2013: The numbers and trends, CRED, IRSS and UCL. 2014)

(2) Number of Victims in the Year 2013 (in Millions)

No. of victims (in millions)	Africa	Americas	Asia	Europe	Oceania	Global
Climatological	2.54	0.53	5.07	0.01	0.01	8.16
Geophysical	0.00	0.07	7.04	0.00	0.02	7.13
Hydrological	2.18	1.76	26.65	1.41	0.05	32.05
Meteorological	0.2	0.41	48.22	0.32	0.01	49.16
Total	4.92	2.77	86.98	1.74	0.08	96.5

(*Source*: Annual Data Statistical Review 2013: The numbers and trends, CRED, IRSS and UCL. 2014)

(3) Damages (in US $ Billions)

Damages (in US $ billion)	Africa	Americas	Asia	Europe	Oceania	Global
Climatological	0.06	2.64	0.00	0.00	1.19	3.89
Geophysical	0.00	0.00	9.03	0.00	0.05	9.08
Hydrological	0.14	9.86	25.97	17.2	0.00	53.17
Meteorological	0.03	21.83	23.45	5.09	2.02	52.42
Total	0.23	34.33	58.45	22.29	3.26	118.57

(*Source*: Annual Data Statistical Review 2013: The numbers and trends, CRED, IRSS and UCL. 2014)

Note: Some totals in Table 1.1 may not correspond to the cells addition due to rounding.

The global nature of natural disasters where it does not differentiate between national boundaries or socio-economic status of countries whenever it strikes led to the

declaration of the decade from 1990 till 2000 as the International Decade for Natural Disaster Reduction (IDNDR). The objective of the IDNDR is 'to reduce through concerted international action, especially in the developing countries, the loss of life, property damage and social and economic disruption caused by natural disasters'.[4] A major conference was held at Yokohama city in Japan from 23-27 May 1994, where a plan of action for disaster reduction, called "*Yokohama Strategy for a Safer World: Guidelines for Natural Disaster Prevention, Preparedness and Mitigation Plan of Action* ('Yokohama Strategy')" was adopted.[5] The Yokohama Strategy gave the guidelines for natural disaster prevention, preparedness and mitigation that signatory countries are expected to implement by the year 2000.

As per the plan of the IDNDR, by the year 2000 all countries should have (1) comprehensive national assessments of risks from natural hazards, with these assessments taken into account on development plans; (2) mitigation plans at national and/ or local levels involving long-term prevention and preparedness and community awareness; and (3) ready access to global, regional, national and local warning systems and broad dissemination of warnings.[6]

In a follow up to the Yokohama Conference, the World Conference on Disaster Risk Reduction held from January 18-22, 2005 in Kobe, Japan led to the adoption of the present *"Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters"* by 168 countries where it emphasized the need for and identification of measures to strengthen the capacity of nations and communities to cope with and manage natural disasters.[7] The *Hyogo Framework for Action 2005-2015* (HFA) sought to achieve over the next 10 years 'substantial reduction of disaster losses, in lives and in the social, economic and environmental assets of communities and countries'.

The Hyogo Framework Action (HFA) priorities for action 2005-2015 are:

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[4] UN/ISDR, *'IDNDR Briefing Paper'*, November 1994.
[5] UN/ISDR, '*Yokohama Strategy for a Safer World: Guidelines for Natural Disaster Prevention, Preparedness and Mitigation Plan of Action'.*
[6] Sharma, V. K. (2001), Disaster Management, New Delhi: IIPA.
[7] UN/ISDR, '*Hyogo Framework for Action 2005-2015: Building Resilience of Nations and Communities to Disasters'.*

1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation;
2. Identify, assess and monitor disaster risks and enhance early warning;
3. Use knowledge, innovation and education to build a culture of safety and resilience at all levels;
4. Reduce the underlying risk factors;
5. Strengthen disaster preparedness for effective response at all levels.[8]

The latest edition of the World Conference on Disaster Risk Reduction was held from14-18 March 2015 in Sendai, Miyagi Prefecture, Japan and it led to the adoption of the *"Sendai Framework for Disaster Risk Reduction 2015-2030"*.[9] The venue is significant against the backdrop of the massive devastation it suffered during the 2011 Great East Japan Earthquake. The Sendai Framework aims to achieve over the next 15 years "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." The Sendai Framework for Disaster Reduction 2015-2030 identified the following four priority areas for focused action by States at local, national, regional and global levels to attain the above goals:

1) Understanding disaster risk;

2) Strengthening disaster risk governance to manage disaster risk;

3) Investing in disaster risk reduction for resilience;

4) Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction.[10]

Japan is no stranger to natural disasters. The Japanese archipelago, located in the *Circum-Pacific Mobile Belt* where seismic and volcanic activities occurred constantly, is a major theatre of natural disasters. Though it accounts for only 0.25% of the earth's total

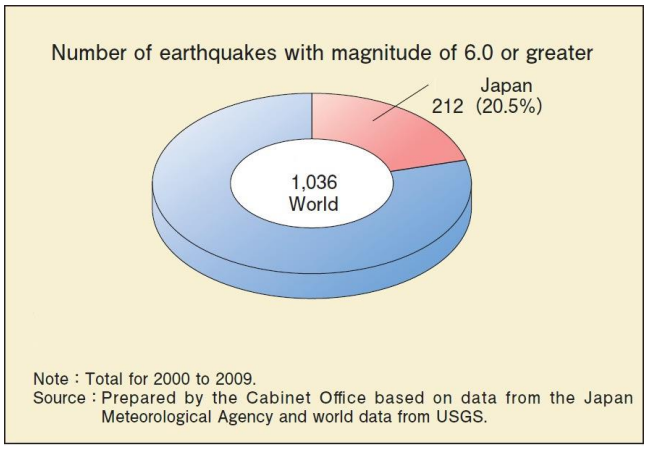
[8] UN/ISDR, '*Hyogo Framework for Action 2005-2015: Building Resilience of Nations and Communities to Disasters'*.
[9] UN/ISDR, '*Sendai Framework for Disaster Risk Reduction 2015-2030'*.
[10] *Ibid*, no. 9, pp. 9.

land area, approximately 20% of earthquake of magnitude M6 or greater in the world occurred around Japan (Cabinet Office, Government of Japan, 2011). There are two main mechanisms that cause earthquakes in Japan:

1. Earthquakes generated near convergent boundaries;
2. Earthquakes generated by active faults.

The 1995 Kobe Earthquake is of the second type where it occurred along an active fault. The massive destruction was due to the fact that it occurred right under the urban areas with high population density. The 2011 Great East Japan Earthquake is of the first type where it occurred along the plate boundary between the Pacific and the Continental plates.

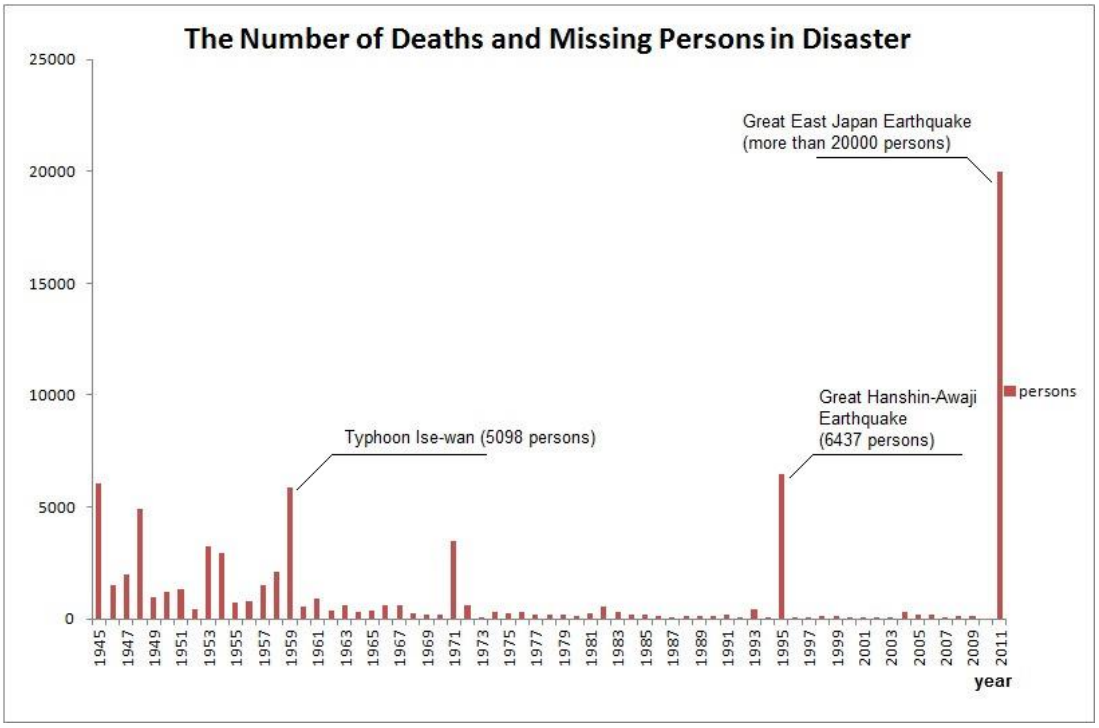
The unprecedented death and destruction due to the devastating earthquake and subsequent massive tsunami and later nuclear meltdown, often referred to as '*triple disasters*', in Japan on March 11, 2011 is a reminder of the devastation that natural disasters can caused. Japan is also prone to other frequent disasters such as torrential rains, snow avalanches, typhoons, volcanic eruptions, tsunamis etc. due to its meteorological, topographical and geographical conditions.



(*Source*: Cabinet Office, Government of Japan.**)**

Figure 1.1 Number of Earthquakes with magnitude of 6.0 or more.

Figure1.2 Number of deaths and missing persons in various natural disasters in Japan (1945-2011)



(*Source*: Cabinet Office, Government of Japan)

Japan has a long history of catastrophic natural disasters. The Great Kanto earthquake of September 1, 1923 measuring M7.9 (hereinafter referred to as 1923 Kanto Earthquake) is the first major natural disaster in Japan in 20th century that resulted in 105,385 death or missing along with massive infrastructural damage in Tokyo and surrounding areas. September 1 is celebrated as 'Disaster Reduction Day' in Japan where earthquake evacuation drills, disaster awareness programs, exhibitions, poster competitions are held to raise the awareness of the people as well as to remind the people of the challenges pose by disasters. Besides, the Mikawa earthquake of 1948 that resulted in 2306 deaths , Ise-Wan typhoon of 1959 that killed 5098 people are the other major natural disasters prior to 1995.[11]

[11]Cabinet Office, Government of Japan (2011), " Disaster Management in Japan", pp.3

The Great Hanshin-Awaji Earthquake of January 17, 1995 measuring M7.2 (hereinafter referred to as 1995 Kobe Earthquake) rocked the city of Kobe, Nishinomiya, Ashiya and its environs killing 6279 people and injuring many more. "*Buildings were toppled, houses were in rubbles, infernos swallowed entire towns, elevated highways and railways collapsed and crumbled cliffs buried houses. Everywhere people died*", reported the Asahi Evening News on the next day after the earthquake.[12] As such over 136,000 housing units were destroyed or subsequently demolished, and more than 300,000 persons lost their homes (Hyogo Prefecture, 1996). It also caused massive infrastructural damages of varying degree on roads, railroads, lifeline facilities like electricity, gas networks, water, sanitation etc. The economic loss is estimated to be around 9.9 trillion JPY (Edgington 2010). The slow and ineffectual response of the government was widely criticized by the people.

On March 11, 2011 at 14:46 JST, a gigantic 9.0 M earthquake shook the Pacific coast of northeast Japan. It is the largest earthquake in Japan's history and fourth largest earthquake since the beginning of 20th century (US Geological Survey). The 1995 Kobe Earthquake dwarfs in comparison to this disaster and the destruction is roughly four times of the 1995 disaster. The Japan Meteorological Agency (JMA) called the earthquake as 'The 2011 Earthquake off the Pacific coast of Tohoku'. This giant earthquake and the subsequent massive tsunami resulted in 15892 deaths, 2574 missing persons, 6152 injured, 124663 totally collapsed houses and 274638 half collapsed houses.[13] The economic damage from this disaster is estimated to be around 16.9 trillion JPY.[14] This mainly affected the three prefectures – *Iwate, Miyagi and Fukushima*. As of February 2014, there were still 267,419 victims still living in temporary shelters which is more than half of the 470,000 evacuees recorded after the disaster.[15] The 2011 *Great East*

[12] This excerpt is taken out from Tsuneo Katayama's article "Earthquake Disaster Mitigation and Earthquake Engineering in Japan – A Review with a Special Emphasis on the Kobe Earthquake and its Impact", *Journal of Disaster Research*, Vol. 1, No. 1, 2006, pp. 12.
[13] National Police Agency of Japan (2015), "Damage Situations and Police Countermeasures associated with 2011 Tohoku district – off the Pacific Ocean Earthquake", July 10.
[14] 'Road to Recovery', Cabinet Office, Government of Japan, 2012.
[15] Kimura, R., *et.al*. 2014.

Japan Earthquake (GEJE)[16] revealed the inherent weakness and inability of the Japanese disaster management system to cope with mega-disaster. Yet one cannot ignore the unprecedented nature of the *'triple disasters'* that even the best prepared disaster response system found themselves inadequate and ineffective.

Japan, a disaster prone country, is also regarded as one of the most disaster resilient country in the world. Japan's bitter experiences with multiple disasters in the past help them to shape a *culture of resilience* that showed great forbearance and adaptability in immensely difficult situation. Japan has an effective and comprehensive disaster management system strengthened through its bitter experiences with disasters in the past. The Disaster Countermeasures Basic Act (1961), passed in the aftermath of the 1959 Ise-Wan typhoon, formed the basis for disaster management in Japan. This Act led to the establishment of a 3-tier disaster management system – national, prefectural and municipality – with the Central Disaster Management Council (CDMC) as the apex body at the national level.

The various mitigating measures, structural as well as non-structural, undertaken in the pre-disaster phase as well as in the post-disaster phase contributed tremendously in reducing the adverse impacts of natural disasters. This study tries to make a comparative study of the 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake and analyzes the response of the government while at the same time highlighting the major strength and weakness of the current disaster management system in Japan. This research will also look into the role played by NGOs and volunteer groups in the aftermath of these disasters. This study also looks at the major changes incorporated after the 1995 Kobe Earthquake and the disaster forecasting mechanisms available in Japan that played an important role in mitigating the adverse impacts of natural disasters.

Review of Literature

The literature of this proposed research is categorised into 3-broad themes. The first theme –'***Concept of Disaster'*** includes a set of literature dealing with the concept of

[16] The Government of Japan named the March 11 disaster as the *'Great East Japan Earthquake'* following a Cabinet decision on April 11, 2011.

'disaster management'. The second theme – ***'Response of Government to the 1995 and the 2011 Earthquakes'*** examines the response of government in the 1995 Kobe earthquake and how the response was more effective in 2011 in the light of the changes incorporated after the 1995 Kobe Earthquake, better forecasting technology, early warning systems and other pre-disaster mitigation measures. The third theme – ***'Lacunae in the disaster management system'*** examines the inherent structural and operational weaknesses of the disaster management system in Japan in light of the 1995 and the 2011 earthquakes experience and explores measures that would render it an effective and efficient system in countering future mega-natural disasters.

Concept of Disaster

The concept of disaster is difficult to define precisely as the concept of disaster tends to change over time. Till the early 20th century, earthquakes, floods, epidemics are regarded as natural disasters that are largely inevitable '*Acts of God'*[17] implying human cannot do anything. Most conventional definitions of disaster view the event or the hazard as an aberrant natural phenomenon, one which is unique and distinct. However, in the second half of 20th century, there is a marked shift in the concept of disaster where it is no longer regarded as discrete physical phenomenon but rather amenable to human interventions and seen in the context of its interface with human population and its environment.

According to Carr (1932), a disaster is defined by human beings and not by nature. To him 'not every windstorm, earth-tremor, or rush of water is a catastrophe'. He defined disaster in the context of its impact on human lives and environment. Disasters occur at the interface of society, technology and environment (Oliver-Smith 1996). So a distinction may be made between the 'triggering events' or hazards like earthquake, tsunami, volcanic eruption, storms etc. which may be natural and the associated disasters it caused. The term '*hazard*' has been defined in 4-ways. It is:

[17]As Ted Steinberg term in his work '*Acts of God: The Unnatural History of Natural Disaster in America'* (2000)

a) "A naturally occurring or man-made geologic condition or phenomenon that presents a risk or is a potential danger to life or property"(AGI,1984);

b) "An interaction of people and nature governed by the co-existent state of adjustment of the human use system and the state of nature in the natural events system" (White 1973);

c) "These elements in the physical environment (which are) harmful to man caused by forces extraneous to him"(Burton & Kates 1964);

d) "The probability of occurrence within a specified period of time and within a given area of a potentially damaging phenomenon" (UNDRO 1982).[18]

From the above, it is clear that a physical event (hazard) makes an impact on human beings and their environment. So hazard may be defined as 'a dangerous condition/event, which threat or have the potential for causing injury to life or damage to property or the environment'. In and of themselves, hazards or disaster agents need not necessarily lead to disasters.

Alexander (1993) defined disaster as some rapid, instantaneous or profound impact of the natural environment upon the socio-economic system. The UN/ISDR (2009) defined disasters as 'a serious disruption of the functioning of a community or a society causing wide-spread human, material, economic and environmental losses which exceed the ability of the affected community/society to cope using its own resources'. The definition given by Turner is the most acceptable one where he regarded disaster as 'an event concentrated in time and space, which threatens a society or a relatively self-sufficient sub-division of society with major unwanted consequences as a result of the collapse of precautions which had hitherto been culturally accepted as adequate"(Turner 1976: 755-6).

[18] Alexander, David (1993), *Natural Disasters*, Chapman & Hall, New York., pp. 4.

Types of disasters

Disaster can be broadly categorised into **natural and man-made disasters**. Natural disasters can be further sub-divided into following:

i) **Meteorological**: storms, cold spell, typhoons.

ii) **Geological**: earthquake, volcanic eruption, tsunami.

iii) **Water & climate**: cyclone, floods, droughts, hailstorms.

Disaster Management

It may not be possible to prevent the occurrence of natural disasters totally but the harmful impacts of natural disasters can be considerably reduced through proper planning and effective preparedness. Disaster Management is an evolving field where changes need to be incorporated into the system to counter challenges posed by disasters. There is a paradigm shift in approach of disaster management from the earlier emphasis on providing immediate humanitarian aid and relief after a disaster struck towards more emphasis on pre-disaster mitigation measures to avoid or reduce impact of disaster through various initiatives. Warfield (2008) argued that disaster management aims to reduce, or avoid the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery.

Disaster Management covers the wider scope of prediction, warning, emergency relief, rehabilitation, and reconstruction (Lin Moe and Pathranarakul 2006:402). The emphasis now is on pre-disaster planning, training, information management, public relations and many other fields. Disaster management is the sum total of all activities, programs and measures which can be taken up before, during and after a disaster with the purpose to avoid a disaster, reduce its impact or recover from its losses (Khan and Khan 2008: 46). In short, it can be defined as the effective organisation, direction and utilisation of available counter-disaster resources.

Disaster Management Cycle

There are five broad stages/phases in disaster management. They are as follows:

1) Mitigation/Prevention
2) Preparedness
3) Disaster phase
4) Response
5) Recovery/Rehabilitation

This Disaster Management System of Japan spans these entire phases of Disaster Management Cycle and this can be seen in its response to disasters.

Response of Government to the 1995 and the 2011 Earthquakes

Japan has a long history with natural disasters that wreak havoc on lives and properties. Such catastrophic natural disasters have been testing Japan's preparedness and capability to counter and handle disasters. They have been investing a lot of efforts and resources in developing effective disaster management infrastructure to enable them to respond to future disaster effectively. Yet natural disasters remain a menacing threat to the safety and security of the country (Cabinet Office, 2011).

The United Nations recognised the 1995 Great Hanshin-Awaji Earthquake as 'the first really severe test for a modern city built, theoretically, to be earthquake resistant' (UNCRD 1995). Tokyo's lack of leadership and absence of crisis management in the initial hours after the earthquake was widely criticised as the government failed to grasp the extent of the damage despite information. The Japanese government was heavily criticised for its slow and ineffectual response, poor management of volunteer efforts, and for rejecting offers of assistance from foreign countries (Shaw and Goda 2004; Tierney and Goltz 1997; Leng 2015).

The Disaster Countermeasures Basic Act 1961 stipulates a three-tiered response system with the local municipality designated as the first responder to disaster and help can be sought from the prefectural and the national government only when local

authority cannot cope with the disaster. This was based on the premise that damage from natural disasters would not exceed the boundaries of a prefecture (Kato *et al*. 2013). The Prime Minister came to know of the disaster from news on TV underlining the absence of a communication system for prompt gathering of information and assessment of the extent of damage.[19]

The government's inability to quickly gather and assess the situation and mobilise critical resources in the immediate aftermath of the disaster was aggravated by damage to communication lines obstructing the flow of information and the destruction of the transportation system (Ozerdem and Jacoby 2006). Even when the magnitude of the devastation become apparent, the Self Defense Forces (SDF) were not mobilise immediately until 24 hours after the earthquake (Tierney and Goltz 1997). However, one major development is the transformation and recognition of the role of Japanese civil society in responding to disasters. As such around 1.3 million volunteers poured into Kobe to help within the first four months of the disaster, transforming the public image of volunteering from an obscure activity to something commonplace that people could engage in (Leng 2015).

The failure to respond effectively during the 1995 Kobe Earthquake stirred the government to initiate a number of changes both institutional as well as structural. The institutional changes relate to the changes in agencies responsible for responding to disasters and establishment of new organisations. The structural changes refer to the programs for augmenting physical infrastructure through new improved technologies. The Disaster Countermeasures Basic Act 1961 was reviewed and revised where it empowered the Prime Minister to mobilise SDF immediately without waiting for request from local governor if he or she is of the opinion that the catastrophe is a major disaster. Besides, the Deputy Chief Cabinet Secretary for Crisis Management was created after the Kobe Earthquake to augment local efforts in gathering data and clarifying information for disaster management (Terry 1998; Leng 2015). Besides, a Minister of State for Disaster Management was set up in 2001 to integrate and co-ordinate disaster impact reduction policies and measures of ministries and agencies; Cabinet Crisis Management Centre

[19] Leng, Rachel (2015), pp. 8.

(2002), Cabinet Information Collection Centre (1996) was established which run on 24x7 basis.

Earlier the mayor of a municipal authority could only mobilised the local fire department directly in response to a disaster as police department is under Prefectural administration and the Self Defence Force and Japan Coast Guard are under the national government. So this creates obstacle in swift mobilisation of manpower in response to large scale disasters. To promote swift mobilisation and co-ordination of manpower from various agencies, Wide Area Support System was established comprising of National Police Agency (NPA), Fire and Disaster Management Agency (FDMA), Japanese Coast Guard (JCG).[20]

The Seismic Rehabilitation Promotion Act for Existing Buildings was established in October 1995. There was retrofit program and revision of design specifications of highway bridges. The Headquarters for Earthquake Research Promotion (HERP) was established in 1995 in Prime Minister's office to carry out comprehensive research on seismology.

As compared to the 1995 Kobe Earthquake, government's response to the Great East Japan Earthquake (M 9.0) of 11 March 2011 was swift but the disaster proved to be overwhelming even for the Japanese Government. The government responded swiftly by convening the Emergency Response Team immediately and established the Extreme Disaster Management Headquarters for the first time in the history of Japan. Within hours, the government despatched SDF and Disaster Medical Assistance Teams (DMAT) for rescue and medical operations (Koresawa 2011). Inspection teams were sent to Miyagi prefecture and established the Local Headquarters for Extreme Disaster Management there on the next day. Around 470,000 people were evacuated and measures were taken to rehabilitate the lives of the disaster stricken people.

The damage would have been much higher if not for the various pre-disaster mitigation initiatives taken up by the government such as early warning system, evacuation exercise from building, regular drill, disaster education, quick flow of

[20] Disaster Management in Japan, Cabinet Office, Government of Japan, February 2011

information, greater public awareness. However, the tsunami resulted in waves that were as high as 40 metres in some areas which is unprecedented and the resulting nuclear meltdown made it worst.

The societal response to the above mentioned disasters is phenomenal and exemplary. The Japanese people are stoic and resilient and knew how to behave and maintain order without panicking in the face of extreme disasters. They have developed a 'culture of resilience' out of its experience with multiple disasters in the past. Many civil society organisations, called 'Non-Profit Organisations' (NPOs) in Japan, participate actively in disaster relief efforts both within and outside Japan. Besides, there is a robust culture of volunteerism among the Japanese people during the time of disasters. They complement the efforts of the government in countering the disasters effectively. Besides Japanese branch of international organisations like Red Cross, Japan Overseas Christian Medical Cooperative Services (JOCS) etc. participate in relief and rescue efforts in times of disasters.

Despite the advancement in forecasting and information dissemination technology, structural and non-structural pre-disaster mitigation measures incorporated after the experience of the 1995 Kobe earthquake, the local government was found to be incapable of handling the mega disaster effectively. Questions can be raised as to why the government could not respond to mega disasters effectively? What are the factors that make disaster management system ineffective in the face of major disasters?

Lacunae in the disaster management system

The ineffective response of the government to the 1995 and the 2011 earthquakes revealed the weakness/gaps in disaster response mechanism in the face of mega disaster. The first major weakness is the lack of a single comprehensive, detailed and realistic national plan to counter mega-disasters (Bosner 2012). The multiple agencies, organisations engaged in disaster response have individual separate plans which pose inter-organisational and inter-governmental co-ordination problems due to non-

familiarity with each other's plans as seen during the 1995 and the 2011 earthquakes. For example, organisations providing different lifeline services were reportedly not well-linked with one another, and have generally not well-linked with local government (Johnson and Eguchi 1995).

There is also the lack of a uniform, integrated Incident Command System (ICS) like that of the United States and this hampered quick flow of information and communication among the multiple government agencies and other organisations. This is due to the hierarchical nature[21] of the Japanese disaster management system where each agencies or organisations took extra care to not to interfere into others' responsibilities. This doesn't incentivise co-operation and co-ordination among various agencies in times of disasters where ministries and other public agencies deal only with their responsible dimensions of disasters.

Besides, the lack of standard training for disaster management personnel especially at the local level results in poor response in the immediate aftermath of disasters. The government also could not effectively utilise the capacity of volunteers, civil society organisations due to lack of communication between government agencies and public agencies. For instance, during the 1995 and 2011 earthquake, there were excess volunteers in some place which didn't need many volunteers while few volunteers in present places where they were needed in large number. The government could have utilised the volunteers to man and run the evacuation centres properly, give medical aid to disaster survivors, give company to elders to avoid loneliness and isolation, play with children evacuees etc. as government could not depute officials to every evacuation centres.

To counter mega-disasters effectively, a single government agency like the FEMA of the United States should be entrusted with the responsibility to co-ordinate and manage natural disasters based on the comprehensive national disaster response plan but flexible enough to adapt to multiple disasters. The government should continue its emphasis on pre-disaster preparedness and response planning in terms of improving

[21] See page 37 on the next chapter.

structural measures, forecasting, information flow, regular multi-jurisdictional drills, disaster education, training etc. There should be a robust Integrated Disaster Management Information System for early assessment and information sharing among relevant organisations. This could enable swift and effective relief efforts by directing response resources to areas of greatest need and by indicating what type of resources and personnel are needed. The disaster management system should move away from separate plan for specific disaster towards an integrated response plan to deal with all disasters effectively and efficiently.

Definition, Rationale and Scope of the Study

Japan is prone to natural disasters and at the same time it is also regarded as one of the most disaster resilient country in the world. Japan's disaster management system is regarded as one of the most effective system in the world based on its experience with multiple disasters in the past. Despite its massive investment on technology and other structural measures, Japan is not totally safe against major disasters. However, what puzzles researcher is the ineffectiveness of the Japanese disaster management system in the face of mega disaster? What are the flaws that render it ineffective against mega disasters? What are the changes that need to be implemented to make the system more effective in coping with major natural disaster? These are the questions that come to mind when one looks at government's handling of the 1995 and the 2011 earthquakes. The scope of this study is limited to the 1995 Great Hanshin-Awaji earthquake and the 2011 Great East Japan Earthquake.

The time period chosen is from 1995 to 2011 as the aftermath of the 1995 Kobe earthquake marked a major turning point in Japan's disaster management system. The need for a comprehensive centralised disaster management system to counter mega-disasters became more pronounced after the experience of the 1995 Great Hanshin-Awaji earthquake.

Research Questions /Objectives

1) To assess and examine the current disaster management system in Japan.

2) To examine comparatively the response of government after the 1995 Kobe Earthquake and 2011 Great East Japan Earthquake.

3) To examine comparatively societal and international response during the 1995 and the 2011 earthquakes.

4) To examine the factors of delays in government's response to disasters.

5) To explore measures that could render the current disaster management system more effective in tackling future mega-disasters.

Hypotheses

1) An integrated centralised or 'top-down' disaster management approach is more effective in tackling mega-natural disasters.

2) Investment on pre-disaster mitigating measures in anticipation of disaster proves more effective in reducing the impact of natural disasters.

Research Methodology

This study focuses on the response of Japanese government and civil society to natural disasters in the context of the 1995 and the 2011 earthquakes. This research is based on a combination of both qualitative as well as quantitative approach. The study adopts a descriptive and analytical method. The occurrence of natural disasters like earthquake, tsunami is the independent variable. The response of the government in terms of immediate rescue, recovery, rehabilitation, pre-disaster mitigating initiatives constitutes the dependent variables. While analysing the response of government, the study includes the actions of government before and after the disaster. Materials for this research were collected from primary and secondary sources. The primary sources

include: annual reports of government, official documents, declarations, statements and reports of international organisations dealing with disaster management like UN/ISDR, Asian Disaster Reduction Center (ADRC), Asian Disaster Preparedness Center (ADPC), and Centre for Research on the Epidemiology of Disasters. For the purpose of the study, secondary sources available in the form of books, journals, articles, newspapers, clippings are made used of. Internet sources are scrutinised and made used of.

Structure of the Study

This work consists of three main chapters in addition to the introduction and the conclusion. The introductory chapter gives a brief overview of disasters in Japan and highlights the 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake which constitutes the core of this study. The first chapter also gives the Scope, Rationale and Significance of the study.

The second chapter titled **'Disaster: A Conceptual Discourse'** begins with an analysis of the concept and meaning of disaster, briefly tracing its historical origins and its varied definitions. This chapter also discusses disaster management as a concept and its broad phases. It emphasises on the need for pre-disaster mitigation and preparedness measures to counter natural disasters effectively. This chapter also analyses the current disaster management system in Japan.

The third and fourth chapters are closely related and form the core of this work. The third chapter entitled **'Response of Government to the 1995 and the 2011 Earthquakes'** analyses the response of the government comparatively with respect to the 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake. This chapter discusses the damage to the socio-economic and physical infrastructure suffered during the 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake comparatively. This chapter tries to highlight as to how the lessons learnt after the 1995 Kobe Earthquake made the government quicker in responding to disasters later and the changes incorporated thereafter helped in mitigating the adverse impacts of future disasters. This chapter also

analyses how investment on pre-disaster mitigating measures like early warning systems, stricter building codes, hazard mapping, land use planning, disaster education, evacuation exercises etc. contribute in reducing the adverse impact of natural disasters.

The fourth chapter entitled **'Societal and International Response to the 1995 and the 2011 Earthquakes'** tries to analyse the role of civil society organisations in tackling disasters. This chapter discusses the response of various civil society organisations in Japan, known as Non-Profit Organisations (NPOs), during the 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake. This chapter also highlights as to how the activities of NPOs complemented and augmented the efforts of government during and after disasters. This chapter will also discuss international response during the above two disasters.

Finally, the concluding chapter describes the summary and research findings of this study. It also assesses the nature of current disaster management system in Japan and highlights the need for improvement against the backdrop of the 2011 Great East Japan Earthquake experience.

Limitations of the Work

The present work is limited to a comparative analysis of the response of the government and society towards the 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake. The primary and secondary material sources used for this study are those available in English language only. Given the time and scope of the study, it is not feasible to undertake detailed examination of the various aspects of disaster management in Japan.

Chapter 2
Disaster: A Conceptual Discourse

Disasters have always co-existed with human civilisations. The faces of disaster are many. Globally, the toll of death and destruction in natural disasters has increased to such a dramatic extent that it has become a cause of national and international concern. Natural catastrophes like earthquake, flood, landslide, volcanic eruption, tsunami etc. have the power to exert a substantial and consistent impact on modern society, be it developed or developing. However, developing and underdeveloped countries suffered a far greater extent of damage and destruction than developed societies due to various factors like low productivity, poverty, inadequate infrastructure, under-exploited resources, absence of stable institutional mechanisms etc. (UNFCCC 2007; Alexander 1993: 1-20).

The multiplicity of these factors coupled with the inevitability of natural disasters make disaster management a complex process requiring comprehensive planning and multi-pronged actions at various levels in a coordinated manner. However, the question that still haunts social scientists dealing with the issue of disaster management in modern times has been: Is mankind, despite the tremendous scientific and technical progress made, still a mute spectator to the fury unleashed by disasters even today? This question probes on the varied inter linkages between society, polity, economy and environment all of which need to be carefully examined and explored in any research undertaken in this area.[22]

2.1 Concept and Meaning of Disaster

Although considerable efforts have been made to conceptualise the term disaster, many views with diverge definitions appear in the literature. The reason partly being that politicians, scientists, decision makers, environmentalists, geologists, relief workers,

[22] Cuny, Frederick C. (1983), Disasters and Development, Oxford University Press, New York/ Oxford, pp. 20. Also see, Paul Susman, Phil O. Keefe and Ben Wisner (1984) "Global Disaster: A Radical Interpretation", in K. Hewitt (ed.), *Interpretations of Calamity from the Viewpoint of Human Ecology*, Boston; Allen & Unwin, pp. 264-83.

journalists and general public perceive disaster differently.[23] As such there lacks a common accepted definition, with one varying from the other due to many reasons primarily related to the complexity of the natural event.

In earlier days, disasters were considered to be an outcome or outburst of some unfavourable alignment of the stars. Physical science researchers concentrated on the physical aspect of natural disasters i.e. monitoring, characterizing and analysing in order to predict or forecast the magnitude of natural disasters. However, for social scientists, it is not the physical characteristics i.e. magnitude or intensity of the natural disasters, but the severity that matters. The impact of natural disasters on source of livelihoods, community culture, impact on environment, mass displacement interest the social scientists and these impacts are not easily quantifiable. For instance, a great earthquake in the middle of Atlantic Ocean doesn't concern social scientists if it fails to cause any death and destruction to life and property.

The social scientists perspectives help in understanding the impact of disaster on human beings and society on a broader level. The first major attempt to apply systematic social science concepts to the study of disaster was done by S.H. Prince, in his investigation of the massive explosion following the collision of two ships in Halifax harbour, Nova Scotia in 1917(Drabek 2007; Drabek & McEntire 2003). After this, many researchers have made an attempt to reduce the impact of disasters in society/community in the later part of 20th Century.

Science has not had much success in defining what it means by the term 'disaster'. In defining the term, dictionaries use words such as 'misfortune' or 'calamity' implying that for there to be a disaster, people must suffer (i.e. unless a cyclone or an earthquake kills people or damage property, it is not a disaster). Since 1966, the UNESCO has been listing 'natural disasters' occurring each year: earthquakes, tsunami (large ocean waves),

[23] Wijkman, Anders and Timberlake, Llyod, Natural Disasters: Acts of God or Acts of Man? Earthscan Paperback, International Institute for Environment and Development and the Swedish Red Cross, Geneva, 1984, p.18.

storm surges and volcanic eruptions. In 1969, it listed 759 disasters but named only 12 as destructive disasters suggesting others to be harmless disasters.[24]

Other experts take an almost contrary view, defining disasters only in terms of their impact upon people. However, in order to provide certain consistency; the Natural Hazard Research Centre at the University of Colorado (US) came up in 1969 with the following definition of a disaster:

* more than $1million in damage, or

* more than 100 people dead, or

* more than 100 people injured.

These definitions based solely on quantifiable terms like number of deaths and physical damages measured in dollars can be misleading because it does not take into account the other dimensions of the impact of disasters which are not easily measurable in terms of number of deaths or economic damages. These definitions also had the effect of separating the disaster event - destruction, death and injuries from the trigger mechanisms - high winds, earthquakes, lack of rain, excess of water, lava and high tidal waves. The above definition of disaster showed that most of the emphasis stressed by geologists and climatologists is on the trigger mechanisms.[25] However, a disaster is more than just the outbreak of a hazardous event; it is the avoidable loss of life and property that could cripple a country and have resonance throughout the world.

In this context, understanding the concepts of hazard and disaster, which tends to be used interminglingly, is imperative and will be helpful in disaster management. Establishing the relationship between them can have a significant impact on social, economic, cultural and environmental systems. The term 'hazard' can be defined in four ways:

a) "A naturally occurring or man-made geologic condition or phenomenon that presents a risk or is a potential danger to life or property" (AGI, 1984);

[24] Wijkman and Lloyd (1984), pp. 18.
[25] Wijkman and Llyod (1984), pp. 18-19.

b) "An interaction of people and nature governed by the co-existent state of adjustment of the human use system and the state of nature in the natural events system" (White 1973);

c) "These elements in the physical environment (which are) harmful to man caused by forces extraneous to him" (Burton & Kates 1964);

d) "The probability of occurrence within a specified period of time and within a given area of a potentially damaging phenomenon" (UNDRO 1982).[26]

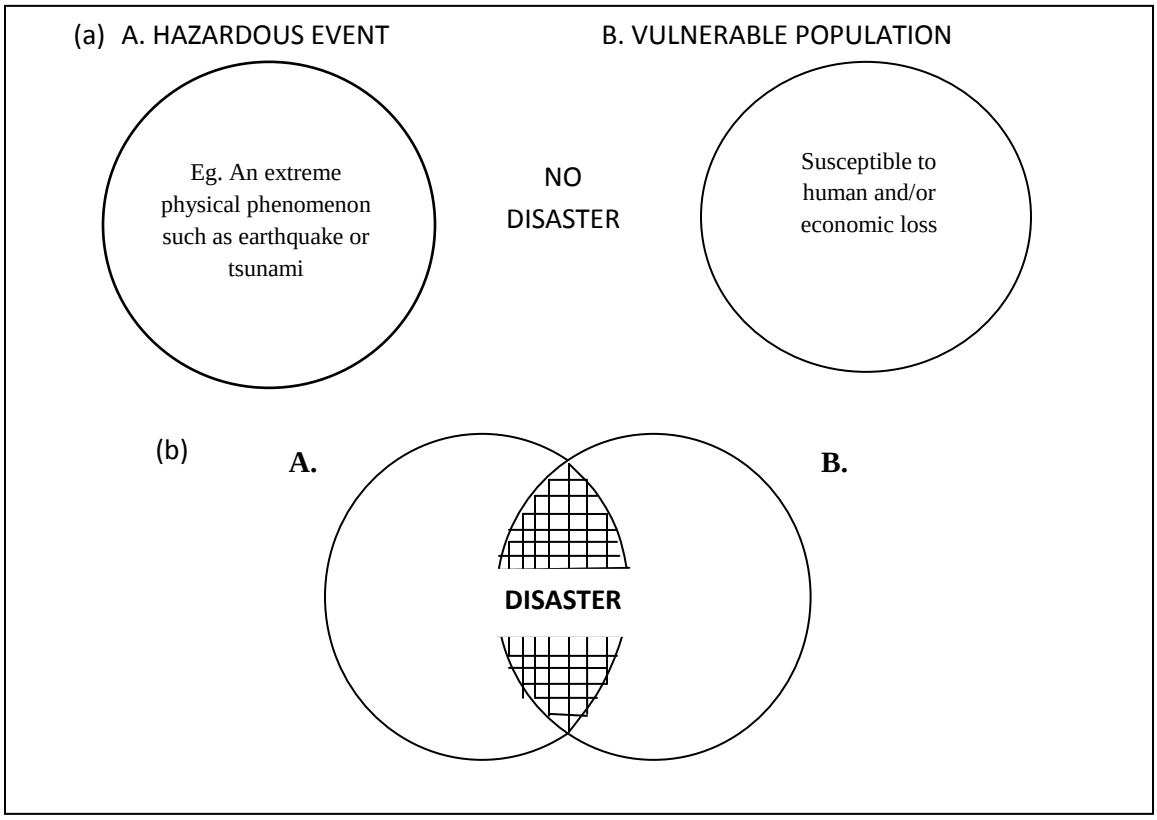
Hazard is defined as "a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydro-meteorological and biological) or induced by human processes (environmental degradation and technological hazards)" (UN/ISDR Geneva 2004a: 16).

From the above definitions, it is clear that hazards have the potential to cause harm to human lives and environment. In and of themselves, disaster agents or hazards need not necessarily lead to disasters. Hazards would be regarded as disaster only it if causes harm to man and environment and that too beyond a threshold level accepted by a society. The threshold level depends on the socio-economic, technological, physical infrastructure, awareness of disasters among the people etc. of the society. For instance Japan has higher capacity to withstand major disasters than a country like Haiti or Indonesia or Nepal as the disaster countermeasure infrastructure, technology, and general awareness of the population of Japan with regard to disasters is more than those of Indonesia, Nepal or Haiti.

According to Oliver-Smith (1996), disasters only occur at the interface of society, technology and environment. According to Degg (1992), a natural disaster results from spatial interaction between hazardous environmental process and a population that is sensitive to that process and likely to experience tangible or intangible (e.g. psychological

[26] Alexander, David (1993), Natural Disasters, Chapman & Hall, New York, pp. 4.

damage) loss from it. This susceptibility to loss is termed 'vulnerability', and can be assessed in human and economic terms. The UN/ISDR (2004a) defined vulnerability as "the conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards". Vulnerability varies greatly from one society to another and from one individual to another, depending upon a wide range of socio-economic factors such as material welfare, education, politics, age, religion and gender (Alexander, 1993). The following figure illustrates the relationship between hazard, vulnerability and disaster.



Source: Degg, Martin (1992)

Figure 2.1 Disaster equations - the relationship between hazard, disaster, and vulnerability.[27]

[27] The disaster will be more catastrophic if the event (A) is severe as well as if the population (B) is also very vulnerable.

These definitions showed that a physical event (hazard) makes an impact on human beings and their environment. However, it is also of importance to note that it is not only the degree of physical damage but the degree of impact on society that is more important in defining disaster. In such a situation, the hazard disrupts the normal functioning or the basic fabric of the society or community. For instance during the 2011 Great East Japan Earthquake, massive destruction on buildings that resulted in mass evacuation affected the normal functioning of the affected regions as they were uprooted from their own places, many lost sources of livelihood, forced to take shelter in new places.

Some other definitions of disasters include:

* "an event (or series of events) which seriously disrupts normal activities" (Cisin & Clark, 1962)[28]

* ".....an accident on a large scale"[29]

* ".....occurrence of imminent threat of widespread or severe injury or loss of life or property resulting from any natural or manmade cause....."[30]

These definitions point to one or the other dimensions of disaster but could not comprehensively define all the diverse aspects of disaster. Some common features of disasters can be seen from the above definitions:

i) It has a major impact on human lives in terms of loss of life, loss of employment opportunities, damage to property, physical injury and psychological effects on the disaster stricken people as seen during the 1995 and the 211 earthquakes.
ii) It affects the normal functioning of human society especially during 'large scale wide area' disaster like the 2011 Great East Japan Earthquake due to mass displacement of people, extensive socio-economic damages suffered and environmental deterioration.

[28] Narayan, S., pp. 22.
[29] Wijkman and Llyod (1984), pp. 19.
[30] Wijkman and Llyod (1984), pp. 19.

iii) It causes massive damage on physical infrastructure like roads, buildings, railroads etc. as well as civic utilities like water, electricity, gas, telecommunication etc. of the disaster stricken areas.

iv) The extent and degree of the devastation alongwith the capability of the disaster stricken regions impacted the recovery and return of lives to pre-disaster stage.

v) The devastation caused by large scale disasters is beyond the capacity of the local authority to handle, thereby necessitating help and assistance from outside the disaster stricken regions.

The definition given by UN International Strategy for Disaster Reduction is more broader where it defined disaster as 'a serious disruption of the functioning of a community or a society causing wide-spread human, material, economic and environmental losses which exceed the ability of the affect community/society to cope using its own resources'(UNISDR 2009). Centre for Research on the Epidemiology of Disasters (CRED) went a step further where it defined disasters as 'a situation or event which overwhelms the local capacity, necessitating a request to a national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering'.[31]

In the Japanese setting, natural disasters are found to be very destructive that occur frequently such as earthquakes, volcanic eruption, tsunami, flood etc. Due to the technological advancement, Japan could manage and mitigate the impact of major disaster which would otherwise have been devastating for developing countries. However, despite being one of the best prepared systems, Japan found itself overwhelmed when the 'triple disaster' of March 11, 2011 struck that resulted in massive unprecedented death and destruction.

[31] Guha-Sapir, D., Vos, Femke, Below, R. with Ponserre, S. (2012), Annual Disaster Statistical Review 2011: The Numbers and Trends, Brussels:CRED, pp. 7.

2.2 Disaster: Nature &Causes

The varied researches being undertaken on natural disasters suggest the following:

• Natural events result basically from interaction between the atmosphere, hydrosphere and lithosphere i.e., they are geographical processes. The gradual environmental degradation coupled with depleting resources change this natural interactions leading to increased frequency and magnitude of natural disaster.[32]

• Natural hazards are the result of the interaction between the natural events system and human use system. Earthquakes and tsunami would not lead to disasters if humans did not live in active seismic zones. This means that natural hazards potentially threaten human society.[33]

• Natural disasters are interaction between natural hazards and their vulnerable conditions (socio-economic, cultural and political), which are usually the result of unwise human actions. Thus, the distinction between natural and man-made disaster is blurred by the tragic impact of the natural disaster that result from the human misuse of resources, inappropriate actions, and lack of foresight.[34]

• Natural disasters cause massive devastation and disrupt the normal functioning of society. Some of impacts of natural disasters are quantifiable like loss of life, damage and destruction to property, physical infrastructure, economic losses it engender. But other impacts like the loss of opportunities, impact on culture, environment, and socio-economic life are not easily quantifiable. This interrelated complex nature of the diverse faces of disasters renders any thought of a single comprehensive definition of natural disaster both contentious and difficult. However, the United Nations Center of Human

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[32] Souhil El- Masri and Graham Tipple, "Urbanisation, Poverty and Natural Disasters: Vulnerability of Settlements in Developing Countries", in Andrenelle Awotona (ed.), *Reconstruction After Disaster: Issues And Practices*, Ashgate Publishing Company, London, 1997, pp. l-2.

[33] Burton, Ian, Kates, R.W., and White, G.F., The Environment as Hazard, Guilford Press, New York, 1993. pp. 9.

[34]Davis, Ian (ed.), Disaster and the Small Dwelling, Pergamon Press, Oxford, 1981, p.8. Also see James Lewis, "Development, Vulnerability and Disaster Reduction", in Andrenelle Awotona (ed.), *Reconstruction after Disaster: Issues and Practices*, Ashgate Publishing Company, London, 1997, pp. 45-46.

Settlements (UNCHS) offers a holistic framework for natural disaster in terms of creation, effects, outcomes and responses.

"A natural disaster can be defined as the interaction between natural hazards, generated in most cases from sudden and unexpected natural event, and vulnerable conditions causes severe losses to man and his environment (built and natural)".[35]

The above definition represents a paradigm shift from earlier focus solely on the technological aspects of the physical phenomena (i.e., quantifiable in terms of its impact on people and infrastructure) to a broader perception that natural disasters are predominantly environmental, social, and development issues. This necessitates a comprehensive analysis of different perspectives of natural disaster and their management.

2.3 Types of Disaster

Disasters can be broadly categorized into two kinds, either **man made or natural.** The natural disaster can be further classified as:

1) Meteorological: storms (of various kinds), cold spells, cyclones, tidal waves, tornadoes, hurricanes;

2) Geophysical: earthquakes, tsunami, avalanches, landslides, and volcanic eruptions;

3) Hydrological: flood, mass movement (wet);

4) Climatological: drought, wildfire.[36]

The other categories under man- made disasters include:

1) Civil disturbances - riots and demonstrations;

[35] United Nations Centre for Human Settlements (UNCHS) Reports, United Nations, New York, 1994, pp.3-10.
[36] EM-DAT/ The International Disaster Database, CRED. (www.emdat.be/new-classification)

2) Accidents - relating to transportation, building collapses, mines, fires, chemical leaks, industrial accidents, oil spill, nuclear accidents, etc.;

3) Refugees - due to partition of countries, wars and civil strife (ethnic and religious); and

4) Warfare - conventional, nuclear, biological, chemical, guerrilla warfare including terrorism.[37]

Natural hazards can also be categorized based on their five primordial origins (i.e., the five primary elements that constitute the universe-sky, air, fire, water and earth).

Table 2.1 Primordial Origins of Natural Disasters

Element	**Illustrative Disaster**
Sky	Ionosphere : Meteor, Comet, Particle shower Stratosphere : Thunderstorm, Lighting
Air	Oceanic : Surges Surface : Gale, Storm, Cyclone, Tornado, Typhoon Dry Land : Hot wind, sandstorm
Fire	Sub-terranean : Gaseous fire Terranean : Forest fire
Water	Rain, Ice : Flood Snow/Ice : Hailstorm sleet Ocean : Tidal waves Lack of water : Drought
Earth	Core/Mantle : Earthquake, Volcano Surface : Landslides

Source: S. C. Bhatia, "Types of Hazards and Their Characteristics" Proceedings of WCNHR, IOE and WFOE, New Delhi, January 1992.

[37]Biswas, Kalyan, 'Organization for Disaster Management at City Level', Paper presented at Asian Disaster Preparedness Center, Thailand, October 1997.

2.4 Management of Natural Disasters

Against the backdrop of increasing deleterious effect of natural disasters on human and environment, the United Nations (UN) declared the decade 1990-2000 as the 'International Decade for Natural Disaster Reduction' (IDNDR 1990-2000) dedicated to promoting solutions to reduce risks from natural disasters. The objective of IDNDR (1990-2000) is to reduce, through concerted international actions, the loss of life, property damage as also social and economic disruption caused by natural disasters, especially in developing countries.[38]

The world Conference on Natural Disaster Reduction held in Kobe, Hyogo, Japan from 18-22 January 2005 was an important milestone in IDNDR's awareness building process. The third and the latest World Conference on Disaster Risk Reduction, held from 14-18 March 2015 in Sendai, Miyagi Prefecture, Japan, adopted the Sendai Framework for Disaster Risk Reduction (2015-2030) where it sought to achieve over the next 15 years:

> 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.[39]

To realise this goal, the Sendai Framework for Disaster Risk Reduction 2015-2030 states the need for focussed action within and across sectors by states at local, national, regional and global levels in four priority areas:

1. Understanding disaster risk;

2. Strengthening disaster risk governance to manage disaster risk;

3. Investing in disaster risk reduction for resilience;

4. Enhancing disaster preparedness for effective response and to *"Build Back Better"* in recovery, rehabilitation and reconstruction.[40]

[38] Sharma, Vinod K., Disaster Management, New Delhi:IIPA, 1994, pp. 244.
[39] UN/ISDR, '*Sendai Framework for Disaster Risk Reduction 2015-2030*'.

An effective Disaster Management System should be a fine blending of both technocratic approach as well as socio-economic approach as ultimately we are dealing with human beings existing collectively as societies. There has to be an integrated harmonious synergy between technology and policy.

The predominant discourse on disaster management is focused primarily on two stages viz. emergency rescue and relief period and post disaster rehabilitation. This is due to these two components being strong in terms of visibility, political support and funding provisions. Instead of allocating funds to strengthen measures to prevent or reduce the impact of future disaster, the authority was forced into action after a disaster struck. This situation is similar to that of preventive health care, where curative medicine is relatively well funded while preventive medicine is not.[41]

However, there is a paradigm shift towards a more proactive, mitigation-based approach more so in the case of Japan, as it was being observed time and again that reactive mechanism yield only temporary results and do not strengthen the capacity of the system to counter future disasters. According to G. K. Mishra and G. C. Mathur (1993) disaster management is a planned systematic approach towards understanding and solving problems that arises in the wake of disasters. It encompass all programs and measures through the different phases of disaster management such as disaster preparedness, prevention, rescue, relief, rehabilitation planning. While Raghuvulu B. Naidu (1984) emphasises on the humanitarian, social and economic matters concerning prevention, and mitigation of natural disasters.

Disaster Management is defined as "the discipline and profession of applying science, technology, planning, and management to deal with extreme events that can injure or kill great numbers of people, do extensive property damage and disrupt community life" (Sylves 2008:5). In short, it can be defined as the effective organisation, direction and utilisation of viable counter disaster resources. The smooth synergy

[40] UN/ISDR, '*Sendai Framework for Disaster Risk Reduction 2015-2030'*

[41] Planning and Management of Disaster Reduction, Report by United Nations Centre for Human Settlements (UNCHS), Nairobi, 1990, pp. 14-24.

between technology and policy should be effectively ensured in all the 3-key stages of activities in disaster management.

1. **Pre-disaster:** This is important to reduce the potential human, material or environmental losses caused by hazards, and to ensure that losses are minimised when the disaster actually strikes.

2**. During a disaster**: The synergy is require to ensure that needs and provisions of victims are met to alleviate and minimise sufferings.

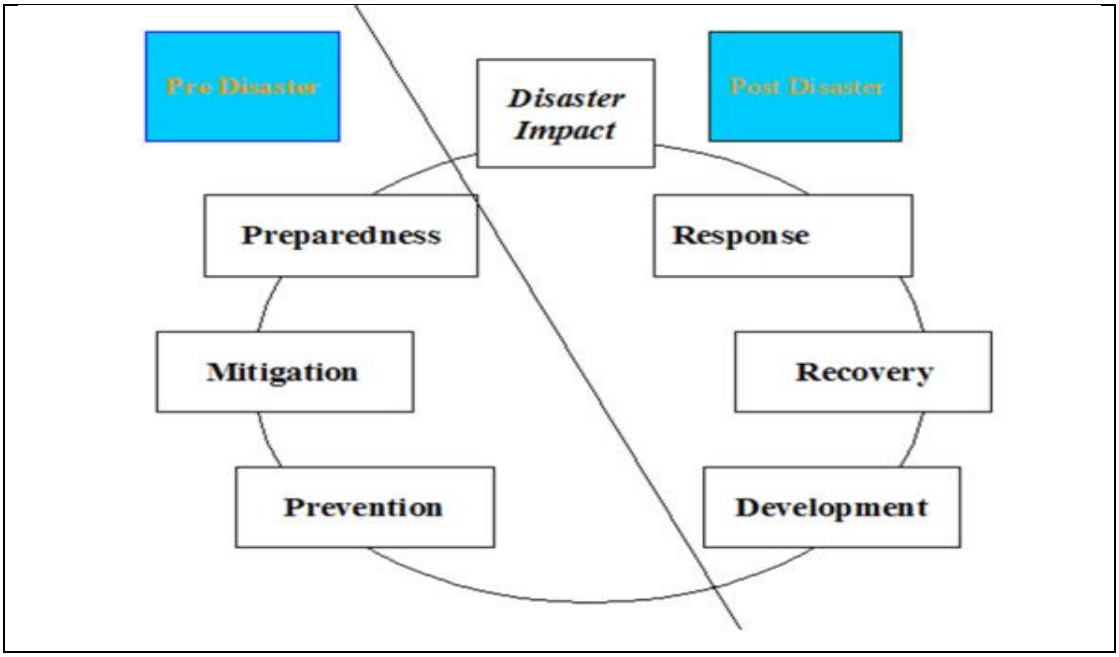
3. **After a disaster** (Post-disaster): This is necessary to achieve rapid and durable recovery which does not reproduce the original vulnerable conditions and bring back normalcy.

While emergency relief and rehabilitation are important and vital activities, successful disaster management planning must cover the whole range of policies and programs before, during and after the disaster. These phases can be represented as a cycle or continuum, which if circumstances allow reduce the negative effects of future disasters.

2.4.1 Disaster Management Cycle

Disaster Management cycle illustrates the on-going process by which all stakeholders viz., governments, business and civil society plan for reducing the impact of disasters, during and immediately following a disaster along with steps taken to recover after the disaster. The different phases of disaster management can be best visualised as a disaster management cycle as given below.

Figure 2.2 Different Phases of Disaster Management represented as 'Cycle'.



It generally consists of five phases/stages:

1. **Disaster phase:** This refers to the 'real time' occurrence of disaster that resulted in profound damages to the human and the environment. The duration of the event depends on the type of hazard that occurred. The damages suffered may be in the form of loss of life, property, and harm to environment or anything else.

2. **Response and Relief:** This is a reactive approach that refers to the period immediately following the occurrence of a disaster when emergency search and rescue (SAR) begins along with steps taken to meet the basic humanitarian needs of the affected people in respect of food, shelter, water, medical first-aid. Besides, emergency resources are mobilised, extent of the damage is assessed, evacuation is initiated and clearance of debris begins to facilitate quick movement of relief materials, volunteers and rescue personnel.

3. **Recovery/Rehabilitation phase:** This reactive phase aims to restore the affected area to its earlier state and support the return of the affected people to normal life and

activities. Temporary public shelter, utilities, medical assistance is provided. The recovery efforts are concerned with rebuilding damaged and destroyed property, reemployment, restoration of essential infrastructure/lifelines such as water supply, electricity so as to assist long term recovery.

4. Preventive/Mitigation phase: Measures/actions are initiated to reduce or eliminate the risk of disaster. These are long term measures which goes a long way in reducing or in effective control of the impact of natural disasters. Such mitigating measures can be structural (e.g. earthquake early warning system, tsunami breakwaters, flood levees, dikes etc.) or non-structural (e.g. land-use planning, community awareness and education, disaster resistant building codes/laws). Prevention is more applicable to man-made and technological disasters.

5. Preparedness: These proactive measures which are planned and conducted in anticipation of disasters enable governments, communities and individuals to respond to and cope with disaster more effectively whenever it strikes. Preparedness includes formulation of emergency plans, development of effective warning systems, and maintenance of inventory of resources (both human and material), effective multi-agency coordination and regular training of emergency personnel. It may also embrace identification of vulnerable groups and evacuation plans for areas prone to recurring disaster. Therefore, proactive preparedness measures, if effectively implemented, would significantly help in minimising and mitigating the adverse impacts of natural disasters.

2.5 Disaster Management System in Japan

An effective and comprehensive disaster management system is very significant for a disaster prone country like Japan whose disaster management capabilities have been tested numerous times in the past. The enactment of the Disaster Countermeasures Basic Act (DCBA) in 1961 following the massive devastation caused by Ise-Wan Typhoon in 1959, marked a major turning point in the evolution of a comprehensive and strategic

disaster management system in Japan. Following the massive devastation caused by the 1995 Kobe Earthquake, disaster management system in Japan was reviewed thoroughly, resulting in a new Disaster Countermeasures Basic Act 1995.

The DCBA 1961 states the 'protection of national land as well as citizen's lives, livelihood, and property from natural disasters' as a national priority. The DCBA lays down the general framework for disaster management to be organised and implemented in an integrated and well planned manner. It addresses all the different disaster phases of prevention, mitigation, preparedness, response, recovery and rehabilitation with clear roles and responsibilities for the national, prefectural and municipal authorities, the relevant stakeholders, the public and private sector cooperating in the response, relief and recovery efforts.[42]

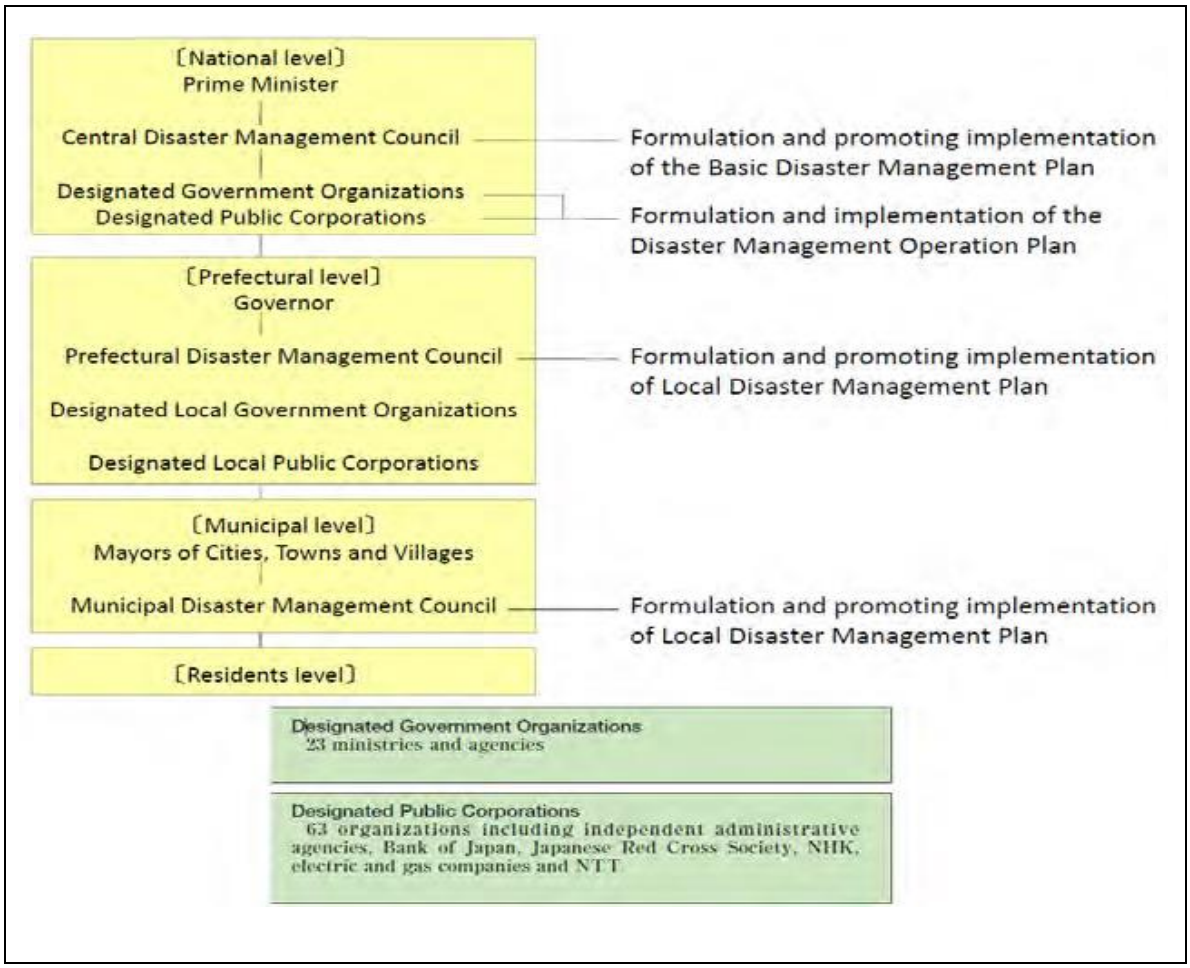
The Japanese disaster management system is a hierarchical structure with the national government at the top, followed by prefectural governments and municipal governments at the bottom. This stipulates the establishment of disaster management councils at three levels: National - Central Disaster Management Council; Prefectural - Local Disaster Management Council and Municipal Disaster Management Council. In the event of catastrophic mega disasters, the DCBA authorises the government to set up temporary emergency response organisation like Major Disaster management Headquarters (headed by Minister of State for Disaster Management) or Extreme Disaster Management Headquarters (headed by the Prime Minister) depending upon the extent of damage.

Different Ministries are charged with responsibility for different dimensions of disaster management in Japan. Search and rescue operations are handled by personnel of Fire and Disaster Management Agency (FDMA), National Police Agency (NPA) and Self Defense Forces (SDF). The emergency medical services in the aftermath of disaster are handled by Ministry of Health, Labour and Welfare. The financial aid and assistance given to the disaster affected areas is administered by Cabinet Office of the central government. This division of responsibilities among the different ministries helped to

[42] Disaster Management in Japan, Cabinet Office, 2011.

facilitate quick response to disasters and cater to the multiple needs of the disaster victims promptly. However, this division of responsibilities would become an obstacle if there is no smooth co-ordination among the personnel looking after the different dimensions of disaster response at the ground level. To facilitate this inter-ministerial collaboration and co-operation, regular drills and exposure to different ministries should be held among the personnel of the different ministries.

Figure 2.3 Outline of Japan's Disaster Management System



Source: Cabinet Office, Government of Japan, 2011.

The DCBA designates the affected municipalities (cities, towns and villages) as the first responder to a disaster and can asked for assistance from prefectural government if it is beyond the capacity of the local municipality to cope with the disaster. The role of the national government is to support the local government when asked for and provide

financial aid. This decentralised 'bottom-up' approach is found to be ineffective in tackling mega disasters like the 2011 Great East Japan Earthquake. The local governments does not have the capacity to mobilise resources (man and material) to cope with mega disasters as seen during the 1995 and the 2011 earthquakes. The Kobe City Disaster Management Plan stipulated that if Kobe is to be hit with an earthquake of magnitude 5.0 M or more, each of the city government officials must report for duty to the nearest government office. But in the aftermath of the Kobe Earthquake it was found that only 41% of the total city government officials could be mobilised.[43]

Similarly, during the 2011 Great East Japan Earthquake (GEJE), 51 municipalities were affected. The Rikuzentakata municipality in Iwate prefecture was severely hit that around 10% (or 2007) residents were died or missing and another 17000 (i.e.70%) of the residents were evacuated.[44] Besides the municipality fire-fighting headquarters and local prefectural hospital which could have delivered emergency medical care was damaged. Similarly, in the Minamisoma municipality in the Fukushima prefecture, more than 600 residents were reported dead or missing and the total residents of the municipality reduced from 70000 to 10000 in later half of March 2011.[45] This loss of lives and extensive damage to infrastructure dealt a massive blow to the capacity of the local governments to respond to disasters effectively.

Against this backdrop, there is need for a centralised 'top-down' approach to disaster management with the national government taking a more prominent role in coordination with local governments to tackle future mega disasters effectively. The national government should step in without waiting for request from local governments as seen during the 2011 disaster. The national government has the capacity to quickly mobilise man and material to effectively counter mega disasters.

The three levels of governments have their own disaster management organisations, policy frameworks and budgets. They have their own personnel and

[43] City of Kobe (2010), "Comprehensive Strategy for Recovery from the Great Hanshin-Awaji Earthquake", pp. 61.
[44] Funabashi and Takenaka (2011), pp.60.
[45] *Ibid* no.43, pp.68.

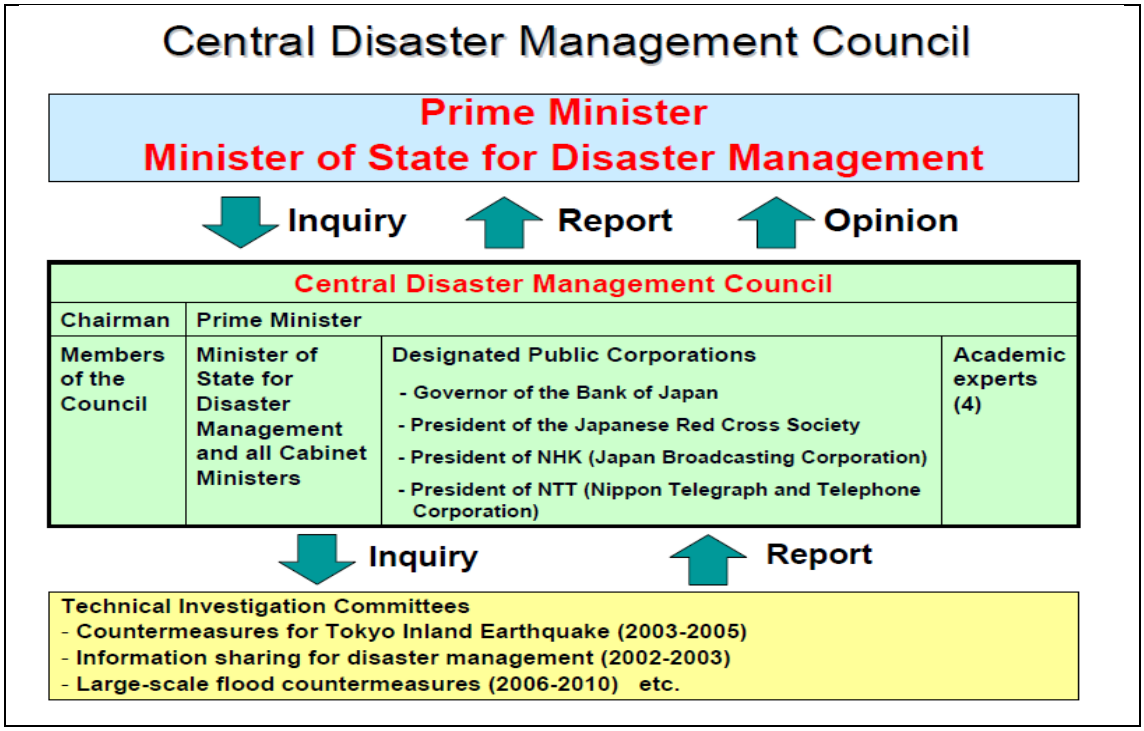
agencies looking into different dimensions of disaster management. However, this rigid vertical division of labour in disaster management by different ministries and agencies in-charge of different dimensions of response stands in the way of developing a flexible system that is adaptable to different types of disasters as seen in the 2011 earthquake experience where the response measures were not synchronised (Okada and Ogura, 2014).

As a measure towards synchronisation, the post of Minister of State for Disaster Management was set up in 2001 to facilitate coordination and cooperation among related government organisations on a range of issues and the Director General for Disaster Management is tasked with planning of disaster management policies and response to large-scale disasters. This was further strengthened with the appointment of the Deputy Chief Cabinet Secretary for Crisis Management and the establishment of the Cabinet Information Collection Center thereby creating a mechanism to address major disasters effectively. The impact of these changes after the 1995 Kobe Earthquake can be seen during the 2011 GEJE where the assessment for the extent of damage was known quickly, there was better co-ordination of the response activities of the various ministries and agencies.

2.5.1 Central Disaster Management Council (CDMC)

Based on Article 11-13 of the Disaster Countermeasures Basic Act, the Central Disaster Management Council (CDMC) was formed as a permanent institution to ensure multi-ministerial and multi-sectorial participation in disaster management in a co-ordinated manner chaired by the Prime Minister. The CDMC comprises of all the Cabinet Ministers including the Minister of State for Disaster Management and all state ministers, heads of relevant public corporations such as Bank of Japan, NHK (public broadcasting cooperation), NTT (telecommunication company) and some academic experts . In Japan, public agencies such as NTT, NHK are seen as primary actors responsible for dealing with disaster preparedness, response and recovery (Comfort, Okada & Ertan, 2013).

The Council is the apex body for formulation of policies at the national level.



Source: Cabinet Office, Government of Japan, 2011.

Figure 2.4 Structure of the Central Disaster Management Council (CDMC)

The functions of CDMC are:

1) to create and promote the implementation of the Basic Disaster Management Plan;
2) to formulate and promote the implementation of emergency measures for major disasters;
3) to deliberate on important matters related to disaster reduction according to requests from the Prime Minister or Minister of State for Disaster Management.[46]

Besides, the council and its investigation committees facilitate a mechanism through which research findings can factor in actual government plans, measures and policies. Being the apex boy at the national level, the CDMC has important role formulation and implementation of plans for different disasters for the whole of Japan.

[46] Cabinet Office, Government of Japan, 'Disaster Management in Japan', February 2011, pp. 10.

They have the best expertise, resources and manpower for formulating effective disaster management plans for various types of disasters.

Some of the major organisations/agencies involved in disaster management at the national level are.

1) **Fire and Disaster Management Agency (FDMA):** This agency undertake research and formulate plan relating to fire service systems in order to strengthen capability of local municipalities to handle fire disaster. It also attends to request for assistance during emergency situation by despatching its personnel. In the aftermath of the 1995 Kobe earthquake, Emergency Fire Response Team (EFRT) was set up to respond to major disaster situations. This agency is very important as every municipality has own fire department that is under the administration of the local municipality and they are the first to respond in disaster situations. However, the problem is that the local fire department does not have large manpower e.g. Kobe city had only 1372 officials[47] in the fire department at the time of the 1995 earthquake, so it was unable to launch rescue operations on a large scale due to manpower shortage. This problem was overcome to some extent by the establishment of the EFRT where FDMA can mobilise large manpower to respond to disasters promptly as seen during the 2011 Great East Japan Earthquake.

2) Ministry of Land, Infrastructure, Transport & Tourism (MLIT): The MLIT formulates disaster management policy at national level with regard to flood & sediment disasters as well as town development to ensure safety against both natural and man- made disasters. This is significant as Japan is also prone to frequent torrential rains and flooding. During the 2011 GEJE, personnel of the ministry conducted damage assessment of the coastal areas and the physical infrastructure.

3) Japan Meteorological Agency (JMA): This external organ under MLIT maintains a wide range of disaster warning systems that enable Japan to minimise

[47]City of Kobe (2010), 'Comprehensive Strategy for Recovery from the Great Hanshin-Awaji Earthquake.', pp. 62.

the impacts of disasters. It maintains a nationwide network of seismometers to detect earth tremors, tsunami warning system, and weather forecasting etc. that render Japan well prepared to cope with disasters. As such during the 2011 GEJE, dissemination of early warning enabled people to evacuate to safety before the S-wave earthquake tremors hit Japan. Besides, the early dissemination of tsunami warning at 8.6 seconds after the earthquake enabled people to run to higher ground or evacuation centers thereby saving precious lives.

In retrospect, Japan has a robust and comprehensive disaster management system in place that addresses all the different phases of disaster management. The system has evolved over a period of time wherein past experiences with disasters has been channelled towards creating an even better system to cope with future challenges. In Japan, the primary responsibility for immediate response to disasters lies with the local municipal authority where the disaster struck while the prefectural and the national government complemented the activities of the municipal authority. The existence of multiple agencies with individual separate plans for disaster response, the emphasis on major role of local government, the rigid hierarchical nature, emphasis on pre-disaster mitigation measures, adoption of new technology etc. make Japan's disaster management system as one of the most effective disaster response system in the world.

Chapter 3
Response of Government to the 1995 and the 2011 Earthquakes

The unique geo-climatic conditions of the Japanese archipelago make this region most vulnerable to natural disasters. Disasters occur with amazing frequency and regularity. While the community at large has adapted itself to these regular occurrences, the economic and social costs continue to mount year after year.

The preparedness and effectiveness of Japan's disaster management system have been put to test numerous times in the past. Building on its bitter experience with disasters before, Japan has an evolving effective disaster management system. However, two major disasters - the 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake (GEJE), which resulted in massive devastation to life and property, shattered the Japanese belief that they are safe and well protected against any natural disaster. The Japan Times editorial mentioned that 'the Hanshin-Awaji earthquake has forced all Japanese to recognize that this country does not have a reliable crisis management system' (The Japan Times, January 26, 1995). The slow and ineffectual response of the government was widely criticized.

Learning its lessons the hard way, the response of government to the 2011 Great East Japan Earthquake (GEJE) was swift and prompt. However, the magnitude of devastation was unprecedented that even the best prepared system will find itself overwhelmed. This was not a single disaster event but a succession of interrelated events - earthquakes, tsunamis, nuclear power plant accidents, power shortage nationwide, disruption of supply chain etc. often referred to as 'sequential crisis'.[48] This is something the Japanese government didn't envisaged and was caught unprepared. The response mechanism of the government was found to be inadequate. It generated discussion on the need to prepare for future mega disasters.

[48]United Nations, '*Global Assessment Report on Disaster Risk Reduction 2011*'.

This chapter focuses on the socio-economic and physical damage caused by the above two disasters comparatively and analyses the response of the government of the day in a comparative perspective highlighting how improvements made after the 1995 Kobe earthquake helped to reduce damages in the 2011 disaster. This chapter draws attention to the need for an integrated centralised 'top-down' approach in responding to future mega disasters. This chapter focuses on the forecasting and early warning systems available in Japan showing how it is important in reducing the impact of major disasters.

3.1 Disaster in Context

3.1.1 The Great Hanshin-Awaji Earthquake (January 17, 1995)

The Great Hanshin-Awaji Earthquake is clearly the biggest devastating natural disaster to hit Japan since the Great Kanto Earthquake (September 1, 1923). Officially called the Hyogo-ken Nanbu earthquake of 17 January 1995, but it is better known as the 1995 Kobe Earthquake worldwide in reference to the city of Kobe that sustained maximum devastation. The earthquake occurred at 5:46:52 am Japanese Standard Time (JST). The epicenter is located in the Akashi Strait, off the northern end of Awaji Island. The 7.2 Mw earthquakes[49] with a seismic intensity of 7[50]caught the residents of Kobe and its neighboring cities by surprise as it struck early morning.

The devastation affected the prefectures of Hyogo, Kyoto and Osaka but the damage to Kobe city was very severe and crippling. Kobe is the 6th largest city with 1.6 million residents (as of 1993) on an area of 546 km². This major earthquake caused the death of 6279 residents while 300,000 were rendered homeless (Tierney and Goltz 1997:1). Besides, the region's physical infrastructure including lifelines like water and sanitation, gas and electricity etc. and highways, railways, roadways were severely damaged. The economic losses were extensive. The Port of Kobe, the sixth largest cargo port in the world and Japan's largest container facility was shut down due to the devastation.

[49] The moment magnitude of earthquakes is represented as 'Mw' while JMA's measure of magnitude is represented as 'M'.

[50] The 10-degree seismic intensity scale in Japan is measured in units of *shindo* that ranges from 0 to 7, with 7 being the highest. It describes the degree of shaking at a specific location.

Map 3.1 Map of Japan (showing the place of 1995 Kobe Earthquake)

Source: Japan Meteorological Agency (JMA)

The intensity of the ground shaking, the urban nature of devastation and the geography and human ecology of the affected area compounded the physical damage and disruption of the functioning of the society where the emergency response of the government was found wanting.

Table 3.1 Basic Comparison of the 1995 Kobe Earthquake and the 2011 GEJE

	1995 Kobe Earthquake	2011 GEJE
Date	January 17, 1995	March 11, 2011
Time	5:46:52 JST	14:46JST
Hypocenter (epicentre)	In the Akashi Strait, off the northern end of Awaji island	Off the Pacific coast of Tohoku region
Hypocenter depth	16 Km	24 Km
Magnitude	7.2	9.0
Maximum seismic intensity	7 (Awaji Island)	7 (Kurihara city, Miyagi Prefecture)
Type of Earthquake	Earthquake occurring along an active fault	Ocean trench earthquake (occurs at intervals of

	(occurs at the intervals of one thousand to several ten thousands of years)	several decades to several centuries)
Affected areas	Urban areas/ 10 cities	Mainly agricultural and fishing areas/ 37 cities and towns
Main damage	Collapsed buildings, fires	Giant Tsunami, accident at Fukushima- Daiichi Nuclear Power Plant.
Number of deaths	6279	15892

Source: Cabinet Office, Government of Japan; NPA (2015); Headquarters for Emergency Disaster Response, Prime Minister and His Cabinet; Edgington (2010)

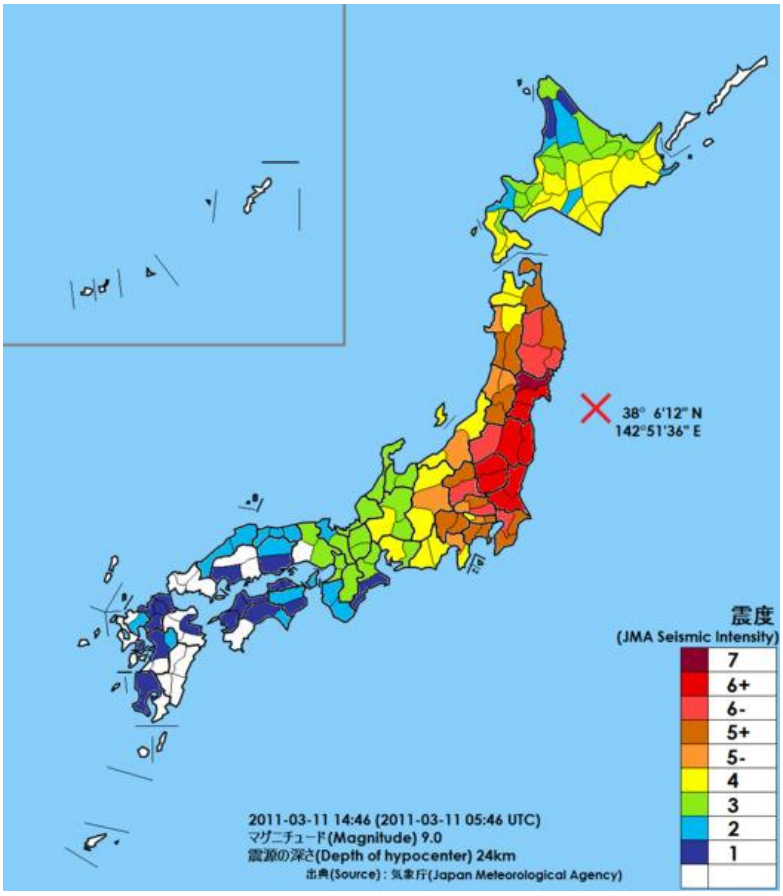
3.1.2 The Great East Japan Earthquake (11 March, 2011)

At 2.46 p.m. JST (5:46 UTC) on Friday, March 11, 2011, a devastating earthquake of 9.0 Mw and seismic intensity of 7 struck Japan, with its hypocenter located 24 km below the earth's surface at 142.9ºE longitude and 38.1ºN latitude, or approximately 130 km off the Pacific coast of the North eastern Japan. The Japan Meteorological Agency (JMA) named the earthquake "The 2011 Earthquake off the Pacific coast of Tohoku".[51] It is the largest earthquake in Japan's history and fourth largest (according to US Geological Survey) to be recorded globally since the beginning of 20th Century.[52]

This gigantic ocean-tectonic earthquake was caused by thrust faulting at the plate boundary between the Pacific and the Continental plate. The Pacific plate moved westwards with the convergence rate of 8.5 cm per year and was sub-ducting beneath the Continental plate at the Japan Trench. The earthquake source region stretched from off the Iwate Coast to off the Ibaraki coast. It is estimated that a massive fault measuring 200km wide and more than 450 km long rupture with maximum slip of 60-80m.[53]

[51] Tohoku is the name of the northeastern region of Honshu Island which includes the three severely affected prefectures of Iwate, Miyagi and Fukushima in the disaster.
[52] US Geological Survey Press Release, March 14, 2011.
[53] Koshimura, S., Hayashi S. and Gokon H. (2013), pp. 549.

Map 3.2 Map showing the different seismic intensity level during the 2011 GEJE

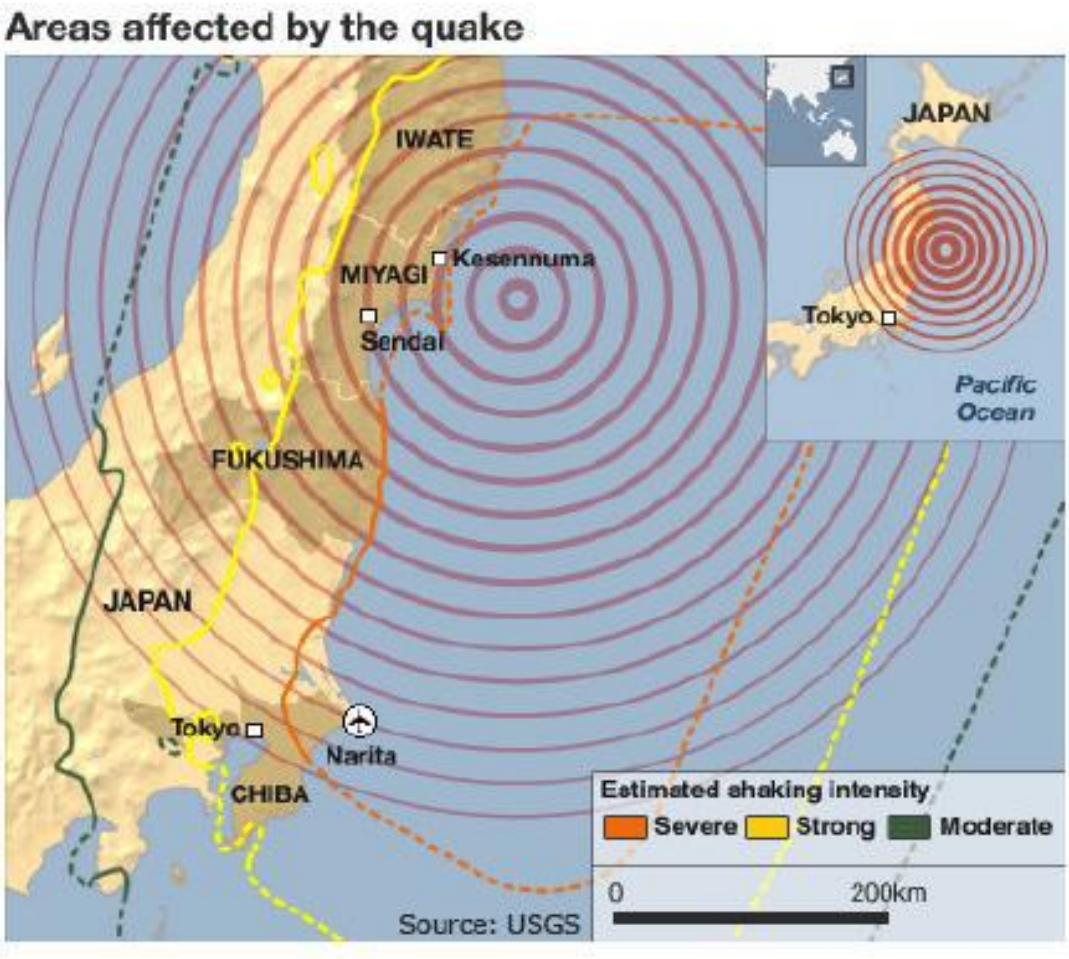


Source: Japan Meteorological Agency (JMA)

The giant earthquake triggered a series of massive tsunami (where the 'tsunami run-up height'[54] reached up to 40 metre in Miyako, Iwate Prefecture[55]) along the north-eastern coast of Japan affecting a total area of 561 km². The Iwate, Miyagi, Fukushima, Aomori and Ibaraki prefectures were severely affected. The economic loss from the physical devastation is estimated at US $195 - $305 billion.[56] This disaster led to death of 15892 residents while 2574 people went missing (NPA 2015). Besides, massive destruction is seen in roads, bridges, ports, railroads, buildings and other physical infrastructure and utility and lifelines network.

[54]It refers to the gap in sea level raised by Tsunami from normal sea level when no Tsunami takes place.
[55] Funabashi and Takenaka (2011), pp. 24.
[56] See METI, Japan, '*Japan's Nuclear Emergency –Update*', April 6, 2011.

Map 3.3 Map showing the mainly affected prefectures during the 2011 GEJE



In addition to this destruction and loss of life, the gigantic earthquake and the resulting tsunami caused severe damage to the facilities at the Fukushima Daiichi Nuclear Power Plant of Tokyo Electric Power Co. Ltd, (TEPCO). Of the total six reactors at the plant only Units 1, 2 & 3 were in operation at the time of the earthquake. The steel towers on the plant grounds collapsed as a result of the earthquake, preventing Units 1 to 6 from receiving external power as the electrical grid was damaged. This led to the automatic start-up of the emergency diesel generators. However, the massive tsunami flooded the nuclear power plant resulting in disabling of the diesel generators that had powered the cooling system in the reactors and the pools in which fuel rods were restored. The loss of the coolant resulted in overheating, which caused the breach of the containment vessels and subsequently the release of radiation into the air, ground and water. This led to the

declaration of a nuclear power emergency by TEPCO and order mass evacuation of the local population. This nuclear meltdown compounded the devastation of the disaster which the Japanese government found itself unable to control within the existing disaster management mechanism. This posed a new kind of crisis situation that Japan had never been confronted before. This led to a big debate regarding the safety of nuclear power plant.

3.2 Impact on Japan

The 1995 Kobe Earthquake and the 2011 Great East Earthquake are the worst natural disasters that Japan had faced in the post-WW II period. The Great East Japan Earthquake was four times as large as the 1995 Kobe earthquake in terms of human casualty. In a news conference, Prime Minister Naoto Kan called the situation triggered by the earthquake and the tsunami as Japan's 'worst post-war crisis'.[57]

The 1995 Kobe Earthquake caught the government as well as residents unaware and unprepared as they believed that the Kansai region will be least likely hit by a major earthquake. Most attention had been on the plate boundary earthquakes that took place in subduction zones. Besides, till then, anti-earthquake policies had been directed toward the Kanto region with special emphasis on Tokyo.

The 'unexpectedness' of the Great East Japan Earthquake is something that has no historical precedent and scientific knowledge. Who could have imagined that a great earthquake would trigger off massive tsunami and caused nuclear meltdown? The massive tsunami swept across the Pacific coast of Japan from Aomori to Ibaraki, reportedly reaching several miles inland and flooding hundreds of square miles of land (including 42 municipalities in four prefectures).[58] Such kind of tsunami had no precedent before that even the highly strong breakwaters and sea walls couldn't prevent the tsunami waves from hitting far inland. These two disasters demonstrated the limitations of science and technology against the wrath of nature. This also exposed the

[57] The Japan Times Special Report 3.11, pp. 13
[58] OCHA, "Japan: Earthquake and Tsunami," *Situation Report* No. 15, 30 March 2011.

inability of the local government in handling such mega disasters that the national government must take the lead in tackling such mega disasters.

3.2.1 Social Impact

The most significant societal impact of the 1995 Kobe Earthquake and the 2011 GEJE earthquake was the tremendous loss of human life and massive displacement of residents. In the 1995 earthquake, the greatest losses of life were reported in the cities of Kobe (4484), Nishinomiya (1107) and Ashiya (453) (Tierney and Goltz 1997:1). In the 2011 GEJE, the greatest loss of life were reported in the prefectures of Miyagi(8190), Iwate(3867), Fukushima(1272), Ibaraki(23) as of April 13,2011(NPA 2011). The Kobe Earthquake had a low death rate of 0.44 people per 10,000 as compared to death rate of the Great East Japan Earthquake which stands at 1.85 persons per 10,000.

One significant difference between the 1995 Kobe Earthquake and the 2011 GEJE is the nature of the causes of deaths. We see that majority of deaths resulted from building collapse and fires in the 1995 Kobe Earthquake while most of the deaths during the 2011 GEJE resulted from drowning as they are being swept away by the great tsunami.

Table 3.2 Comparison of the causes of death in the 1995 Kobe and 2011 GEJE

1995 Kobe Earthquake		2011 GEJE	
Cause of death	Share (%)	Cause of death	Share (%)
Head and neck trauma, suffocation or traumatic shock caused by building collapse	83.3	Drowning	92.5
Burns	12.8	Crushing, laceration etc.	4.4
Unknown	3.9	Burns	1.1
Total	100	Unknown	2
		Total	100

Source: MLIT, Japan, White Paper on Land, Infrastructure, Transport and Tourism (2011)
(Note: Figures for GEJE are as of April 11, 2011.)

Thousands of people were displaced in both the disasters where they faced the problem of finding shelter, securing food and water, locating missing friends and

relatives. The temporary evacuation shelters were not enough to accommodate all the evacuees. The massive damage to the communication and transport network further crippled the supply of essential commodities to the affected people.

Many towns and cities located along the Pacific coast of north-eastern Japan were swept away; the nuclear meltdown necessitate the imposition of "off limits" in nearby area and those who are rendered homeless are forced to spread out in various location. As of January 2015, there were still 82,000 people living in temporary houses.[59] This disrupts the normal functioning of the community and breakdown of local communities.

Table 3.3 Comparison of the impact on the Population in the 1995 and the 2011 Earthquakes

	1995 Kobe Earthquake	2011 GEJE
Deaths	6279	15892
Death rate per 10,000 people	0.44	1.85
Injured	41527	5890 (as of December 22, 2011)
Missing	2	2574
Evacuees	342,000 (peak, Jan 20-24, 1995) 35,280 (4 months after the disaster)	470,000 (peak 15 march, 2011) 267,419 (Feb. 13, 2014)

Source: FDMA (2014), Funabashi and Takenaka (2011), NPA (2015), Edgington (2010).

The main victims in both the disasters were the vulnerable groups, such as the old and disabled people. It is found that majority of the deaths were among the old and physically disabled who are above 60 years as they constituted more than 50% of the total casualty during the 1995 Kobe Earthquake. The disaster also disproportionately affected old women and residents who stay single as they couldn't escape the collapsing building. It is found that 65% of the fatalities during the March 11,2011 disaster were those of age 60 or older and it is believed that many other older people couldn't escaped the fast approaching tsunami.[60] In the three severely devastated prefectures - Iwate,

[59] Reconstruction Agency (2015), '*Current Status of Reconstruction and Challenges*', March.
[60] Funabashi and Takenaka (2011), pp.25.

Miyagi, Fukushima - 31% of the total population is constituted by old people age 60 or more.[61]

3.2.2 Impact on Physical Infrastructure

The two disasters - the 1995 Kobe Earthquake and the 2011GEJE - greatly damaged the physical infrastructure in the urban as well as coastal areas, including damage to buildings, roadways, railway lines, telephone networks, electricity and water supply, soil liquefaction, bridges, ports and harbours. Against the backdrop of this severe physical infrastructural damage and harm to the environment along with the massive damage to 'lifelines' and utilities over a wide area, the survivors of the two disasters faced extreme mental and physical hardships. The situation was one of chaos and disorientation in the main areas that endured the maximum devastation.

a) Buildings/Housings

The two disasters caused the destruction - partial and total - of numerous residential, commercial and public buildings. In the 1995 Kobe Earthquake, the destruction was due to the intense ground shaking but compounded by the weak wooden houses that are defective and not earthquake resistant in design. Initially, it was reported that over 136,000 housing units were damaged rendering more than 300,000 persons homeless (Hyogo Prefecture, 1996). Damages were also reported in public buildings (549) and other buildings account for 3126 (Egington 2010).

As such majority of the totally damaged houses were of old style wooden houses built before 1970 according to old building code. This tragic experience led to the establishment of the *Seismic Rehabilitation Promotion Act for Existing Buildings* in October 1995 where the government promoted assessment and strengthening of old style houses against earthquake. Government also encouraged the assessment initiative by giving financial assistance and loans. The result of this measure is reflected in the 2011 disaster where buildings could withstand the great earthquake more effectively and the damaged were mainly due to inundation by tsunami. The following table shows the extent of damage.

[61] *Ibid* no.59, pp.25.

Table 3.4 Comparison of damage on buildings in the 1995 and the 2011 Earthquakes

	1995 Kobe Earthquake	2011 GEJE
Total destruction	100,282*	126,602* (as of November 2013)
Half collapse	----	272,426* (as of November 2013)
Partial destruction	294,158*	743,089*
Total	394,440'	1,142,117

Source: * Cabinet Office and Reconstruction Agency; ′ FDMA (as reported in Edgington, 2010)

As of March 2012, around 1.2 million buildings are estimated to have been damaged during the 2011 disaster. What is distinctive is the maximum damage caused by the tsunami through flooding and inundation. It is reported that a total of 535 km² was flooded in 62 municipalities of Iwate, Ibaraki, Miyagi, Aomori, Fukushima and Chiba prefectures. They account for 119 km² of urbanised area, 236 km² of farmland and 180 km² of forests and rural settlements.[62] The following table shows the extent of damage of buildings in 4 severely affected prefectures.

Table 3.5 Damaged buildings in 4 prefectures

Type of damage	Iwate	Miyagi	Fukushima	Ibaraki
Fully destroyed	21,017	69,154	16,871	2,544
Partially destroyed	3,552	63,704	40,280	17,587
Partially damaged	5,217	110,644	122,955	149,513
Total	29,786	243,502	180,106	169,644

Source: FDMA, Ministry of Internal Affairs and Communications, NPA.

[62] Funabashi and Takenaka (2011), pp. 25

The damage to buildings is compounded by incidence of 'soil liquefaction'[63] observed in various locations in Tohoku and Kanto where groundwater levels are high. This phenomenon caused the buildings to sink in as the soil acts like a liquid resulting in the collapse of nearby buildings.

(b) Transportation facilities

The 1995 Kobe Earthquake and the 2011 GEJE damaged the transport infrastructure resulting in piling up of mass of debris which hampered quick movement to affected region for rescue and relief operations. A total of 9413 roads and highways sites sustained damages of varying degrees (Edgington 2010). The 1995 Kobe Earthquake damaged the two main highways Hanshin Expressway and Wagan (Harbour) Expressway that served as main transport corridors between central and southern Honshu Island. Railway lines especially JR West, Hankyu and Hanshin that run through the Kobe corridor mostly on elevated embankments and sustained embankment failures, overpass collapses, distorted rails and other severe damage.

Besides, ports and harbours, airports also sustained damages. The Port of Kobe, regarded as 6th largest cargo port in the world was effectively shut down. Access points to Port Island and Rokko Island was interrupted and the area experienced widespread soil liquefaction. The two nearby airports that lies 10–30 kilometres away from the epicentre didn't sustained much damages.

The intense shaking and extensive inundation from the tsunami severely damaged transportation facilities in eastern Japan. There were 2,206 sites where damages on roads and bridges are reported as of April 13, 2011(NPA, 2011). In the immediate aftermath of the disaster, 15 highway routes, 171 segments of national roads, 540 segments of prefectural roads were closed.[64] The Tohoku Jukan expressway connecting Tokyo to Aomori was closed down between Utsunomiya and Ichinoseki to facilitate movement of emergency vehicles. Besides, many national and local roads sustained damages of varying degrees.

[63] It is a phenomenon where strong earth tremors cause sandy soil to behave like liquid.
[64] Funabashi and Takenaka (2011), pp. 26.

Damages of varying degrees were reported from seven segments of the East Railway Company lines, i.e., the Hachinohe, Yamada, Ofunato, Kesennuma, Ishinomaki, Senseki and Joban lines along the Pacific coast. Sixty-two of the 70 railway lines run by the East Japan Railway were affected and 23 railway stations and seven lines were completely destroyed.[65] The Tohoku-Shinkansen services were suspended immediately after the disaster but resumed service by the late April only.

After the earthquake, all ports in Japan were closed down for a short time. However, 11 major ports on the Pacific coast of Tohoku were paralysed due to damages to their cargo handling machinery, breakwaters, berthing facilities. These ports accounted for 7% of all domestic cargo and 3% of Japan's foreign trade.[66] The long sea-walls, breakwaters, dikes, levees etc. could not protect the coastal areas against the fury of the giant tsunami. Waterways and anchorage areas were covered with massive floating debris of containers, vehicles swept away by the tsunami. This devastation of ports caused stagnation of both logistics and industrial activities and had a negative impact on the residents' lives and economy.

The giant tsunami also caused damages of varying degree on airports located along the coastal areas of Tohoku region. The images of Sendai airport runways, taxiways and aprons covering with tons of debris after being swept away by the tsunami is very clear and was rendered inoperable. Besides, Hanamaki Airport, Ibaraki Airport, Fukushima Airport also sustained varying degrees of damages.

(c) Utilities and lifeline services

The two disasters - the 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake, disrupted the operation of utilities and lifeline services throughout the impact region. The intense shaking caused damage to the water purification plants and pipes leading to water leakages, shortage of potable water for most part of Kobe, Ashiya and Nishinomiya during the 1995 disaster.

[65] Okada, Norio and others (2011), pp.36
[66] Funabashi and Takenaka (2011), pp. 27.

The household gas supply also sustained extensive damage in its underground pipe network causing curtailment of gas supply to household. The general residents of the impact region were being informed to prepare for a situation of no gas supply for about two months as the damaged pipes needed to be fixed. This inconvenienced the disaster survivor as they had to endure the harsh winter cold.

Electric supply was disrupted to many households as there was extensive damage to overhead distribution poles in the worst affected region during the 1995 disaster. The disruption in telecommunication services was mainly due to damage to underground cables. However, the damage was not very severe and the reduction in service was low. There was network congestion due to people calling to affected areas simultaneously. The following Table gives comparison of the magnitude of damage to lifelines.

Table 3.6 Comparison of the magnitude of damage to lifelines.

Category	1995 Kobe earthquake	2011 GEJE
Water	1,270,000 households	1,800,000 households in 19 prefectures
Gas	845,000 households	440,000 households in Iwate, Miyagi, Fukushima, Ibaraki prefectures
Electricity	2,600,000 households (including northern Osaka)	8,914,246 households*
Telecommunication	285,000 lines (switch boards) 193,000 lines (subscriber)	1,000,000 (approx.) subscribers of NTT 14,800 mobile phone base stations

Source: Cabinet Office, Funabashi and Takenaka (2011).

(Note: * it is inclusive of the TEPCO, Tohoku Electric Power Company and the Hokkaido Electric Power Company's subscriber.)

The 2011 Great East Japan Earthquake affected normal water supply in 19 prefectures but mostly in the prefectures of Iwate, Fukushima, Miyagi, Aomori, Akita,

Yamagata, Ibaraki, Tochigi and Chiba.[67] There was difficulty in accessing potable drinking water by the disaster survivors. The supply of pipe natural gas was also disrupted in many disaster impact prefectures as the automatic switch disconnected itself after the intense shaking. Besides, there were damage to gas pipelines due to inundation, soil liquefaction and intense ground shaking.

The supply of electricity was severely affected due to closing down of nuclear power plants after the accident at Fukushima-Daiichi run by TEPCO. The power company resorted to *'rolling blackout'* and urged the residents to use power economically. Even hospitals were not exempted from 'rolling blackout' that it greatly disrupted the functioning of hospital emergency services.

In the telecommunication sector, landline subscribers of the Nippon Telegraph and Telephone Corporation (NTT) were cut off due to extensive damage on the underground telephone cables. Besides, around 14,800 mobile phone based stations remained out of operation after the disaster.[68] This already compounded the suffering of the survivor and hampered rescue and relief activities due to communication breakdown.

(d) Health

Hospitals and other health infrastructure sustained considerable damages during the 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake. Healthcare services were greatly affected due to collapse of hospital buildings, damage to hospital equipments and facilities, shortage of drugs etc. The absence of independent source of supply for gas, water, electricity at hospital impeded the normal delivery of medical services.

During the 2011 Great East Japan Earthquake, hospitals sustained considerable damage. In the three severely affected prefectures of Iwate, Miyagi and Fukushima, 11

[67] Funabashi and Takenaka (2011), pp. 37.
[68] *Ibid* no. 67, pp.28.

hospitals buildings were totally destroyed while 296 others sustained partial damage.[69] This greatly hindered the delivery of emergency medical services during the disasters.

3.2.3 Economic Impact

The 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake had a profound paralysing effect on the economy of the worst affected regions. The 1995 earthquake crippled the economy of Kobe city in a way that had no previous precedent. The massive destruction to the region's transport networks, structural damages sustained to lifeline services as discussed before greatly impacted the industries and business activity. Various industries from manufacturing to commercial to service industries centered in the affected area sustained huge economic loss of varying degree. Damage to the capital stock in Kobe city alone was approximately 7 trillion JPY.[70]

Large industries like the steel industry, ship industry etc. suspended production lines due to damage to buildings. As a result, many large companies relocated some of their business functions to other areas. For example, Kobe Steel Limited relocated its high blast furnace and processing division to Kawasaki city; Kawasaki Heavy Industries Ltd. relocated its commercial ship construction division to Sakaide City and Sumitomo Rubber Industries Ltd. shut down their plants in Kobe.[71]

Besides, in small and medium sized industries, 95% of the 418 companies belonging to the Society of Machinery and Metal Corporations in 1994 were damaged by the earthquake.[72] The hybrid shoe industry suffered damage to the tune of 300 billion JPY as about 80% of shoe factory buildings collapsed or were partially or totally burned down.[73] More than 50% of sake breweries based around Kobe city collapsed partially or totally.[74] The massive earthquake also affected one-third of all shopping malls in the city.

[69] Funabashi and Takenaka (2011), pp. 28.
[70] City of Kobe (2010), 'Comprehensive Strategy for Recovery from the Great Hanshin-Awaji Earthquake', pp. 49.
[71] *Ibid* no.70, pp. 50.
[72] *Ibid* no. 70, pp. 50.
[73] *Ibid* no. 70, pp. 51.
[74] *Ibid* no. 70, pp. 51.

The closing down of Kobe port which handled about 12% of Japanese exports is very damaging. According to Tokai Research and Consulting Corporation, the economic damage sustained during the 1995 disaster amount to around 1.6% of Japan's Gross Domestic Product (GDP). The earthquake is estimated to have cause damage of about 9.9 trillion JPY (Edgington 2010:11).

The negative economic impact of the 2011 disaster was compounded due to various factors like mass evacuation, nuclear meltdown, reduction in power supply etc. The three severely affected prefectures - Iwate, Miyagi and Fukushima accounted for about 6% to 7% of Japan's GDP.[75] An official release of the Cabinet office on 23 March 2011, estimated the cost of damage to range between 16 trillion - 25 trillion yen. According to Development Bank of Japan, Tohoku Branch Office, estimate the four prefectures - Iwate, Miyagi, Fukushima and Ibaraki sustained a total economic damage of 16373 billion JPY.[76]

The greater impact of the 2011 GEJE on production is due to various reasons. Large companies like Hitachi (equipment for power plants), Renesas Electronics (semiconductors), Sony (electronics) and NEC (electronics) had suspended operations at some of their plants in the disaster affected area. The factories in the disaster stricken areas produced hard to replace integral parts and materials that were critical to supply chains. As of March 2011, all 12 automakers in Japan stopped production at some of their plants temporarily.[77] Auto parts manufactured in this region were also supplied to other manufacturing centres in China, South Korea, Thailand, Vietnam etc. Besides, the power generating facilities of Japan had decreased owing to the nuclear meltdown at Fukushima-Daiichi Nuclear Power Plant. In the short term, the impact of this supply side constraint was severe but it gradually subsided as various recovery measures were initiated.

[75] Nanto, Dick K. *et.al*. (2011), '*Japan's 2011 Earthquake and Tsunami: Economic Effects and Implications for the Unitedd States*', April 6, pp. 6.
[76] ADRC, Great East Japan Earthquake: Preliminary Observations, May 2011, pp. 6
[77] *Ibid* no. 75, pp. 6.

Most of the severely affected prefectures hosted predominantly agricultural, fishery, marine farming and marine product industries. The five worst affected prefectures - Aomori, Iwate, Miyagi, Fukushima and Yamagata - account for about 17% of all cultivated farmland in Japan; 21% of Japan's total fisheries and aquaculture production by volume; 17% of agricultural all output by volume.[78] Besides, the disaster affected areas also produced vegetables, soybeans, rice and livestock. The damage to these industries dealt a crippling blow to the local economy in particular. Around 250 fishing ports on the coasts of Iwate and Miyagi Prefectures were destroyed completely.[79] Agriculture, too, was affected due to inundation during tsunami that rendered the soil saline. Given these profound damages, the recovery and regeneration of the economy should be fast tracked. The following Table 3.7 gives a comparison of the economic damages sustained during the 1995 Kobe Earthquake and the 2011 GEJE.

Table 3.7 Comparison of Economic Damage between the 1995 Kobe Earthquake and the 2011 GEJE

	1995 Kobe earthquake	2011 GEJE
Buildings (housing, offices, plants, machinery etc.)	6.3 trillion JPY (approx.)	10.4 Trillion JPY(approx.)
Lifeline utilities (water services, gas, electricity, communication and broadcasting facilities)	0.6 trillion JPY (approx.)	1.3 trillion JPY (approx.)
Social Infrastructure (river, road, harbours, drainage and airport etc.)	2.2 trillion JPY (approx.)	2.2 trillion JPY (approx.)
Others (including fisheries, agriculture, forestry, healthcare and welfare facilities, education facilities etc.)	0.5 trillion JPY (approx.)	3.0 trillion JPY (approx.)
Total	9.6 trillion JPY (approx.)	16.9 trillion JPY (approx.)

Source: Cabinet Office

[78] *Ibid* no.75, pp.14.
[79] Funabashi and Takenaka (2011), pp. 55.

From the above table, it is clear that economic impact of the 2011 GEJE is more severe than the 1995 Kobe Earthquake. There is difference in the nature of devastation suffered during the two disasters. The 1995 earthquake happened in a heavily industrialised urban area and the damage due to the collapse of buildings account for maximum percentage of the total damage. However, the share of the damage to agriculture, fisheries, healthcare, and forestry etc. is very less as it happened in an urban environment. On the other hand, damage to physical infrastructure accounts for a large share of the total economic damage. But the impact on the agriculture, fisheries, forestry etc. is very high as the disaster occurred in a predominantly rural region. Due to the nuclear accident many countries like US, EU, Australia, South Korea, China, Hong Kong, Singapore, India and Canada increased surveillance on food imports from Japan produced in the disaster affected areas especially food grown in Fukushima due to fear of radioactive contamination. These had adversely impacted the economy of the Tohoku region and Japan in general.

3.2.4 Nuclear Meltdown

The 2011 disaster took a debilitating toll on human life and property that it is regarded as a great tragedy. However, the nature of the tragedy was transformed after the meltdown at Fukushima-Daiichi Nuclear Power Plant. Japan faced a 'complex disaster'[80] that it had never experienced before and they hadn't imagined that such a disaster could happen. This was a world's first combined earthquake, tsunami and nuclear plant disaster that are also referred to as the 'triple disasters'. The damage and later release of large amount of radiation into the ocean water magnified the severity of the disaster.

A total of 15 nuclear power plants are located on the Pacific coast of east Japan, in the Tohoku and Kanto regions. The nuclear meltdown occurred at the TEPCO's Fukushima Daiichi Nuclear Power Plant. Of the six reactors at the plant, Units 1, 2, 3 were in operation at the time of the earthquake while units 4, 5 and 6 had been shut down before for regular maintenance. After the 9.0 Mw magnitude earthquakes occurred at 2:46 pm (JST) on March 11, 2011, the nuclear reactors and the turbines of Units 1, 2 and

[80] According to Randolph C. Kent, a 'complex disaster' is one where one disaster agent exposes vulnerabilities which open the way for the impact of other disaster agents.

3 stopped automatically. The intense shaking caused the collapse of steel towers which caused damage to electrical grids thereby cutting off external power supply.

The emergency diesel generators at the plant started up automatically. However, due to the giant tsunami that hit the plant around 3:41 p.m. (JST), all the emergency diesel generators at Units 1 through 4 were disabled and later diesel oil tanks were swept away. This cut off all AC power supply and operation continued on battery power only.

The power cut-off led to the failure of cooling system in the reactors and pools where fuel rods were stored. This lead to excessive increase in temperature of the fuel rods, and the zirconium in the zirconium alloy fuel cladding tubes reacted with the water, producing large quantities of hydrogen. On March 12 at 3:36 p.m. (JST) a hydrogen explosion occurred inside the building housing the nuclear reactor blowing the building apart at Unit 1. Radiation leakages were notice from Unit 2 and 3. There was hydrogen explosion at Unit 4 on March 15 that further compounded that disaster. The amount of radioactivity released into the atmosphere and in radioactive water at Fukushima-Daiichi plant was equivalent to level 7 event according to International Nuclear Events Scale (INES) provided by Nuclear Energy Agency (NEA).

Map 3.4 Fukushima-Daiichi Nuclear Power Plant before and after the meltdown.

In response to this tragedy, government ordered evacuation of residents within a radius of 3 km from the plant and advised those living within a radius of 10 km to stay indoor on March 11 evening. On March 12, due to explosion at reactor 1, evacuation

order was issued for residents living within a radius of 20 km. This nuclear event was unprecedented and government found itself incapable of handling it effectively.

The Fukushima-Daiichi Nuclear Power Plant had major impact on residents and compounded the suffering of the people overall. Over 100,000 residents had to evacuate, of which 78,000, were those living in cities, towns and villages within the 20 km radius exclusion zone (Funabashi and Takenaka 2011:180). Many who stayed back face the risk of exposure to radiation and danger of the accident escalating. The nuclear accident caused the loss of livelihoods, families, properties, homes. Besides, the predominantly agricultural, livestock and fisheries industry of the region had been damaged.

Many people were unable to return home for years given the extent of the devastation that occurred. The impact of the Fukushima-Daiichi Nuclear power plant were felt on other parts of Japan where 'rolling blackout' were imposed after the reduction in the generation capacity of power. This accident also incited people's concern about the safety of nuclear power plant and domestic opinions were against nuclear power plant. But the question that arises is - can Japan altogether do away with power generation from nuclear power plant given its current share in total power generation capacity of the country?

The tsunami and nuclear meltdown during the Great East Japan Earthquake is a major point of difference from the 1995 Kobe Earthquake. Kobe Earthquake (1995) was a single disaster in mainly urban areas while the Great East Japan Earthquake was a complex crisis where one incident causes the outbreak of the other. The way government handled the nuclear accident was criticised by all. What complicates the matter is that Japan had never expected that such kind of intense disaster would occur and they were found to be unprepared. The response of government will be discussed later.

3.2.5 Tourism

The Great East Japan Earthquake also impacted the inflow of tourism in Japan. There was a marked increase in outflow of foreigners after the disaster. Around 157,000

foreigners[81] visit Japan one week before the earthquake. This was reduced to 58,000 i.e., decline of two-third (approx.) tourists and further decrease to 51,000 tourists two weeks after the disaster.[82] In the following weeks, however, the number began to increase to around 358,000 in May. But, this represented a drop of 50.4% as compared to May 2010 according to Japan National Tourism Organization (JNTO).[83] The main factor behind the exodus of tourists was the nuclear accident at Fukushima and the general fear of spread of radioactivity contamination. Even the foreign embassies announced 'travel advisory' to its citizens who planned to visit Japan when the disaster struck.

3.3 Emergency Response System

The response of government immediately after the disaster is crucial in minimising the impact of disaster. The national and local governments need to quickly collect and disseminate disaster and damage information and secure communications to enable to carry out search and rescue operations promptly and effectively. Depending upon the degree and extent of devastation, local and national governments may set up their own Emergency disaster management headquarters to facilitate coordination in relief and rescue activities.

Japan has well defined emergency response mechanism. In the hierarchical 3-tiered structure, municipality government is the first responder immediately after a disaster struck. If the extent and degree of the devastation is large, then municipality government can request the Prefectural government for support and assistance. When the disaster is beyond the capacity of the local and prefectural government to handle it effectively, then national government came into the picture providing manpower, resources and coordinating the rescue and relief operations as seen during the 1995 and the 2011 earthquakes.

This 'bottom-up' approach is premised on the belief that disaster wouldn't exceed beyond the boundaries of a prefecture. This was true until the devastating 1995

[81] Funabashi and Takenaka (2011), pp. 103.
[82] *Ibid*. no. 52, pp. 103.
[83] *Ibid.* no. 52, pp. 103.

Kobe Earthquake. This disaster clearly revealed the weakness and failure of this 'bottom-up' approach that give primary emphasis on the role of local municipal government. The municipal government was found to be understaffed, not properly trained; lack expertise and many of them also become victim in the disaster. Enhancement of disaster response capacity of local government should be encouraged but in the case of mega natural disasters, the decentralised or 'bottom-up' approach is not effective. This model only burdens the local government and delay quick response to disaster.

Against this backdrop, the 'top-down' approach where the national government, at whose disposal are the resources and manpower, should take the lead in the responding to mega-disasters. It would help to save precious time lost in sending request from municipal to prefectural, to national government. Besides, the national government could facilitate inter-agency, inter-ministerial co-ordination faster. Analysing the response of government to the 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake would demonstrate the need for an integrated 'top down' approach in handling mega-natural disasters.

3.3.1 Response of Japanese Government to the 1995 Kobe Earthquake

The 1995 Kobe Earthquake was a significant turning point for disaster management in Japan. The 7.2 Mw intense earthquake caused massive death and destruction in an urban environment with dense population. The local government was caught unprepared. The magnitude and extent of the damage far exceeded the prediction and preparation that the local disaster management authority had earlier practised for. People had been lulled into a false sense of security by the advancement in earthquake engineering technology, relative absence of major disasters in a long time and the general prediction that Kansai region is not likely to be hit by a major disaster.

Immediately after the disaster struck, the local Disaster Management Headquarter was established and immediate actions were directed towards rescue and fire fighting operations. The local Disaster Management officials - fire brigade police,

workers etc. were unable to get a real assessment of the degree and extent of damage. This was due to the breakdown of transport and communication networks. Roadways and highways were filled with debris and communication was affected due to damage to underground telephone cables. The local government especially the worst affected city of Kobe was paralysed as the devastation was beyond the capacity of the local administration to handle in terms of personnel, equipment, expertise and resources. One major mistake was the late request for assistance to prefectural and national government.

The clumsy and delayed response of the central government was also heavily criticised. The central government didn't respond immediately unlike during the 2011 Great East Japan Earthquake. This was mainly due to lack of information on assessment of the extent of devastation from the local officials. The first cabinet meeting was held around 4 hours after the disaster struck. As the extent of damage became clearer, the central government established the Major Disaster Headquarter to coordinate and assist relief and rescue operation. However, precious time was lost which could have been utilised to mobilise resources and personnel to begin rescue operations on a war footing.

The coming of the central government with resources and expertise could bring some semblance of order in the immediate response activities. Even then these was not very effective and prompt as is expected when faced with a disaster of the scale of 1995 Kobe Earthquake, due to bureaucratic jurisdictional issues and absence of clear lines of authority. Each agency jealously guards their jurisdiction and is cautious not to tread into others turf. This inflexible bureaucratic approach hampered smooth coordination when required at critical time. In this context the need for a centralised 'top-down' approach with well-defined chain of command and responsibilities like the US Federal Emergency Management Agency (FEMA) is a must for a country like Japan that faces major disaster regularly.

Another cabinet level group, Emergency Countermeasures Headquarters was set up on 19th January to facilitate response and recovery activities. The local disaster management officials engaged in rescue and evacuation along with the personnel from other prefectures. They were also engaged in clearing the debris to facilitate smooth

movement of emergency services and to restore communication to enable to undertake relief and rescue operations.

However, the unprecedented nature of the disaster and the extent of damage on transportation system, telecommunication, lifeline services, mass evacuation, and temporary shelter proved to be beyond the capacity of the local government.

The delayed mobilisation of Self Defence Force (SDF), even when the magnitude of devastation was apparent, was widely criticised. The SDF came into the picture around 24 hours after the disaster. Had they came earlier, the rescue operations could have been more effective and helped save lives? Given the shortage of personnel at local level, the participation of SDF would have strengthened the response capacity of the local government. There was shortage of food, potable water, sanitation, blankets and warm clothing for at least the few days after the disaster. There was lack of evacuation centers and temporary shelters were set up in public parks and buildings.

The massive devastation due to the earthquake led to massive outpouring of volunteers. The response of volunteers will be discussed in next Chapter. Here the problem of coordination and communication gap is very clear. Lack of information led to the presence of excess volunteers and relief materials at some place while shortage of men and materials at other place. This could have been avoided had there been an effective Integrated Disaster Management Information System for early assessment and information sharing among relevant organisations.

On the medical front, the damaged to many hospital buildings, equipments, machines, medicines affect the delivery of emergency medical services. As the local government was paralysed, systematic coordination of medical assistance couldn't be established immediately after the disaster. Besides, there were lesser healthcare personnel but the number of victims that required medical attention was very high. In some wards of Kobe city, health centres conducted 'the roller operation' through which public health nurses and other health experts screened the medical care of evacuees especially the

elderly and critically injured ones.[84] Besides, they also provide counselling and took measures to prevent outbreak of chronic diseases.

3.3.1 (A) Recovery and Rehabilitation after 1995 disaster

After having suffered a major disaster, the government both local and national took pro-active role in rehabilitation to enable the victims to come back to normal pre-disaster life. There are many facets of post-disaster reconstruction where one thing leads to the other. Reconstruction of individual lives and of the wider community is closely related, as are material and psycho-spiritual reconstruction.[85] "The objective of promoting the recovery and reconstruction of a disaster-stricken area is to aid victims to return to normal life, restore facilities with the intention of preventing disasters in the future and implementing fundamental development plans that focus on safety in the community. In view of the decline in social activities in a community following a disaster, recovery and reconstruction measures are conducted as swiftly and as smoothly as possible" (Cabinet Office, Government of Japan).

Within a month of the disaster, the Headquarters for Reconstruction of the Hanshin-Awaji Area was set up under the leadership of Prime Minister Tomiichi Murayama, to expedite the process for recovery and rehabilitation of the disaster affected people. All the Cabinet members are part of the Headquarter for Reconstruction of the Hanshin-Awaji Area. The 'Committee for the Reconstruction of the Hanshin-Awaji Area' having consultative status was asked to submit recommendation and set guidelines for reconstruction. The housing sector recover steadily, over a seven month period 50,000 temporary housing units were constructed and after three years, the number of housing unit built was 150,000[86] i.e. which is more than the number of damaged houses. This increase in housing units is mainly because of public support for housing and spurt in private sector housing construction. The disaster evacuees moved from temporary shelter to emergency housing and finally to permanent housing. The reconstruction of housing sector took longer as compared to recovery lifeline and utility services.

[84] Kunii, Osamu (1995)
[85] Murosaki, Yoshiteru (2007), pp. 330.
[86] Koshiyama, Kenji (2007), pp. 335.

Though lifelines and utility services sustained massive damaged in the earthquake, they could be recovered quickly due to untiring efforts of engineers, officials, technicians who work round the clock. Electric power was restored within 6 days; telecommunications took14 days; water supply recovered in 90 days and city gas network was restored in about 90 days.[87] Temporary restoration of sewer and sanitation took 93 days.

Besides, restoration works on physical infrastructure - roads, railways, ports were started on war footing immediately after the disaster as faster movement of relief materials was required. Roads and railways were restored within seven months and were repaired in the next fourteen month. The massive damage on physical infrastructure due to the intense earthquake led to the overall re-evacuation and retrofitting with strict seismic codes began. This investment on pre-disaster structural mitigation measures proved effective as physical infrastructure sustained less damages due to earthquake in the 2011 disaster.

However, recovery of industry especially chemical, synthetic leather, shoe, steel sector that centred on the severely affected area took longer to recover. Government provided many tax incentives, schemes to re-invigorate the disaster damage industrial activity.

3.3.1 (B) Major Changes Implemented after the 1995 Kobe Earthquake

The 1995 Kobe Earthquake dealt a heavy blow to Japan's disaster management system. In a sense, it was a watershed event for disaster management and education in light of the various changes that had been implemented to strengthen the capability of the system to handle major disaster effectively. This disaster made people realised that excessive reliance only on technology is not effective but government has to invest on pre-disaster mitigation measures - both structural and non-structural - to effectively counter the impact of natural disasters.

[87] Suganuma, Katsutoshi (2006), pp. 95.

1. Headquarters for Earthquake Research Promotion (HERP)

The Special Measures Law on Earthquake Disaster Prevention was enacted on July 18, 1995. This law established the HERP in the Prime Minister's Office to undertake comprehensive research on seismology. The HERP's business was administered by Science and Technology Agency (STA) but now by MEXT.

The HERP has been tasked to carry out the following work:

i. Formulation of comprehensive and basic policies;

ii. Co-ordination of administrative works of relevant Ministries;

iii. Formulation of comprehensive survey and observation plans;

iv. Collection, analysis and evaluation of the results of surveys and observations; and

v. Public relations based on the comprehensive evaluation of the most recent observations.[88]

2. Wide Area Support System

Against the backdrop of the 1995 Kobe Earthquake experience where the local government found itself short of resources and manpower to handle major disasters. Various wide area support mechanisms that transcend the boundary of municipal or prefectural government were established. The Inter-prefectural Emergency Rescue Unit of NPA, Emergency Fire Rescue Team of FDMA and Japan Coast Guard (JCG) are available for deployment if requested by governor of the affected prefecture. Besides, disaster Medical Assistance Teams (DMAT) was established to provide emergency medical services in disaster stricken areas.

3. Building Codes Revised

The Seismic Rehabilitation Promotion Act for Existing Buildings was established where it promote assessment and strengthening of old houses with new disaster resistant

[88] Katayama, Tsuneo (2006), pp. 14.

technology. Against the experience of Kobe Earthquake, this revision of building codes is significant as it will help to avoid repeat of Kobe disaster in future. Many municipal governments provide financial incentive to those who want to strengthen their houses. This results in less damage to buildings during the 2011 GEJE.

4. Bridges Retrofit Program

Post 1995 disaster, there was renewed thrust on the part of government to strengthen highway bridges with retrofitting or new designs enabling them to sustain future major disasters. The bridges were examined and strengthened with anti-seismic technology. The result of this measure was visible during the 2011 Great East Japan Earthquake where we see minimum damage to bridges as the capacity to withstand earth tremors was strengthened.

5. The Disaster Victims Livelihood Recovery Support System

It was established based on the Act on Support for Livelihood Recovery of Disaster Victims enacted in 1998 after the 1995 Kobe Earthquake. Under this system, a 'livelihood recovery support payment for disaster victims' is distributed to persons whose livelihoods are seriously harmed by disasters. This system sought to support quick recovery of disaster victims back to normal lives.

6. Institutional arrangement

After the bitter experience of 1995 Kobe Earthquake devastation, Cabinet Information Collection Centre and Cabinet Crisis Management Centre was created headed by Deputy Chief Cabinet Secretary. The Cabinet Information Collection Centre runs 24×7 monitoring and collecting disaster information. Besides, in January 2001, the Minister of state for Disaster Management was created to oversee inter-ministerial planning and coordination.

Besides, the Science and Technology Agency (STA) were merged with Ministry of Education and Sports to become Ministry of Education, Culture, Sports and

Technology (MEXT). NIED became an autonomous unit within the frame work of MEXT. The disaster management function of National Land Agency (NLA) was transferred to the Cabinet office in 2001.

7. Disaster Education and Awareness

After the 1995 Kobe earthquake shattered Japanese belief in them being 'safe and secure', there is greater impetus to disaster education to make children, public aware of the danger of disaster and how they have to behave in disaster situations. There are regular disaster drills, poster competitions etc. to make the people prepared for any disaster. This awareness is reflected in the way the Japanese respond to the above two disasters.

After the 1995 Kobe earthquake, the Disaster Countermeasures Basic Act 1961 was reviewed and revised. Today the Prime Minister can mobilise Self Defence Force (SDF) without any request from local governor if it is a major disaster. This reflects the need for a strong integrated flexible 'top-down' approach to disaster management where the disaster assumes devastating proportions and it transcends prefectural boundaries. The effectiveness of this change becomes clear when the national government could respond to the 2011 Great East Japan Earthquake swiftly and can mobilise resources and manpower very fast.

3.3.2 Response of Government to the Great East Japan Earthquake

The 9.0 Mw earthquake on March 11, 2011 wreaked havoc over a large swathe of area on the Pacific coast of Tohoku region extending from Aomori to Chiba prefectures. Many termed the Great East Japan Earthquake as a '*complex inter-related crisis*' where one incident caused the other, having ripple effects. This disaster was unprecedented in terms of the intensity and magnitude of hazard as well as the devastation it caused. This disaster caused unprecedented loss of life, damage to infrastructure, power shortages over a large swathe of the country, breakdown of in transportation and communication networks, inundation of large swathe of Pacific coastal

areas. This made the effort of response and recovery very daunting and complex thus posing unprecedented challenges to emergency response agencies.

The Disaster Countermeasures Basic Act (DCBA) designates the municipal and prefectural government as the first respondent to disaster. Only when they could not handle the national government come into the picture. However, during the Great East Japan Earthquake many of the municipal government buildings were seriously damaged and local government officials became victims thereby paralysing their response capacity. The absence of single ministry or agency that took the lead in emergency response unlike FEMA of US hampered fast and smooth operation of relief and rescue activities on a large scale.

Unlike during the 1995 Kobe Earthquake , the national government under the leadership of Prime Minister Naoto Kan responded swiftly by convening the Emergency Response Team at 2:50 p.m. JST. They began to collect information regarding the extent of damage through the Cabinet Information Collection Center from all over Japan on a 24x7 basis. Heads of different relevant ministries and agencies gathered at the Cabinet Crisis Management Centre to analyse the emerging situation as preliminary assessment of the unprecedented scale of the disaster became clear. Government established the Extreme Disaster Management Headquarter (EDMH) for the first time in the history of Japan to enable government to mobilise resources and direct activities towards emergency response at 15:14 pm JST. In the first meeting of the Extreme Disaster Management Headquarter (EDMH) held at 15:37 p.m. JST, it adopted Basic Policy on Response to the Disaster which outlines the priorities for emergency disaster response. They are:

i. Making every effort to collect information and grasp the extent of the damage;
ii. Putting priority on saving people's lives by taking the following steps

    • Despatching Self-Defence Force (SDF), mobilising the Wide Area Support Systems' of NPA, FDMA, DMAT to disaster stricken areas from all over Japan to the maximum extent;

• Doing the best to secure important routes to facilitate transport of emergency personnel and supplies;

• Securing air-traffic over disaster stricken areas and around them by issuing NOTAM (Notice to Airmen) when necessary and cooperating with relevant organisations to facilitate emergency search and rescue operations;

iii. Making every possible effort to recover lifelines and utilities (gas, water, power, communications etc.) and transport facilities;

iv. Strengthening the nationwide support system through public-private collaboration in securing supply of emergency medicines, food, water, other daily necessities etc;

v. Providing accurate information to disaster stricken areas to enable them to make appropriate decisions and actions.[89]

Government despatched Inspection Team to Miyagi Prefecture, which sustained maximum devastation, at 18:42 p.m. JST on March 11. The government established Local Headquarters for Extreme Disaster Management in Miyagi Prefecture on March 12 given the extent of damage there. Besides, Inspection teams were also sent to Iwate and Fukushima on March 12. The EDMH also decided to supply disaster relief goods worth 30 billion JPY.[90] Government liquidate reserve funds to facilitate purchase of emergency relief goods.

The swift mobilisation of resources and manpower through the 'Wide Area Support System' enabled the government to expedite the search and rescue operations besides diverting manpower to clear roads and restore communication networks. In line with the Basic policy on response to the disaster, the government could mobilise 85,000 personnel from National Police Agency; 7577 Emergency Fire Response Team of 28,620 personnel from Fire and Disaster Management Agency; the Japan Coast Guard despatched a total of 10314 ships, 3276 aircraft and 2492 personnel and the Ministry of

[89] Koresawa, Atushi (2012), pp. 109.
[90] ADRC (2011), '*Natural Disaster Report – 2011 Tohoku Pacific Ocean Earthquake'*, Vol. 01, March 30.

Defence Force.[91] This quick mobilisation and despatching of personnel at disaster sites rescued 27,157 lives.[92] These efforts of the personnel from various agencies are being complemented by volunteer participation and assistance from foreign countries especially the USA.

The Self Defence Force personnel were engaged in search and rescue as well as clearing transport routes, logistics supply, and care and shelter operations. The Emergency Fire Response Teams were engaged in search and rescue, recovering efforts. The Inter-prefectural emergency police units were also engaged in evacuation guidance, transport of injured people, search and rescue, victim identification and patrolling activities. Crime rates in disaster stricken areas were low and this reflects the mentality of Japanese society.

A total of 193 Disaster Medical Assistance Team were despatched to the disaster stricken areas.[93] DMAT is a specially trained group of doctors, nurses and operational coordinators that deliver emergency medical services during super critical period of 48 hours after a large scale disaster or accident. The need for DMAT was felt after the 1995 Kobe experience where many lives could have been saved if prompt emergency medical services were given.

Personnel of Technical Emergency Control Force (TEC-Force) also contributed in disaster response. The TEC-Force is specialised group of employees of Ministry of Land, Infrastructure, Transport and Tourism (MLIT) deployed to disaster stricken areas helping in areas of damage assessment, technical help for recovery and response activities.

These combined efforts of the various ministries and agencies helped to expedite the search and rescue and relief activities and saved lives. Despite these best of efforts, however, the Japanese government was criticised for being not very effective. There were shortage of temporary shelters, fuel, sanitary napkins and the condition of the vulnerable section of the population - elderly person, women, children, and disabled persons - are

[91] Koresawa, Atushi (2012), pp. 109.
[92] *Ibid* no. 91, pp. 109.
[93] *Ibid* no. 90, pp. 2.

not better. But one has to bear in mind that this was an unprecedented disaster unparalleled in the history of Japan.

The Extreme Disaster Management Headquarters established the 'Headquarters for Special Measures to Assist the Lives of Disaster Victims' (afterward renamed 'Team in charge of Assisting the Lives of Disaster Victims' on May 9, 2011). This body seeks to assist disaster victims in coordination with other organisations through various measures:

i. solving the problem of isolated emergency shelters;

ii. supplying disaster stricken areas with emergency supplies;

iii. recovering lifelines;

iv. providing temporary housing;

iv. disposing of debris.[94]

The initial response after the Great East Japan Earthquake bears resemblance to centralisation of disaster management where the prime Minister through the Extreme Disaster Management Headquarter oversees the overall response operations. It mobilises personnel from different ministries and agencies without waiting for request from prefectural government. This enables swift and effective response as compared to government response during the 1995 Kobe Earthquake.

3.3.2 (A) Recovery and Rehabilitation after the disaster

The government faced the daunting challenge of rehabilitation and recovery of disaster stricken population and rejuvenation of economic activity in the disaster afflicted areas. The rehabilitation work began immediately after the disaster by concerned organisations which was subsidised heavily by the central government under the National Government Defrayment Act for Reconstruction of Disaster Stricken Public Facilities (1951). Monetary aid and employment support initiative called "Japan as One" were launched in the aftermath of the disaster.

[94] Koresawa, Atushi (2012), pp. 110.

To expedite recovery of the disaster stricken areas, government established the Reconstruction Design Council by a cabinet decision on April 11 in response to the GEJE. The Reconstruction Design Council (RDC) was mandated to formulate a reconstruction plan that would serve as guidelines for reconstruction of areas affected during the Great East Japan Earthquake. The Council consist of scholars, professionals and governors of the respective disaster stricken local authorities. Dr. Makoto Iokibe, president of the National Defence Academy is appointed as Chairman. The Reconstruction Design Council (RDC) came out with a report on June 25 titled "Towards Reconstruction: Hope Beyond the Disaster" to serve as guidelines for recovery and reconstruction.

The recovery and reconstruction period was estimated to last 10 years and cost 23 trillion JPY (approximately $290 bn), with the bulk of the efforts focused on the first five years.[95] The reconstruction was sought to be funded by issuing reconstruction bonds, reduction in public expenditures, increase in non-tax revenues and temporary taxation. As of February 2012, the national government had passed four supplementary budgets worth 21.9 trillion JPY ($274 billion).[96]

Based on the Basic Guidelines for Reconstruction and Basic Act for Reconstruction, the severely affected prefectures and municipalities developed their own recovery plans with greater focus on 'local communities'. The infrastructure damages are reported by local governments to the national government with a request for subsidy within ten days of the occurrence of disaster. The national government contributes two-third of the project cost and the share of the local government is covered by issuing local bonds.[97] The share of the local government decreases as the severity of the disaster increases, so during the 2011 GEJE, the share of the local government for infrastructure rehabilitation was low.

Though lifelines and utilities services sustained massive damage in the disaster, gas, electricity, water supply were restored within seven days. Besides, after the disaster,

[95] Ranghieri and Ishiwatari (2014), pp. 183.
[96] *Ibid* no. 95, pp. 183.
[97] *Ibid* no. 95, pp. 174.

radios were distributed immediately and internet and telephones services were restored in 3-7 days.

The Tohoku Regional Bureau of the MLIT launched the '*Operation Toothcomb*' on March 11 in co-ordination with Self Defence Forces (SDF), prefectural governments and local construction companies to facilitate swift clearance of strategic roads that were covered with debris after the giant tsunami. This was completed by March 18 and lead to the opening up of Tohoku Expressway and National Route 4 within a week.[98] The success of this massive clean-up operation forms the basis for later quick relief and rescue activities. Bridges that sustained damaged were repaired within one month after the disaster. The Sendai Airport in Miyagi Prefecture that sustained massive damage was made functional by March 17 and normal civilian service resumed on April 13.[99] Besides, the Tohoku Shinkansen and local railways resumed operation by 29 April 2011.[100]

The reconstruction of housing, livelihood of the affected people took longer as compared to 1995 Kobe Earthquake. Construction of temporary houses started in eight days an around 100.000 houses were constructed in the next 3 to 4 weeks (Leng 2015). As of February 13, 2014 still 267,419 victims live in evacuation centres.[101] Even the industrial activity took longer to regenerate. Given the extent of the damage, it will take long time for people to recover back to pre-disaster condition. The following Table 3.8 give the status of reconstruction of public infrastructure, agriculture and fisheries.

Table 3.8 Status of Reconstruction of Public Infrastructure; Agriculture and Fisheries after the 2011 GEJE

Category	Progress (%)	Status
Public housing development (as of Jan.2013)	37%	Land secured for 7779/20952 houses (excluding Fukushima prefecture)
Collective household relocation (as of Jan.2013)	92%	Consent of MLIT secured for 205/224 districts
Land Readjustment (as of Jan.2013)	61%	Urban planning decisions made for 35/57 districts

[98] *Ibid* no. 95, pp. 174.
[99] Funabashi and Takenaka (2011), pp. 45.
[100] *Ibid* no. 95, pp. 172.
[101] Kimura, R. *et. al*,(2014), pp.674.

Hospitals (as of Nov.2012)	90%	166/184 hospitals resumed services
School (as of Nov.2012)	81%	1876/2325 schools resumed classes
Agricultural land (as of Jan.2013)	38%	8190/21480 hectare of farming land restored
Fishing ports (as of Dec.2012)	77%	51568/67121 clear prospects of resuming business
Fish processing facilities (as of Sept.2012)	69%	567/820 facilities resumed operation

Source: Reconstruction Agency, 2013

3.4 Comparative Assessment of Response

The 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake caused tremendous devastation in Japan. However, the impact of the 1995 Kobe Earthquake dwarfs in comparison with the 2011 Great East Japan Earthquake. It is not possible to draw a definite parallel between the two disasters. However, one notices certain factors that delay the response of government to the two disasters which in turn reveal the weakness or lacunae of the Japanese disaster management system.

The response of government to the Great East Japan Earthquake was swift as compared to 1995 Kobe Earthquake. The government get early information on the magnitude and extent of the devastation. Government was better prepared during the 2011 as a result of the various structural and non-structural mitigation measures undertaken after the 1995 earthquake. International assistance was not accepted during the 1995 earthquake while international assistance complemented the rescue and relief operation of Japanese officials during the 2011 GEJE. Mobilisation of manpower through 'Wide Area Support System' was successful during the 2011 earthquake and expedited emergency response efforts of government. However, the response of Self Defense Forces was delayed during the 1995 earthquake. During the 2011 earthquake, the national government took the initiative and oversaw the response activities. This represents a marked change from the 1995 earthquake experience.

Table 3.9 Comparison of the post-disaster response of government to the 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake (GEJE).

Government Response	1995 Kobe Earthquake	2011GEJE
Quickness of Response	Delayed response due to failure to assess the extent of damage	Swift response and immediate convening of National Emergency Management Committee
Effectiveness	Not effective	More effective as national government oversee the response activities.
Inter-agency Co-ordination	No prompt and smooth inter-agency co-ordination.	Better co-ordination among various agencies handling different aspects of the relief and rescue activities.
Coordination with NGOs	No co-ordination or co-operation with NGOs, volunteers	Active engagement and cooperation with NGOs and volunteers.
Mobilisation of Resources	Delayed mobilisation and deployment of SDF (4 days after the disaster)	Quick mobilisation and deployment of SDF, EFRT, DMAT, JCG, police.

Sources: Cabinet Office (2006); Edgington 2010; MEXT 2011: MLIT 2011.

Analysing the response mechanism during the two disasters, the need for an integrated centralised 'top-down' approach to disaster management becomes clear. In both the disasters, the local government were found to be incapable and lacking in expertise, resources and manpower to handle mega-disaster. When disasters are confined to a local area, the local government could handle it well.

There is absence of a single ministry or agency unlike FEMA of USA or EMERCOM of Russia that took lead during disaster response. This creates problems of coordination among and between different agencies or ministry. This is more acute in Japan where a hierarchic structure made officials protective of their own jurisdiction.

Despite the absence of a single agency like FEMA of USA, there was better co-ordination and collaboration among the personnel at the ground level during the GEJE as compared to the 1995 Kobe Earthquake. Even with regard to co-ordination with NGOs and other civil society and volunteer groups, there was better synergy with government

officials and the role of these NGOs were acknowledged and complemented the efforts of the government in tackling the mega-disaster effectively.

So, in the face of mega-disasters, the earlier emphasis on primary role of local government as first responder is found to be ineffective. The disaster management system needs to be centralised where the national government should take the lead in coordination and operation of the disaster response.

The national government had the resources, manpower and expertise to handle mega-disaster. They should play a leadership role in responding to mega-disasters as this would make the Japanese disaster management system more effective in tackling future mega-disasters.

3.5 Disaster Prevention and Preparedness

It may not be possible to prevent the occurrence of natural disasters totally but the resultant disastrous effects can be reduced considerably though proper planning and effective preparedness. Disaster prevention and preparedness consists of a wide spectrum of measures both long-term and short-term which are designed to save lives and limit the damage to minimum. It has been noticed in the past that, if adequate attention and resources are invested in preparedness measures, the damage from natural disasters could be minimised. The classic example is Japan where its technological prowess and adequate preparedness measures enable Japan to limit the damage from natural disasters to minimum.

Japan is one of the most disaster prone countries in the world due to its unique geo-climatic location in the Pacific '*Ring of Fire*' earthquake belt. The extensive devastation suffered in the 1995 Kobe Earthquake underlined the importance of an effective and reliable early disaster warning system while at the same time revealed the weak areas in the system that need improvement. Japan is regarded as a world leader in disaster warning technology and has been sharing its experience with other countries too.

3.5.1 Early Warning Systems in Japan

The term 'early warning' implies the dissemination of advanced information of an impending disaster which may enable people to take prior action to face and minimise the damage from the disaster. Priority 2 of the Hyogo Framework for Action 2005-2015 stress the need to 'identify, assess and monitor disaster risks and enhance early warning' as the starting point for reducing disaster risk and developing a disaster resilience culture. The UN/ISDR defined early warning as 'the set of capabilities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organisations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss'.[102] These encompass the entire activities of identification, monitoring, analysis, forecasting and dissemination of warning to people.

A) Earthquake Early Warning System (EEWS)

The evolution of the nationwide Earthquake Early Warning System in Japan can be traced back to the establishment of the Headquarter for Earthquake Research and Promotion in the aftermath of the 1995 Kobe Earthquake where it initiated the construction of a dense network of seismometers covering the whole of Japan. Japan's EEWS, maintained and operated by the Japan Meteorological Agency (JMA), was launched on October 1st 2007. JMA's EEWS is a type of front-detection system in which seismometers near the hypocentre or source of the earthquake send warnings to more distant urban areas (Yamasaki 2012). The EEWS is divided into two stages: *earthquake detection* and *warning dissemination*. To determine the time and place of the occurrence of an earthquake, JMA collects data on ground movement from its dense seismic network.

Once the P-wave is detected by seismograph, the data is sent to JMA's Earthquake Phenomenon Observation System (EPOS) which determine the epicentre location (the point on earth's surface directly above the hypocenter) and magnitude of the earthquake. This data is further supported by the seismic intensity meters that predict the

[102] UN/ISDR (2009) 'UN/ISDR Terminology on Disaster Risk Reduction'

maximum seismic intensity[103]and damage radius. This increased the accuracy of the magnitude and intensity level of the earthquake. The seismic intensity data is collected from the 619 seismic intensity meters operated by JMA as well as from 3600 meters operated by National Research Institute for Earth Seismic and Disaster Prevention (NIED) and 2842 units operated by local governments (JMA 2011d).

Depending on the predicted seismic intensity value, JMA disseminate two types of warnings: *advanced notice forecasts* and *earthquake alert warnings*. If an earthquake of magnitude 3.5 or greater or seismic intensity of 3 or greater is forecast then JMA issued advanced notice to expert users about the time, estimated magnitude and seismic intensity of the earthquake. Advanced users include railway companies, apartment complexes, hospitals, schools, malls, elevator operator etc. that are pre-automated to perform emergency countermeasures.

However, if an earthquake of seismic intensity of 5 - lower or greater is expected, then JMA issued earthquake alert warnings for general public through multiple channels like outdoor loudspeakers, television and radio networks, cellular broadcasting including the J-ALERT national early warning system developed by FDMA as quickly as possible. To overcome the limitations of dissemination of warning through TV and radio networks, JMA used Short Message Service-Cell Broadcast (SMS-CB) that deliver mass text-warning simultaneously to cell phone users.

The importance of this Earthquake Early Warning System was very visible in the 2011 Great East Japan Earthquake. The JMA issued the first earthquake early warning 8.6 seconds after the detection of the first P-wave at the nearest seismic station. This warning is 15 seconds before the arrival of S-wave at Sendai, located nearest to the epicentre.[104] These 15 seconds of lead time enable people to take precautionary measures like taking shelter under desks, running out in open space, shut down of elevators, train, running car etc. before the actual ground shaking starts. The overall impact is that lesser number of people dies from collapse buildings or people getting trapped.

[103] It is the measure of the strength of seismic waves and represents the degree of shaking of ground at specified location.
[104] Yamasaki, Erika (2011), pp. 10.

Besides, the used of Urgent Earthquake Detection and Alarm System (UrEDAS) on Japan Railway network including Shinkansen (bullet train) protected the rail services from damage or accidents. At the time of the GEJE, 27 Tohoku Shinkansen trains were running including 2 at maximum speed of 270 km/hr.[105] The UrEDAS detects the P-wave and stopped the trains by cutting off their electricity supply automatically without any derailment or injury to passenger.

Tokyo Gas Company also uses a real time seismic based disaster prevention system called SUPREME since 2001 on its distribution network. Upon the detection of earthquake tremors above certain magnitude, the supply of gas into the disaster hit area was shut-off promptly thereby preventing the occurrence of fire. This is attested during the 2011 GEJE where no major fire disaster is reported despite the earthquake measuring 9.0 M magnitude and seismic intensity of 7.

This experience during the 2011 GEJE proved that investment in pre-disaster early warning system is more effective in reducing the impact of natural disasters. However, Japan's EEWS is also not infallible. One grave mistake committed during the 2011 GEJE was the underestimation of the magnitude of the earthquake. This caught many people unaware when the actual size of the earthquake hit them. Yet, in a survey conducted by JMA, over 80% of people found EEW information helpful in protecting themselves during disasters.[106]

B) Tsunami Warning System

The history of Tsunami Warning System in Japan can be traced back to the Tsunami Warning System developed for the Sanriku Coastal Area in 1941 in the aftermath of the devastation sustained during the Sanriku Tsunami of 1993. This was formally operationalized on a nationwide scale in 1952. The current Tsunami Warning System in Japan is a computer- aided simulation system, introduced in 1999 in which tsunami arrival times and heights are simulated and stored in a database for the forecasting of tsunamis after an earthquake actually occurs by referring to the stored data

[105] Funabashi and Takenaka (2011), pp. 43.
[106] Yamasaki, Erika (2011), pp.19.

(Imamura and Abe 2009). This quantitative tsunami forecasting system enables accurate prediction and dissemination of tsunami arrival times and height across the 66 districts in Japan within 3 minutes.

JMA issued two types of Tsunami forecasts: *tsunami warnings* and *tsunami advisories*. Tsunami warning is further categorised into two: *tsunami* and *major tsunami* depending on the expected height of tsunami.

Table 3.10 Content and Categories of Tsunami Forecast

Categories of Tsunami Forecast		Tsunami Height
Tsunami Warning	Major Tsunami	3m, 4m, 6m, 8m, over 10m
	Tsunami	1m, 2m
Tsunami Advisory		0.5m

Source: Ranghieri and Ishiwatari (2014)

On March 11, 2011, the JMA issued the first tsunami warning 3 minutes after the earthquake. This advanced warning enabled people to evacuate in time thereby saving lives. Besides, concerned organisations also began preparation to face the coming tsunami. However, there was underestimation of the magnitude of the earthquake and the resulting tsunami that led to delay in evacuation at many places. The JMA first issued the predicted tsunami heights ranging from 3-6 metre in Iwate, Miyagi and Fukushima prefectures which was well below the actual tsunami height. These tsunami heights were revised upwards of 10 metres in Miyagi and Fukushima but such revised warnings did not reach many people, mostly due to power outages or communication breakdown and as a result, many people drowned in the giant tsunami.[107]

The 2011 Great East Japan Earthquake exposed the limitations of technology in accurate prediction and dissemination of the magnitude and height of tsunami. This is a big lesson for the public that tsunami warnings help to make informed choices but it can't guarantee full safety. There is need to further develop technology that can accurately determine the magnitude of an earthquake and the expected tsunami height, so that public could take appropriate actions to protect themselves from the incoming disaster. Now,

[107] Koresawa (2012), pp. 522

JMA is planning to put new improved tsunami warning system all over Japan as well as using all available means of communication to avoid a situation like the 2011 GEJE in future.

3.5.2 Hazard Mapping

Hazard maps help to identify disaster prone regions and to formulate mitigating measures. In Japan, hazard maps are prepared for various hazards like earthquakes, tsunamis, floods, volcanic eruptions etc. The Hyogo Framework for Action 2005-2015 stresses the need for 'developing, periodically updating and widely disseminating risk maps and related information to decision-makers, the general public and communities at risk in an appropriate format'.[108] Under the Act on Special Measures for Earthquake Disaster Countermeasures 1995, the Prefectural governments and municipalities need to prepare hazard maps of their jurisdiction. Earthquake hazard mapping for entire Japan was completed by 2005 using the most sophisticated methods. Two types of earthquake hazard maps were prepared: *a probabilistic hazard map for Japan* and *a scenario earthquake map* in which hazard is estimated for each site by taking into account the causative faults and local seismicity (Katayama 2006). The probabilistic hazard map is used to prioritise areas for closed observations and determination of maximum seismic forces while the scenario earthquake map is utilised by local municipalities to formulate disaster mitigation policy.

By 2010, more than 80% of the prefectures had prepared tsunami hazard maps that included the expected inundation depth and extent. This maps used by local municipalities to design evacuation procedures. These developed hazard maps are displayed in public places to raise public awareness of impending disasters as well as to guide them during evacuation whenever disaster strikes.

However, it is being argued that hazard maps give a false sense of security among people and many times actual tsunamis or earthquakes exceeded the predicted level. This was evident during the 2011 Great East Japan Earthquake where the giant tsunami was much bigger than the maximum possible height given in tsunami hazard

[108] UN/ISDR '*Hyogo Framework for Action 2005-2015'*, pp.7.

maps thereby causing extensive damage. The lesson for Japan is to prepared hazard maps based on an anticipation of the largest ever possible hazard scenario in future.

3.5.3 Disaster Education

The inevitability of the occurrence of natural disasters and the limitation of modern science and technology in guaranteeing full safety against natural disasters make the role of disaster education very relevant and important in fostering a culture of disaster preparedness and resilience. The Hyogo Framework for Action stresses the 'use of knowledge, innovation and education to build a culture of safety and resilience at all levels'[109] implying that the impact of disasters can be considerably minimised if people are well informed and prepared of the disaster.

Japan excels in raising public awareness through disaster education. In Japan, earthquake education begins in kindergarten and includes a curriculum of evacuation guidelines, earthquake causes and effects, and hands on practical training (Shaw, Shiwaku, Kobayashi, Kobayashi 2004; Yamasaki 2012). Disaster education is compulsory from elementary to high school. The students are provided with pictures of earthquake damage and disaster response animations to teach them on how to react during an earthquake. Through this measure a culture of disaster preparedness was imbibed into students. The effectiveness of this measure is demonstrated in the so called 'Kamaishi Miracle' during the 2011 GEJE.

When the 9.0 M earthquake struck on March 11, 2011, students of the Kamaishi East Junior High School along with those of Unosumai Elementary School evacuated to the designated evacuation site located 700 metre from the school. As soon as they reach there, they saw a cliff collapsed then they moved further to higher ground. When they heard the roaring scream of the giant tsunami, they moved even further to higher ground thereby saving their lives. The Kamaishi miracle is attributed to disaster education and the local tradition of '*tsunami tendenko*', which means to run for one's life without caring for others in the face of tsunami.

[109] UN/ISDR '*Hyogo Framework for Action 2005-2015*', pp.6.

3.5.4 Disaster Reduction Drills and Exercises

As part of government initiative to raise public awareness and enhance disaster preparedness, regular disaster drills and exercises are held at workplace and at community level. The purpose is to help the community learn how to react immediately and appropriately when a disaster occurs. This becomes clear from the celebration of 1st of week of September every year as 'National Disaster Prevention Week' where disaster drills and evacuation exercises are held at many places to remind people of the need to remain aware of future disasters and to increase their capacity to cope with the disaster. The result of these preventive measures is visible during the 2011 GEJE where people run to the evacuation site. Thus disaster reduction drills empowered public to take required action readily during emergency situations and increased the chance for saving lives.

With a robust disaster prevention and preparedness system, it is possible to limit the damage from disaster to the least minimum. Japan's massive investment on early warning system enabled Japan to counter and manage disaster effectively as seen during the 2011 GEJE. Information from the early warning system enables people to make informed choices and help to direct their course of action in the face of disaster. Thus the combination of early warning technology with aware and educated people and earthquake-proof structures contribute immensely to the effectiveness of the disaster management system.

3.6 Lessons for future disaster

The experience of the 1995 Kobe Earthquake and the 2011 GEJE provided opportunity to reflect on the need to prepare for future mega disasters. As occurrence of natural disasters cannot be stopped, the best way to counter them is to take precautionary measures at the optimum level as Japan did. The way Japan handled the 1995 and the 2011 disasters offers lessons for Japan as well as other countries.

The 2011 GEJE demonstrated that preparedness and response planning is very effective in countering mega-disasters. The emphasis should be based on the concept of

'disaster reduction' which focuses on minimising the impact of natural disaster rather than trying to completely prevent disaster.

The two disasters demonstrated the limitations of over reliance on modern technology. As such during the 2011 GEJE, the Tsunami early warning system failed to determine the exact height of tsunami-wave where the actual tsunami-height is far greater than the predicted one. This doesn't mean that technology should be doing away with but rather early warning technology should be improved.

There should be proper mechanism for robust coordination among the various agencies/ministries engaged in disaster management. This is crucial to an effective disaster response. A smooth coordination mechanism would result in optimum utilisation of resources and expertise and prompt effective response to disaster.

Disaster management should continue to prepare for future catastrophic mega-disaster scenario. Such anticipation of future disaster would enable them to prepare and take requisite measures to cope well the impact of future mega-disasters.

There should be mechanism for effective communication during disasters so that public could be informed of the accurate data and help them to make decisions. Besides, quick flow of information from ground level is necessary to co-ordinate the rescue and relief activities as well as direct personnel and materials to areas where they are needed.

To counter future mega-disasters, the disaster management system should be a centralised 'top-down' model with the national government taking lead role. There should be proper medium for coordination among all the stakeholders and a well-defined chain of command as decisions are to be taken promptly in disaster situations. The 2011 Great East Japan Earthquake amply proved how the local system collapses during major disasters. So the national government should be ready to respond to such disasters in future.

Chapter 4
Societal and International Response to the 1995 and the 2011 Earthquakes

"Professional emergency personnel cannot respond immediately. In the event of disaster, you will be on your own for anytime between three days and two weeks. You need to prepare".

- *Naomi Zack* (2009).

The above statement by Naomi Zack emphasises upon the need for preparedness in disaster situations. In this context, the role of society becomes important as the first 'responder' in the real sense is the local people who lives next to each other and neighbours in the disaster affected areas. It is often found that when great disasters occur, the disaster stricken people started looking out for their family members, relatives, and friends even before the government began to respond. This is 'a race against time' for both the government and local people to save survivors who may have been trapped or injured as the survival rate drops rapidly as time went by. In this context, the societal response i.e., response of the civil society organisations (CSOs) like Non-Governmental Organisations (NGOs), volunteer groups etc. become very important.

Japan has an unenviable long experience with disasters - earthquakes, tsunami, flood, volcanic eruption etc. and has been devoting a lot of resources in developing an effective and robust disaster management infrastructure. However, governmental measures are not enough and in this context the role of civil society organisations become very important to complement and fill up the gaps in the efforts of government. As such the massive turn-out of about 1.3 million volunteers in the aftermath of the 1995 Kobe Earthquake has been termed as the 'birth of Japanese volunteerism' (*borantia no gannen*) and a 'volunteer revolution' (*borantia kakumei*), one that has brought about civil society growth with stronger Japanese NGOs and volunteerism (Takao 2001; Yamamoto 1999; Leng 2015).

This chapter focuses on the emergence of citizen volunteerism during the 1995 Kobe Earthquake and the role played by NGOs during the 1995 and the 2011 disasters. This chapter also accounts for the change in effectiveness of disaster response and the growing recognition of the role of civil society organisations in disaster relief and response activities after the 1995 Kobe Earthquake. This emergence and evolution of civil society organisations in such relief measures will be analysed alongwith the growing need for international assistance and cooperation to counter mega-disasters such as during the 2011 Great East Japan Earthquake.

Through its bitter experience with past natural disasters, Japanese have developed a culture of disaster prevention and acceptance. The response of Japanese society show remarkable adaptability and forbearance in the face of extreme disasters. Japanese displayed a sense of calm, poise and order in its bitter encounter with disasters. This can best be explained by the Japanese philosophy of *gaman* - dignified endurance in the face of suffering. T.R. Reid wrote in an article on National Geographic in the aftermath of the 1995 Kobe Earthquake explaining this unique Japanese response:

> "The Japanese have a word for this - one of their favourite words, in fact: *gaman*. Japan's version of the stiff upper lip, *gaman* represents one of the virtues encompassed in the Bushido, the code of the samurai. It means, as the late Emperor Hirohito once put it, "to bear the unbearable", to accept without complaint whatever fate may throw in your path. The concept is closely connected with the Japanese predilection for hard work. When something awful happens, the determination of *gaman*, to get back to work, can serve as a kind of narcotic. It dulls the pain and gives victims something other than their losses to think about."[110]

The uniqueness of Japan's response to disasters with stoicism and restraint speaks a lot about Japan's national character. Their capacity to absorb and bounce back reinvigorated after disasters is phenomenal. As such Japan is regarded as one of the most 'disaster resilient' country in the world. The UN defined resilience as 'capacity of a

[110] Reid, T. R. (1995), pp. 123

system, community or society potentially exposed to hazard to adapt, by resisting or changing in order to research and maintain an accepting level of functioning and structure. This is determined by the degree to which the societal system is capable of organising itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures (UN/ISDR 2004). This resilience was not developed overnight but through its long bitter experience with catastrophic disasters in the past.

There is a sense of order and normality among the disaster stricken people. This is reflected in the long queues one observes at evacuation centres for food, clothing, water, medicines. Evacuees were observed to be requesting only for bare needs. They don't complain when the limited supplies of relief materials like food and blankets are being given preferentially to children and elderly. In the aftermath of the 1995 and 2011 earthquakes, there was no increased in prices of food, medicine and other essential commodities in markets. There was no sharp increase in crime of theft, robbery etc. in the affected area. All these make Japan stand out from other societies when faced with disasters. This is also a reflection of the general awareness of the public regarding disaster and their responsibility to other fellow victims.

4.1 The Role of Non-Government Organizations

The idea of 'civil society' has multiple meanings in today's world, but it is usually used to 'describe a society or space consisting of sustained, organised social activity that is non-state, non-market and is distinct from the family or individual' (Cohen & Arato 1992; Pharr 2003; Leng 2015). This represents a western concept of civil society. The question of how to define civil society in the Japanese context given the dominant role of state in the society has generated a lot of debate (Alagappa 2004; Okimoto 1988; Leng 2015). According to Leng (20150), civil society covers a wide spectrum of voluntary groups, such as non-profit foundations, charities, non-profit organisations (NPOs), and non-governmental organisations (NGOs).

As compared to other advanced western countries, civil society is relatively underdeveloped in Japan. As such Japanese civil society is said to be characterised by

'four smalls': small budgets, small membership, small numbers of professional staff, and small geographic scopes (Pekkanen 2006; Phar 2003 2015). In a survey conducted by Cabinet Office in 2011 of 2345 Japanese non-profit organisations (NPOs), 54% of those NPOs had annual budgets of less than 10 million JPY, 11% had more than 100 members, and 50% had less than 20 staff.[111] This main weakness of the Japanese civil society can be attributed to the overwhelming dominance of the so-called 'Iron-Triangle': politicians, business leaders and bureaucracy in Japan.

In the Japanese context, it is important to make a distinction between the Non-Governmental Organisations (NGOs) and Non-Profit Organisations (NPOs). Many times they overlapped and are being used changeably. NGO is used in an international context to refer to non- profit, voluntary citizens groups which are organised on the local, national, or international levels and not directly affiliated with the government (Leng 2015). While NPOs are used in a broad sense as an all-encompassing term referring to both NGOs doing international work and groups working domestically (Fernando & Heston 1997; Leng 2015). In Japan, NPO refers to a non-profit organisation that is only engaged in domestic activity (Yamaoka 1996). While NGO includes both international and domestic non-profit citizens' organisations that address both local and global issues, engaging in overseas programs (Heins 2008).

The paradigm shift in our approach to disaster management from a response and relief centric to a multi-dimensional endeavour involving diverse scientific engineering and social processes acknowledge the crucial role of civil society organisations in all the phases of disaster cycle. In Japan, the 1995 Kobe Earthquake is regarded as a watershed moment for evolution and gradual development and recognition of the role of civil society organisations in disaster management where the governments' failure to respond effectively revealed the importance of having a civil society that can provide self-support and assistance in the event of a crisis (Imada 2003).

The role of civil society, NGOs and formal and non-formal volunteers in pre, during and post-disaster situations have emerged as one of the most effective alternative

[111] Cabinet Office (2011), pp. 3-7.

means of achieving an efficient communication link between the disaster management agencies and the affected community. Many different types of NGOs are already working at the advocacy level as well as at the grassroots level. In a typical disaster situation, they can be of help in preparedness, relief and rescue, rehabilitation and reconstruction, and also in monitoring and feedback.

The role of NGOs is a potential key element in disaster management. The NGOs operating at the grassroots level can provide a suitable alternative as they have an edge over governmental agencies for invoking community involvement. This is chiefly because the NGO sector has strong linkages with the community base, and can exhibit great flexibility in procedural matters on which the government effort can be found wanting.

Based on the identified types of NGOs and their capabilities, organised action of NGOs can be very useful in following activities in different stages of disaster management.

Table 4.1 Organised Activities of NGOs at different Stages of Disaster Management

Stage	Activity
Pre-Disaster	Awareness and information campaigns Training of local volunteers Advocacy and planning
During Disaster	Immediate rescue and first-aid including psychological aid, supply of food, water, medicines and other immediate need materials Ensuring sanitation and hygiene Damage Assessment
After Disaster	Technical and material aid in reconstruction Assistance in seeking financial aid Monitoring

Source: Narayan (2000)

The NGOs sector has played a major role in strengthening the community to face disasters in different parts of the world. This trend is based on a long-term experience of the need of maximum self-reliance at the grassroots level. The local community, if well aware of the preventive actions it is required to take in the event of disasters can substantially reduce the damage from disaster. The result of this awareness and training of local community is significant for a disaster prone country like Japan.

As mentioned before, the role of civil society in Japan in disaster situations became very prominent after the 1995 Kobe Earthquake where voluntary organisations or non-profit organisations played an important role in the immediate aftermath of the disaster. Japan's volunteering activity has long history but citizen participation in voluntary organisations declined after the end of WW II, as the state and its large bureaucracy increasingly took on functions that had previously been performed by the non-governmental sector. As a result, volunteer activity either during disaster or non-disaster situation was not as widespread as was earlier in Japan.

The 1995 Kobe Earthquake witnessed mass outpouring of public concern for the disaster stricken people. Estimates of the number of people who were engaged in volunteer activity in the impact area in the months following the earthquake range from 630,000 to 1.3 million (International Federation of Red Cross and Red Crescent Societies, 1996; The Economist, 1997). This was unprecedented in the Japanese history. As such the year 1995 has been referred to as 'the start of year of volunteering' in Japan in reference to the new phenomenon of civic participation in voluntary activities in relation to disaster preparedness and response. Thereafter, the number of such volunteer activities increased manifold and the sprouting of various not for-profit organisations in different parts of Japan. After this there is no turning back.

Established NGOs such as the Japan Overseas Christian Medical Cooperative Service (JOCS), The Japan Red Cross were there immediately after the disaster providing medical and emergency services. Besides, other local groups like Osaka Voluntary

Action Centre, Peace Boat, and Rescue Stockyard were also busy distributing relief materials, providing information, helping the evacuated victims.

One major NGO that was established in the aftermath of the 1995 Kobe Earthquake was the Nishinomiya Volunteer Network (NVN) which participated widely during the disaster. This volunteer group donated and also collected goods, clothing, food supplies etc. and distributed the same to the disaster stricken people. Now, NVN is known by the name Nippon Volunteer Network Active in Disaster.

During the 1995 Kobe Earthquake, due to delayed response of government, organisations such as the infamous yakuza, having nationwide network with clear lines of authority, were involved in the supply of relief materials (food, water, toiletries, sanitary diapers etc.) to the disaster stricken area and disbursed them to disaster afflicted residents.

The extensiveness of volunteer efforts in this particular earthquake event has been attributed to severe factors, including the severity of the disaster; the tremendous evidence of need among the victim population; intense media reporting; and the fact that the earthquake occurred during a break between academic terms, so that students were free to travel to the disaster stricken areas.[112]

Thus, the participation of non-government organisations helped to fill up the gaps and complement the disaster response of the government especially in the aftermath of the disaster. However, the participation of NGOs, NPOs was not without problems if not properly coordinated. During the 1995 Kobe Earthquake, it was observed that there was a surplus of volunteers in some while shortage in other areas that needed it the most. The massive volunteers were disorganised at first and the local government did not have any manual to guide or co-ordinate the volunteers. Mass congregation of non-skilled volunteer could also hampered swift search and rescue efforts. The challenge is mainly of achieving coordination and of directing them to the appropriate areas.

[112] Tierney and Goltz (1997), pp.3.

As compared to the response of volunteers during the 1995 Kobe Earthquake, the participation of volunteers was found to be less during the 2011 Great East Japan Earthquake. The numbers of volunteers were estimated at quarter of a million. The main reasons for the decline in volunteer participation are:

i. shut-down of transportation network due to extensive damaged affect transport relief supplies;

ii. towns and municipalities are washed away thereby paralysing the capacity to receive and direct personnel to rescue;

iii. a prospective volunteer had to be financially self-sufficient;

iv. the nuclear meltdown influenced people's decisions as they fear contamination.(Yamashita and Kudo 2014).

But a large number of domestic NGOs, NPOs participated in the disaster management activities. As of January 20, 2012, there were 712 organisations participating in the Japan Civil Network for Disaster Relief in East Japan. There is no limitation either on the type of organization that can join the network, such as the non-profit, public-interest, or religious, as also on the basis of the budget size. The following table gives a comparison of the response of NGOs and volunteers following the 1995 and the 2011 Earthquakes.

Table 4.2 Comparison of NGOs, Volunteers and International response after the 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake.

	1995 Kobe Earthquake	2011 GEJE
NGOs activity	Less than 20 NGOs recognised by UN participate.	More than 100 NGOs recognised by UN participate.
	Most of them are small with a few members only and poor resources.	Many of them are large NGOs with marge membership and better funding structure.
	No prior experienced or training	Better organised with proper training

	so no proper co-ordination with government or other NGOs.	and better co-ordination with other NGOs too.
Volunteer activity	Around 1.3 million volunteers participate	Around quarter of a million participate.
	Most of them were unregistered, untrained, unprepared an inefficient and no proper co-ordination.	Most of them were registered, prepared and helped in smooth co-ordination of relief work.
	There was no government recognition. Mostly the volunteers were engaged in short-term relief activities.	There was recognition of volunteer activity by government post-1995 disaster. Many of them were engaged in long-term relief and recovery activities.
International Assistance	Not accepted.	Accepted assistance from 163 countries and regions; 43 international organisations.

Sources: Cabinet Office 2006; Edgington 2010; MEXT 2011; MILT 2011; MILT 2012; UNCRD 2003; Tierney and Goltz 1997; Leng 2015

The early responder to the 2011 disaster can be categorized into two groups: Japan based (mainly Tokyo based) NGOs specializing in international relief operations even before Great East Japan Earthquake, and Japanese NGOs and NPOs based in different parts of Japan that address domestic need. The Japan Platform, a platform for international emergency humanitarian aid organization, mobilized funding relief operations within 3 hours after the earthquake. These organizations, experienced in providing emergency humanitarian aid overseas, were able to leverage international standards and expertise. They played a vital role in mobilizing experts in specialized fields.

The Japanese NGOs and NPOs had been mainly involved in domestic emergency relief activities. Organizations based and operating in the disaster-affected areas made

long-term commitments to sustaining activities such as assessing people-centred needs, and facilitating a seamless transition from emergency to recovery.

The Japan Red Cross Society (JRCS) played a significant role during the disaster. The JRCS has a well-organized disaster response regime, with 488 response teams throughout the country and 6844 medical relief personnel who are officially registered. Each team consists of six personnel: a doctor, a head nurse, two nurses and two administrators. The domestic disaster relief activities of the JRCS included medical relief and psychological care, storage and distribution of relief goods, provision of blood products, collection and distribution of voluntary donations.

Within 24 hours of the disaster, JRCS dispatched 55 medical teams (out of which 22 teams as DMAT). Subsequently 935 teams of about 6700 personnel were deployed during the next 6 months, after the disaster, treating altogether 87, 445 persons besides providing psychological counselling to the disaster stricken population to enable them to recover the pre-disaster live quickly.[113] The Japanese Red Cross Society responded proactively in rebuilding health infrastructure like temporary hospitals, providing emergency medical care, nursering homes, kindergarten and other vital institutions.

The JRCS has been pulling together 307 billion JPY in donations as of January 19, 2012 and its counterpart, the Central Community Chest of Japan, Red Feather Campaign had gathered 38.8 billion JPY in donations as of October 2011.[114] The donated money is being disbursed through disbursement committee. They continued to provide medical and psychosocial counselling and assistance to the disaster affected people.

The Humanitarian Medical Assistance (HuMA), a medical non-government organization established in 2002, played a significant role in providing emergency medical service during the disaster. With strength of approximately 500 members, it provided acute medical support as well as counselling humanitarian support to disaster victims.

[113] World Bank and GFDDR, "Mobilising and Co-ordinating Expert Teams, Nongovernmental Organisations, Nonprofit Organisations and Volunteers", Knowledge Note 3-1, pp.6.
[114] *Ibid* no. 113, p.8.

Another local NGO, the Tokyo Voluntary Action Centre (TVAC) coordinated volunteer busses to Tohoku besides providing volunteers with explanatory sessions and pre-departure briefings, a process that reveals the increased professionalism and autonomy of NGOs in volunteer training and coordination, fund raising and overall relief (Leng 2015).

The unprecedented nature of the devastation posed a challenge not only to the governmental response mechanism but also to the NGOs and NPOs. In the absence of a dedicated designated agency for overall coordination in Japan, the NGOs and NPOs had to handle the coordination of relief efforts. The Tokyo-based NGO - the Japan NGO Center for International Cooperation (JANIC) which had already created a network of NGOs, functioned as a provider of information and helped in the coordination of relief activities.

The importance of understanding local content and the need to involve local people and community was very important. The 'NGOs may see themselves as genuine partners of the local community and its organisation, [but] in many cases the same view is not shared by the people' (Shaw and Goda 2004; Ozerdem and Jacoby 2006). The local NGOs help to dispel the distrust locals had on Japan- based International NGOs (INGOs). A successful example of the involvement of local community is the NPO Aichi-Net from the Nagoya Prefecture that worked closely with the Ofunato Junior Chamber of Commerce and the local newspaper in city and Rikuzentakada. Aware of the affected community's anxiousness about the upcoming Summer Festival (Tanabata Festival), Aichi-Net helped to organize the festival with financial grant from INGOs - Give2Asia. This successful organization of the festival helped to bring a sense of normalcy and uplift the motivation of residents to rebuild their lives.

Similarly, another NPO Peace Boat Disaster Relief Volunteers Center (PBV) succeeded in providing food, relief support, and electric generators after having open discussion with local leaders on the Ojika Peninsula of Miyagi Prefecture. The PBV volunteers have been working closely with the locals on soil desalination, clearing toxic mud and debris and rebuilding local oyster farms. This effort of PBV supported the

recovery of villagers. Peace Boat also established a base to collect information about damage and needs to deliver emergency supplies and help in co-ordination of relief efforts between the local government and numerous other NGOs, institutions and individuals in the disaster affected region (Peace Boat 2011a).

Besides, there were other challenges relating to differing work culture, operational gaps, language barrier, communication gaps etc. Overall Japanese NGOs and NPOs played significant role in addressing the needs of disaster stricken people and contributed to make the disaster management system more effective by filling in the gaps and completing government disaster response.

It is difficult to draw a definite parallel between the 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake as both the disaster differ in terms of nature, scale, magnitude, intensity and the response of the government and civil society. Yet one could figure the changes in the mood and depth of participation of civil society organisations. Upon the foundation laid during the late 1995 Kobe Earthquake, the various civil society organisations began to flourish with better organisation and more professionalism and resourcefulness as can be seen in the response of civil society organisations during the 2011 Great East Japan Earthquake.

3.2 International Assistance

As the giant 9.0 Mw earthquake and resulting massive tsunami wreaked havoc on a large swathe of the Pacific Coast of Tohoku region from Aomori to Chiba Prefecture, Japan faced a disaster situation of unprecedented in nature. With live images of the devastation caused by Tsunami broadcasted around the globe, offers of international assistance began arriving in Japan from 163 countries and regions and 43 international organizations.

During the 1995 Kobe Earthquake, Japan received offers of assistance from foreign countries but refused to accept them. This was one of the defining features of government's disaster response in 1995. This reluctance of Japanese Officials to accept assistance from foreign countries stemmed from three factors. First, a strong sense of

national pride and self-sufficiency made Japanese Officials reject such offers and particularly so if the offer comes from less-developed countries. Secondly, it is difficult to bypass the hierarchical multi-layered bureaucratic decision-making process that it is not possible to respond quickly to offers of aid from many countries around the world. Third, the risk-averse Japanese bureaucrats resisted allowing medicines, rescue dogs into the country without first subjecting them to time consuming procedures, such as the testing of drugs to account for Japanese uniqueness, animal quarantine measures and government licenses.

Besides, the government was reluctant to relinquish their authority over relief operations to others. Moreover accepting outside help could be perceived as an abnegation of responsibility which can be used to discredit the government at home. A government wants to be seen as responsible and capable of handling any disasters.

So there was no acceptance of international assistance except for some assistance from a few countries and support from US. Based on this experience of accepting little help from foreign countries during the 1995 Kobe Earthquake, a system for managing international assistance was developed and incorporated into the government's disaster management plans and manuals. This management system was first tested following the Great East Japan Earthquake.

During the 2011 Great East Japan Earthquake, Japan promptly accepted offers of international assistance from 163 countries and regions and 43 international assistance organizations. The improvement in system for management was reflected in the smooth procedure of CIQ (Customs, Immigration Quarantine) due to the collective governmental ministerial efforts. In addition, liaison officers dispatched by Ministry of Foreign Affairs (MOFA) and Emergency Fire Response Teams coordinated by the FDMA, both contributed significantly to international Search and Rescue (SAR) team activities.

The foreign assistance was in the form of emergency assistance squads, medical teams and reconstruction teams. Immediately after the disaster struck, 20 SAR teams from the 15 countries comprising 890 rescuers were available. Besides, there were medical teams from Israel, Jordan, Thailand and Philippines. Emergency relief goods like

fuel, food and non-food items came from 63 countries. There were monetary donations from many countries too. The scale of assistance was much larger than that of the 1995 Kobe Earthquake.

The response and assistance provided by USA needs special mention as it was unprecedented. The US launched '*Operation Tomodachi*' ('*Friend*' in Japanese) and dispatched more than 18,000 US military personnel. They also provided humanitarian aid including 246 tonnes of food and 21 million gallons of water. At the peak of the action, approximately 149 aircrafts were deployed in the disaster affected areas including C-130 aircraft and helicopters; U-2 reconnaissance planes; 20 US naval ships including the USS Ronald Reagan Carrier Strike Group; 33 department of energy experts; nine Nuclear Regulatory Commission experts;12 rescue dogs.[115]

They performed a multitude of tasks ranging from damage assessment, inter agency collaboration, search, rescue, relief and cleaning up operation, providing surveillance of the affected area, logistic support for distribution, support points to increase the flow of humanitarian aid, and restoration of critical physical infrastructure such as arterial roads and Sendai airport to counter the complications arising out of nuclear meltdown at Fukushima Daiichi Nuclear Power Plant. From the above, the unprecedented nature of the US assistance is clear and contributed in expediting the disaster response activities of the Japanese government.

The Government of India sent a consignment of 25000 blankets, 13000 bottles of mineral water and 10 tonnes of high-calorie biscuits to Japan to help the disaster stricken people.[116] Besides, a contingent of 46-member National Disaster Response Force (NDRF) was despatched to assist relief efforts in the disaster affected areas.[117] China despatched a consignment of 900 tents, 2000 blankets and 200 flashlights initially on 14 March 2011.[118]

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[115] Nalwa, Preeti (2012), pp. 21.
[116] Panda, R. (2012), pp. 66.
[117] *Ibid* no.115, pp.66.
[118] Cabinet Office of Japan (2011), 'Co-ordination of International Disaster Relief during the Great East Japan Earthquake – A Perspective from the Government Headquarters', December 16.

In retrospect, in the context of ‘large scale wide area’ disaster, the active participation of civil society organizations complemented the efforts of the government and most importantly filled up the gaps in government’s response mechanism. Their active participation is important in bringing quick recovery and rehabilitation of the disaster stricken people. In the process they contributed to make the response mechanism of Japan’s disaster management system more effective. Besides, assistance from foreign countries is important in carrying out SAR operations over a wide area thereby increasing the chance of saving more lives.

Chapter 5
Conclusion

Mankind has survived and lived with natural disasters for long centuries. Earthquakes, volcanic eruptions, tsunamis, floods have plagued and devastated humanity since time immemorial. We can do nothing about shifting of tectonic plates beneath the oceans causing devastating earthquakes or lava simmering underneath the earth's crust to erupt violently. What can be done, however, is to take preventive measures at various levels of society in order to make the impact of such natural disasters as harmless as possible to lives and property.

The traditional view of natural disasters as discrete physical phenomenon has undergone a radical change. Disasters are now seen in the context of its interface with human society and its environment. Natural phenomenon like volcanic eruption, floods, earthquake, and tsunami become calamitous only when they interact with the vulnerable conditions present in the human society and environment. As such an earthquake in an uninhabitable desert would not be regarded as a disaster. So natural disaster is began to be seen in the context of its impact on human life, though quantifiable in terms of direct and tangible loss or otherwise unquantifiable in terms of its impact on the normal functioning of a society or environment.

This has necessitated the evolution of a model disaster management strategy moving beyond the technocratic and bureaucratic approach concerning mainly with the physical aspects of disasters to a more broader understanding where natural disasters are primarily seen as socio-political, environment and developmental issues. This new approach where disasters are seen in the context of its impact on human and environment foster the development of disaster management strategy that emphasises on prevention and mitigating the impact of disasters rather than the strict technocratic approach burdened with bureaucracy that emphasise on monitoring, analysing and prediction of disasters.

As evident from this study, a disaster management strategy should be comprehensive multi-sectoral approach. This is a multi-disciplinary, interrelated and co-ordinated work, which requires inputs and involvement of experts from different disciplines as well as governmental, non-governmental and voluntary agencies. Combined and co-ordinated efforts from all the corners can only develop attitudes and capabilities to deal forcefully with the natural disasters.

There is a paradigm shift in the way disaster management is carried out and approached from a relief-centric approach to a multi-dimensional endeavour involving diverse scientific, engineering and social processes that span the pre-disaster, during and post-disaster phases. This is a long term strategy that focuses on prevention and mitigation of future disasters.

Being one of the most disaster prone countries in the world, Japan has developed a comprehensive and sophisticated disaster management system. The evolution of Japan's disaster management strategy is shaped by its unfavourable geo-climatic location and topographical setting/conditions as well as its bitter experience with multiple disasters in the past that compel Japan to strengthen and enhance its disaster management system to counter future disasters effectively. Japan's modern Disaster Management System originated in the Disaster Countermeasures Basic Act 1961 and evolved over years and it was revised in 1995 after the 1995 Kobe Earthquake.

The disaster management system in Japan is a 3-tiered structure with the national government at the top, the prefectural government in the middle and the local municipalities at the bottom. This disaster management system designated the local municipalities as the first responder to any disaster. If the municipal government could not cope with the disaster then they can request the help of prefectural government and then to national government. This is a decentralised 'bottom-up' approach to disaster management that is found to be ineffective while tackling mega-disasters like the 2011 Great East Japan Earthquake.

The 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake are often regarded as catastrophic disasters which has no precedent. The 1995 Kobe Earthquake is

regarded as the worst post-WW II crisis until the occurrence of the 2011 Tohoku Earthquake. It was overshadowed by the Great East Japan Earthquake that wreaked havoc on the Pacific coast of north-eastern Japan from Aomori to Chiba prefectures. The 2011 Great East Japan Earthquake is regarded as the largest earthquake in the history of Japan and the fourth largest in the world since the beginning of the 20th century. The 1995 Kobe earthquake occurred along active fault and measured 7.2 M. The 2011 Great East Japan earthquake was an ocean-trench earthquake that measured 9.0 M. It is also referred to as 'sequential crises' where a 9.0 M earthquake triggers giant tsunami that caused nuclear meltdown.

The devastation caused by the 1995 Kobe earthquake pales in comparison to the 2011 GEJE. The 1995 disaster occurring in a heavily populated urban environment caused the death of 6279 lives, injured 41527 and forced 342,000 residents to evacuate after the disaster while the 2011 GEJE claimed 18958 lives, injured 5890 (as of December 22, 2011) and forced 470,000 people to evacuate. The major brunt of the 1995 disaster was borne by Kobe city. The worst devastation was reported in the 3 prefectures of Iwate, Miyagi and Fukushima during the 2011 GEJE. The devastation in the 1995 disaster was mainly due to collapse buildings and fires while it was the giant tsunami and resulting inundation that caused the devastation.

The 1995 Kobe Earthquake and the 2011 GEJE also caused massive devastation to physical infrastructure including lifelines and civic utility services. The 1995 disaster destroyed 100,282 buildings and damaged around 294,158 buildings partially while the 2011 disaster destroyed 126,602 buildings and partially damaged 743,089 buildings. Electricity, water supply, telecommunication services were extensively damaged during the 1995 disaster which crippled the rescue and recovery efforts. Extensive damage on electricity, gas, and water supply was reported from Iwate, Miyagi and Fukushima prefectures that rolling blackouts were imposed in the affected areas. The economic damage is estimated to be around 9.6 trillion JPY (or US $ 130 billion). The economic damage from the 2011 GEJE is estimated to be around 16.9 trillion JPY or 3.4% of Japan's GDP.

One common feature during the 1995 Kobe earthquake and the 2011 GEJE is the large percentage of old and physically weak residents among the deaths. The old and elderly could not run fast for safety and they were trapped during the 1995 disaster and drowned in the 2011 disaster. The extensive nature of the devastation and societal issues like ageing and depopulation compounded the challenges of recovery post-disaster.

Within a month of the 1995 disaster, government set up the 'Headquarters for Reconstruction of the Hanshin-Awaji Area' to expedite the process of recovery and rehabilitation of the disaster affected people. Construction of housing units began and restoration of physical and civic infrastructure began on war footing. In the aftermath of the 2011 GEJE, the then government established the Reconstruction Design Council (RDC) to formulate reconstruction plan for the disaster affected areas. For this, RDC came out with a comprehensive report titled "Towards Reconstruction: Hope beyond the Disaster". Sector wise allocation of funds has been granted to recover the basic infrastructure and to resuscitate the economy of the disaster stricken areas. The recovery and rehabilitation process is still going on today.

The slow and ineffectual response of the Japanese government to the 1995 Kobe Earthquake drew widespread criticism. The government both local and national failed to assess the extent of damage due to the massive devastation on transport and communication networks. This delayed the response of the national government. Besides, the late request for the deployment of Self Defence Forces even when the extent of damage become apparent was widely criticised. The 1995 Kobe Earthquake exposed the chinks in the Japan's disaster management system that led to revision of the disaster management system later.

The 1995 Kobe Earthquake caught Japan unaware and unprepared. They were not prepared to handle major disasters like the 1995 disaster. This led to questioning the emphasis on local municipalities as the first responder to any disaster. This decentralised 'bottoms up' approach is not suitable for a large scale disaster as the local municipalities had neither resources nor manpower or expertise to cope with such disasters effectively. Rather many of the officials were found to be among the victims which paralyse the local

disaster management system. In this context, the need for a centralised 'top-down' approach is significant and suitable to handle situations arising out of major or mega-disasters.

Against the backdrop of ineffectiveness of government response during the 1995 Kobe Earthquake, the government initiated a number of measures like establishment of Headquarters for Earthquake Research and Promotion, stricter building codes, wide area support system, and program for retrofitting bridges. Besides, institutional changes were initiated where a Minister of State for Disaster Management was created to oversee inter-ministerial planning and coordination. Cabinet Crisis Management Centre and Cabinet Information Collection Centre were set up that open 24 hours monitoring and collecting disaster information. More importantly now, the national government can respond swiftly to major disaster without waiting for request from the prefectural government if they believed that the disaster would be large scale. This led to more effective government response as seen during the 2011 Great East Japan Earthquake.

The swift response of the national government by mobilising the massive manpower and resources enable prompt relief and rescue operations that save many lives. The immediate response activities are monitored and oversee by the national government under the leadership of the Prime Minister. Many of the problems encountered during the 1995 Kobe Earthquake response were absent as government learnt its lesson the hard way. The government responses were more successful and prompt as compared to the 1995 Kobe Earthquake in terms of inter-agency coordination, mobilisation and deployment of manpower, engagement and coordination with NGOs and volunteer groups. Yet it was criticised for not being as much effective as the disaster of the scale of 2011 GEJE warranted/ demanded.

Japan's massive investment on various disaster warning systems makes them one of the most disaster resistant countries in the world. As such during the 2011 Great East Japan Earthquake, early dissemination of the impending tsunami enables people to run for safe covers. Besides, the minimal damage on Shinkansen train is attributed to the used of early warning system called Urgent Earthquake Detection and Alarm System

(UrEDAS) that detects earthquake tremors and immediately stops the train if the tremors is above certain pre-determined limit.

The response of the government during the 1995 and 2011 disasters revealed the inherent structural weakness of a decentralised 'bottom-up' approach in handling mega disasters. For tackling mega disaster, a centralised 'top-down' approach is necessary and suitable to launch effective and robust response to mega disaster. The national government should take the lead and co-ordinate the emergency response activities. Besides, effective and reliable early warning systems also played important role in countering mega disaster effectively.

The massive outpouring of volunteers during the 1995 and 2011 disasters is a reflection of the awareness and social responsibility of the people for disaster reduction. Though the volunteers were found to be untrained and disorganised initially during the 1995 Kobe Earthquake, they were more organised and prepared during the 2011 GEJE. They participated in various activities like distributing relief materials, clearing debris, providing first aid and maintaining evacuation centres, providing information, giving psychological counselling to disaster stricken people etc. Their activities complement the efforts of government to aid quick recovery and rehabilitation of the disaster stricken people.

The role of NGOs is a potential key element in disaster management as seen during the 1995 Kobe Earthquake and more prominently during the 2011 Great East Japan Earthquake. There exist obvious limitations in government taking up activities for mobilization of community efforts, awareness generation, extension of technologies etc. NGOs with expertise and experience can discharge this role more effectively by acting as linkages between government and people. Besides, NGOs operating at grassroots level can provide a suitable alternative as they have an edge over governmental agencies for invoking community involvement. Japanese NGO activities in disaster management are not confined only to emergency response, provision of relief or reconstruction but extend to areas of conducting disaster drills, disaster education, raising public awareness etc. The

role of NGOs in disaster management and reduction programs is widely recognised today and forms a vital component of the disaster management system.

The 2011 Great East Japan Earthquake proved that international assistance is necessary and should be accepted to handle mega-disaster effectively. As mega-disasters stretch the capacity of a country's emergency response mechanism, expert professional in relevant fields from foreign countries if properly co-ordinated and channelized proved to be useful in responding to disaster effectively.

Notwithstanding the high frequency and unprecedented levels of natural disasters that continue to challenge Japan's disaster response system, Japan emerge out of the disaster stronger. Every disaster is a lesson for Japan and its proactive approach to disaster management render it as one of the most disaster resilient country in the world. The 1995 Kobe Earthquake and the 2011 Great East Japan Earthquake that caused massive death and destruction on lives and property demonstrated the need to remain alert and further improve disaster preparedness and response capacity of the country. These two major disasters also demonstrated the need and suitability of a centralised 'top-down' approach to tackle mega disasters effectively and swiftly.

One noticeable area in which clear recommendations and advisories being issued to prefectural governments and local bodies regarding evacuations in the disaster zones accounted for 40% of the total area. For example, land slide disaster in Hiroshima in August 2014 that killed 75 people was designated as caution zone. Responding to a series of disasters due to sediment movement, a variety of guidelines on evaluation warnings have been issued by all levels of government as risks of human casualties rise further.

As occurrence of natural disasters cannot be stopped, the emphasis of Japan on improving prevention and preparedness levels need to continue. It has been noticed in the past that as and when attention has been paid to adequate preparedness measures, the loss of life and property has been considerably reduced. All these proactive measures and institutional changes contributed to make Japan one of the most disaster resilient countries in the world today.

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