DATA COLLECTION SURVEY
ON
ASEAN REGIONAL COLLABORATION
IN
DISASTER MANAGEMENT

FINAL REPORT
COUNTRY REPORT
INDONESIA

DECEMBER 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD.
ALMEC CORPORATION
MITSUBISHI RESEARCH INSTITUTE, INC.

DATA COLLECTION SURVEY
ON
ASEAN REGIONAL COLLABORATION
IN
DISASTER MANAGEMENT

FINAL REPORT
COUNTRY REPORT
INDONESIA

DECEMBER 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD.
ALMEC CORPORATION
MITSUBISHI RESEARCH INSTITUTE, INC.

List of Abbreviations and Acronyms

A

AADMER	:	ASEAN Agreement on Disaster Management and Emergency Response
ABaDRM	:	Aceh Barat Disaster Risk Map
ACDM	:	ASEAN Committee for Disaster Management
ADMIS	:	ASEAN Disaster Management Information System
ADPC	:	Asian Disaster Preparedness Center
ADRM	:	Aceh Disaster Risk Map
AEIC	:	ASEAN Earthquake Information Center
AHA Center	:	ASEAN Coordination Center for Humanitarian Assistance on Disaster Management
ASEAN	:	Association of South East Asian Nations
ATaDRM	:	Aceh Tamiang Disaster Risk Map
B		
BAKORNAS PB	:	Badan Koordinasi Nasional Penanggulangan Bencana (National Coordinating Board for Disaster Management)
BAKOSURTANAL	:	Badan Koordinasi Survei dan Pemetaan Nasional (National Coordination Agency for Surveys and Mapping)
BBWS	:	Balai Besar Wilayah Sungai (River Basin Development Agency)
BCP	:	Business Continuity Plan
BIG	:	Badan Informasi Geospasial (Geospatial Information Agency)
BMKG	:	Badan Meteorologi, Klimatologi, dan Geofisika (Meteorological, Climatological and Geophysical Agency)
BNPB	:	National Agency for Disaster Management
BPBA	:	Badan Penanggulangan Bencana Aceh (Aceh Disaster Management Agency)
BPBD	:	Badan Penanggulangan Bencana Daerah (Regional Disaster Management Agency)
BPBK	:	Fire and Disaster Management Agency
BPPT	:	Badan Pengkajian dan Penerapan Teknologi (Agency for the Assessment and Application of Technology)
C		
CBDRM	:	Community-Based Disaster Risk Management
CCFSC	:	Central Committee for Flood and Storm Control
CCTV	:	Closed Circuit Television
COD	:	Chief of officer on duty
CRED	:	Center for Research on the Epidemiology of Disasters
CVGHM	:	Centre for Volcanology and Geological Hazard Mitigation
D		
DDMFSC	:	Department of Dyke Management, Flood and Storm Control
DDMRC	:	District Disaster Management and Relief Committee
DGWR	:	Directorate General of Water Resources
DIBA	:	Data dan informasi bencana aceh
DIBI	:	Data dan Informasi Bencana Indonesia (Indonesian Disaster Information and Data)
DID	:	Department of Irrigation and Drainage
DKI	:	Daerah Khusus Ibukota (Special Capital Territory)
DMH	:	Department of Meteorology and Hydrology

DMIS	:	Disaster Management Information System
DRR	:	Disaster Risk Reduction
DSS	:	Decision Support System
DVB	:	Digital Video Broadcasting
E, F		
EDM	:	electro-optical distance measurement
EM-DAT	:	Emergency Disaster Database
EOS	:	Emergency Operating System
EWS	:	Early Warning System
FMRDS	:	FM Radio Data System
G, H		
GDP	:	Gross Domestic Product
GIS	:	Geographic Information System
GPS	:	Global Positioning System
GRDC	:	Geology Research Development Centre
GTS	:	Global Telecommunication System
HFA	:	Hyogo Framework for Actions
I		
ICHARM	:	International Centre for Water Hazard and Risk Management
I-DRMP	:	Integrated Disaster Risk Management Plan
InaTEWS	:	Indonesia Tsunami Early Warning System
INGO	:	International Non-government Organisation
IOTWS	:	Indian Ocean Tsunami Warning and Mitigation System
J, K		
JICA	:	Japan International Cooperation Agency
JMG	:	Minerals and Geoscience Department Malaysia
KOMINFO	:	Kementerian Komunikasi dan Informatika (Ministry of Communication and Information Technology)
L		
Lao PDR	:	Lao People's Democratic Republic
LAPAN	:	Lembaga Penerbangan dan Antariksa Nasional (National Institute of Aeronautics and Space)
LIPI	:	National Institute of Science
M		
MES	:	Myanmar Engineering Society
MGB	:	Mines and Geosciences Bureau
MGS	:	Myanmar Geosciences Society
MMDA	:	Metro Manila Development Authority
MPWT	:	Ministry of Public Works and Transportation
N		
NDMC	:	National Disaster Management Center
NDMC	:	National Disaster Management Committee
NFP	:	National Focal Point
NGO	:	Non-governmental Organization
O, P		
OFDA	:	Office of Foreign Disaster Assistance
PHIVOLCS	:	Philippine Institute of Volcanology and Seismology
POKOMAS	:	Kelompok Masyaraka (Flood operation Community Units)

PU	:	Pekerjaan Umum (Ministry of Public Works)
R		
REDAS	:	Rapid Earthquake Damage Assessment System
RISTEK	:	Kementerian Riset dan Teknologi (Ministry of Research and Technology)
RTSP	:	Regional Tsunami Service Provider
S		
SATREPS	:	Science and Technology Research Partnership for Sustainable Development
SMS	:	Short Messaging System
SNS	:	Social Networking Service
SOP	:	Standard Operating Procedure
T		
TDMRC	:	Tsunami and Disaster Mitigation Research Center
TMD	:	Thai Meteorological Department
U~		
UPS	:	Uninterruptible power supply
USGS	:	United States Geological Survey
YCDC	:	Yangon City Development Committee

Abbreviations of Measures

Length

mm	=	millimeter
cm	=	centimeter
m	=	meter
km	=	kilometer

Area

ha	=	hectare
m^2	=	square meter
km^2	=	square kilometer

Volume

1, lit	=	liter
m^3	=	cubic meter
m^3/s, cms	=	cubic meter per second
MCM	=	million cubic meter
m^3/d, cmd	=	cubic meter per day

Weight

mg	=	milligram
g	=	gram
kg	=	kilogram
t	=	ton
MT	=	metric ton

Time

sec	=	second
hr	=	hour
d	=	day
yr	=	year

Money

BND	=	Brunei Dollar
KHR	=	Cambodian Riel
IDR	=	Indonesian Rupiah
LAK	=	Lao Kip
MMK	=	Myanmar Kyat
MYR	=	Malaysian Ringgit
PHP	=	Philippine Peso
SGD	=	Singapore Dollar
THB	=	Thai Baht
USD	=	U.S. Dollar
VND	=	Vietnamese Dong

Energy

Kcal	=	Kilocalorie
KW	=	kilowatt
MW	=	megawatt
KWh	=	kilowatt-hour
GWh	=	gigawatt-hour

Others

%	=	percent
o	=	degree
'	=	minute
"	=	second
°C	=	degree Celsius
cap.	=	capital
LU	=	livestock unit
md	=	man-day
mil.	=	million
no.	=	number
pers.	=	person
mmho	=	micromho
ppm	=	parts per million
ppb	=	parts per billion
lpcd	=	litter per capita per day
Mw	=	moment magnitude scale

Exchange Rate

Exchange Rate			**August 18, 2012**
Country	Currency		Exchange rate to USD (1USD=79.55JPY)
Brunei	BND	Brunei Dollar	1.2538
Cambodia	KHR	Cambodian Riel	4,068
Indonesia	IDR	Indonesian Rupiah	9,490
Lao PDR	LAK	Lao Kip	7,982.5
Malaysia	MYR	Malaysian Ringgit	3.1315
Myanmar	MMK	Myanmar Kyat	875.5
Philippines	PHP	Philippine Peso	42.4
Singapore	SGD	Singapore Dollar	1.2538
Thailand	THB	Thai Baht	31.51
Vietnam	VND	Vietnamese Dong	20,845

DATA COLLECTION SURVEY
ON
ASEAN REGIONAL COLLABORATION
IN
DISASTER MANAGEMENT

FINAL REPORT

COUNTRY REPORT

INDONESIA

Abbreviation

Table of Contents

Page

List of Tables

List of Figures

CHAPTER 1 INTRODUCTION

1.1 Background of the Survey

Frequency of natural disasters has been increasing for last 30 years in the world, having caused great damages/losses. Among those damages/losses, about 90 % are concentrated in the Asian region where natural disasters are one of the serious issues not only for humanitarian but also for economic and industrial point of view.

1.2 AADMER, HFA and AADMER Work Program

Under such circumstance, the ASEAN 10 countries had reached an agreement of "the ASEAN Agreement on Disaster Management and Emergency Response (AADMER)" on 26th July, 2005 (ratified on 24th December, 2009); in order to strengthen the disaster management structure in the region for the implementation of the Hyogo Framework for Actions (HFA) 2005-2015.

In relation to those activities above, the ASEAN Committee for Disaster Management (ACDM) adopted "AADMER Work Program 2010-2015" as the guideline of the activities for the AADMER, at its 15th Meeting of March, 2010 held in Singapore.

1.3 AHA Centre

At the same time, the ASEAN countries recognized the necessity to establish "the ASEAN Coordination Centre for Humanitarian Assistance on Disaster Management (AHA Centre)" and set up as a provisional status in Jakarta, Indonesia in October, 2007.

As the first phase of the AADMER Work Program 2010-2015, the AHA Centre has formally been established in November 2011 at the ASEAN Summit Meeting in Bali, Indonesia; and to be ratified in due course. The AHA Centre has started various activities with such assistance as procurement of facilities/equipment, provision of technical supports and so on from donors including Japan.

1.4 Cooperation between ASEAN and Japan

On the other hand, it was re-affirmed that Japan and the ASEAN would continue the mutual cooperation in the field of disaster management, at the Special Japan-ASEAN Ministerial Meeting in Jakarta on April 9, 2011 held soon after the Great East Japan Great Earthquake; at the ASEAN Post Ministerial Conference of July 21, 2011; and at the Japan-ASEAN Summit on November 18, 2011. At the meeting/conference, Japan has expressed its commitment to support the activities of AHA Centre not only directly to the Centre but also through bi-lateral cooperation with each ASEAN country for the regional natural disaster management.

1.5 Data Collection Survey

The activities of the AHA Centre have just started and therefore they do not have much information even fundamental on natural disasters and disaster management of the ASEAN countries.

Japan International Cooperation Agency (JICA) has therefore decided to conduct "the Data Collection Survey on ASEAN Regional Collaboration in Disaster Management" for considerations of future plans of assistances to the AHA Centre and each ASEAN country in the field of natural disaster management.

1.6 Purposes of the Survey

The purposes of the survey are as follows:

- To collect basic information on disaster management of the ASEAN counties;
- To conduct needs and potential assessment for development of disaster management in the ASEAN region; and,
- To propose an ASEAN guideline/reference for flood risk assessment.

1.7 Outputs to Be Expected

- Inventory of information on disaster management of each ASEAN country;
- List of programs/projects/schemes for future assistances for disaster management;
    - Bi-lateral assistance;
    - Regional assistance;
- ASEAN guideline/reference for flood risk assessment.

This report presents the country report of Indonesia. The full reports for the study were prepared separately as Main Report.

CHAPTER 2 HAZARD PROFILE

2.1 Introduction

The ASEAN countries are geographically located in Southeast Asia and north of Australia continent. The region is generally in areas of a tropical hot and humid climate zone the exception of the north-western part that experiences a humid sub-tropical climate. The region receives plentiful rainfall and remains humid in years. Generally, the countries have a dry and wet season due to seasonal shifts in monsoon, while the mountainous areas in the northern part have a milder and drier climate at high attitude.

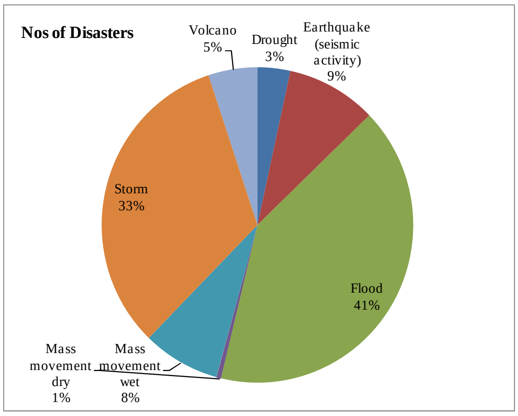
The ASEAN region is geographically diverse and includes high hills and rugged mountains, elevated plateaus, highlands, floodplains, coastal plains and deltas underlined by various types of geology. The region is also home to large river systems such as the Mekong and Ayeyarwady River, and major water bodies as the Tonle Sap and Lake Tobe. There are several tectonic plates in the region that have cause earthquakes, volcanic eruptions and tsunamis; also locate the two great oceans of the Pacific and the Indians that are origins of seasonal typhoons or cyclones and tsunami. All these natural set-up are the background of a history of devastating disasters of various types that have caused economic and human losses across the regions.

Hereafter Chapter 2 describes an overview of disasters for the past 32 years from 1980 to 2011 based mainly on the data from “EM-DAT: The OFDA/CRED International Disaster Database: www.emdat.be - Université Catholique de Louvain - Brussels – Belgium.[1]” “Criteria and definitions” by EM-DAT; and the full set of data used this chapter are shown in Chapter 2.4.

The Team notes that there are such issues in EM-DAT to be improved/ clarified that definitions of some hazards including multi-hazard are unclear, disasters of small scales are not, so on. However, this data base is considered useful when outlines of disasters among different states are compared on a same assumption. The Team presents this chapter with intention that ASEAN states may share the knowledge of disasters in neighboring states and that the states may re-recognize that a data base on the basis of the unified ASEAN criteria, instead of EM-DAT, should be needed for detail analysis/understanding of disasters in the ASEAN region.

[1] Among the data set categorized as natural disaster in EM-DAT, “epidemic”, “insect infestation” and “wildfire” are not included in this survey.

2.2 Natural Disasters in the ASEAN Region



Disasters from 1980 to 2011	Nos of Disasters	%
Drought	36	3.4%
Earthquake (seismic activity)	99	9.4%
Flood	433	41.0%
Mass movement dry	5	0.5%
Mass movement wet	85	8.0%
Storm	344	32.6%
Volcano	54	5.1%
Total	1,056	100.0%

Data from 1980 to 2011
Source: "EM-DAT: The OFDA/CRED International Disaster Database
www.emdat.be - Université Catholique de Louvain - Brussels - Belgium"
Presentation: JICA Study Team (2012)

Figure 2.2.1 Nos. of Natural Disasters in ASEAN Region (1980-2011)

<u>Number of Natural Disasters:</u>

Figure 2.2.1 shows that in 1980-2011, 41% of the total number of disasters in the ASEAN region was due to flooding, followed by storms (33%). 'Storms[2]' and 'floods' (water related hazard totaling to about 74%) are the most frequent hazards in the region. It may be noted that the 'mass movement' has similar frequency as the earthquake, implying that mass movement/sediment disasters may not be negligible in the ASEAN region.

<u>Total Number of Affected People</u>:

Figure 2.2.2 shows the total number of affected people. About 47% of the total number of people was affected due to 'storm' followed by 'flood' (33%). Water related hazards totaled to 80% and have significant impact on the people in the ASEAN region (Figure 2.2.2 above). On the other hand, 'drought' affects a large number of people per event followed by 'storm' and 'flood' (Figure 2.2.2 below), implying that 'drought' prevails in wider areas of the region.

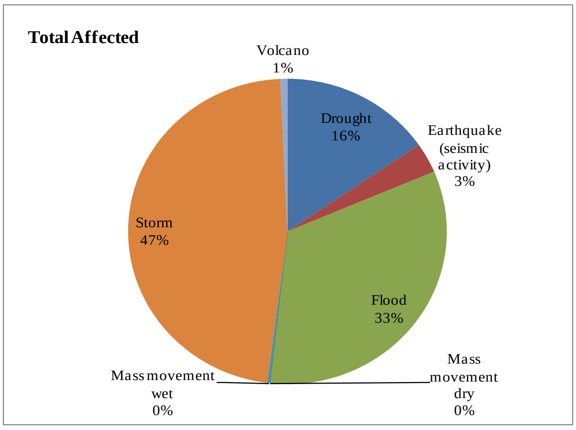
<u>Total Number of Deaths</u>:

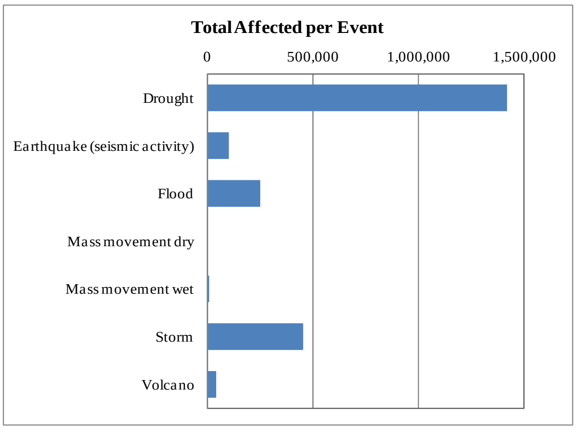
Figure 2.2.3 shows that 49% of deaths were due to 'earthquake' followed by 'storm (45%)'; these two disasters take 94% of the total death from natural disasters (Figure 2.2.3 above). In particular, 'earthquakes[3] (including tsunamis)' have the largest number of 'death per event' (Figure 2.2.3 middle), implying its devastating effects on human lives even with one occurrence.

It should be noted that in case of 'mass movement (dry)', 80% of affected people had been killed (Figure 2.2.3 below) that is the remarkable characteristic of the disaster of 'mass movement (dry)'. Mass movement (dry) will have fatal impacts on human who are to be involved.

[2] EM-DAT defines: Severe Storm: A severe storm or thunderstorm is the result of convection and condensation in the lower atmosphere and the accompanying formation of a cumulonimbus cloud. A severe storm usually comes along with high winds, heavy precipitation (rain, sleet, hail), thunder and lightning"

[3] EM-DAT does not include the terminology 'tsunami' in the 'disaster type' of the data base of July version.

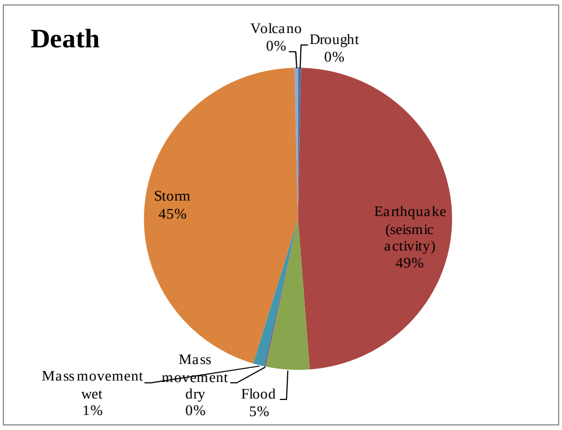


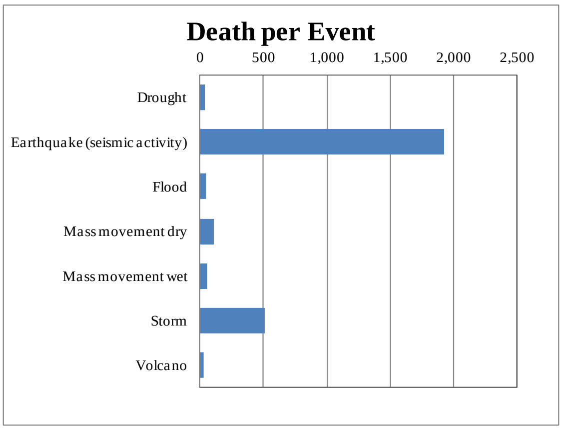


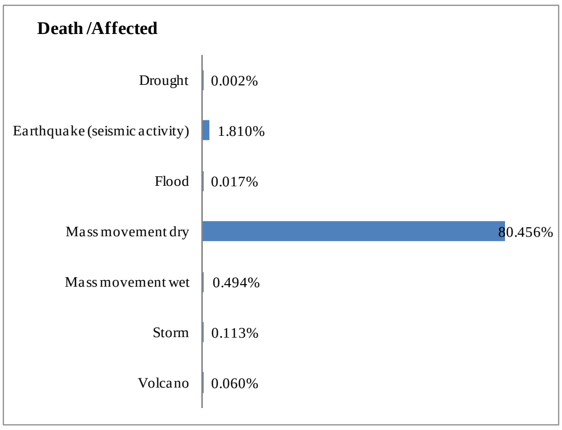
Total Affected	Total Affected	%	Nos of Disasters	Total Affected per event
Drought	51,030,144	15.4%	36	1,417,504
Earthquake (seismic activity)	10,526,945	3.2%	99	106,333
Flood	109,697,680	33.1%	433	253,343
Mass movement dry	701	0.0%	5	140
Mass movement wet	939,325	0.3%	85	11,051
Storm	156,402,854	47.3%	344	454,659
Volcano	2,358,679	0.7%	54	43,679
Total	330,956,328	100%	1,056	2,286,710

Data from 1980 to 2011
Data Source: "EM-DAT: The OFDA/CRED International Disaster Database
www.emdat.be - Université Catholique de Louvain - Brussels - Belgium"
Presentation: JICA Study Team (2012)

Figure 2.2.2 Total Number of Affected People in the ASEAN Region (1980-2011)







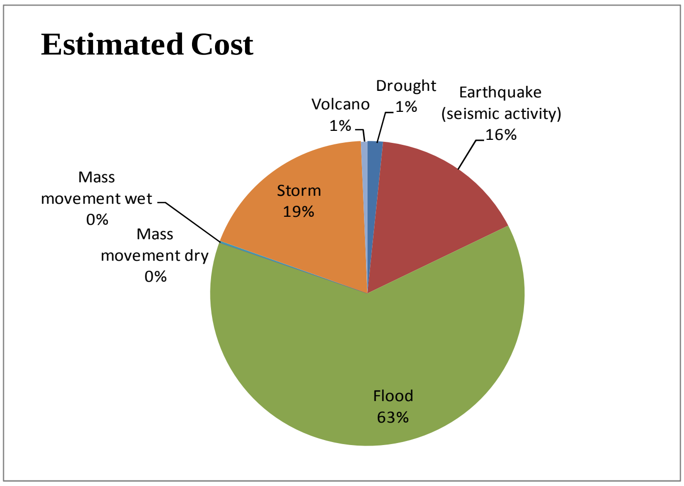
Death	Death	%	Nos of Disasters	Death per event	Death /Affected
Drought	1,274	0.3%	36	35	0.002%
Earthquake (seismic activity)	190,489	48.4%	99	1,924	1.810%
Flood	18,115	4.6%	433	42	0.017%
Mass movement dry	564	0.1%	5	113	80.456%
Mass movement wet	4,643	1.2%	85	55	0.494%
Storm	176,706	44.9%	344	514	0.113%
Volcano	1,409	0.4%	54	26	0.060%
Total	393,200	100%	1,056	2,709	0.119%

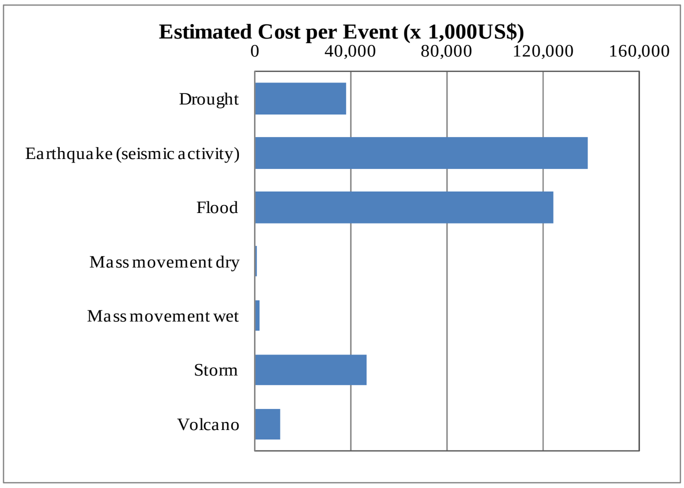
Data from 1980 to 2011
Data Source: "EM-DAT: The OFDA/CRED International Disaster Database
www.emdat.be - Université Catholique de Louvain - Brussels - Belgium"
Presentation: JICA Study Team (2012)

Figure 2.2.3 Total Number of Deaths in the ASEAN Region (1980-2011)

Estimated Cost per Disaster:

Figure 2.2.4 shows that 63% of the estimated cost of disasters in the ASEAN region is due to flooding followed by 'storm (19%)' and 'earthquake (16%)'. This implies that flood disasters have caused serious economic damages in the ASEAN region for the past 32 years (1980-2011).Among the estimated cost due to flood about 37% (45.7 million USD) is due to the flood in Thailand (2011). This event indicates that natural disasters striking industrial areas will cause great economic losses. On the other hand, earthquake disasters (including 'tsunami') have the largest number in estimated cost per event followed by flood, implying its destructive effects on tangibles that can be converted to cost.





Estimated Cost	Estimated Cost	%	Nos of Disasters	Estimated Cost per event
Drought	1,365,873	1.6%	36	37,941
Earthquake (seismic activity)	13,733,201	16.0%	99	138,719
Flood	53,771,117	62.8%	433	124,183
Mass movement dry	1,000	0.0%	5	200
Mass movement wet	156,326	0.2%	85	1,839
Storm	16,024,450	18.7%	344	46,583
Volcano	560,472	0.7%	54	10,379
Total	85,612,439	1	1,056	359,844

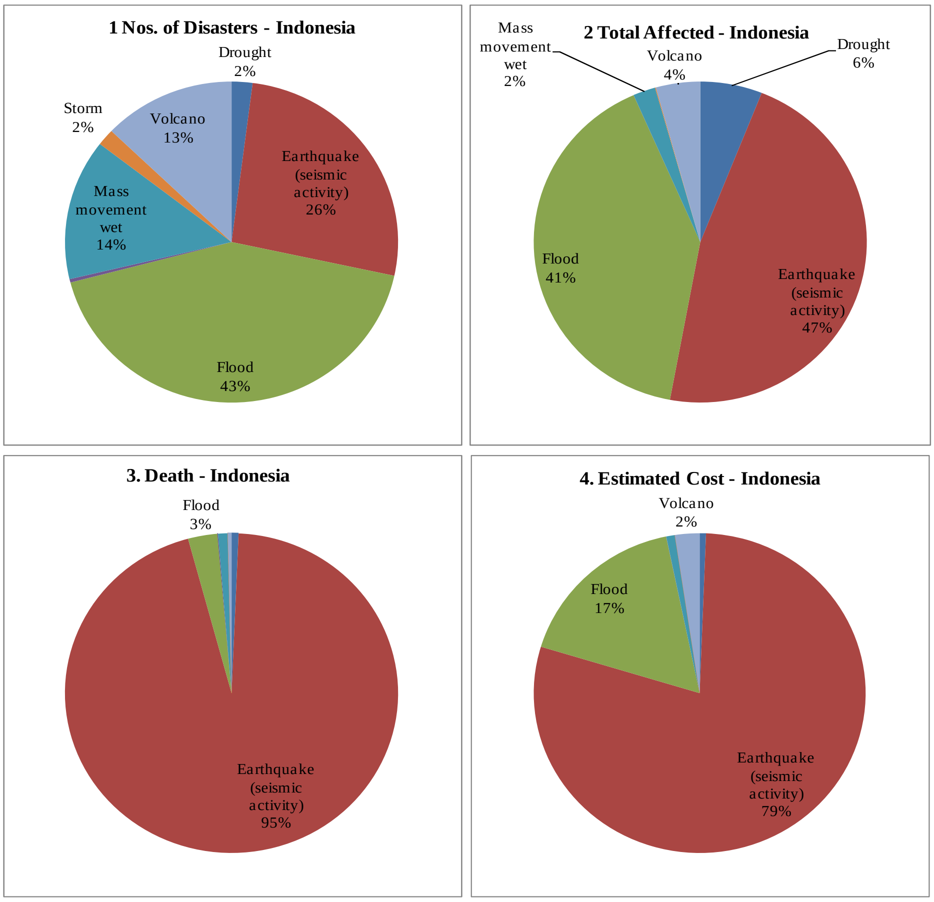
Data from 1980 to 2011
Data Source: "EM-DAT: The OFDA/CRED International Disaster Database
www.emdat.be - Université Catholique de Louvain - Brussels - Belgium"
Presentation: JICA Study Team (2012)

(x 1,000US$)

Figure 2.2.4 Estimated Cost per Disaster in the ASEAN Region (1980-2011) (x US$1,000)

2.3 Outline of Natural Disasters

Figure 2.3.1 shows the various types of disasters occurred in Indonesia such as flooding (43%), earthquake (26%), mass movement-wet (14%), and volcanic eruption (13%). Earthquake (47%) and flood (41%) disrupted 88% of the total number of affected people. On the other hand, earthquake caused the highest number of death (95% of the total death) and significant economic losses to 79% of the total estimated damage cost as shown in Figure 2.3.2. This is mainly due to the Sumatra Earthquake in 2004 and Java Earthquake in 2006. Flooding and earthquake will be the two major disasters that have great impact in Indonesia.



	Drought	Earthquake (seismic activity)	Flood	Mass movement dry	Mass movement wet	Storm	Volcano	Total
1 Nos. of Disasters - Indonesia	6	78	126	1	42	5	38	296
2 Total Affected - Indonesia	1,083,000	8,438,429	7,290,138	701	392,967	14,638	772,966	17,992,839
3. Death - Indonesia	1,266	179,378	5,382	131	1,757	6	690	188,610
4. Estimated Cost - Indonesia	89,000	11,349,576	2,452,016	1,000	120,745	0	344,190	14,356,527

Data from 1980 to 2011
Data Source: "EM-DAT: The OFDA/CRED International Disaster Database
www.emdat.be - Université Catholique de Louvain - Brussels - Belgium"
Presentation: JICA Study Team (2012)

Cost (x 1,000US$)

Figure 2.3.1 Outline of Natural Disasters in Indonesia

2.4 Appendix to Chapter 2: Data Set Utilized for the Descriptions

The data set for the period of 1980 – 2011 were used for the description of the disaster outline in ASEAN region in this Chapter 2; and are presented in the tables for further reference.

The data were downloaded from "EM-DAT: The OFDA/CRED International Disaster Database; www.emdat.be - Université Catholique de Louvain - Brussels - Belgium" in July 2012.

The followings are criteria for a disaster to be entered in the database and definitions for classification for damages. Please refer to the web-site indicated above, for further information.

CRITERIA AND DEFINITION

CRITERIA

For a disaster to be entered into the database, at least one of the following criteria must be fulfilled:

- Ten or more people reported killed.
- One hundred or more people reported affected.
- Declaration of a state of emergency.
- Call for international assistance.

DEFINITION

EM-DAT data include the main following information:

Country: Country (ies) in which the disaster has occurred.

Disaster type: Description of the disaster according to a pre-defined classification

Date: When the disaster occurred. The date is entered as follow: Month/Day/Year

Killed: Persons confirmed as dead and persons missing and presumed dead (official figures when available)

Injured: People suffering from physical injuries, trauma or illness, requiring medical treatment as a direct result of a disaster

Homeless: People needing immediate assistance for shelter

Affected: People requiring immediate assistance during a period of emergency; it can also include displaced or evacuated people

Total affected: Sum of injured, homeless, and affected

Estimated Damage: Several institutions have developed methodologies to quantify these losses in their specific domain. However, there is no standard procedure to determine a global figure for economic impact. Estimated damage are given (000') US$

(http://www.emdat.be/criteria-and-definition)

Table 2.4.1 Disaster Data Set of ASEAN Member States – Number of Disaster

No.	State	Drought	Earthquake (Ground Shaking)	Flood	Mass Movement (Wet)	Mass Movement (Dry)	Storm	Volcanic Eruption
1	Brunei	0	0	0	0	0	0	0
2	Cambodia	5	0	15	0	0	3	0
3	**Indonesia**	6	78	126	1	42	5	38
4	Lao	4	0	15	0	0	5	0
5	Malaysia	1	1	32	1	4	6	0
6	Myanmar	0	4	13	0	3	6	0
7	Philippines	7	13	109	3	27	209	16
8	Singapore	0	0	0	0	0	0	0
9	Thailand	8	3	60	0	3	30	0
10	Vietnam	5	0	63	0	6	80	0
	ASEAN	36	99	433	5	85	344	54

Data source: "EM-DAT: The OFDA/CRED International Disaster Database; www.emdat.be - Université Catholique de Louvain - Brussels - Belgium" in July 2012

Table 2.4.2 Disaster Data Set of ASEAN Member States– Total Number of Affected People

No.	State	Drought	Earthquake (Ground Shaking)	Flood	Mass Movement (Wet)	Mass Movement (Dry)	Storm	Volcanic Eruption
1	Brunei	0	0	0	0	0	0	0
2	Cambodia	6,550,000	0	11,173,637	0	0	178,091	0
3	**Indonesia**	1,083,000	8,438,429	7,290,138	701	392,967	14,638	772,966
4	Lao	750,000	0	3,259,740	0	0	1,436,199	0
5	Malaysia	5,000	5,063	566,058	0	291	47,946	0
6	Myanmar	0	37,137	850,112	0	146,367	2,866,125	0
7	Philippines	6,549,542	1,979,293	15,414,285	0	317,516	103,563,950	1,585,713
8	Singapore	0	0	0	0	0	0	0
9	Thailand	29,982,602	67,023	46,426,691	0	43,110	4,235,503	0
10	Vietnam	6,110,000	0	24,717,019	0	39,074	44,060,402	0
	ASEAN	51,030,144	10,526,945	109,697,680	701	939,325	156,402,854	2,358,679

Data source: "EM-DAT: The OFDA/CRED International Disaster Database; www.emdat.be - Université Catholique de Louvain - Brussels - Belgium" in July 2012

Table 2.4.3 Disaster Data Set of ASEAN Member States – Total Number of Deaths

No.	State	Drought	Earthquake (Ground Shaking)	Flood	Mass Movement (Wet)	Mass Movement (Dry)	Storm	Volcanic Eruption
1	Brunei	0	0	0	0	0	0	0
2	Cambodia	0	0	1,382	0	0	44	0
3	**Indonesia**	1,266	179,378	5,382	131	1,757	6	690
4	Lao	0	0	135	0	0	72	0
5	Malaysia	0	80	196	72	96	275	0
6	Myanmar	0	145	422	0	109	138,709	0
7	Philippines	8	2,540	2,396	361	2,304	26,055	719
8	Singapore	0	0	0	0	0	0	0
9	Thailand	0	8,346	3,493	0	47	895	0
10	Vietnam	0	0	4,709	0	330	10,650	0
	ASEAN	1,274	190,489	18,115	564	4,643	176,706	1,409

Data source: "EM-DAT: The OFDA/CRED International Disaster Database; www.emdat.be - Université Catholique de Louvain - Brussels - Belgium" in July 2012

Table 2.4.4 Disaster Data Set of ASEAN Member States – Estimated Cost (x US$1,000)

No.	State	Drought	Earthquake (Ground Shaking)	Flood	Mass Movement (Wet)	Mass Movement (Dry)	Storm	Volcanic Eruption
1	Brunei	0	0	0	0	0	0	0
2	Cambodia	138,000	0	919,100	0	0	10	0
3	**Indonesia**	89,000	11,349,576	2,452,016	1,000	120,745	0	344,190
4	Lao	1,000	0	22,828	0	0	405,951	0
5	Malaysia	0	500,000	1,012,500	0	0	53,000	0
6	Myanmar	0	503,600	136,655	0	0	4,067,688	0
7	Philippines	64,453	380,025	1,234,883	0	33,281	6,265,657	216,282
8	Singapore	0	0	0	0	0	0	0
9	Thailand	424,300	1,000,000	44,355,408	0	0	892,039	0
10	Vietnam	649,120	0	3,637,727	0	2,300	4,340,105	0
	ASEAN	1,365,873	13,733,201	53,771,117	1,000	156,326	16,024,450	560,472

Data source: "EM-DAT: The OFDA/CRED International Disaster Database; www.emdat.be - Université Catholique de Louvain - Brussels - Belgium" in July 2012

CHAPTER 3 ORGANIZATION AND INSTITUTION

3.1 Disaster Management Law and Policy

The Disaster Management Law (No. 24) was enacted in 2007. Ancillary regulations for this law are also enacted in 2008: 1) Regulation No. 22 on Disaster Aid Financing and Management, 2) Regulation No.23 on Participation of International Institutions and Foreign Non-Governmental Organizations in Disaster Management, and 3) Regulation No.8 on National Agency Disaster Management. Disaster mitigation aspects are reflected in nearly all of the ministries' policy framework.

3.2 Disaster Management Plan and Budget

In 2006, the National Action Plan for Disaster Reduction 2006-2009 was issued. The budget for disaster management had been allocated to special recovery fund for the incurred disasters, to Public Works, the Department of Social Services, and the disaster management agency, BAKORNAS PB (National Coordinating Board for Disaster Management). This was done without giving BAKORNAS PB an authority over budget control for disaster management activities.

Following its former plan and as Law No. 24 requires, the National Action Plan for Disaster Risk Reduction 2010-2012 was issued by BAPPENAS (the State Ministry for National Development Planning) and BNPB (National Agency for Disaster Management) in 2010 as the basis and reference for the stakeholders to implement disaster management measures. ' By March 2012, all 33 provinces have prepared provisional versions of their respective plans[1]. The local plan is supposed to be prepared in the regency and city level where BPBDs (Local Disaster Management Agency) are also to be established. Disaster Management is one of the priorities in the National Middle-term Development Plan (2010-2014) .

The National Disaster Management Plan 2010-2014 was also issued by BNPB (National Agency for Disaster Management) for reference in order that disaster management activities/programs are integrated into the mainstream strategic plans for every government organization in Indonesia. The National Disaster Management Plan consists of data and information related to disaster risks in Indonesia in 2010-1014 and of the government's plan to reduce these risks through development programs and activities.

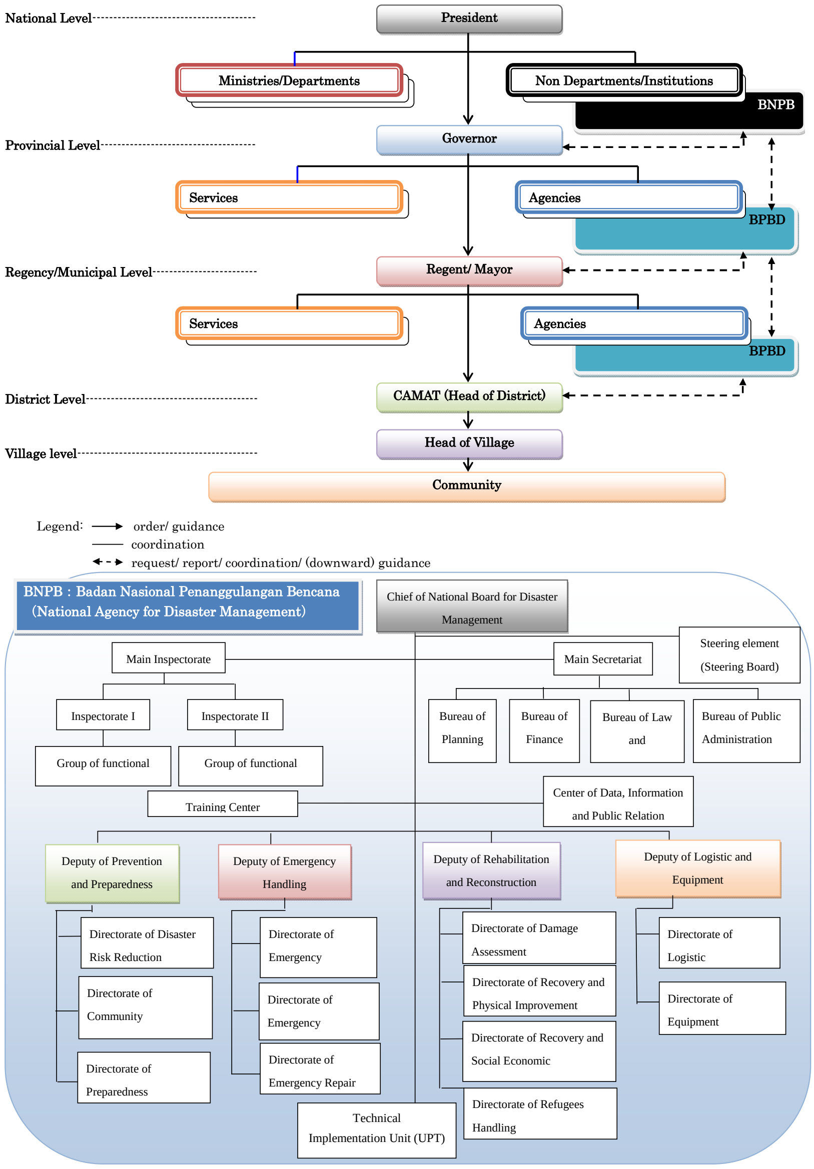
The new law ensures that BNPB has authority of budget control to a certain degree (including "ready fund"). Within the scope of decentralization, regional government budgets such as the special allocation fund and de-concentration fund are available to strengthen institutions, emergency response, and recovery/rehabilitation expense.

[1] According to interview survey to BNPB by JICA Study Team (2012)

3.3 Disaster Management Organization

In 2008, BNPB was established as a comprehensive disaster management implementation and coordination body. BNPB is a non-departmental agency similar to the ministries with about 250 staffs[2]. The Chief of BNPB, with equal rank to the ministers, has an obligation to report to President of Indonesia once a month. BNPB is a self-contained agency comprising the elements as the 'steering committee' and 'management executing body'.

It is supposed that BPBD (Local Disaster Management Agency) is established at every province, district, and city. All 33 provinces already have BPBDs, while 395 out of 405 regencies and 97 cities have established them[3].



Sources: (Above) Dr. Syamsul Maarif, Msi (date unknown) *Disaster Management in Indonesia*, (Presentation Slide), p.11. (Below) http://www.bnpb.go.id/website/asp/content.asp?id=4 [Accessed: June 3, 2012] (BNPB's organogram was provisionally translated in English by the JICA Study Team)

Figure 3.3.1 Indonesia's Disaster Management Structure (Top) and BNPB's Organogram (Bottom)

[2] According to the information obtained from BNPB by JICA Study Team (2012)
[3] Indonesia (2011) *National Progress Report on the Implementation of the Hyogo Framework for Action (2009-2011)*, p.3.

3.4 Disaster Management at Community Level

Clauses 26 and 27 of the Disaster Management Law No.24 prescribe the rights and obligations of the community in disaster management. Several activities have been conducted by government agencies and donors. BNPB has conducted the Resilient Village Program for selected villages. Nevertheless, it is said that the communities have not been well-involved in the formulation process of disaster management and risk reduction programs. The existing mechanism needs to be improved in terms of the participatory process, which applies to the same issue of information dissemination to, and valid data collection from, the community[4].

In the case of DKI Jakarta, BPBD has created closer relationship with local communities, networking and having meetings with them from time to time, and listing available resources with which these communities can provide when disaster strikes.

3.5 Issues and Needs Concerning Organization and Institution

(1) Issues[5]

a) To enhance understanding and prioritize disaster risk reduction at the local level;

b) To apply BNPB's guideline for the preparation of a Regional Action Plan for Disaster Risk Reduction at the BPBD level;

c) To enhance expertise in both BNPB and BPBDs; and

d) To get valid data and information of community-based disaster management in place in order to prepare local level risk maps.

(2) Needs[6]

a) Dissemination and mainstreaming of disaster risk reduction at the local level;

b) Training of BNPBs' as well as BPBDs' experts/staffs for capacity development; and

c) Development of BPBD's capacity to implement community-based disaster management activities.

4 *Ibid.*, p.7.

5 All the views, based on the analysis of Indonesia's "*National Progress Report on the Implementation of the Hyogo Framework for Action (2009-2011)*" and the answer sheet of the questionnaire prepared for the study, are attributed to the JICA Study Team.

6 All the views are attributed to the JICA Study Team.

CHAPTER 4 PRESENT SITUATION OF DISASTER MANAGEMENT AGAINST PREVAILING NATURAL DISASTERS IN INDONESIA

4.1 Flood

(1) Present Situation of Flood Disaster

Indonesia has suffered from flooding almost every year at some area in the country. During the last decade, flooding has caused more than 1,800 deaths in total all over the country. There are 5590 main rivers throughout the country and 600 of them have the potential to cause floods.

(2) Risk Assessment

Flood hazard maps of each province have been prepared and updated every year by the Ministry of Public Works (PU) in cooperation with the Meteorological, Climatological and Geophysical Agency (BMKG) and the Geospatial Information Agency (BIG), formerly BAKOSURTANAL.

(3) Monitoring / Early Warning System

The Directorate General of Water Resources (DGWR) under PU is responsible for overall flood management. Based on the Ministry of Public Works Decree No. 12/PRT/M/2006, the BBWS and BWS offices were established in 2006 to manage water resources in particular strategic basins. At present, there are 12 BBWS and 21 BWS offices managing a total of 65 basins.

Each BBWS office prepares guidelines on flood alert every rainy reason. The guidelines indicate institutional arrangement, monitoring network, and flow chart of reporting, coordinating and disseminating warning information. All major rivers have three steps in warning the water level.

In some river basins, telemetric systems for flood forecasting and early warning have been installed and operated by BBWS.

On the other hand, BMKG also has 175 automatic weather stations in the country. BMKG provides information on flood potential areas in Jakarta everyday based on analysis using rainfall data, and also provides flood warning based on rainfall.

(4) Preparedness / Prevention and Mitigation

Based on the master plan on flood control and drainage, various short-term and mid-term programs (2002-2016) are being implemented. Structural measures for flood control such as dams, dikes, diversion channels, retarding basins, and other related river improvement works have been constructed and managed by PU.

(5) Emergency Response

As an institutional system to respond to flood disasters, Flood Operation Community Units (POKOMAS) are organized at each local level office under Ministry of Public Works. The Flood Operation Community Units correspond to Regional Disaster Management Agency

(BPBD) at provincial, *kabupaten/kota*, *kechamatan*, and town/village levels under BNPB at national level. Flood Operation Community Units respond to only flood, while Disaster Management Agency (BPBD) under BNBP respond to all kinds of disaster.

Flood Operation Community Unit at the town/village level, performs as the center of flood response activities and evacuation, and also prepares evacuation centers and necessary equipment.

- Although Ministry of Public Works has developed a manual for preparation of early warning and evacuation system for flood, evacuation plans have been prepared for the limited flood prone areas. This may be because sufficiently detailed flood hazard maps have not been prepared.[1]
- Establishment of FFWS (Flood Forecast and Warning System) is still limited to certain parts of flood prone areas. It is required to establish such systems in other flood prone areas[1].

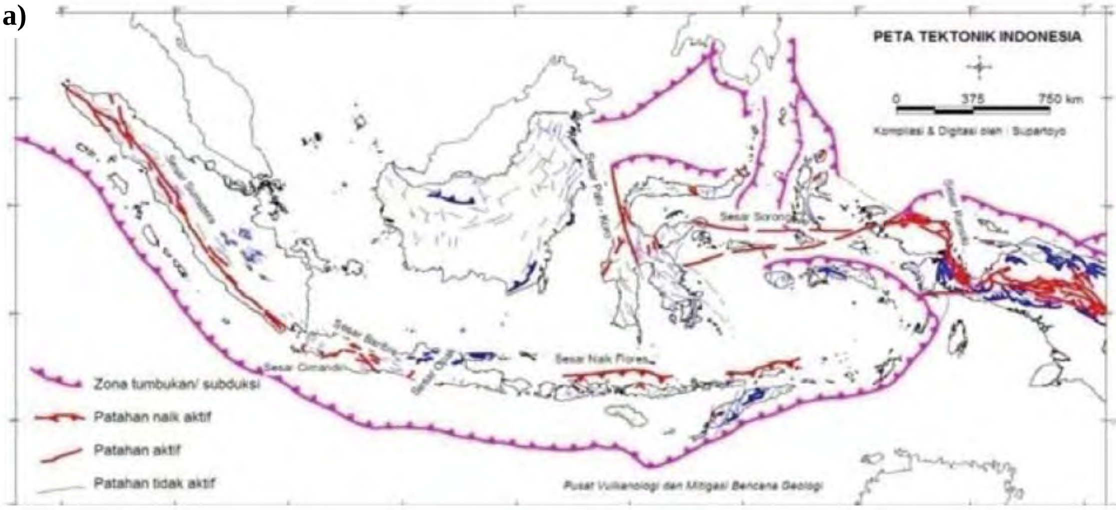
4.2 Earthquake and Tsunami

(1) Present Situation of Earthquake and Tsunami Disaster

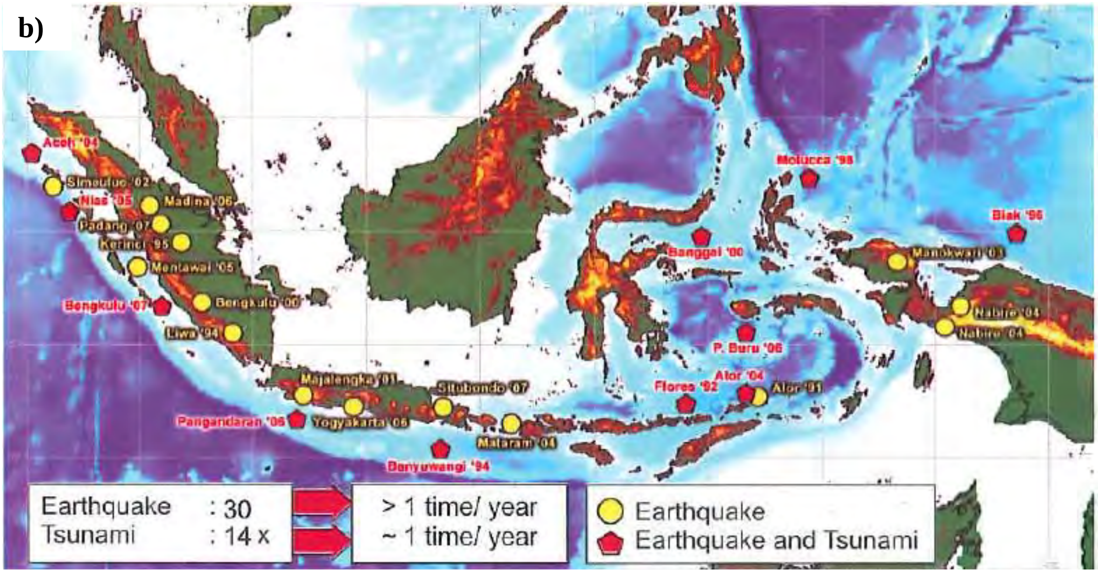
Indonesia is located on an earthquake belt along the boundary of tectonic plates, and has many active faults (Figure 4.2.1a). Earthquakes with a magnitude of greater than 5.5 have occurred at an average of about 100 times per year. From 1991 to 2009, a total of 30 destructive earthquakes and 14 destructive tsunamis have been recorded (Figure 4.2.1b). In particular, many large earthquakes have occurred at the Java and Sumatran trenches wherein the Indo-Australian Plate is subducting beneath the Eurasian Plate.

Earthquakes greater than M_w=8 have occurred in the past, particularly in Bengkulu and West Sumatra in 1833 (M_w=8.3), Mangole and Taliabu in 1998 (M_w=8.3), Maluku in 2004 (M_w=9.0), Northern Sumatra in 2004 (M_w=9.1), Aceh and North Sumatra in 2005 (M_w=8.7), Nias Island and Bengkulu in 2007 (M_w=8.4), and Northern Sumatra in 2012 (M_w=8.6). In particular, the earthquake in the Indian Ocean off Sumatra was followed by a large-scale tsunami that hit Aceh on December 26, 2004 (M_w=9.1) killing over 170,000 people and leaving 120,000 missing people.

[1] The view is attributed to the JICA Study Team.

a)


Source: BNPB, National Disaster Management Plan 2010-2014, pp.7, Figure 2.1

b)


Source: BMKG, InaTEWS Concept and Implementation, pp.4, Figure 9

Figure 4.2.1 a) Map of Tectonic Plates and Distribution of Active Faults in Indonesia, b) Destructive Earthquakes and Tsunamis in 1991-2009

(2) Risk Assessment

Several seismic hazard maps have been developed by relevant institutions. Multi-hazard maps for flooding and tsunami have been published and posted on the website by the Geospatial Information Agency (BIG)[2] of Ministry of Energy and Mineral Resources. The active fault maps of Merapi volcano and Karkato volcano; and the seismotectonic map of Manado were developed by the Geology Research Development Centre (GRDC). In 2012, investigation on the Palu-Koro Fault in Celebes Island has been conducted using aerial photographs.

Tsunami hazard maps of Sulawesi, Barat, Grontalo, and Aceh have been developed by the GRDC. In 2012, developments of tsunami hazard maps of Sulawesi Utara and Sulawesi Selatan have commenced. For Aceh Province, risk maps have been developed by TDMRC

[2] BIG website: http://www.bakosurtanal.go.id/bakosurtanal/multihazard/sumatera.html

(Tsunami & Disaster Mitigation Research Center, Syiah Kuala University) as shown in Table 4.2.1 and Figure 4.2.2.

Table 4.2.1 Risk Maps of Aceh Province

Name	Summary
ADRM (Aceh Disaster Risk Map)	Hazard map and vulnerability map of earthquakes, tsunamis, volcanoes, and landslides in Aceh Province.
ATaDRM (Aceh Tamiang Disaster Risk Map)	Hazard map and risk map of earthquakes and landslides in Aceh Tamiang District.
ABaDRM (Aceh Barat Disaster Risk Map)	Hazard map and risk map of earthquakes, landslides, and tsunamis in Aceh Barat District.

Source: Ache Disaster Risk Map, 2011

Figure 4.2.2 Example of Aceh Disaster Risk Map (ADRM)

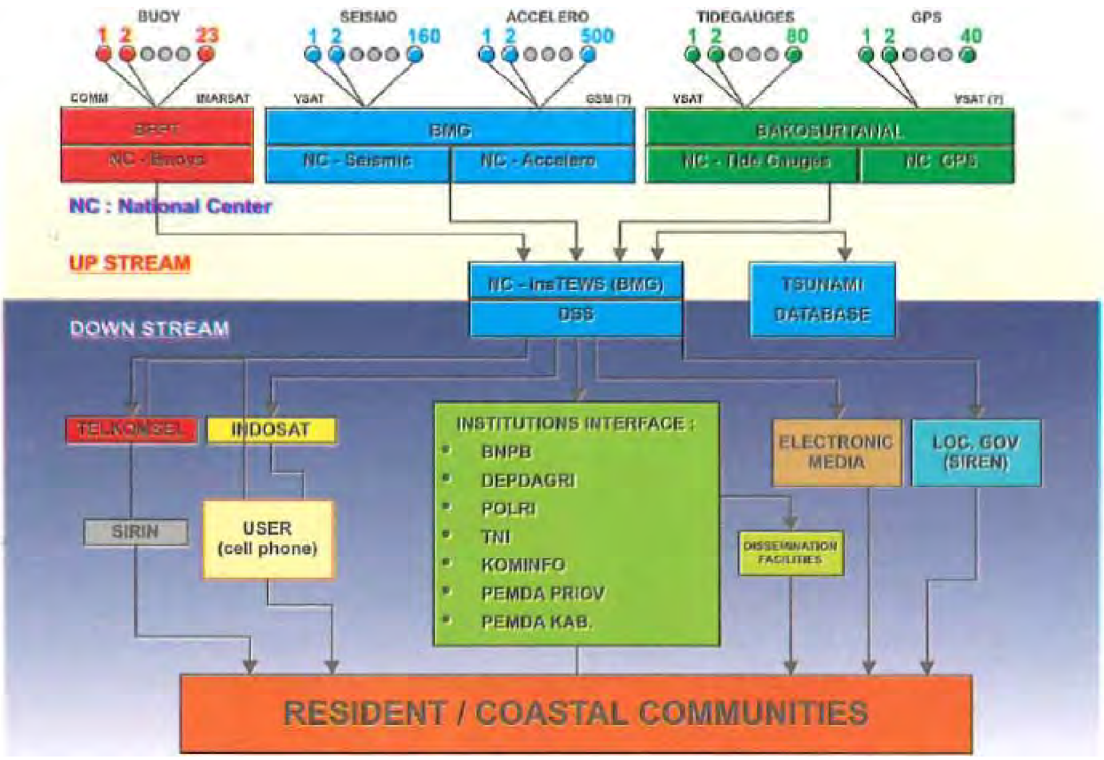
A database on disasters in Indonesia called DIBI (Data dan Informasi Bencana Indonesia) has been published on the website of BNPB (http://dibi.bnpb.go.id).

Since the maps have been drawn by various government offices, the JICA Study Team recommends that the portal site for hazard maps and risk maps needs to be developed in order for users to collect information easily.

(3) Monitoring / Early Warning System

Shake maps, which indicate the modified Mercalli intensity of each earthquake event, are produced by the BMKG using USGS software after the occurrence of an earthquake. Such maps have been transmitted to BNPB and published on the BMKG website (http://inatews.bmkg.go.id).

The early warning system for tsunami called InaTEWS (Indonesia Tsunami Early Warning System) has been introduced to Indonesia through the support from Germany and it has been operated by the BMKG. InaTEWS is an integrated system composed of seismic and tsunami observations, analysis, judgment, and dissemination (see Figure 4.2.3).



Source: BMKG, InaTEWS Concept and Implementation, pp.11, Figure 14

Figure 4.2.3 Basic Concept of InaTEWS

Seismic observation has been conducted using the instruments listed in Table 4.2.2. The observation data is transmitted through satellite VSAT system to the InaTEWS National Center operated by BMKG. According to the BMKG, the number of observation instruments have been planned to be increased in order to improve the observation accuracy for earthquakes and tsunamis and the speed of hypocenter and magnitude determinations.

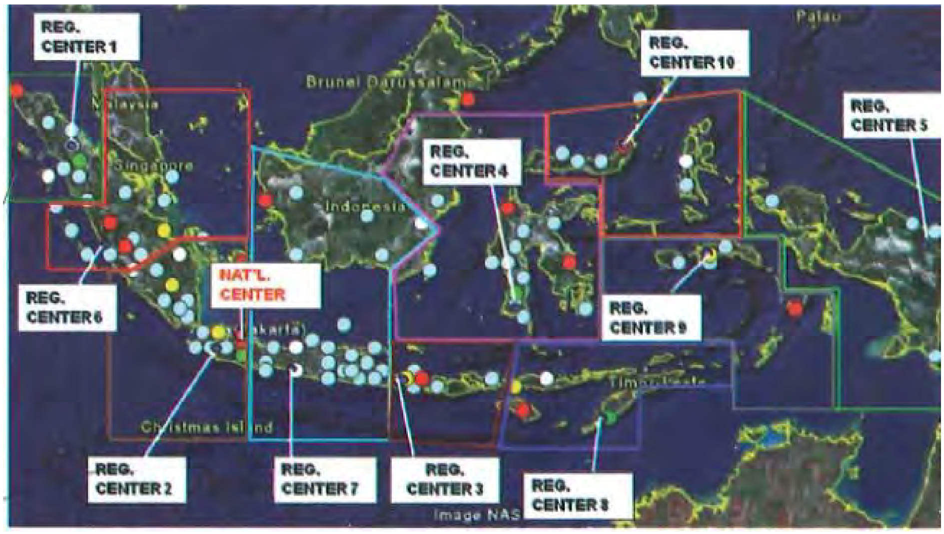
Since observation instruments are manufactured in foreign countries making them expensive for the nation, many Indonesian researchers wish to develop/manufacture such observation instruments in Indonesia. The BMKG says that technology and knowledge need to be introduced in order to be able to manufacture the additional observation instruments in the country.

Table 4.2.2 List of Observation Instruments for InaTEWS

Name	Planned Quantity**	Present Quantity*	Failure**	Responsibility*
Broadband Seismometer	160	160	About 20%	BMKG
Accelerometer	500	216	About 20%	BMKG
GPS	40	20	-	BIG
Buoy	23	2	-	BPPT
Tide Gauge	80	58	Low	BIG

Source: *BMKG, *InaTEWS Concept and Implementation*, pp.412-15, ** Interview with BMKG, on February 8, 2011

The software "SeisComp3" in InaTEWS has been utilized to analyze the hypocenter, magnitude and occurrence time of an earthquake.



Source: BMKG, InaTEWS Concept and Implementation, pp.12, Figure 16

Figure 4.2.4 Broadband Seismograph and Accelerograph Network

The information system of InaTEWS disseminate the warnings to the BNPB, Ministry of Communication and Information Technology (KOMINFO), BPBD, police, army, local governments, TV station, etc. by digital video broadcasting (DVB) through satellite connection, telephone, fax, SMS, and internet. Regular television programs are interrupted to broadcast early warnings.

In Indonesia, several ways of transmitting disaster information have been established. The JICA Study Team recommends that a study on information methods needs to be conducted, considering the possibility that electricity and information networks would not be available due to an earthquake.

The building of the InaTEWS National Center, wherein InaTEWS is being operated, was built based on the seismic design code in Jakarta and is equipped with emergency electricity sources such as uninterruptible power supply (UPS) (for 30 minutes) and diesel generator (for six hours) in case a blackout occurs due to an earthquake.

The tsunami buoys are being operated by the BPPT at only two stations (whereas 23 stations are planned) because some of the buoys had either been stolen or vandalized. The BPPT has planned to install a new tsunami early warning system using submarine cable. The first one will be installed in June 2012. The BPPT conducts tsunami forecasting and issues a warning within 20 minutes after an earthquake occurs, based on tsunami monitoring results and their own tsunami simulation results. However, these results were not been taken into account in InaTEWS. InaTEWS utilizes the results of tsunami simulation conducted by the BMKG.

The BMKG, which operates the InaTEWS system, plans to introduce two new tide gauge systems. The existing tide gauge system of BIG is not capable enough to be utilized for the tsunami early warning system due to transmission speed, as it was installed for tidal fluctuation observation.

A tsunami warning is issued by BMKG within five minutes after an earthquake using Decision Support System (DSS), which takes into account the following:

a) The magnitude is over 7.0.
b) The earthquake focal depth is less than 100km.
c) The epicenter is under the sea.

The chief officer on duty (COD) of the team operating InaTEWS presented information on the height and arrival time of a tsunami within ten minutes, which is supported by DSS with reference to the tsunami simulation database. The tsunami computer simulation has already been conducted for all seas around Indonesia; however, only the tsunami simulation results on the west side of Sumatra Island and Java Island had been registered to DSS. Therefore, in case that an earthquake occurs in other unregistered regions, the InaTEWS operators have to determine corresponding tsunami simulation results manually. After which InaTEWS releases visual information through CCTV and observation data. If the tsunami had not been observed by the observation system, the tsunami warning would be cancelled.

Since only tsunami simulation results from a limited number of cases have been registered in InaTEWS, it is necessary to register the results of BPPT's and University's simulation into InaTEWS for timely issuance of tsunami early warnings, and also to improve the accuracy of tsunami warning simulation results by comparing actual tsunami observation data with the tsunami simulation results.

In case of the tsunami caused by the Mentawai Earthquake in 2010 (M_w=7.7), the tsunami simulation was not consistent with the result of actual tsunami observation. Hence, a new tsunami simulation program has been installed in InaTEWS; however, a comparison between tsunami simulation results and observed data has not been made yet.

In Aceh Province, tsunami warnings have been disseminated through the following steps:

a) Badan Penanggulangan Bencana Aceh (BPBA) receives information on a tsunami warning from the BMKG.
b) The BPBA transfers the information to the governor for confirmation of the necessity of a tsunami warning to the public.
c) Should a governor decide to release a tsunami warning, the BPBA alarms four sirens and informs the tsunami warning to the Fire and Disaster Management Agency (BPBK) via telephone.
d) The BPBK then informs the tsunami warning to the army, police, etc. via telephone. The tsunami information is broadcasted at the mosques as well through audio speakers.

A detailed tsunami simulation has been conducted by the Tsunami and Disaster Mitigation Research Center of Syiah Kuala University (TDMRC) in Aceh Province. However, its results have not been applied to InaTEWS. Also, the notification of a tsunami warning to registrants via SMS was tested through a pilot project by Syiah Kuala University.

The Ministry of Research and Technology (RISTEK) has adjusted for the differences between the investigations conducted by the National Institute of Science (LIPI), BPPT, and BIG.

Led by UNESCO, the Indian Ocean Tsunami Warning and Mitigation System (IOTWS) were established in 2011 as a tsunami early warning system in countries along the Indian Ocean. Indonesia has provided seismic information to IOTWS as the Regional Tsunami Information Center (RTSP) and informed early warnings to the ASEAN Earthquake Information Center (AEIC).

(4) Preparedness / Prevention and Mitigation

The following guidelines were published and upgraded by RISTEK, and are utilized as national standards:

- Guideline Tsunami Evacuation Map,
- Guideline Tsunami Evacuation Sign Boards (includes examples of full-size sign boards),
- Guideline Tsunami Evacuation Building Development, and
- Guideline Tsunami Evacuation Drill Implementation for City and Regency (edited by RISTEK and published as national guidelines).

Educational materials on tsunami disaster prevention were published by LIPI (see Figure 4.2.5).

Source: LIPI, Selamat dari Terjangen Tsunami, Cara Menarik Mewaspadai Dan Mengantisipasi Bencana.

Figure 4.2.5 Educational Materials on Tsunamis

A database on the disasters that have occurred in Aceh Province called DIBA (Data dan Informasi Bencana Aceh) has been posted on the website[3]. A pilot project which supported the preparedness and education in schools was carried out by Syiah Kuala University. The Aceh Tsunami Museum was constructed to educate people on tsunamis, and also to be used as a tsunami evacuation building that could accommodate 6000 people. Educational materials on tsunami disaster prevention were published by the TDMRC (Figure 4.2.6).

The residents of Aceh Province were confused or did know how to respond when the magnitude 8.0 earthquakes occurred on April 12, 2012, possibly because knowledge on emergency evacuation has not been imparted enough to the public even in Aceh Province.

3 http://diva.acehprov.go.id

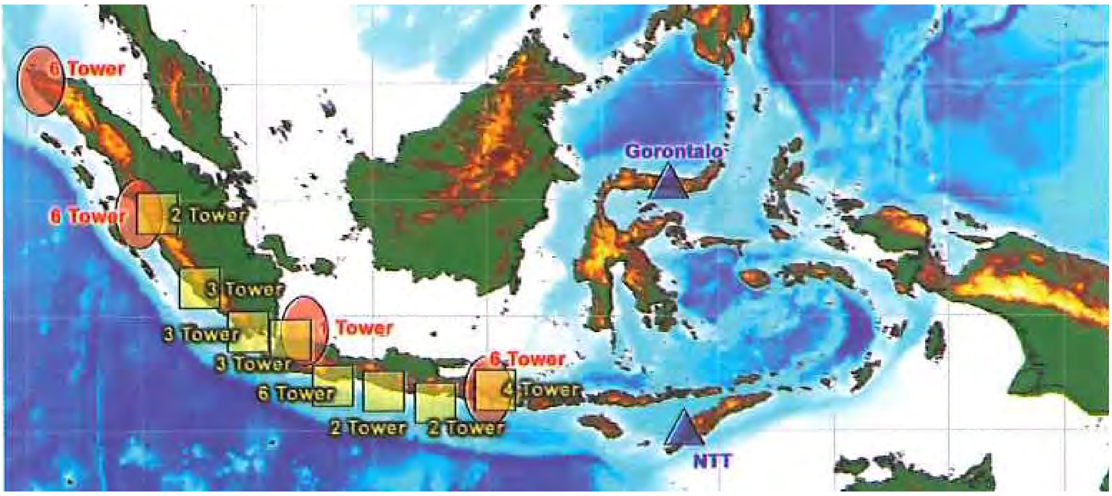
Since it may be difficult to build large-scale structural countermeasures immediately due to economic and technical constraints, the JICA Study Team recommended that intensive education and training/exercises on evacuation as well as preparation of evacuation routes need to be carried out.

Source: a) TDMRC, *SMONG*, Vol.2, No.6, b) TDMRC, Kesiapsiagaan Bencana

Figure 4.2.6 Educational Materials on Tsunami

(5) Emergency Response

The warning system of InaTEWS is considered an effective method for dissemination of tsunami information. Twenty four units of the Tsunami siren have been installed in six provinces and are being operated by the BMKG in Jakarta (see Figures 4.2.7 and 4.2.8).



Source: BMKG, InaTEWS Concept and Implementation, pp.25, Figure 37

Figure 4.2.7 Tsunami Siren Network in Indonesia

Source: JICA Study Team

Figure 4.2.8 Tsunami Siren in Aceh Province

BPBA developed the SOP for tsunami disaster prevention including an evacuation plan and the contingency plans in all districts of Aceh Province.

There are four evacuation buildings in Aceh Province (Figure 4.2.9) constructed by a Japan's grant aid project; however, breakwaters and seawalls against tsunamis have not been constructed there.

According to Aceh province government, since local organizations sometimes are not familiar with the SOP, their officers need to master the SOP as part of their disaster management in case an emergency situation occurs. Therefore, further education and training are necessary.

Source: JICA Study Team

Figure 4.2.9 Evacuation Building at Aceh Province
(Four evacuation buildings were constructed by a Japan's grant aid project)

(6) Issues and Needs

1) Issues[4]

a) The BMKG plans to establish a monitoring network for InaTEWS strengthening that would consist of 160 broadband seismographs, 500 accelerometers, 40 GPSs, 80 tide gauges, and 23 buoys.
b) Since a large-scale earthquake could occur in the near future, an earthquake disaster management plan should be established. Jakarta is now being developed as an economic center of the ASEAN region, and a large-scale earthquake could greatly affect the city.
c) Research on seismology in the eastern part of Indonesia, particularly the regions facing the Cleves Sea where large earthquakes are considered to occur, has not been carried out. Detailed tsunami simulations have been conducted by various agencies in Indonesia, but the results have not been integrated into InaTEWS.

2) Needs[5]

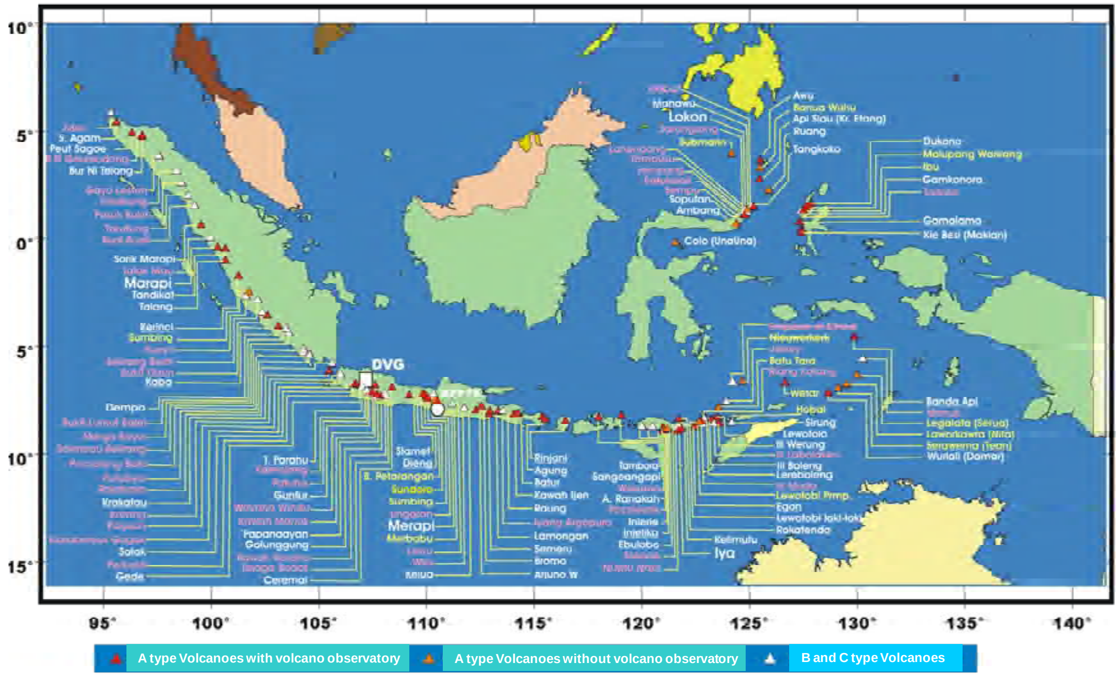
a) Enhancement of the tsunami observation system for InaTEWS.
b) Formulation of a disaster management plan and BCP for Jakarta.
c) Research on seismology and tsunami in Celebes Sea.

4.3 Volcano

(1) Present Situation of Volcanic Disaster

Indonesia consists of many volcanic islands because the boundaries of tectonic plates are located around Indonesia. There are about 129 volcanoes in Indonesia, of which 80 are active volcanoes. Of all the volcanoes in the world, 13% are in Indonesia. The eruptions of Tambora Volcano in 1815 killed 92,000 people. The tsunami caused by sector collapse of the volcanic body with the eruption of Krakatau Volcano at Selat Sunda in 1883 killed 36,600 people. There are potential volcanic activities at Merapi, Semeru, Soputan, Karangetang, Ibu, Talang, Batur and Lokon Volcanoes. Merapi Volcano in Yogyakarta has erupted at short period of intervals, in 1994, 1997, 1998, 2001, 2006, and 2010.

[4] All views are identified by the BMKG, BPPT and relevant organizations on earthquake and tsunami disaster management in the interview with the JICA Study Team.
[5] All views are attributed to the JICA Study Team.



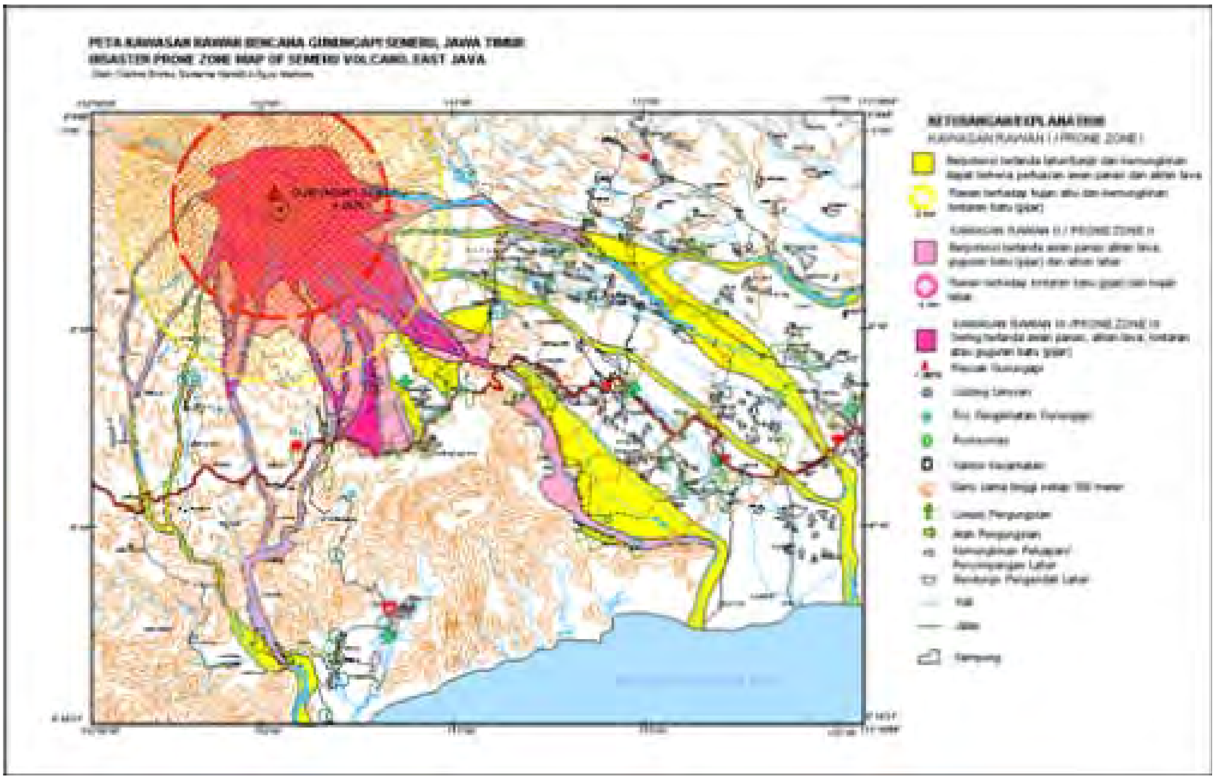
Note: A type is a volcano with minimum of one eruption after year 1600.
Source: CVGHM, Volcanic hazard mitigation in Indonesia (PPT Slide 3)

Figure 4.3.1 Distribution of Active Volcanoes in Indonesia

(2) Risk Assessment

Survey and monitoring activities of active volcanoes, such as creating geological maps, seismic observations, ground deformations, magnetic and gravity surveys and geochemical surveys, etc., have been conducted by the Center for Volcanology and Geological Hazard Mitigation (CVGHM).

The CVGHM has developed 80 hazard maps of volcanoes (Figure 4.3.2). The classification of volcanic hazardous areas in volcano hazard maps is shown in Table 4.3.1. Since Merapi Volcano is located on two provinces, the hazard map of Merapi Volcano was published in both maps of Yogyakarta and Central Java.



Source: CVGHM, Volcanic hazard mitigation in Indonesia (PPT Slide 12)

Figure 4.3.2 Disaster Prone Zone Map of Semeru Volcano in East Java

Table 4.3.1 Classification of Volcanic Hazardous Area in Volcanic Disaster Hazard Map

Classification	Explanation
Region I	Affected by secondary risk from eruption (lahars, ash clouds)
Region II	Affected by material eruption by climatic condition
Region III	Directory affected by material eruption (pyroclastic flow, debris, gasses)

Source: CVGHM, *Volcanic hazard mitigation in Indonesia* (PPT Slide 11) (summarized by the JICA Study Team)

(3) Monitoring / Early Warning System

The early warning system for volcanic eruption has been operated by the CVGHM. The classification of warning levels for volcanic eruption is shown in Table 4.3.2.

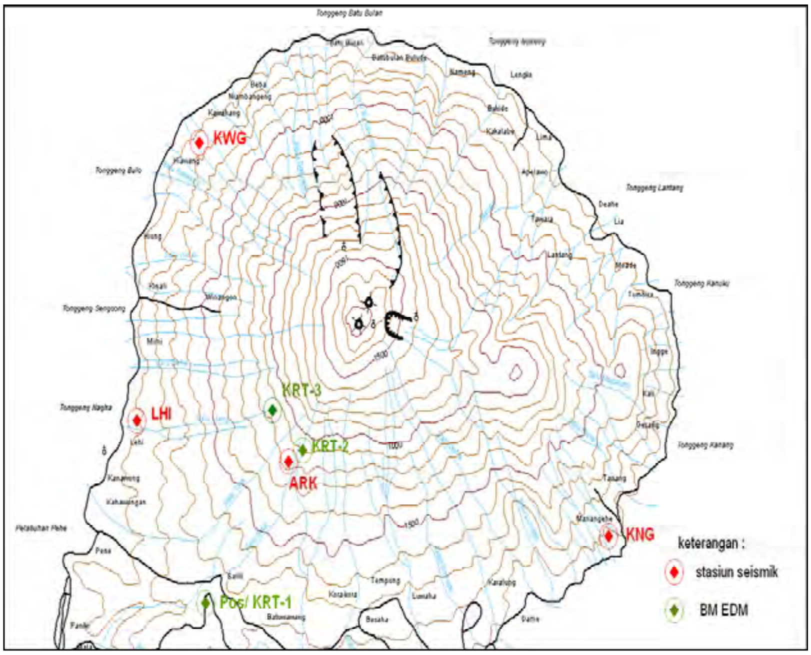
Table 4.3.2 Volcanic Activity Alert Level

Alert level	Condition
Level I: Normal	Volcanic activity stays in normal without any difference from its background levels.
Level II: Alert	Volcanic activity begins to increase and has pass over its background levels.
Level III: Stand by	Volcanic activity has shown its precursor before eruption.
Level IV: Danger	Started with volcanic ash eruption, and then approaching the main eruption.

Source: CVGHM, *Volcanic hazard mitigation in Indonesia* (PPT Slide 24) (summarized by the JICA Study Team)

Seismographs have been installed in all a type volcanoes. Such volcanoes are the ones which have had at least one eruption since year 1600. GPSs have been installed in five volcanoes and there are 75 monitoring stations collecting observation data. Maintenance of observation instruments are conducted by the CVGHM.

The volcanic observation system consists of seismograph, GPS, electro-optical distance measurement (EDM), tiltmeter, leveling and telescope (see Figure 4.3.3). According to the CVGHM, there is a need to increase the number and type of observation instruments and to improve the accuracy of volcanic eruption observation and prediction.



Source: CVGHM, Volcanic hazard mitigation in Indonesia (PPT Slide 17)

Figure 4.3.3 Seismic and EDM Network at Karangetang, July 2006

In general, when evacuation is planned, not only the result of risk assessment indicated in the hazard map but also the conditions of the local community such as tribe and religion need to be taken into account.

The new bridge across Selat Sunda has been planned; in connection with this, LIPI points that the eruption of Krakatau Volcano needs to be monitored with special care.

(4) Preparedness / Prevention and Mitigation

A database on all disasters in Indonesia called DIBI (Data dan Informasi Bencana Indonesia) has been developed and posted on the website of the BNPB (http://dibi.bnpb.go.id).

Relocation of communities from hazardous areas has been conducted in the rehabilitation and reconstruction program at Merapi.

In some areas where indigenous beliefs and traditional methods of preventing disaster are prevailing, the JICA Study Team recommended that risk reduction, scientific education and public awareness should be implemented considering and respecting these customs.

(5) Issues and Needs

1) Issues[6]

a) Increase the number and type of observation instruments, and improve the accuracy of volcanic eruption observation and prediction.

2) Needs[7]

a) Improvement/enhancement of the existing volcanic observation network

4.4 Sediment Disaster

(1) Present Situation of Sediment Disaster

Since Indonesian islands are located on volcanic plate which mainly composed of weak and erosive volcanic body with many steep slopes, sediment disasters have occurred every year and inflicted big damages on human lives and infrastructure. The landslide disaster which occurred in Cililin, Bandung, West Java on April 21, 2004 killed 15 people, collapsed 21 houses, and severely damaged 22 houses, more than 60 ha of rice fields and 85 ha of plantations (see Figure 4.4.1). Around 70 houses were hit and 123 people were killed by the landslide on February 21, 2005. In April 2004, the landslide with 45m in width and 80m in length destroyed railway tracks in Malangbong, Garut, West Java. Landslide mainly occurs due to slope destabilization triggered by rainfall. Several earthquakes in Indonesia such as the Palolo earthquake (2005), Bantul earthquake (2006), Solok earthquake (2007), Muko-Muko earthquake (2007) and Painan earthquake (2007) have also triggered landslides.

Source: RISTEK, Science and technology as a principle of disaster management in Indonesia, pp.169, Figure 4.6.5

Figure 4.4.1 Landslide Disasters in Cililin, Bandung District on, April 21, 2004

Banjir Bandang caused the collapse of a natural dam triggering floods and debris flows. In Wasior, Kabupaten Teluk Wondama, West Papua, 287 people were killed or missing and 80% of infrastructures were damaged by the Banjir Bandang that occurred in October 2010.

(2) Risk Assessment

Hazard maps on landslides of each of the 33 provinces were published by the CVGHM. The CVGHM has developed small-scale hazard maps on sediment disasters.

6 All views were identified by the CVGHM in the interview with the JICA Study Team.
7 All views are attributed to the JICA Study Team.

(3) Monitoring / Early Warning System

The CVGHM has conducted landslide observation using GPS, rainfall observation and extensometer, and has transferred the data to their office by telemeter systems.

Landslide warning based on rainfall forecast and landslide susceptibility maps are issued by the CVGHM. Since the correlation between rainfall and landslide occurrence has not been acceptably clarified, there is a need to develop an alert level according to scientific and concrete basis.

Three technical references, (1) “Guideline for Banjir Bandang Disaster Mitigation Management”, (2) “Manual for Researching Banjir Bandang Hazardous Area”, and (3) “Manual for Emergency Evacuation for Banjir Bandang”, were published in the technical cooperation project “Integrated Disaster Mitigation Management Project for Banjir Bandang” conducted by JICA from 2008 to 2012.

As some ASEAN countries do not have any guidelines or manuals on sediment disasters, it is considered that such guidelines and manuals are worth disseminating to other ASEAN countries.

(4) Problems facing Indonesia

ADPC pointed out that[8]:

- The number of settlements and pubic activity in medium and high susceptibility areas are still growing;
- Landslide Susceptibility Maps and the Early Warning System[9] are not being optimally used as a database for land-use planning and regional development based on geo-hazard thread; and
- Geo-hazard management is not formally a part of the early education curriculum in school

(5) Issues and Needs

Based on the above observations, the JICA Study Team considers the issues and needs as follows.

1) Issues

a) To upgrade the hazard maps in order for them to be used for such practical uses as planning of countermeasures, land-use, evacuation and so on;
b) To install early warning systems utilizing the existing landslide observation system in addition to the present warning practice based on rainfall ;
c) To develop an alert level based on scientific basis
d) To implement CBDRM to increase the awareness

[8] http://www.adrc.asia/publications/TDRM2005/TDRM_Good_Practices/PDF/PDF-2008e/3.Indonesia.pdf

[9] The Early Warning System means to provide potential landslide map prepared by overlaying landslide susceptibility maps and monthly rainfall forecasts; does not mean any warnings based on the monitoring the landslides themselves.

In addition the Team considers it necessary:

e) To introduce effective countermeasures to mitigate landslides

2) Needs:

a) To develop hazard maps of strategic priority areas that should be identified using the existing such information as the hazard maps
b) To install early updated warning systems to the strategic priority landslides, together with proposing reliable alert levels
c) To implement CBDRM to communities as necessary
d) To conduct public awareness campaigns

In summary, it is considered necessary to implement "A Study on Comprehensive sediment disaster management plan in strategic priority areas".

CHAPTER 5 DISASTER MANAGEMENT INFORMATION, EARLY WARNING AND DISASTER EDUCATION

The HFA-3 mentions that stakeholders need to use knowledge, innovation and education to build a culture of safety and resilience at all levels. In order to achieve that, it is important to collect and integrate various types of information on disaster management to be able to share, and freely use it.

In this chapter, the JICA Study Team organized an overview of the current situation and challenges of each ASEAN country regarding Disaster Management Information System (DMIS) and education for disaster prevention and mitigation.

5.1 Disaster Management Information System (DMIS)

Table 5.1.1 Information System on Disaster Management (Indonesia)

		Availability	Competent Agency
Disaster Management Information System		○ GEOSPASIAL	BNPB
Disaster Loss Database		○ DIBI	BNPB
Early Warning System	Weather warning	○ Indonesia Meteorological EWS, CEWS, C-waves	BMKG
	Flood	○ Flood Early Warning System	PU (w/BMKG)
	Flash Flood	-	-
	Typhoon/Cyclone	○ Early warning of Tropical Cyclone	BMKG
	Sediment disaster	-	-
	Tsunami	○ InaTEWS	BMKG
	Volcano	○ Early warning of volcanic eruption	PVMBG
	Others	○ Forest fire EWS*	LAPAN*
		(Plan to develop tornado EWS**)	BNPB, BMKG**

Source: JICA Study Team, (*) HFA Progress Report (2009-2011), (**) PreventionWeb (April 09, 2012) http://www.preventionweb.net/english/professional/news/v.php?id=26145
(○: available, -: not available)

(1) DMIS and Disaster Loss Database

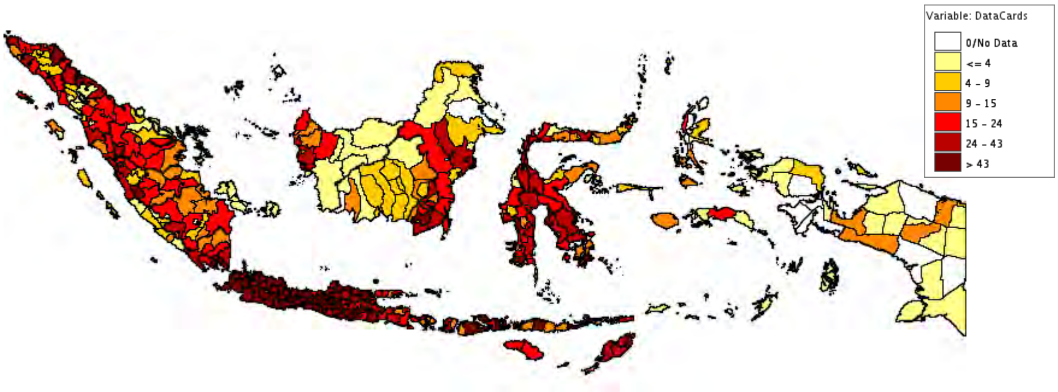
Two database systems have been put into operation in Indonesia within BNPB, namely: GEOSPASIAL[1] and DIBI[2].

GEOSPASIAL is a Web-GIS database system that displays; (1) disaster/damage information caused by disasters occurring within 30 days, (2) various types of hazard maps, and (3) administrative boundaries on maps.

DIBI is a database that stores information on historical disaster events in Indonesia. After a disaster has emerged, BNPB collects the disaster information from the national government,

[1] http://geospasial.bnpb.go.id/
[2] http://dibi.bnpb.go.id/DesInventar/dashboard.jsp?lang=ID

local governments, NGOs, universities, etc. After that, BNPB then enters the information into the database. The DIBI has accumulated disaster loss data since 1815.



Source: DIBI Website (http://dibi.bnpb.go.id/DesInventar/dashboard.jsp?lang=ID)

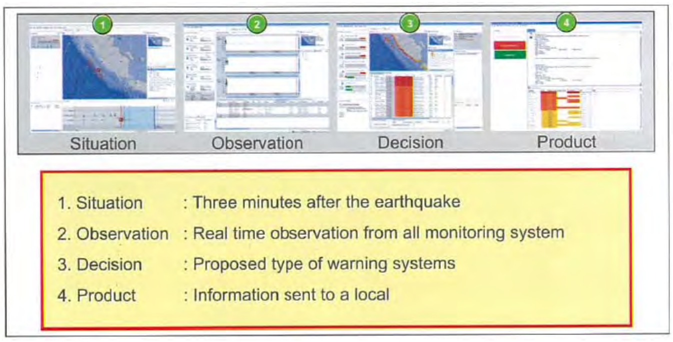
Figure 5.1.1 Distribution of Disaster Event per District (1815 - 2012)

(2) Early Warning System (EWS)

Early warning of weather and tsunami is under the responsibility of BMKG while flood warning is under PU.

BMKG has several warning systems which include: (1) Indonesia Tsunami EWS (InaTEWS), (2) Indonesia Meteorological EWS, (3) Climatological EWS (CEWS) and (4) C-wave (EWS for the ferry). Also, BMKG is equipped with a Tropical Cyclone Warning Center. The InaTEWS provides early warning on tsunami that may affect Indonesia within 5 minutes after an occurrence of an earthquake to BNPB, disaster management agencies, local governments, mass media, etc. with the following three standard criteria (red/orange/yellow):

- Red (Major Warning) : Tsunami height > 3 meter
- Orange (Warning) : Tsunami height 0.5-3 meter
- Yellow (Advisory) : Tsunami height < 0.5 meter

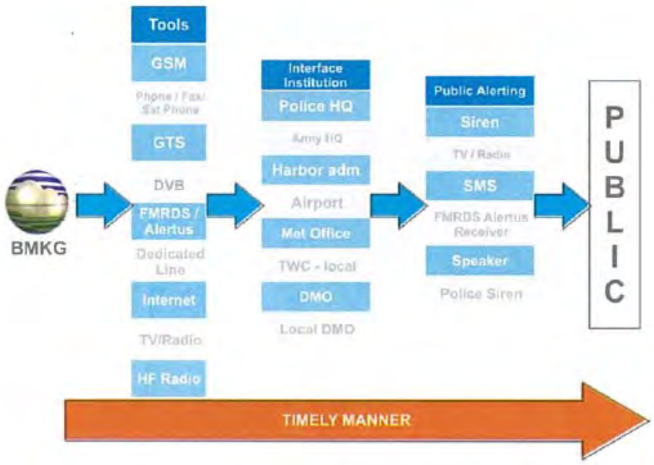


Source: Pamphlet of InaTEWS, BMKG

Figure 5.1.2 Decision Support System (DSS) Procedure of InaTEWS

(3) Means of Dissemination of Early Warning

Early warning to the public is disseminated through siren, television, radio, SMS, FM Radio Data System (FMRDS) alerts receiver, speaker, police siren, social media (Facebook, Twitter), etc [3].



Source: Pamphlet of InaTEWS, BMKG, interview with BMKG

Figure 5.1.3 Dissemination Flow of Tsunami Early Warning

5.2 Education for Disaster Prevention and Mitigation

School curriculum regarding disaster management is available for primary and secondary students.

The Ministry of National Education of Indonesia has issued a circular letter that encourages the mainstreaming of disaster risk reduction in schools through school curriculums. The curriculum contains preparedness education for elementary, junior high and senior high school students in six major hazards, namely: earthquake, tsunami, volcano, flood, landslide and typhoon/cyclone. Education materials will include disaster risk reduction as a local content, school program, or existing extra-curricular programs.

Many universities have developed their own disaster research centers which deal with disaster research and study as a major activity. Some universities, together with the BNPB, have developed DRR-based field exposure programs[4].

Some challenges were reported to the Study Team, as follows:

a) Insufficient public awareness and/or competent resources.

b) No legal or official networks available among disaster experts, managers and planners; information to be circulated with mailing lists, forum database, forum spatial data even when disasters.

3 Pamphlet of InaTEWS, BMKG, interview with BMKG
4 HFA Progress Report (2009-2011), Indonesia

c) No efficient coordination available among agency or institution relevant to disaster management.

These issues are pointed out by BNPB and relevant agencies.

For the item a), it is necessary to understand the present availability of human resources, to analyze the issues they now face, and to identify proper officers that are required at the local level. The item b) is an issue and need for creating mechanisms for effective utilization of human resources. For the item c), it is necessary to identify which agencies and/or organizations have to be coordinated based on the understanding of the mandates of agencies that are relevant to disaster management.

5.3 Issues and Needs Identified - Indonesia

The JICA Study Team identified the issues and needs as shown in the Table 5.3.1.

Table 5.3.1 Issues and Needs Identified by the Study Team (Indonesia)

Issues and Needs	Bilateral cooperation
Enhancement of Disaster Education for CBDRM	- Assistance of CBDRM (e.g. Evacuation drills, Community based hazard mapping, Building shelter management system and evacuation plans, improvement of early warning system, Formulation of community disaster manual and awareness plan) - Development of guide lines how to conduct CBDRM. - Development for knowledge sharing mechanism among communities. - Capacity Building for implementing CBDRM

Source: JICA Study Team

CHAPTER 6 PREPAREDNESS FOR EFFECTIVE RESPONSE

6.1 Current Situation of Preparedness for Emergency Response

There have been several preparedness as well as contingency plans formulated at National level. Contingency plans are also supposed to be formulated by a few provinces and regencies/cities. BNPB prepares the guideline for planning and provides training for all 33 provinces. BNPB leads and coordinates to organize regular stakeholders' meeting among central agencies and BPBDs for local contingency planning.

According to Regulation No. 22, Indonesia's disaster management budget is consists of i) Disaster management reserve fund, ii) BNPB budget iii) BPBD budget, iv) donation/grant and foreign loan, and v) Pre- and Post disaster activities allocation in departments/agencies. While National Coordinating Board for Disaster Management could only manage limited amount on-call budget, BNPB is able to manage the reserve fund for emergency response and post-disaster stages.. The budget allocation to BNPB was increased by 400%, amounting to 800 million Rupiah during the years 2010-2011[1]. The direct budget allocation from the central to the local governments amounted to 108 million Rupiah during the same period. It is planned that in 2012 rehabilitation and reconstruction budgets may be used at the district/city level

In a disaster situation recognized as one at local level, BPBD is responsible for the coordination in utilizing emergency funds from its province, NGO assistance, and resources from communities. BPBD has a "quick response team" to conduct needs assessment when a disaster strikes. In the case of DKI Jakarta, though it is still recognized as local disaster, BNPB rescue resources will also be provided because it is a special capital territory.

BNPB Head Regulation No. 10 defines the command structure for emergency response. BNPB executes during national level disaster while BPBD does for local levels. Nevertheless there are distinctions of national and local levels of disasters, while the criteria of the levels are still ambiguous.

There are emergency items stored in every local site. Villages, for example, have a day's worth of stock of such emergency items. If the emergency situation continues more than three days, the provincial social unit will provide support items. As for evacuation sites, the case of DKI Jakarta has identified areas against flood disasters at least.

6.2 Issues and Needs of Assistance for Emergency Response

(1) Issues[2]

a) To promote awareness among both government and communities for disaster contingency needs and preparedness plans

[1] Indonesia (2011) *National Progress report on the implementation of the Hyogo Framework for Action (2009-2011)*, p.26.

[2] The views a), c) and d) are identified in the answer sheet of the Survey questionnaire and in Indonesia (2011) *National Progress report on the implementation of the Hyogo Framework for Action (2009-2011)*, while the view in b) is identified by the JICA Study Team.

b) To monitor and evaluate local disaster management as well as contingency plans to be planned, budgeted and implemented

c) To clarify the regulation and mechanism to govern disaster budget with smoother bureaucratic process

(2) Needs[3]

a) Awareness-building by establishment and publication of accessible information concerning disaster risks as well as emergency response plans at each local level

b) Inclusion of monitoring and evaluation mechanism for implementation of local disaster management plans

c) Establishment of a firmer and more transparent regulation and mechanism of disaster budget management

[3] The views a) b) and d) are identified by the JICA Study Team, while the view in c) is identified in Indonesia (2011) *National Progress report on the implementation of the Hyogo Framework for Action (2009-2011).*

CHAPTER 7 NEEDS IDENTIFICATION FOR DISASTER MANAGEMENT

This chapter summarizes the survey results and describes the proposals for ASEAN regional collaboration in disaster management.

7.1 Issues and Needs According to Themes

7.1.1 Institution / Organization

(1) Institutional Issues: Disaster Management Law

In keeping with the strategic goals of Hyogo Framework for Action (HFA), ASEAN countries have shifted their disaster management policy focus from responsive to preventive and mitigating orientation. As such policy shift is still in transition, not all ASEAN countries have established their institutional foundation in terms of legal and organizational arrangements.

Out of ten ASEAN countries, four countries (Brunei, **Indonesia**, the Philippines, and Thailand) have disaster management law. Three countries, namely Cambodia, Myanmar, and Vietnam, are in the process of enacting their disaster management law within 2012 or in 2013. Lao PDR expects to formulate and enact disaster management law by 2013. Malaysia needs more steps to start preparing its disaster management law. It seems unnecessary for Singapore to have its comprehensive disaster management law aside from other related laws, because it is relatively free from natural hazards.

Disaster management law is fundamental especially for effectively conducting disaster preventive/mitigating activities as government budget allocation for disaster management attributes to its legal basis. While many countries have spared a portion of special budget through emergency funds when disaster strikes, an integrated budget for comprehensive disaster prevention and mitigating activities is scarcely prepared as these resources are normally allocated to respective sector ministry without sufficient coordination. Such integration of the budget will, on the other hand, require a comprehensive disaster management plan and a specialized agency as its preconditions.

(2) Institutional Issues: Disaster Management Plan and Organization

1) Readiness of Disaster Management Plan of ASEAN countries

Preparation of disaster management plan varies from country to country among ASEAN countries. Four out of ten ASEAN countries (**Indonesia**, the Philippines, Thailand, and Vietnam) possess disaster management plans. Brunei's disaster management plan consists of: i) Strategic National Action Plan and ii) Standard Operating Procedure. Cambodia had a plan for some years but has not been implemented as intended because its legal basis was not yet put into place. Lao PDR is currently drafting the plan to obtain legal approval. Myanmar is in the process of revising its plan together with necessary legal re-arrangement including organizational re-structuring (to be completed within 2012). It seems enough for Singapore to have existing national contingency plan. Disaster management plans at the local level are also expected to be prepared; however, it is an issue for most of ASEAN countries in terms of how these will be well-prepared.

2) Disaster Management Organization at the National Level

All ASEAN countries have disaster management organizations. Most of them are composed of committees presided by high level government authority and secretariats, which are most likely under the leading ministry for disaster management. These committees are organized mainly for emergency response, and the secretariats are expected to deal with disaster prevention, mitigation and preparedness apart from emergency arrangements, without enough resources and authority in most cases. Although a shift of policy focus on disaster management from emergency response to prevention, mitigation, and preparedness has been observed in most of ASEAN countries, it would be necessary for existing secretariat organizations to have clearer mandates and authority or to be an independent agency just like a case of **Indonesia** in order to make inter-governmental coordination as well as disaster management activities smooth.

Table 7.1.1 Institutional Conditions of Disaster Management in ASEAN Countries

Institutional Conditions			Brunei	Cambodia	**Indonesia**	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Disaster Management Law	Presence		O	<2013>	O	<2013>	-*2	<2012>	O	-*3	O	<2013>
	Enacted <Planned> Year		2006*1		2007				2010		2007	
Disaster Management Plan	Presence at the National Level		O*4	O*5	O	-*6	-*7	O	O	O*8	O	O*9
	Presence at the Local Level		O	O	O	O*10	O*11	.	O	-*12	O	O
Disaster Management Organization	National Level	Committee	O	O	O*13	O	O	O	O	O	O	O
		Secretariat	O*14	O		O	O	O	O	O	O	O
	Local Level		O	O	O	O	O	O	O	-*15	-*16	O
Community-based Disaster Management			O	-*17	-*17	-*17	-*17	-*17	-*17	O	-*17	-*17

Source: JICA Study Team

Note: 'O': Available; '-': Not Available

1*: Disaster Management Order subrogates the law; 2*: Malaysia needs more steps to start preparing disaster management law; 3*: It seems unnecessary for Singapore to have comprehensive disaster management law aside from other related laws because it is relatively free from natural hazards; *4: It consists of SNAP and SOP; *5: Implementation issue exists; *6: It will be approved within 2012; *7: SOPs subrogate it; having the plan is considered unnecessary; *8: Emergency plan subrogates it; *9: The plan is to be revised; *10: Five out of 16 provinces prepared it; *11: It will be revised; *12: It seems not necessary; *13: Committee is within the implementing organization; *14: It is still an interim arrangement; *15: It seems not necessary; *16: Local administrations provided its function; *17: Implemented mainly through donor-led program.

3) Disaster Management Organization at the Local Level

Disaster management organizations are also set up locally in most of ASEAN countries. Many of them, however, are established in order to prepare/respond to emergency circumstances which frequently and seasonally occur. Local disaster management organizations are expected to prepare local disaster management plans on the basis of their respective national plan, which extend their functions to mitigation and prevention activities. Local disaster management organizations are also involved in the community-based disaster management activities, with the assistance of external donors in most cases. Generally, community-based disaster management seems not comprehensive as its activities are partial and often serve as ad hoc through donor supports. To make it sustainable, it needs an institutional foundation at the local level by enhancing the capacity of local government organization for disaster management.

Table 7.1.1 summarises the institutional/organizational conditions of ASEAN countries.

According to the information in Table 7.1.1 concerning institution and organization matters obtained by the study, the JICA Study Team identifies and summarizes the issues and needs for cooperation as shown in Table 7.1.2. The JICA Study Team considers that the cooperation can be provided bilaterally between Japan and respective ASEAN country, or can be regionally provided among ASEAN countries as shown in Table 7.1.3.

Table 7.1.2 Issues and Needs on Institution/Organization

Issues and Needs	Country									
	Brunei	Cambodia	**Indonesia**	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
1. Improve the legal system for disaster management	-	O	-	O	O	O	-	-	-	O
2. Build intelligence infrastructure for disaster prevention plan as well as mitigation measures	-	O	-	O	O	O	-	-	-	O
3. Formulate or update the national disaster management plan	-	O	-	O	-	O	-	-	-	-
4. Implement local disaster management plan and community based disaster management	-	O	-	O	O	O	O	-	O	O
5. Strengthen the organization and functions (shifting from response to prevention and mitigation) of disaster management institutions	-	O	-	O	-	O	-	-	-	O

Source: JICA Study Team

Note: 'O': Issues/needs identified; '-': Issues/needs not particularly identified

Table 7.1.3 Issues and Needs for Institutional Improvement of ASEAN Countries

Issues and Needs	Countries	Bilateral/ ASEAN Regional Cooperation
Improvement of legal system for disaster management	Cambodia Lao PDR Malaysia Myanmar Vietnam	(1) Bilateral cooperation International survey for information collection to standardize disaster management law for preparation, modification, and enforcement. (2) ASEAN cooperation Standardization of ASEAN disaster management institutional arrangement. (Lead countries: **Indonesia** and Thailand)
Building intelligence infrastructure for disaster prevention as well as mitigation measures to be planned	Cambodia Lao PDR Malaysia Myanmar Vietnam	(1) Bilateral cooperation Information collection on disaster management plans and its frameworks for replication referring Japan's plan and framework as a basic case. Mitigation measures of every disaster are also collected for reference. (2) ASEAN cooperation Sharing basic information on disaster management plans and mitigation measures with each other in a comparative manner, for regional knowledge base to be created.
National disaster management plan to be formulated or updated	Cambodia Lao PDR Myanmar	(1) Bilateral cooperation Using the frameworks of national disaster management plan of Japan, comprehensive framework is clarified. (2) ASEAN cooperation Standardization and modelling of national disaster management plan extracting good practices of ASEAN countries for replication and mutual learning.
Local disaster management plan and implementation of community based disaster management	Cambodia Lao PDR Malaysia Myanmar Philippines Thailand Vietnam	(1) Bilateral cooperation Using the frameworks of local level disaster management plan of Japan, comprehensive framework is clarified for local level planning (community based disaster management component is also included). (2) ASEAN cooperation Standardization and modelling of local disaster management plan as well as community based disaster management practices extracted from ASEAN countries for replication and mutual learning.
Organizational and functional strengthening (shifting from response to prevention and mitigation) of disaster management institutions	Cambodia Lao PDR Myanmar Vietnam	(1) Bilateral cooperation Optimization of disaster management organizations including law revision. Support capacity development of professional staffs in the area of disaster management. (2) ASEAN cooperation Standardization of disaster management organizational structures and functions by referring the cases of advanced ASEAN countries (e.g., **Indonesia** and Thailand) and support latecomers.

Source: JICA Study Team

7.1.2 Risk Assessment, Early Warning and Mitigation

(1) Flood Disaster Management

1) Recent Trends of Flood Damages and Overview of Needs of Countermeasures

The Typhoon Ketsana caused extensive flood damages to the Philippines, Vietnam, Cambodia, Laos, and Thailand in 2009. Moreover, the compounded impact of Tropical Storm Haima and Typhoon Nock-ten caused extensive damages to Myanmar, Thailand, Laos, and Cambodia in

2011. The severe flood events have confirmed major issues regarding flood damages of recent years in the ASEAN countries.

While occurrences of flash floods of rivers in mountainous and/or semi-arid lands as well as common riveine floods have been recognized, the issues on urban-type floods and urban drainage associated with rapid development of economic zones and urbanization have become obvious. It has been recognized that an increasing speed of flood peak discharge associated with development of economic zones and urbanization tends to be more rapid compared to a variability of rainfall caused by climate change. An increase of flood runoff ratio (an increase of hazard) combined with development; urbanization and expansion of slums caused by increase in poverty have rapidly aggravated the vulnerability of urban areas to floods. As a result, quantitative assessment and identification of flood risk has been highlighted as a major issue. An increase in flood risks has enhanced needs of flood insurance. Rising of sea level caused by global warming have also increased fears of flooding in agricultural areas (Mekong Delta) and urban areas (Jakarta, Ho Chi Min).

Table 7.1.4 Summary on the Preparation of Flood Hazard Map

Country / *Region*	Preparation of Flood Hazard Map			
	Status	Covered Area	Map Scale	Information Source
Brunei	Completed	Whole country	To be confirmed	Interview
Cambodia	In preparation	Whole country	Large scale usable only for policy decision	Interview
Indonesia	Completed (large scale map)	Whole country	Each Province Level	BMKG’s website
Lao PDR	Partially completed	8 Flood Prone Areas	1:90,000 – 1:550,000	ADPC’s report
Malaysia	Partially completed	15 Flood Prone Areas	To be confirmed	DID’s PPT
Myanmar	In preparation	Bago region	To be confirmed	Interview
Philippines	Partially completed	22 Provinces	To be confirmed	Interview
Singapore	Completed	Whole country	1:36,000	PUB’s website
Thailand	Partially completed	Whole country	To be confirmed	Govt.’s PPT
Vietnam	Partially completed	4 Provinces	To be confirmed	Interview
Mekong Basin	*Completed*	*Middle to lower reach*	*1:400,000*	*MRC’s website*

Source: JICA Study Team
Note: The above summary does not totally represent all the information provided.

Efforts have been made by ASEAN member countries in order to prepare hazard maps as shown in Table 7.1.4. However, most of the maps are of scales that are to be used for policy decisions. Those that are yet to be prepared are maps with detailed scales that will be used at the community level for preparedness and emergency response, or for detailed damage analysis for insurance purposes. This may be due to insufficient human and financial resources, including material resources such as topographic base maps of adequate scales.

The study classified the purposes of flood risk assessment as shown in Table 7.1.5 for better understanding.

Table 7.1.5 Purposes of Flood Risk Assessment and the Corresponding Description

Purpose	Description
Policy Making	Formulation of the national and regional development policies on strategic areas for disaster prevention, identification of model areas, and budgetary arrangements
Flood Management Planning	Preparedness for emergency actions (evacuation and rescue) and relief actions
Preparedness and Emergency Actions	Information for disaster mitigation and prevention planning, and river basin flood control master plan
Damage Analysis	Damage analysis for investment on regional industrial clusters and insurance on factories, buildings, and utilities; risk assessment on economic corridors such as roads, ports, and railways

Source: JICA Study Team (Draft Guide to Flood Risk Assessment)

Table 7.1.6 and Table 7.1.7 list example information required for corresponding purposes at the national and local levels, as well as for the local and community levels, respectively.

Table 7.1.6 Required Information for Policy Making and Flood Management Planning

Purpose	National	Local
Policy Making	Map scale: 1:100,000– 1,000,000; Administrative boundaries; Inundation areas, water depth; Notation of flood risk class: Return period of flooding	Map scale: 1:50,000–2 5 0,000; Administrative boundaries; Inundation areas, water dept; Notation of flood risk class; Return period of flooding
Flood Management Planning	Map scale: 1:5,000-25,000 with contour lines and spot elevations; Administrative boundaries; Inundation areas, water depth, flow velocity, return period; Notation of flood risk class or water depth; Land uses (agricultural, industrial, commercial, residential, forest, swamp); Dikes, dams, retarding ponds, drainages, pumping stations; Roads, railways, bridges, port, air port, power stations, water supply facilities	Map scale: 1:5,000-25,000 with contour lines and spot elevations; Administrative boundaries; Inundation areas, water depth, flow velocity, return period; Notation of flood risk class or water depth; Land uses (agricultural, industrial, commercial, public, forest, swamp; Dikes, dams, retarding ponds, urban drainages; Roads, railways, bridges, port, air port, power stations, water supply facilities

Source: JICA Study Team (Draft Guide to Flood Risk Assessment)

Table 7.1.7 Required Information for Preparedness and Damage Analysis

Purpose	Local	Community
Preparedness and Emergency Actions	Map scale: 1:5,000-15,000 with contour lines and spot elevations; Administrative boundaries; Inundation areas, water depth, flow velocity, return period of flood; Dikes, flood posts, laud speaker posts, shelters, schools, dams, retarding ponds, drainages; Roads, railways, bridges; Safe evacuation routes,	Map scale: 1:5,000 – 15,000 or Google map, sketch map; Village or community boundaries; Inundation areas, water depth, flow velocity, return period of flood; Safe evacuation routes; Dikes, flood posts, laud speaker posts, shelters, schools, retarding ponds, drainages, ground water wells; Roads, railways, bridges,
Damage Analysis	Map scale: 1:5,000-25,000 with contour lines and spot elevations; Administrative boundaries; Inundation areas, water depth, flow velocity, return period; Notation of flood risk class; Land uses (agricultural, industrial, commercial, residential, forest, swamp); Flood control level of dikes, dams, retarding ponds, drainages, pumping stations; Roads, railways, bridges, port, air port, power stations, water supply facilities; Population distribution, transport quantity of trunk main roads and ports, production turnover of industrial parks; Rainfall depth, geology and forestation for land slide risk assessment.	

Source: JICA Study Team (Draft Guide to Flood Risk Assessment)

The common issues and needs on flood disasters for ASEAN countries are summarized in Table 7.1.8 below.

Table 7.1.8 Issues and Needs on Flood Disasters

Issues and Needs on Flood Disasters	Country									
	Brunei	Cambodia	**Indonesia**	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Flood early warning system and integrated planning against wide range of floods caused by typhoons and cyclones	-	O	-	O	-	O	O	-	O	O
Flood early warning system and integrated planning against flash floods occurred in the mountainous areas, urban areas, and semi-arid lands	O	O	-	O	O	O	O	-	O	O
Flood control and drainage planning for urban areas and SEZ (securement of safety degree against floods in urban areas, SEZ, and supply chains)	-	O	P	P	P	P	-	P	O	O
Flood control planning in economic corridors including roads and ports (securement of safety degree against floods in supply chains)	-	O	-	P	P	P	-	-	O	-
Urban drainage planning associated with urban land subsidence, storm surges, and rising of sea level	-	-	O*1	-	-	-	-	-	-	O*2
Flood risk assessment survey for the purposes of investment risk assessment and flood insurance (including development of flood hazard maps)	-	O	O	O	O	O	-	-	O	O
Improvement of the legal frameworks for the enactment of reservoir operation rule (Improvement of legal systems in order to prevent artificial flood disasters caused by inappropriate reservoir operation of PFI hydropower dams)	-	O	-	O	-	O	O	-	O	O

Source: JICA Study Team
Legend: 'O' = Considered to be necessary; 'P' = considered to be potentially necessary;
'-'= Information was not made available to consider
Note 1: Regarding urban drainage planning associated with urban land subsidence, storm surges and rising of sea level, the above table shows only areas that were raised in the interview with the JICA Study Team (*1*2).
Note 2: *1 **Indonesia** (DKI Jakarta); *2 Vietnam (Ho Chi Ming, Mekong Delta area)

2) Proposed Aid Projects for Flood Disasters in Each ASEAN Country

To solve the above-mentioned issues, it is proposed to implement the following aid projects in each ASEAN country:

Table 7.1.9 List of Proposed Aid Projects on Flood Disasters in Each ASEAN Country

Country	List of Project
Brunei Darussalam	Although the country suffers from flash floods, it is possible to procure countermeasures by the country's own fund.
Cambodia	(i) Formulation of the Strategic Flood Control Plan in the Kingdom of Cambodia (ii) Master Plan Study on Integrated Flood Management in the Siem Reap River Basin (iii) Review of Master Plan for Urban Drainage in Phnom Penh (iv) Study on Flood Risk Assessment for SEZs in the Kingdom of Cambodia (v) Study on the Improvement of Legal Systems for Enactment of Reservoir Operation Rules (vi) Capacity Development of MOWRAM for Flood Management
Indonesia	(i) Study on Flood and Earthquake Risk Assessment in Bukasi – Karawang Region (ii) Study on Flood and Earthquake Risk Assessment for Economic Corridors Including Tanjung Priok Port, New Kalibau Container Terminal and Planned New Airports
Lao PDR	(i) Formulation of the Strategic Flood Control Plan in Lao People's Democratic Republic (ii) Master Plan Study on Urban Drainage in Vientiane (iii) Study on Flood Risk Assessment for SEZs in Lao People's Democratic Republic (iv) Study on the Improvement of Legal Systems for Enactment of Reservoir Operation Rules
Malaysia	(i) Study on Flood Risk Assessment for the Economic Corridor Johor – Kuala Lumpur – Penan – Kuda
Myanmar	(i) Master Plan Study on Integrated Flood Management in the Sittang River and the Bago River Basins (ii) Study on Flood Risk Assessment for the Thirawa SEZ (iii) Master Plan Study on Urban Drainage in Yangon
Philippines	(i) Technical assistance for development of flood hazard map and flood risk assessment depending on the intended use (ii) Study on the Improvement of Legal Systems for Enactment of Reservoir Operation Rules
Singapore	Urban drainage measures for Orchard Road (commercial accumulation zone): Although it is possible to procure countermeasures by the country's own fund, the issue has not been solved. There is an option that a private sector provides technical assistance for underground drainage tunnel, underground reservoir, pumping facilities, etc., which have been implemented in Tokyo.
Thailand	(i) Urgent Study on the Improvement of Legal Systems for Restructuring of Flood Reinsurance
Vietnam	(i) Master Plan Study on Urban Drainage in Hanoi (ii) Study on Flood Risk Assessment for the West Hanoi SEZ (iii) Master Plan Study on Urban Drainage in Ho Chi Minh (iv) Formulation of the Strategic Flood Control Plan in Can Tho

Source: JICA Study Team

3) Proposed Projects on Flood Disaster for ASEAN Collaboration

The following projects are expected to be more effective if they are implemented through ASEAN collaboration:

- Preparation of guideline on the improvement of legal systems for enactment of reservoir operation rules
- Preparation of guideline on flood risk assessment

(2) Earthquake and Tsunami Disaster Management

The present situation of monitoring and early warning system of the ASEAN member countries are summarized in the Table 7.1.10 below. For reference, the number of monitoring points in Japan is included.

Table 7.1.10 Present Situation of Monitoring and Early Warning System in ASEAN Region

Country		Broadband Seismograph	Accelero-graph	GPS	Tsunami		EWS for Tsunami	Warning System
					Buoy	Gage		
Earthquake Countries	**Indonesia**	160	216	20	23 (2 Operational)	58	BMKG (InaTEWS)	24 Sirens
	Myanmar	12 (5 Operational)	11	0	0	2	nil	nil
	Philippine	66	6	2	1 (Wet Censor)*1	47	PHIVOLCS	Each Barangay
	Thailand	41	22	5	3 (All damaged)	9	NDWC	328 Warning Tower
Surrounding Countries	Brunei	*tbc*	*tbc*	*tbc*	*tbc*	Installed	nil	nil
	Cambodia	nil	nil	nil	nil	nil	nil	nil
	Lao PDR	2	2	9	-	-	-	-
	Malaysia	17	13	191	3	17	MMD (MNTEWC)	23 Sirens
	Singapore	2	6	*tbc*	0	12	MSS (TEWS)	Installed
	Vietnam	15	*tbc*	*tbc*	*tbc*	2	IoG	10 Sirens
Japan (March 2012)		*142 (HSS*2=1,270)*	*3,559*3 724*4*	*1,494*	*Tidal gauge + tsunami gauge=247*5*		*JMA, others*	*Sirens/ TV /Radio /others*

Source: All the information of ASEAN countries was collected by the JICA Study Team (2012); Information of Japan was from HP of Headquarters for Earthquake Research Promotion;

Note: *tbc*: to be confirmed; *1 WET censor: tsunami detecting censor installed at coast land; *2: HSS: High sensitivity seismograph; *3: surface type, there are about 2,900 other points; *4: underground type; *5: there are 15 GPS tidal gauges and 35 water pressure gauges at the bottoms of the sea;

The density of monitoring instruments may differ from country to country depending on the policy taken for disaster management. In Japan for example, a monitoring network was planned to achieve (i) real time monitoring of seismic motion when eathquakes occur, (ii) understanding of geological structures that enhance seisminc motion, (iii) forcasting of strong seismic motion when earthquakes occur, (iv) real time forcasting of tsunami when earthquakes occur and (v) evaluation of possibility of tunami-earthquake (stealth earthquake). To realize those, the plan is to propose intervals of monitoring devices, which are 15-20 km for height sensitivity monitoring seismograph, 100 km for broadband seismograph, 15-20 km for accelerograph, and 20-25 km for GPS[1]. As a result, considerably dense monitoring networks have been established as shown in Table 7.1.10.

1) **Indonesia**

a) Enhancement of the tsunami observation system for **Indonesia** Tsunami Early Warning System (InaTEWS).

- **Indonesia** intended to establish the monitoring network for InaTEWS consisting of 160 broadband seismographs, 500 accelerometers, 40 GPSs, 80 tide gauges and 23 buoys[2].
- As shown in Table 7.1.10, the number of monitoring facilities excluding broadband seismographs, has to be increased to achieve the plan. In particular, tsunami observation buoys or other observation facilities have to be installed to the original level. Presently, the buoy observation facilities are proven to be not sustainable[3]; therefore, options such as new submarine water pressure gauge system or other alternatives have to be considered.
- As for the tide gauges, information from some gauges are transmitted to BMKG via satellite with 15 minutes delay. It is understood that the system is being upgraded to transmit data via GTS to achieve near real time monitoring.

b) Formulation of disaster management plan and BCP for Jakarta

- The Study Team also recommends an earthquake disaster management plan for Jakarta City since large scale earthquakes have not occurred for a long period. Considering that Jakarta is now being developed as an economic center of the ASEAN region, such plan is necessary to minimize effects to the city due to damage caused by large scale earthquakes.
- As recommended in the other section of this report, a comprehensive disaster management plan that includes not only earthquake/tsunami but flood as well, is recommended for formulation.
- Based on the comprehensive disaster management plan, BCP for the city will have to be formulated.

c) Research on seismology and tsunami

- Research in seismology for east **Indonesia** is needed, in particular for the regions facing Cleves Sea where large earthquakes are observed to occur.
- Detailed tsunami simulations have been conducted by various agencies. It is necessary to integrate these results of tsunami simulation into InaTEWS.

[1] "Fundamental Research and Monitoring Plan for Earthquake", August 1997, Headquarters for Earthquake Research Promotion, Japan (in (In Japanese)
[2] Indonesia Tsunami Early Warning System (InaTEWS): Concept and Implementation (2008)

2) Myanmar

a) Development of earthquake and tsunami observation network and capacity development for observation and analysis

- Earthquake monitoring facilities are obviously not enough as shown in Table 7.1.10. It is recognized by the Department of Meteorology and Hydrology (DMH) that seismic and tsunami observation network and early warning system should be urgently developed.
- Also, capacity development is indispensable to engineers in charge of the operation of observation system and early warning system, and analysis of earthquake characteristics (hypocenter, magnitude, and so on).

b) Formulation of disaster management plan and BCP for the main cities

- The main cities including Yangon City are located at an earthquake prone area where Sagaing Fault lies nearby and many large earthquakes have occurred. On the other hand, Yangon City as well as a new economic special zone is being developed rapidly. It is necessary to develop an earthquake and tsunami disaster management plan and BCP for Yangon City, including the special economic zone.

3) Philippines

a) Enhancement of earthquake and tsunami monitoring networks

- Under the Science and Technology Research Partnership for Sustainable Development (SATREPS), efforts were made for real-time earthquake monitoring, advanced source analyses and intensity observation, and evaluation of earthquake generation potential. For this purpose, broadband seismographs and accelerographs were installed, and integrated to the existing satellite telemeter monitoring network in order to realize/improve rapid estimation of ground motion, liquifaction, landslide, and tsunami through enhanced Rapid Earthquake Damage Assessment System (REDAS).
- On the other hand, it is understood that the Philippine Institute of Volcanology and Seismology (PHIVOLCS) intends to increase the number of tsumani monitoring guages rather than increasing the number of broadband seismometer. Presently, tsunami is monitored using one ‘wet censor’ (see Table 7.1.10) that is a water level guage installed at the coast remote islands, although a total of ten wet censors were originally considered to be installed[4].
- In any case, the number of tsunami observation facilities off the coast are not sufficient and should be increased.
- Similarly, the number of GPSs and accelerometer should also be increased to monitor the activities of numerous active faults traversing in the Philippines archipelago.

b) Integrated Urban Disaster Management Plan for Metropolitan Manila and Surrounding Areas

- An earthquake disaster management plan for Metropolitan Manila was conducted through JICA’s technical cooperation project in 2004. Through the detailed discussions on damage estimation, emergency response, Community-Based Disaster Risk Management (CBDRM)

[4]http://tsunami.ihs.ncu.edu.tw/~scstw/2007/doc/5a_01_(Dr.Dimalanta)_Tsunami%20research%20activities_Dimalanta.pdf

and other existing conditions in Manila, and necessary mitigation measures were recommended.

- Since the JICA project was conducted, urbanization of Manila area has progressed rapidly towards outside the Metropolitan area such as Marikina, Rizal, Bulacan, Cavite, and Laguna, with a total population reaching 25 million. Systematic consideration to disaster protection infrastructures have not been given to these areas, which has increased the vulnerability of Mega-Manila to disasters.
- The JICA Study Team therefore considers that review and updating of earthquake damage estimation is required in Manila including surrounding areas of Metropolitan Manila.
- Also, it is necessary to review the tsunami disasters along the coastal area of Manila Bay based on possible earthquake warning raised by the United States Geological Survey (USGS) at the Manila Trench.

c) Earthquake Damage Estimation and Integrated Urban Disaster Management for Large Local Cities such as Cebu and Davao.

- The basic concept of this project is same as that proposed for Metropolitan Manila. Cebu City and Davao City are big cities in the central and southern Philippines. Both cities are located at earthquake prone areas, where topographical condition is mainly coastal lowland. Thus, in case strong earthquakes occur, extensive damages of both ground shakings and tsunamis are expected.
- In order to take necessary earthquake disaster prevention measures, it is necessary to conduct damage estimation and formulate integrated disaster management plans.
- Based on the disaster management plan, priority projects for damage reduction should be selected and implemented.

4) Thailand

The Thai Meteorological Department (TMD) has installed 41 broadband seismographs installed (see the Table 7.1.10) with intervals shorter than 150 km except at some points; nine tidal gauges covering tsunami prone coastal area; and 22 accelerometer in the northwest part where many active faults are located. This deployment was achieved based on the two phased Seismic Network Project (Phase-I: 2005-2006; Phase-II: 2006-2009) initiated after the Sumatra earthquake in 2004. There may not be urgent needs for increasing monitoring stations, except replacing the damaged tsunami buoys. Issues and needs that the Study Team identified are as follows:

a) Study on the development of earthquake monitoring system and disaster prevention plan in northern Thailand

- Earthquakes epicenters in Myanmar and Lao PDR also caused damages to Thailand. However, the seismic observation networks in Myanmar and Lao PDR have not been developed well. The Study Team considers that Thailand may be in a position to assist its surrounding countries in establishing a seismic monitoring network in the bordering areas through installation of monitoring equipment and/or providing technical assistances.

- Based on the results of seismic observations, an earthquake disaster prevention plan on earthquake-resistant design and earthquake-induced landslides in northern Thailand is necessary.

5) Other Countries

a) Brunei, Malaysia, and Vietnam

Tsunamis possibly induced by earthquakes along the Manila Trench in the South China Sea will reach the coastal areas of Brunei, Malaysia, and Vietnam. These countries raised this subject and recognized the need for the establishment of monitoring and early warning system. Consequently, the Study Team recommended the formulation of tsunami disaster management plans while conducting risk/impact assessment. In particular, Brunei and Vietnam should enhance their tsunami monitoring and early warning system (Malaysia has developed their own systems).

b) Lao PDR

Development of seismic observation network and capacity development for the operation of observation network

- Earthquakes have occurred in the areas bordering Thailand and Myanmar. Monitoring facilities are definitely insufficient as shown in Table 7.1.10. Moreover, there is a need for capacity building of seismic engineers in terms of operation and maintenance of instruments and analysis of data as well.
- With the growing economy in main cities such as Vientiane, analysis technique for strong motion observation data need to be improved; and quake-resistance standards need to be developed.

c) Cambodia and Singapore

Both Cambodia and Singapore are almost free from earthquake and tsunami disasters. No urgent issues and needs were identified.

Table 7.1.11 List of Main Projects on Seismic and Tsunami Disaster Management

Country	Project
Countries for detailed survey	
Indonesia	1) Enhancement of the tsunami observation system for InaTEWS 2) Formulation of disaster management plan and BCP for Jakarta 3) Research on seismology and tsunami
Myanmar	1) Development of earthquake and tsunami observation network and capacity development for observation and analysis 2) Formulation of disaster management plan and BCP for main cities
Philippines	1) Enhancement of earthquake and tsunami monitoring networks 2) Integrated urban disaster management plan for Metropolitan Manila and its surrounding areas 3) Earthquake damage estimation and integrated urban disaster management for large local cities such as Cebu and Davao
Thailand	1) Study on the development of earthquake monitoring system and disaster prevention plan
Other countries	
Brunei, Malaysia, Vietnam	1) Formulation of tsunami disaster management plan including disaster risk assessment, proposing tsunami monitoring, and early warning systems 2) Regional collaborative research on the mechanism and characteristics of earthquake and tsunami induced by Manila trench
Lao PDR	3) Development of earthquake observation network and capacity development for operation of observation network.
Singapore, Cambodia	No particular issues and needs were identified.

Source: JICA Study Team

(3) Other Natural Disaster Management

Volcano Disasters Management

The Centre for Volcanology and Geological Hazard Mitigation (CVGHM) in **Indonesia** and PHIVOLCS in the Philippines are leading agencies that have developed volcanic hazard maps, monitoring and early warning systems targeting active volcanoes. In case of eruptions, said agencies issue evacuation orders based on their monitoring information.

When Merapi of **Indonesia** erupted in 2006 and 2010, 110,000 and 151,745 people were affected while less than 10 and 386 were killed, respectively. It is said that the early warnings based on monitoring were timely issued.

When Mt. Mayon of the Philippines erupted in 2006, and 2009-2010, though 43,849 and 141,161 people, respectively, were evacuated, no causalities were reported. This is because of the effective monitoring and early warning, and evacuation education conducted. However, following the eruption in 2006, strong rainfall produced lahar from the volcanic ash, causing boulders from said eruption to kill 1,266 people. Thus, PHIVOLCS has to enhance their monitoring and early warning plan for similar secondary disasters in its program.

SATREPS was implemented in these two countries to improve their monitoring and early warning systems of volcanic activities. Moreover, continuous improvement/enhancement of their existing volcanic observation networks is required.

Needs for volcanic disaster in ASEAN countries are summarized in Table 7.1.12.

Table 7.1.12 List of Draft Main Cooperation Project for Volcanic Disaster

Country	Project
Indonesia	- Improvement/enhancement of the existing volcanic observation network
Philippines	- Expansion of volcanic observation systems - Development of a regional disaster prevention plan

Source: JICA Study Team

Sediment Disasters Management

Sediment disasters have occurred in mountainous areas including not only in residential areas, but also along trunk roads being utilized as economic supply chains. The disasters have affected human lives and social-infrastructures. Sediment disaster prevention measures to ensure a safe and secure transportation in supply chains are urgent issues in ASEAN countries

Table 7.1.13 Issues and Needs on Sediment Disasters

Issues and Needs	Country									
	Brunei	Cambodia	**Indonesia**	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
1. Development/improvement of sediment disaster hazard maps for countermeasure plan, land-use plan, and evacuation plan	-	-	*	O	*	O	*	-	*	*
2. Development of monitoring and early warning system including analysis technology	-	-	O	O	*	O	*	-	*	O
3. Introduction and upgrading of proactive structural measure for sediment disaster	-	-	O	O	*	O	O	-	O	O
4. Sediment disaster prevention planning in economic corridors to develop a safe/secure transportation	-	-	O	O	-	O	*	-	O	O
5. CBDRM for sediment disaster	-	-	*	O	*	O	*	-	*	O

Source: JICA Study Team
Note: ‘O’: Issues/Needs identified; ‘*’: Available at present, to be enhanced/improved; ‘-’: Issues/Needs not particularly relevant

The challenges and needs on sediment disaster management in ASEAN countries are summarized in Table 7.1.13.

Table 7.1.14 List of Draft Cooperation Project for Sediment Disaster Management

Country	Project
Indonesia	- Study on comprehensive sediment disaster management plan in strategic priority areas
Loa PDR	- Development of the road disaster prevention plan for the economic corridor and capacity development for road maintenance and management sector.
Malaysia	- Study on sediment disaster management plan in Kundasang (Kota Kinabalu) of Sabah district, Uluk Klang of Selangor district, and Cameron Highlands of Pahang district
Myanmar	- Study on sediment disaster management in mountainous areas including CBDRM
Philippines	- Study on the comprehensive sediment disaster management plan
Thailand	- Study on the development of sediment disaster monitoring and effective utilization of SABO technology
Vietnam	- Study on basic sediment disaster management plan

Source: JICA Study Team

a) **Indonesia**: Study on comprehensive sediment disaster management plan in strategic priority areas

Indonesia is one of the most sediment disaster prone countries in ASEAN region. The hazard maps were developed in some landslide and debris flow prone areas, and CBDRM for sediment disaster has been implemented in collaboration with JICA in some area. The disaster management composed of risk assessment, planning and implementing countermeasure, early warning and etc has not been implemented systematically. Thus, the JICA Study Team recommends the above mentioned study.

b) Lao PDR: Development of road disaster prevention plan on the economic corridor and capacity development for road maintenance and management sector.

The following are the three needs to strengthen the capacity of road management and to prevent road disasters; 1) Strengthening management capacity for sediment disaster risk reduction, 2) Improvement of countermeasures against large scale landslides, and 3) Development of early warning system for road disaster.

c) Malaysia: Study on comprehensive sediment disaster management plan in Kundasang (Kota Kinabalu) of Sabah district, Uluk Klang of Selangor district, and Cameron Highlands of Pahang district

Minerals and Geoscience Department Malaysia (JMG) raised the issues of sediment disasters in the above three areas. Though much direct information has not been made available, the Team considers the implementing the above mentioned study will provide advanced technology of Japan on sediment disaster management to Malaysia.

d) Myanmar: Study on comprehensive sediment disaster management in mountainous areas including CBDRM

There is a need to conduct countermeasures including early warning against sediment disasters in the mountainous area. The Asian Highway AH-1 that passes through Myanmar from Thailand to Bangladesh and India traverses a mountainous area where sediment disaster occurs. There is a need to improve the maintenance and management capacity of the road administrator.

e) Philippines: Study on the comprehensive sediment disaster management plan

The Mines and Geosciences Bureau (MGB) has developed a sediment disaster hazard map and conducted workshop and evacuation drill in areas susceptible to disasters. Consequently, it enlightened the community on disaster prevention. However, accuracy of the sediment disaster hazard map is so low due to small-scale base topographic map, which is not applicable for establishing a disaster prevention plan and evacuation plan. Monitoring system including early warning system has yet to be developed. Moreover, proactive countermeasures have not been constructed in disaster areas and thus, the main response is rehabilitation after disaster occurrence. There is a need to formulate a comprehensive sediment disaster prevention plan, where priority orders of areas susceptible to sediment disasters are decided based on the existing risk assessment. Based on the plan, improvement of the hazard map and implementation of structural and non-structural measures need to be conducted economically and effectively.

f) Thailand: Study on the development of sediment disaster monitoring and effective utilization of SABO technology

The CBDRM has been actively conducted in many communities in the mountainous areas. There are two needs to strengthen the sediment disaster management, namely, 1) Improvement of the existing monitoring system by introducing automatic observation instruments such as rainfall and river level gauge, and developing the criteria based on correlation between rainfall intensity and disaster occurrence; 2) Introduction of advanced technology on debris flow detection censor and countermeasures against the debris flow and landslides.

g) Vietnam: Study on basic sediment disaster management plan

Not much information was made available in Vietnam regarding sediment disaster management. SATREPS conducted research on disaster management in the central Vietnam. The Team considers that such assistance should be extended to other sediment disaster prone areas in Vietnam. The Study proposed will identify sediment disaster prone areas and prioritize such areas for implementation of disaster management projects.

7.1.3 Disaster Management, Early Warning and Disaster Education

The HFA-3 states that stakeholders need to use knowledge, innovation, and education to build a culture of safety and resilience at all levels. This section describes an overview of the current situation and challenges of each ASEAN country about disaster management information system and education for disaster prevention and mitigation.

(1) Knowledge Management - Disaster Management Information System (DMIS)

The DMIS is a system that supports disaster management planning and decision making effectively and timely for preparedness, emergency response, and recovery activities. Disaster management agencies should accumulate historical disaster data for conducting risk assessment in a normal situation. During emergency situations, such agencies shall issue early warning, order evacuation, conduct search and rescue, and other activities needed based on the monitoring results. At the same time, information on damage, disaster response, necessary support, and others will have to be collected and integrated through a disaster management information system. The information will also be shared among relevant agencies.

The present situation of DMIS, disaster loss database and early warning system are shown in Table 7.1.15 below.

Table 7.1.15 Present Situation of DMIS and Early Warning System

Information System on Disaster Management		Country									
		Brunei	Cambodia	**Indonesia**	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
DMIS		*n/a*	*u/c*	O	*u/c*	O	*n/a*	O	O	*n/a*	*n/a*
Disaster Loss Database		*n/a*[*1]	*u/c*	O	*u/c*	*n/a*	*n/a*	O	*n/r*[*4]	*n/a*	O[*6]
Early Warning System	Flood	O	O	O	O	O	O	O	O	O	O
	Flash Flood	*n/a*	*n/a*	*n/a*	O	*d-n/a*	*d-n/a*	*n/a*	*n/r*	*n/a*	-p
	Typhoon/Cyclone	O	*n/a*	O	O	O	O	O	*n/r*	O	O
	Landslide	*n/a*	*n/a*	O	*n/a*	*n/a*	*n/a*	*d-n/a*	*n/r*	O	-p
	Tsunami	*n/a*	*n/a*	O	*n/r*	O	O	O	O	O	O[*5]
	Volcano (ash monitoring included)	*n/r*	*n/r*	O	*n/r*	O	*n/r*	O	O	*n/r*	*n/r*
	Severe weather[*2]	O	O	O	O	O	O	O	O	O	O
	Rough Sea	O[*3]	*d-n/a*	O	*n/r*	*d-n/a*	*d-n/a*	*d-n/a*	*d-n/a*	*d-n/a*	*d-n/a*
	Drought	*d-n/a*	*d-n/a*	*d-n/a*	*d-n/a*	O	*d-n/a*	*d-n/a*	*d-n/a*	O	*d-n/a*
	Haze	*d-n/a*	*d-n/a*	*d-n/a*	*d-n/a*	O	*d-n/a*	*d-n/a*	O	*d-n/a*	*d-n/a*
	Storm Surge	*d-n/a*	*d-n/a*	*d-n/a*	*n/r*	*d-n/a*	O	*d-n/a*	*d-n/a*	*d-n/a*	*d-n/a*

Source: JICA Study Team (2012), National Progress Report on the Implementation of the Hyogo Framework for Action (2007-2009, 2009-2011)

Note: *1: Disaster losses are systematically reported, monitored and analyzed; *2: Heavy rain, Strong wind; *3: strong wind, tropical storm; *4: A disaster loss database for natural disaster is not needed because a large disaster has not occurred so far; *5: Tsunami EWS has been established only in Da Nang; *6: The database has information on main disasters since 1989, but CCFSC maintains records for much longer but only on hard-copies;

Legend: 'O': available; '*n/a*': not available; "*u/c*": under construction; "*n/r*": not relevant; *d-n/a*: data not available; -p: pilot project only

According to the above information, the following are considered as issues and needs for cooperation.

Table 7.1.16 Issues and Needs for DMIS[5]

Issues and Needs	Country	Bilateral/ ASEAN Regional Cooperation
Development of Disaster Management Information System	Brunei Myanmar Philippines*a (Thailand)*b Vietnam	1. Bilateral cooperation - Development of disaster management information system based on GIS. 2. ASEAN cooperation - (proposed in the other section called "ADMIS")
Development of DMIS	Brunei (Malaysia)*b Myanmar Vietnam	1. Bilateral cooperation - Establishment of a mechanism for collecting and accumulating disaster loss data. - Development of disaster loss database and sharing system. 2. ASEAN cooperation - Improvement of ASEAN DRR Portal and accumulating disaster loss data of each county. (Lead organization: ASEAN Secretariat and/or AHA Centre) - Development of disaster loss database and sharing system for ASEAN Region. (Lead organization: AHA Centre)

Source: JICA Study Team

Note: *a: Available DMIS is not GIS basis; *b: The countries are considered to be capable to establish it by herself.

(2) Education for Disaster Prevention and Mitigation

Disaster education is necessary to raise people's awareness on disaster management in general. Knowledge on disasters such as scientific information, simulating earthquake intensities by shaking tables, and evacuation drills should be practiced in schools, communities, and private sectors. It is important to know how to respond to disaster in order to save own lives during its occurrence. Moreover, it is also important to promote cooperation during emergency cases as a family or community unit, in order to achieve possible evacuation support, maintain evacuation sites, manage social safety, and so on.

School education serves as basic public disaster education. In order to promote school education on disaster management, education system needs to be developed systematically such as enhancement of school curriculum, textbooks, and other necessary materials.

Several ASEAN countries already prepared these education materials including pamphlets, posters, and videos. NGOs are supporting the preparation of education materials and community education.

For effective disaster education, the following items will be developed:

a) Teaching guidelines and teacher's training,
b) Education materials according to grade level,
c) Disaster simulator for earthquake, and smoke/fire extinguisher training, and
d) Regular disaster drill in schools.

In addition to school disaster education, community education is also necessary based on CBDRM. Interchange of disaster knowledge and sharing information among communities are

5 All the views are attributed to JICA Study Team.

key items for community disaster education. Local governments should promote community disaster education in cooperation with NGOs.

Private sectors also need to conduct disaster management education and training for employees to protect or minimize damage. Based on the regional disaster management plan or governmental regulations, private sectors need to prepare emergency management plan by themselves. Regular drill for emergency management should also be conducted regularly.

According to the above information concerning Disaster Management Information System (DMIS), obtained through survey, the following are considered to be issues and needs for cooperation.

Table 7.1.17 Issues and Needs for Education on Disaster Prediction and Mitigation[6]

Issues and Needs	Country	Bilateral/ ASEAN Regional Cooperation
(1) Enhancement of School Education	Cambodia Myanmar Vietnam	(1) Bilateral cooperation - Development of teaching guidelines and teacher's training. - Development of teaching materials according to grade level. - Development of disaster simulator for earthquake, and smoke/fire extinguisher training. - Regular disaster drill at school. - Development of education material databases. (2) ASEAN cooperation - Improvement of ASEAN DRR Portal and accumulating disaster loss data of each county. (Lead organization: ASEAN Secretariat and/or AHA Centre)
(2) Enhancement of Disaster Education for CBDRM	Brunei Cambodia **Indonesia** Lao PDR Philippines Vietnam	(1) Bilateral cooperation - Assistance of CBDRM (e.g., evacuation drills, community based hazard mapping, building shelter management system and evacuation plans, improvement of early warning system, formulation of community disaster manual and awareness plan) - Development of guidelines on how to conduct CBDRM. - Development for knowledge sharing mechanism among communities. - Capacity building for implementing CBDRM
(3) Enhancement of Disaster Education for Private Sectors	All ASEAN countries	(1) ASEAN cooperation - Creation of BCP guide line for private sector. - Creation of BCP guide line for regional industrial clusters

Source: JICA Study Team

[6] All the views are attributed to the JICA Study Team.

7.1.4 Preparedness for Effective Response

(1) Needs for Early Warning System

Early warnings are issued by agencies who conduct monitoring or by disaster management agencies (or coordinating agencies). In any case, routes/means that transmit disaster information within most of administrative agencies at various levels have been established. However, the information routes from administrative agencies to public/communities have not necessarily been established. Table 7.1.18 shows the present situation of the availability of early warning mechanism.

Table 7.1.18 Present Situation of Early Warning

	Information flow		Country									
	From	To	Brunei	Cambodia	**Indonesia**	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Means of warning dissemination (Availability of procedural guidelines, facilities/equipment, mechanism)	Monitoring Agency	Decision making agencies at National level and local level	O a	u/c a	O a	O a	O a	tel a	O a	O a	O a	O a
	Decision making agency	Local government										
	Local government	Communities under impending hazard	* a,b	* a	O b	* a	O a	* a,b	O b	O a	O a	* a

Notes: O: Available for operation; *: Partially available/limited function; u/c: Under construction; tel: Public telephone line only

Source: a: Interview by the Study Team, b: National Progress Report on the Implementation of the Hyogo Framework for Action (2007-2009, 2009-2011)

The main route/means of disseminating warning information to public are the mass media (television, radio, newspapers), internet (social networking websites), and the like. In some ASEAN countries, natural hazard prone communities do not receive timely and/or understandable warnings on impending hazard events. There is, thus, a common challenge/need that public should be informed of an impending hazard or be given proper information in order for them to determine whether they should evacuate or not.

Early warning systems by administrative offices issued to public other than mass media need to be installed/improved in order to realize an end to end warning dissemination to risk prone communities[7]. The early warning systems should include procedural guidelines[8], facilities/ equipment, staffing, and so on.

[7] There are means of dissemination by local staffs riding motorbikes or bicycles with loudspeakers, bells, drums, and speakers of religious facilities, etc.
[8] Including criteria for the decisions to issue evacuation orders

Table 7.1.19 Needs for Early Warning

Country	Needs
Brunei[9], Cambodia[10], Lao PDR[11], Myanmar[12] Vietnam[13]	- Development means of early warning (procedural guidelines and/or facilities/equipment, mechanism) , from government agencies to communities; - Implementation of CBDRM

Source: JICA Study Team

Recently, possibly due to the prevailing climate change, flash floods occur more frequently in various areas in the world. This is also an impending issue for disaster management. Efforts have been made in various countries to predict such flash floods, though needs to be established firmly. Concurrently, with the efforts for prediction, effective and timely early warning systems should be established for flash floods.

It has also been identified that there will be significant scales of earthquakes that could happen at ocean trenches of western and southwestern islands of the Philippines. Such earthquakes are considered to trigger considerable scale of tsunamis that may reach surrounding countries like the Philippines, Malaysia (Saba, Sarawak), Brunei, **Indonesia**, and Vietnam facing South China Sea, Sulu Sea, and Celebs Sea.

- A concentrated research on earthquake and tsunami, hazard mapping, and so on needs to be conducted.
- At the same time, tsunami early warning systems should be installed in those coastal areas together with formulation of (tsunami) disaster management plan including public awareness programs, evacuation exercises and so on.

9 According to interview survey to Tutong District Office by the JICA Study Team (2012)
10 Interview survey to NCDM (Cambodia) by the JICA Study Team
11 Proposed by the JICA Study Team based on the interview with MDMO (Lao PDR)
12 Proposed by the JICA Study Team based on the interview with MDPA (Myanmar)
13 Proposed by the JICA Study Team based on the interview with DDMFSC (Vietnam)

(2) Disaster Preparedness

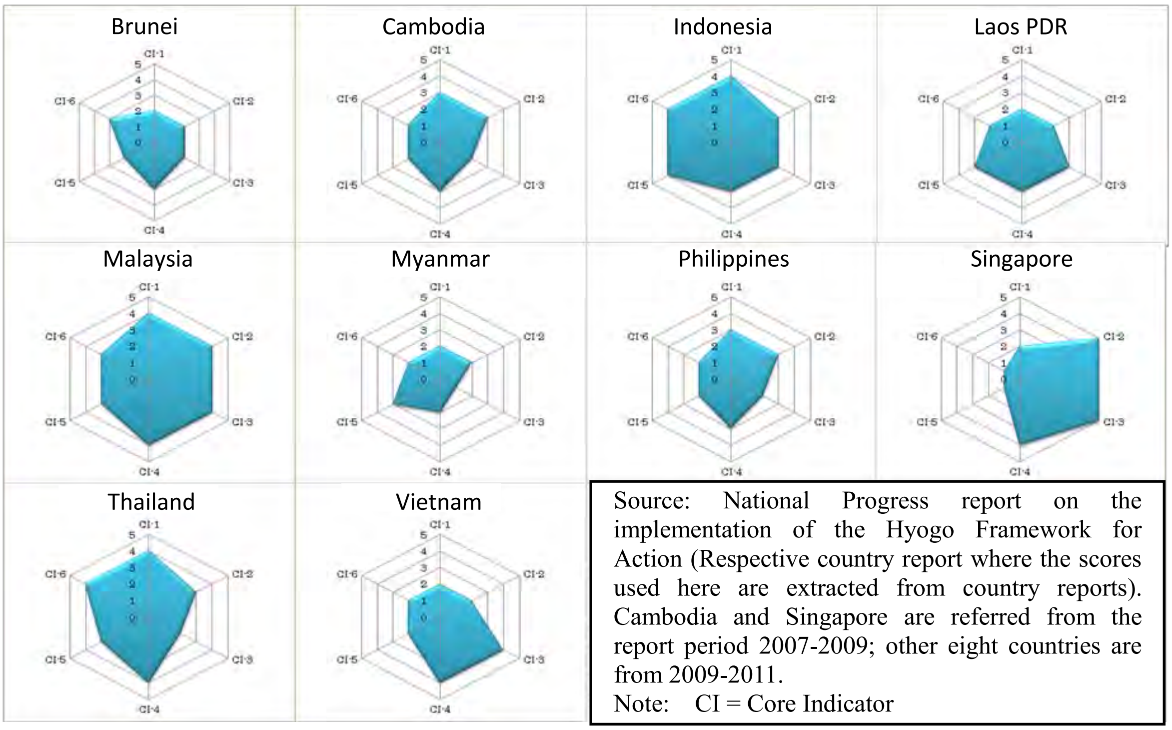
There are six core indicators proposed and used for HFA concerning "reduce the underlying risk factors".

Table 7.1.20 Core Indicators of HFA 4: "Reduce the Underlying Risk Factors"

Core Indicator 1	Disaster risk reduction is an integral objective of the environment-related policies and plans, including for land use, natural resource management and climate change adaptation.
Core Indicator 2	Social development policies and plans are being implemented to reduce the vulnerability of populations most at risk.
Core Indicator 3	Economic and productive sectoral policies and plans have been implemented to reduce the vulnerability of economic activities.
Core Indicator 4	Planning and management of human settlements incorporate disaster risk reduction elements, including enforcement of building codes.
Core Indicator 5	Disaster risk reduction measures are integrated into post-disaster recovery and rehabilitation processes.
Core Indicator 6	Procedures are in place to assess disaster risk impacts of all major development projects, especially infrastructure.

Source: UNISDR, Indicators of Progress: Guidance on Measuring the Reduction of Disaster Risks and the Implementation of the Hyogo Framework for Action, 2008.

Figure 7.1.1 below enumerates the evaluated results of HFA 4 core indicators of 10 ASEAN countries.



Source: National Progress report on the implementation of the Hyogo Framework for Action (Respective country report where the scores used here are extracted from country reports). Cambodia and Singapore are referred from the report period 2007-2009; other eight countries are from 2009-2011.
Note: CI = Core Indicator

Figure 7.1.1 Results of Grading HFA 4 Core Indicators by 10 ASEAN Countries

Glancing over above Figure 7.1.1 provides an idea on what indicators are better or worse for certain countries. **Indonesia**, Malaysia, and Thailand are largely high standing. Some indicators, however, are not so relevant for some countries which resulted in fewer score as progress in such indicators are not necessarily required or urgent (e.g., core indicators 1, 2, 3 and 5 for Brunei, and core indicators 5 and 6 for Singapore). Table 7.1.21 shows indicator by issues in relevant countries (principally countries graded 2 or below were chosen), which gives ideas on necessary assistance.

Table 7.1.21 Issues by HFA 4 Core Indicators: 10 ASEAN Countries

Core Indicator 1	(1) Lao PDR: Pervasiveness of "Environmental Impact Assessment" (2) Myanmar: Development of "Environmental Impact Assessment" Framework (3) Vietnam: Incorporation of Disaster Risk Assessment into "Environmental Impact Assessment" Guideline
Core Indicator 2	(1) Lao PDR: Mobilization of resources to conduct "Social Safety Net" activities (2) Myanmar: Widening the targeted areas to implement social development programs (3) Vietnam: Mobilization of recovery fund and widening of disaster insurance options
Core Indicator 3	(1) Cambodia: Prevalence of disaster risk reduction within the economic sector (2) Myanmar: Formulation of policy in economic and productive sectors (3) Philippines: Creation of reinsurance facilities as a risk transfer mechanism (4) Thailand: Adaptation of disaster risk reduction in productive sector (except for agriculture sector)
Core Indicator 4	(1) Myanmar: Conduct of comprehensive multi-hazard assessment, incorporating human settlements and urban planning process
Core Indicator 5	(1) Cambodia: Integration of disaster risk reduction and post disaster recovery and rehabilitation into a strategy (2) Philippines: Making recovery planning process to be proactive (3) Vietnam: Resource mobilization for recovery and reconstruction
Core Indicator 6	(1) Cambodia: Adding practical experience in the procedure of disaster risk impact assessment (2) Lao PDR: Development of technical capacity and expertise in Environment and Social Impact Assessment (3) Myanmar: Creation of assessment framework for disaster impact, especially at the community level.

Source: National Progress Report on the Implementation of the Hyogo Framework for Action (Respective country report where above the information is extracted from). Also see the note under Table 4.1.6.<2>.

(3) Preparedness for Emergency Response

Table 7.1.22 below enumerates ten ASEAN countries with their respective conditions on preparedness for emergency response from the view point of planning, funding, operation/procedure Standard Operating Procedure (SOP), and disaster drill.

Table 7.1.22 Preparedness for Emergency Response: 10 ASEAN Countries

Country	Contingency Plan	Funding	Operation/Procedure	Disaster drill
Brunei	-	O	O (Waiting for new SOP to be approved within 2012)	O (Conducted in 24 districts)
Cambodia	Expected to be approved within 2012)	O	Expected to have a mechanism of implementation	Donor led
Indonesia	O (20-30 Districts/ cities have prepared)	O	O (Procedures are limited to national level)	O
Lao PDR	Expected to be revised, while it is still limited to flood	O (not enough)	Expected to revise SOP and contingency plan	Donor led
Malaysia	-	O	O (i.e., Seven SOPs)	O
Myanmar	O (Standing order)	O (not enough)	O (i.e., Standing order)	O
Philippines	Expected to prepare plan covering multiple hazards	O	Expected to prepare SOP	O (Coverage unknown)
Singapore	O	O	O	O
Thailand	Expected to formulate new one, reflecting the lessons from 2011 flood.	O	O	O
Vietnam	O (It is formulated every year up to the commune level)	O (not enough)	-	Model activity to be rolled out.

Source: JICA Study Team ; Note: O: Available

Overview of the contingency plans across 10 ASEAN countries indicates the following needs.

a) Plans need to be extended to cope with multiple disasters[14]: Lao PDR, the Philippines, and Vietnam; and

b) Capacity development to gain expertise[15]: Cambodia, Lao PDR, Myanmar, and the Philippines.

As for the operation/procedure for emergency response, certain needs are observed as follows:

a) Establishment of operation mechanism[16]: Cambodia, Lao PDR, and the Philippines; and

b) Preparation of SOP[17]: Lao PDR, the Philippines, and Vietnam.

7.2 Aid Projects Identified

7.2.1 Integrated Disaster Management Plan for Megacities in the ASEAN Region

In the ASEAN region, there are megacities having more than 10 million populations such as Bangkok, Ho Chi Min, Jakarta, and Manila. Other big cities are Davao, Hanoi, Kuala Lumpur, Surabaya, and Yangon. These cities are located mainly in the coastal lowland areas except for Kuala Lumpur. Such coastal lowland areas are relatively subject to high risks such as flood, earthquake, tsunami, and storm surge. Effects of climate change will also cause adverse impact on sea level rise, coastal erosion, rainfall intensity, and storm occurrence. Possible hazards to the ten capital cities and other major cities are listed in the table below.

[14] The need is identified by the JICA Study Team, while the Philippines identified its own need.
[15] The need is identified by the JICA Study Team.
[16] The need is identified by the JICA Study Team.
[17] The need is identified by Lao PDR and the Philippines, while the JICA Study Team identified the needs of Vietnam.

Among the megacities, Jakarta, Yangon, Manila and Bangkok should be highlighted from multi-hazard point of view.

In **Jakarta**, accumulation of social and economic infrastructure is so huge at present. Java Island is located in an earthquake prone area; however, detailed earthquake damage estimation and disaster management plan have not been prepared yet. In order to avoid or minimize earthquake disaster damage, earthquake disaster management plan shall at least be prepared at the soonest. Flooding is also a long lasting issue of this city. Rapid urbanization including excessive groundwater extraction ground subsidence has led to frequent and severe flooding, resulting in frequent disruption of capital functions. A comprehensive and integrated disaster management plan will therefore be needed. This is also necessary for risk management of business continuity with international investors.

Yangon is one of the hottest cities in the world in terms of economic investment. It is expected that its present population of 6 million will increase to 12 million by year 2030. Rapid urbanization will be unavoidable. It is understood that development master plan studies are in the pipe lines for urban development plan, water supply and drainage plan and plan for transportation sector. These master plan studies will incorporate factors of possible natural hazards. However, because Yangon is exposed to various types of hazard such as earthquake/tsunami originated by the Sagaing active fault, urban type floods prevailing even now, and storm surge such as Cyclone Nargis, comprehensive and integrated disaster management plan is considered to be indispensable, based on scientific hazard identification, risk and impact assessments.

In **Manila**, urbanization of its metropolitan area has extended to the north and south. Population of Mega Manila will soon reach 25 million including Bulacan, Marikina, Laguna, Rizal, and Cavite. Under this circumstance, the existing earthquake disaster management plan needs to be reviewed and updated based on recent statistics. Also, surrounding urbanized areas of Metropolitan Manila need to be included in this review. It is noted that Manila suffered from strong typhoon causing big flood disasters in 2009 and 2011, including the one caused by Typhoon Ondoy in 2009, which is compounded with storm surge. Flood disaster management is also important and necessary, especially in Metropolitan Manila. Although it is understood that a study on urban flood management in Metropolitan Manila is being conducted, a comprehensive and integrated disaster risk reduction management plan will be needed, taking into consideration the above-mentioned complexity caused by multi-hazard risks.

In **Bangkok**, after experiencing huge flood disaster in 2011, various disaster management plans for flood risk management are being prepared. However, it is also understood that the ground subsidence being caused by groundwater extraction has worsened the situation. Further, storm surge in coastal area has become a main challenging issue in addition to the risk from tsunami. Under this circumstance, comprehensive and integrated disaster risk reduction management will be needed as well for Bangkok.

Table 7.2.1 Hazard Prone Capital Cities and Large Cities
- Needs for Multi-Hazard Integrated Disaster Risk Management Plan-

Country	Mega-city/ Big City	Potentiality of Sever Hazards					Needs of Multi-hazard I-DRMP*	Needs Raised by the Institutions
		Earth -quake	Tsunami	Flood	Storm Surge	Volcano		
Brunei	Bandar Sri Begawan	-	O	O	-	-	-	NDMC
Cambodia	Phonon Penh	-	-	OO	-	-	-	Study Team
Indonesia	**Jakarta**	**OO**	**OO**	**OO**	-	**O**	☑☑	BPBD/DKI-JKT
	Surabaya	O	O	OO	-	O	☑	Study Team
Lao PDR	Vientiane	-	-	OO	-	-	-	MPWT
Malaysia	Kuala Lumpur	-	-	OO	-	-	-	DID
Myanmar	**Yangon**	**OO**	**O**	**OO**	**OO**	-	☑☑	YCDC
	Naypyidaw	**OO**	-	-	-	-	-	MES/MGS
Philippines	**Manila**	**OO**	**OO**	**OO**	**OO**	**O**	☑☑	MMDA
	Davao	OO	OO	OO	OO	O	☑	Study Team
Singapore	Singapore	-	-	-	-	-	-	-
Thailand	**Bangkok**	**-**	**-**	**OO**	**O**	**-**	☑☑	Study Team
Viet Nam	Ho Chi Min	-	O	OO	O	-	☑	DDMFSC
	Hanoi	O	-	OO	-	-	☑	DDMFSC

OO: High potential , O: Potential, -: Low potential (Source: JICA Study Team)
☑☑: Urgently required, ☑:Required, -: Not required
*) I-DRMP: Integrated Disaster Risk Management Plan

7.2.2 ASEAN Disaster Management – Satellite Imagery Analysis Technology Centre[18]

(1) Background

Satellite imagery is being utilized for quick assessment of situations soon after regional disasters occur. A mechanism of Sentinel Asia was established in 2006 to assist in disaster management of Asian countries. Under the mechanism, the countries who own satellites provide satellite information to other countries without satellites, on demand when disasters occur. It is reported that in the case of the flood of 2011 in Thailand, it analyzed satellite information provided through Sentinel Asia and successfully estimated/counted affected houses in the flooded area. It was also reported that satellite information was utilized effectively in the case of the Great East Japan Earthquake in March 2011.

The AHA Centre has recently joined the 'Sentinel Asia' as part of the Joint Project Team and is able to receive satellite information/imagery of the ASEAN member states. On the other hand, in order to utilize satellite information, analysis and/or visualization techniques of raw data are necessary together with facilities for the utilization of satellite information. Seven ASEAN countries[19] are registered as Data Analysis Nodes (DAN), who are in charge of data analysis when requested.

In order to facilitate quickest coordination when disasters occur, the AHA Centre shall have disaster information as soon as possible. For this reason, the centre shall be desired to possess

[18] This issue was proposed by the JICA Study Team (2012).
[19] Brunei, Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam as of July2011.
(http://www.jaxa.jp/press/2011/07/20110727_sac_sentinel.pdf)

its own capabilities for analyzing satellite information. Further, the future step will be for AHA Centre to have its own receiving antenna, consequently allowing it to receive raw data directly from earth observation satellites (EOS) whenever necessary.

(2) Effective Use of Satellite Imagery

1) Present operation mechanism – Sentinel Asia

The following mechanisms have been established through Sentinel Asia:

a) Disaster struck member countries to request the Sentinel Asia for satellite images of disaster struck areas;

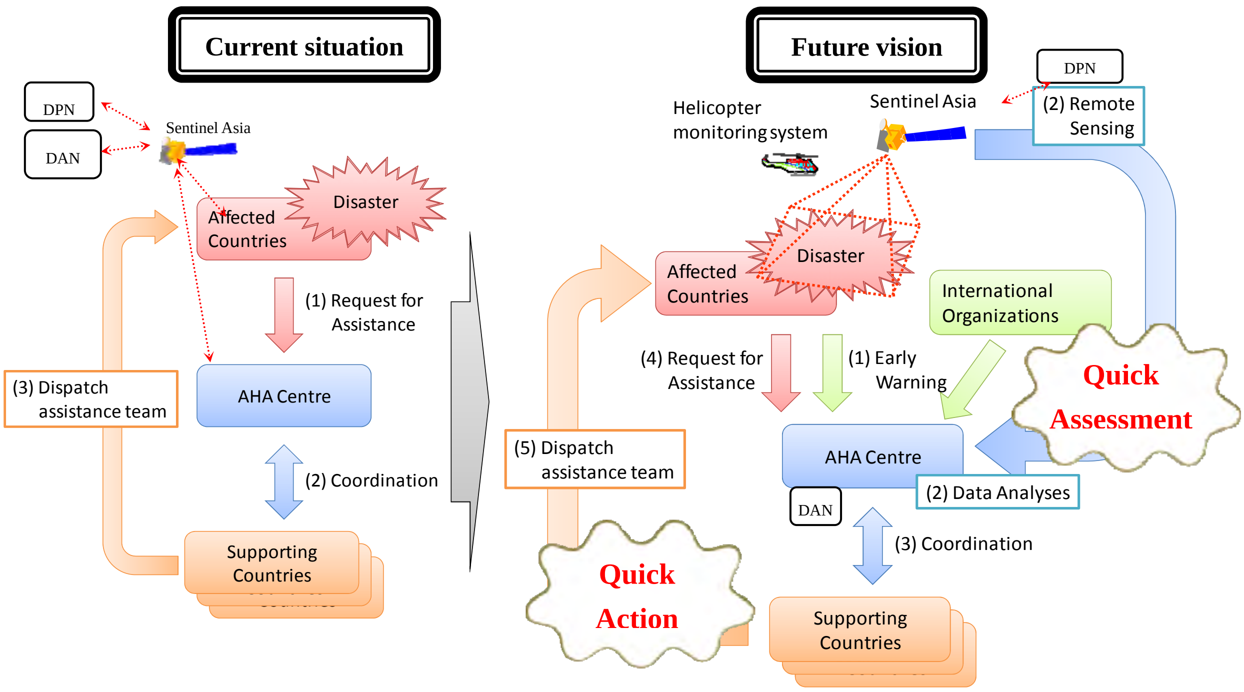
b) Sentinel Asia to request satellite data providers (called as Data Provider Nodes) for satellite images (raw digital information) concerned;

c) The "Data Analysis Nodes" of member organizations to analyze the raw digital information for conversion into analysed visible images (value added images); and

d) Sentinel Asia to send the value-added images to disaster struck members who requested such information.

2) Recommendation for speedy data utilization

Above-mentioned steps are required for any disaster-affected member country or AHA Centre to finally obtain analysed visible images. If AHA Centre should conduct all the steps above, a quicker impact assessment would become possible, enabling speedy response and relief activities on disasters in member countries. An image of operation mode of current situation and future vision is shown below.



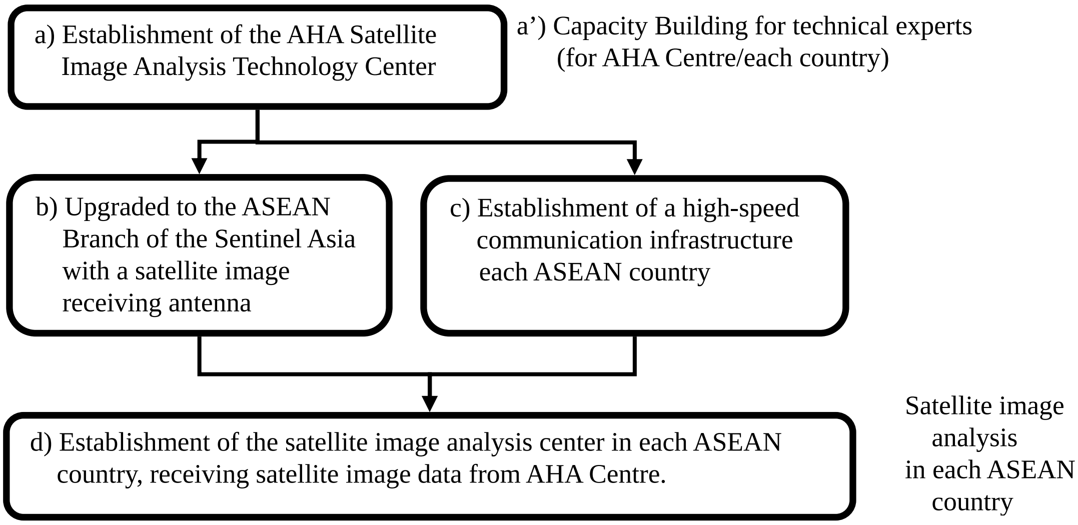
Source: JICA Study Team

Figure 7.2.1 Comparison between Current Situation and Future Vision on ASEAN Regional Support

Further, if each ASEAN country would have the capacity to analyse raw digital information taken by satellites, the operation speed of hazard assessment could be maximized.

(3) Recommended steps to be taken

Recommended steps for realization of the above mentioned concept is shown in Table 7.2.2 and are also illustrated in Figure 7.2.2 below.



Notes: Item codes (a) – (d) corresponds to the codes in the table below
Source: JICA Study Team (2012)

Figure 7.2.2 Recommended Flow of Steps to be Taken

Table 7.2.2 Establishment of the AHA Satellite Image Analysis Technology Centre

Establishment of the AHA Satellite Image Analysis Technology Centre				
Items			AHA Centre	Each ASEAN Country
1st Step	~3 years	a) Establishment of the "AHA Satellite Image Analysis Technology Center" for image analysis. Capacity Building for technical experts of AHA Centre.	O	
		a') Capacity building for technical experts in each ASEAN country at AHA Centre		O
2nd Step	~5 years	b) Establishment of the "ASEAN Branch Office" of the Sentinel Asia with a newly constructed image receiving antenna for direct receiving of image; for image analysis, training of AHA Centre.	O	
		a') Capacity building for technical experts in each ASEAN country at the ASEAN Branch of the Sentinel Asia		O
		c) Development of communication infrastructures between AHA Centre and ASEAN countries for transmitting images		O
3rd Step	~10 years	a') Capacity building for technical experts in each ASEAN country at the ASEAN Branch of the Sentinel Asia (tentative name).		O
		d) Establishment of the satellite image analysis center on the Sentinel Asia in each ASEAN country		O (if required)

Notes: item codes (a) – (d) corresponds to the codes in the figure above
Source: JICA Study Team (2012)

(4) Input needed

The following inputs will be required for the establishment of the AHA Satellite Image Analysis Technology Center:

Table 7.2.3 Inputs Required for the Establishment of the AHA Satellite Image Analysis Technology Center

Step	Goal	Input required
First Step	To introduce satellite image analysis technology to the AHA Centre	a. Provide equipment for data analysis and relevant computer software b. Dispatch experts on satellite image analysis to AHA Centre (a number of short period assignment) c. Invite experts from ASEAN member countries for training on satellite image analysis (a number of short period training) d. Employ experts to AHA Centre who are in charge of satellite image analysis
Second Step	For the AHA Centre to upgrade to "ASEAN Branch of Sentinel Asia" with own satellite data receiving antenna	a. Expand/enforce the function of the the satellite image analysis center b. Construct a data receiving antenna and provide necessary equipment c. Continue training to AHA Centre and the ASEAN member countries
	For ten ASEAN member states to be connected with high-speed communication infrastructure	a. Provide high-speed communication infrastructure connecting the ten ASEAN countries, and necessary capacity building and training
Third Step (in future)	To establish the satellite image analysis center in each ASEAN state, receiving satellite image data from AHA Centre	(as required)

Source: JICA Study Team

7.2.3 Natural Disaster Risk Assessment and Formulation of BCP for Regional Industrial Clusters[20]

(1) Background

Flood disasters in 2011 had caused serious and historical damages to ASEAN countries. In particular, the flooding of the Chao Phraya River of Thailand has not only caused direct economic losses of USD 45.7 billion[21] to firms in industrial parks and clusters of Thailand, but also indirectly and considerably affected economies of other ASEAN member countries and Japan, who are closely linked through networks of supply chains.

As a result, the flood disaster forced industries engaged in electronics, automotive parts, machinery parts, and others to shut down, which adversely affected the worldwide production of related businesses such as automotive industries, for a long period. According to the Office

[20] This subject was presented by the Study Team to the representative from ten ASEAN countries at the workshop held on 11 June 2011 in Jakarta

[21] According to the estimation of the World Bank as of December 2011

of Insurance Commission, insured losses from the floods in Thailand 2011 were expected to be in excess of USD 10.8 billion[22], which would be further adjusted in the final loss figures. Consequently, they were forced to withdraw from the affected areas or revise their terms and conditions, causing investors/industries to be hesitant in continuing their activities in the affected areas.

From the experiences of the Chao Phraya River flood in 2011, it was reaffirmed that natural disasters will have severe and adverse impacts not only on humanitarian aspects but also on national and inter-regional nations, as well as worldwide economy. It has also been recognized that against such huge natural disasters, efforts by individual firm/factory will experience limited effects. Therefore, an approach where industrial park/cluster acting as one unit of economic body, will have to be taken into consideration for disaster management.

Under such circumstance, formulation of business continuity plan (BCP)[23] is indispensable for each regional industrial cluster based on scientific risk assessment to minimize economic losses/damages resulting from natural disasters.

(2) Purpose

a) To conduct natural disaster risk assessment for industrial clusters in the ASEAN region,
b) To formulate a BCP for the target industrial cluster based on risk assessment, and
c) To propose an ASEAN standard procedure for natural disaster risk assessment, and formulate business continuity plan for industrial clusters.

(3) Target Area for Research/Study

Industrial clusters in ASEAN member countries are to be nominated and selected through dialogues among relevant organizations.

(4) Contents/Outputs from Research/Study

The items for research and study are, but not limited to, the following shown in table below:

[22] As of December 2011: Office of Insurance Commission
[23] In a broad sense, it is called as “Incident Preparedness and Operational Continuity Management (IPOCM)”

Table 7.2.4 Draft Work Items – Bi-lateral Cooperation

Phase 1 Natural Disaster Risk Assessment	Phase 2 Regional BCP
1. Collect, organize analyze data of hazard, exposure, vulnerability, damage and others of identified natural disasters. Data collection of maps-information is also included. 2. Build a GIS database of natural disasters and socio-economic conditions. 3. Conduct hazard assessment and impact assessment of natural disasters; (1) Identification of hazard, risk and thread of flood, earthquake/tsunami, storm and others, (2) Estimation of direct and/or indirect economic damages/losses to industries and/or macro-economy, (3) Development of hazard maps according to various scenarios of hazard identified, and (4) Impact analysis 4. Assess impact on industries, supply chains and macro-economy. 5. Analyze and assess vulnerability and risk of facilities and/or properties susceptible to natural disasters.	6. BCP formulation (1) Prevention and mitigation programs (2) Response management programs (3) Emergency response management program (4) Continuity management program (5) Recovery management program (6) Risk transfer 7. Implementation and operation (1) Resources, roles, responsibility, and authority (2) Building and embedding BCP in the organization’s culture (3) Competence, training, and awareness (4) Communication and warning (5) Operation control 8. Finance and administration 9. BCP performance assessment (1) System evaluation (2) Performance measurement and monitoring (3) Testing and exercise (4) Corrective and preventive action (5) Maintenance (6) Internal audits and self assessment 10. Management review （Items 6～10: after ISO/PAS 22399, except 6-（5）added by the Study Team）

Notes:
1) Indirect damages/losses (damages to industries and macro-economy) will have to be estimated from the viewpoint of ASEAN regional collaboration (Item 3. (2)), which necessitates a considerable period for comprehensive data collection and analysis.
2) Items 6 to 10 in Phase 2 defined as Regional BCP will be similar to comprehensive natural disaster management plan with a special emphasis on ‘activity continuity’.
3) Accuracy of hazard maps and/or risk maps to be formulated will be subject to topographic maps (availability, scale and accuracy), accuracy of hazard analysis and others; those are largely dependent on volume of input from human resources and time. Accuracy of hazard maps will have therefore to be determined through an assessment of availability of resources to be input.
4) Items 7 -10 are standard items included in ISO procedures for sustaining the actual operation of the BCP.
5) Risk Transfer (6. (6)) is included by the Study Team in the plan is considered to be an essential alternative for risk management.

Source: JICA Study Team

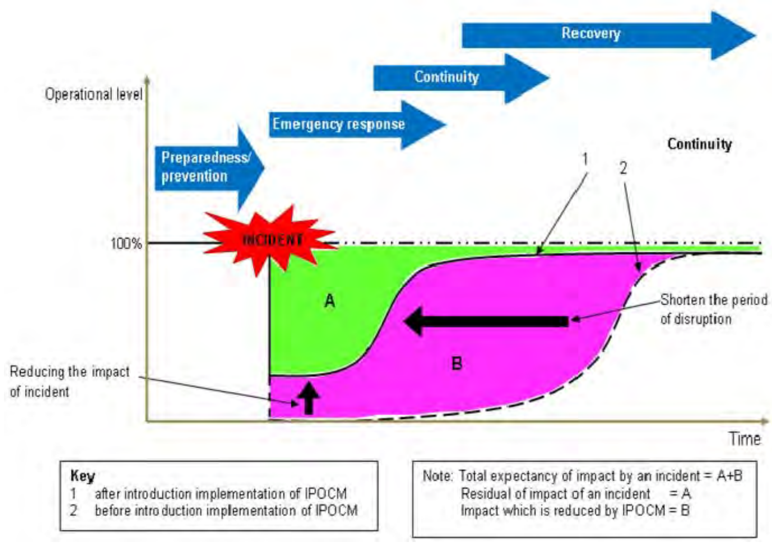
(5) Implementation Framework as ASEAN Regional Collaboration

Proposed implementation framework is shown in Table 7.2.5 below.

Table 7.2.5 Implementation Framework (Draft)

ASEAN Regional Collaboration (Input from ASEAN)	Bi-lateral Cooperation (Input from state where target industrial cluster will locate)
・ Coordination: AHA Centre ・ Panel of Experts: Disaster related-organizations/institution in ASEAN region: ➢ ASEAN Secretariat[note-1] ➢ Researching/academic institutions[Note-2]	・ Counterpart agency: a government entity in charge of industrial clusters or the like, ・ Member of implementation committee: entity in charge of disaster management at national (such as NFP), and local levels where the target industrial clusters are located, and entities in charge of relevant disasters
Input from Japan	
・ Funding Agency: Japan International Cooperation Agency (JICA) ・ Technical Advisors: Researching /academic institutions/agency in Japan[Note-3] ・ Implementation: Consultants	
Examples of organization/institutions Note-1 : ASEAN Committee on Disaster Management（ACDM） Committee on Science and Technology (COST) Sub-committee on Meteorology and Geophysics Note-2: ASEAN Earthquake Modeling Group (Nanyang University, Singapore）, BMKG(**Indonesia**), PHIVOLCS (Philippines) Chulalongkorn University (Thailand) Asia Institute of Technology (Thailand) Southeast Asia Disaster Research Institute (SEADPRI-UKM) (Malaysia) LIPI, **Indonesia** University, ITB, Gadhja Mada University (Jogjakarta), Syiah Kuala University（Aceh） (**Indonesia**) Note-3: Tokyo University, Kyoto University, Tohoku University, I-Charm (Japan)	

Source: JICA Study Team



Source: ISO/PAS 22399, Societal security – Guideline for incident preparedness and operational continuity management

Figure 7.2.3 Concept of Disaster Preparedness and BCP

7.2.4 Earthquake and Tsunami Disaster Management in Member Countries Facing South China Sea, Sulu Sea, and Celebes Sea[24]

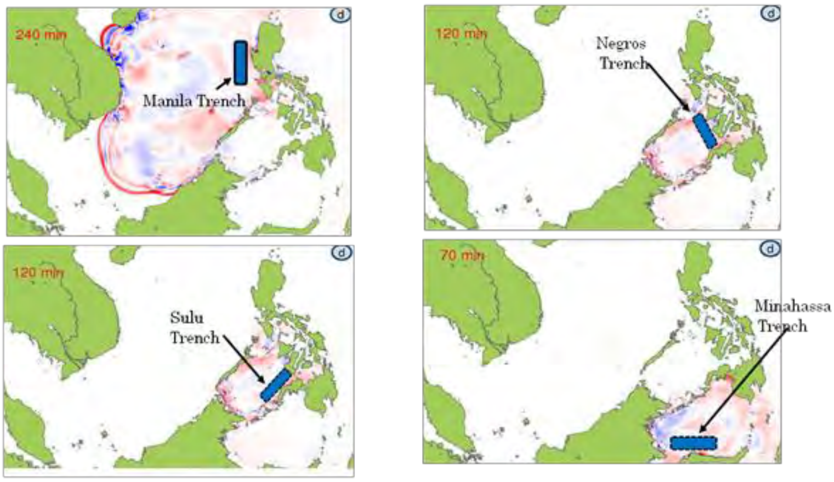
(1) Background

In the western offshore area of the Philippine Island, many trench structures are formed such as Manila Trench, Negros Trench, Sulu Trench, and Cotabato Trench. In the northern offshore area of Sulawesi Island in **Indonesia**, Minahasa Trench and Celebes Trench are distributed.

Out of these, USGS pointed out that there is a possibility of strong earthquake occurrence at M 8.5~9.0 in Manila Trench in near future. In case of occurrence of earthquake at this magnitude, not only an earthquake damage the Philippines, but also tsunami disaster will occur at the east central coast of Vietnam, Saba Sarawak area in Malaysia, and coastal area of Brunei. Other five trenches are also considered to be as possible sources of strong earthquakes accompanied with tsunamis.

Disaster management agencies of each country have already recognized the possibility of strong earthquake and tsunami originating in Manila Trench. The coastal area of the central Vietnam is beach resort areas having a world heritage. Similarly, the coastal area of Saba Sarawak in Malaysia is designated as a priority development area according to Saba Development Corridor Blue Print 2008~2025. At Seria coast in Brunei, petroleum and natural gas processing and exporting facilities are developed.

Once a strong earthquake and tsunami occur as pointed out by USGS and other researchers, such areas will possibly be severely affected. It is therefore recommended to implement (a) research on earthquake and tsunami and (b) formulation of disaster management plan in the western coast of the Philippines, central part of Vietnam coast, coastal area of Saba Sarawak, Brunei, and northern coast of Sulawesi Island in **Indonesia**.



Source: Tsunami simulation by MHD, Malaysia; locations of trenches added by JICA Study Team

Figure 7.2.4 Techtronic Trenches in South China Sea, Sulu Sea and Celebes Sea

[24] This issue was raised by the countries facing the seas; and was presented by the Study Team to the representatives from 10 ASEAN countries at the workshop held on 11 June 2011 in Jakarta.

(2) Purpose

a) To conduct research on earthquakes/tsunamis that could possibly occur in South China Sea, Sulu Sea, and Celebes Sea (ASEAN Collaboration),
b) To conduct impact/damage assessment through hazard mapping,
c) To formulate disaster management plans, including monitoring, early warning system and evacuation plan (➔ option only for bi-lateral cooperation),

(3) Target Area for Research/Study

a) The western coast of the Philippines,
b) The coastal area of the central part of Vietnam,
c) Coastal area of Saba Sarawak of Malaysia,
d) Coastal area of Brunei,
e) Northern coast of Sulawesi Island of **Indonesia**

(4) Research/Study Contents

Activities of collaborative research and study are proposed as follows.

Table 7.2.6 Activities to be Conducted (Draft)

ASEAN Regional Collaboration (ASEAN Collaborative Research)	Development Study for Bi-Lateral Cooperation[Note-1] (Brunei, **Indonesia**, Malaysia, Philippines, Vietnam)
(1) To conduct collaborative research on earthquake/tsunami in South China Sea, Sulu Sea, and Celebes Sea. (2) To develop earthquake/tsunami models for the target hypo-central region. (3) To conduct computerized tsunami simulations with various assumptions. (4) To propose a scenario of earthquake for each hypo-central region. (5) To propose overall framework of earthquake and tsunami monitoring and warning system.	(1) To review the scenario of earthquake in view of selected target areas. (2) To conduct tsunami simulation based on scenario earthquake with bathymetric information. (3) To estimate damages/losses with reasonably accurate topographic maps, especially for industry-invested area. (4) To evaluate impact on economic activities and supply chain. (5) To propose monitoring system for earthquake and tsunami. (6) To propose tsunami early warning system. (7) To propose disaster management plan. (8) To conduct training on disaster management in related countries.

Source: JICA Study Team
Note-1: Development study in member countries may start after scenario earthquakes are proposed from the collaborative research.

(5) Implementation Framework

A similar framework as in the previous section is proposed in Table 7.2.5.

(6) Implementation Period

- ASEAN Regional Collaboration : 24 months
- Bi-lateral cooperation : 24 months

Table 7.2.7 Implementation Framework (Draft)

ASEAN Regional Collaboration (Input from ASEAN)	Bilateral Cooperation (Input from state where target country)
・ Coordination: AHA Centre ・ Panel of Experts: Disaster related-organizations/institution in ASEAN region: ➢ ASEAN Secretariat[note-1] ➢ Research/academic institutions[Note-2]	・ Counterpart agency: entity in charge of disaster management at the national (NFP), and local levels where the target cities are located and entities in charge of relevant disasters
Input from Japan	
・ Funding Agency: Japan International Cooperation Agency (JICA)[Note-4] ・ Technical Advisors: Research/academic institutions/agency in Japan[Note-3] ・ Implementation: Consultants	
Examples of organization/institutions Note-1 : ASEAN Committee on Disaster Management（ACDM） Committee on Science and Technology (COST) Sub-committee on Meteorology and Geophysics Note-2: ASEAN Earthquake Modeling Group (Nanyang Univ., Singapore）, BMKG(**Indonesia**), PHIVOLCS(Philippine)) Chulalongkorn University (Thailand), Asia Institute of Technology (Thailand), Southeast Asia Disaster Research Institute (SEADPRI-UKM) (Malaysia) LIPI, **Indonesia** Univ., ITB, etc. (**Indonesia**) Note-3: Tokyo University, Kyoto University, Tohoku University, I-Charm (Japan) Note-4: Funding by other sources within ASEAN member countries may be applicable.	

Source: JICA Study Team

7.2.5 Development of ASEAN Disaster Management Information System (ADMIS)[25]

(1) Background

For effective disaster management, a comprehensive database system that stores vast variety of information, which are not only related to disasters but also to socio-economics. Thus, development of GIS based ASEAN Disaster Management Information System (ADMIS) is necessary to support the basic activity of AHA Centre as an information hub for disaster management in the ASEAN region.

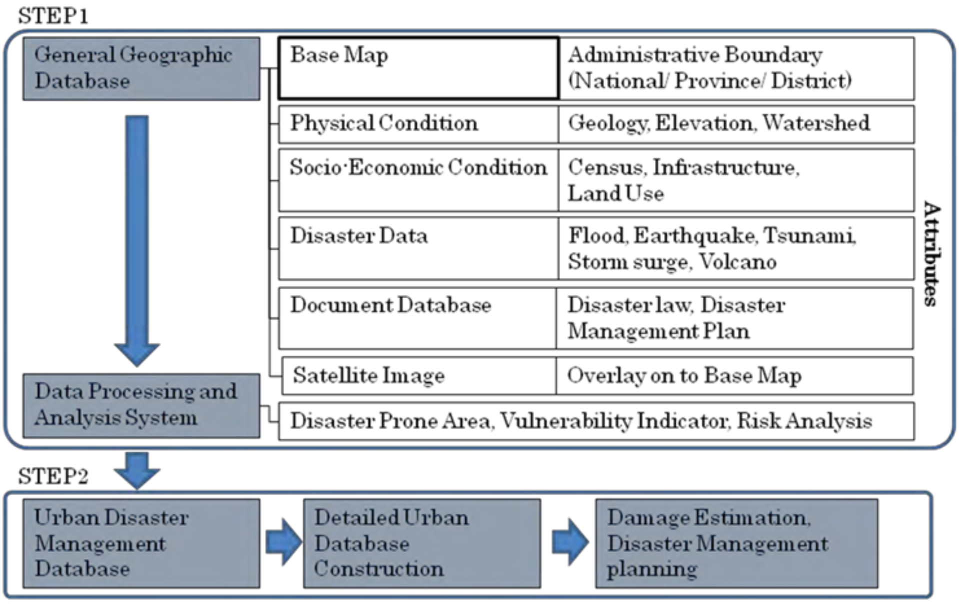
It is understood that the project for the development and deployment of Disaster Monitoring and Response System (DMRS) for the AHA Centre was launched in April 2012. It is expected that the system will offer early warning and decision support systems to be customized for the needs of AHA Centre and the ASEAN member countries. DMRS is considered to become much more powerful if linked with a comprehensive database that ADMIS can provide.

Thus, the present study recommends that the GIS based ADMIS be developed together with data set, which shall be collected as one component of the project.

(2) Concept of ADMIS Development

The concept of the proposed ADMIS is illustrated in the Figure 7.2.5

[25] This issue was briefly presented to the AHA Centre who was interested in the concept.



Source: JICA Study Team

Figure 7.2.5 Concept of ADMIS

ADMIS shall be developed in the following two steps.

1) The First Step of ADMIS Development

The first step consists of development of a general database, data collection and development of data analysis system

a) Development of a general database and data collection

In this step, general map data with scale of one to one million covering each ASEAN member country is created. Together with the creation of a base map, related natural and physical data, socio-economic data, infrastructure data, census data, and disaster data will be collected. Existing digital files of these geographic and statistical data will be utilized as much as possible to avoid duplicated investment.

Data collection items are indicated below as examples:

Table 7.2.8 Example of Information to be Collected

a.	Administrative boundary such as national, provincial, district, etc.,
b.	Census data such as population,
c.	Socio-economic statistics including income level,
d.	Existing land use,
e.	Physical conditions such as elevation, geology, fault line, and watershed boundary,
f.	Climatic data,
g.	Main road network, railway network, port location, airport location, urban center,
h.	River network, lakes, reservoirs, dam,
i.	Main hospitals related to disaster management,
j.	Satellite imageries, and
k.	Others.

Source: JICA Study Team

Collected map data will be specifically manipulated to adjust its scale and legends, and finally integrated into a uniform projection system.

b) Development of data analysis system

Data processing and analysis system are among the important aspects, which will be developed for effective use of geographic database using the overlay technique, for example, the spatial analysis.

In addition to the development of data processing and analysis system, many numerical data will be analyzed and mapped to generate indicators to support decision making. General vulnerability indicators for example will be generated through the numerical data analysis, and mapped using the data processing and analysis system. These will result in general vulnerability maps. Thereafter, existing disaster prone areas will be combined with the general vulnerability maps to identify fundamentally problematic areas in the ASEAN region.

ADMIS will be linked with related database system or existing regional disaster management system such as flood risk analysis and earthquake disaster analysis.

2) The Second Step of ADMIS Development

The second step of ADMIS development will focus on detailed geographic database development for large or megacity disaster management system. Large topographic maps with scales such as 1:2,500 or 1:5,000 will be collected /generated in this system for the creation of a detailed database system. Similar information is listed in Table 7.2.8 although more detailed information shall be collected.

AHA Centre will conduct the necessary systems operation and maintenance through effective use of GIS-based ADMIS for disaster management.

(3) Issues to be solved for ADMIS Development

In order to develop ADMIS, the member countries shall agree on map data sharing system including the scale, projection system and accuracy, data collection and dissemination methodology in disaster management field.

Specific cooperation with AHA Centre will be needed to make a general agreement for ADMIS development, similar to the cooperation being conducted for the development of ASEAN Guideline on flood risk assessment.

(4) Implementation Framework

The study proposes the following framework for implementation. The AHA Centre is expected to act as the coordinator for the project.

Table 7.2.9 Activities to be conducted

ASEAN Regional Collaboration	In Each Member State
● Creation of ADMIS	● Collection of information for the database system. The information to be collected will also be provided to each member state for the creation of their own database system, which may be implemented in the next stage.

Source: JICA Study Team

Table 7.2.10 Implementation Framework

ASEAN Regional Collaboration	In Each Member State
● Counterpart/coordination: AHA Centre ● Implementation: Consultants ● Cooperation: PDC[*1]	● Collaboration: the ASEAN member countries
● Funding agency: Japan International Cooperation Agency (JICA) Note *1: Pacific disaster center implemented DMRS project	

Source: JICA Study Team

(5) Implementation Period

1. Preparation : 6 months
2. Data collection in the ASEAN member countries : 6 months
3. Development of database, creation of analysis system : 9 months

Total : 21 months

7.2.6 Disaster Information System in Major Cities of ASEAN Region with ASEAN Common Data Format[26]

(1) Background

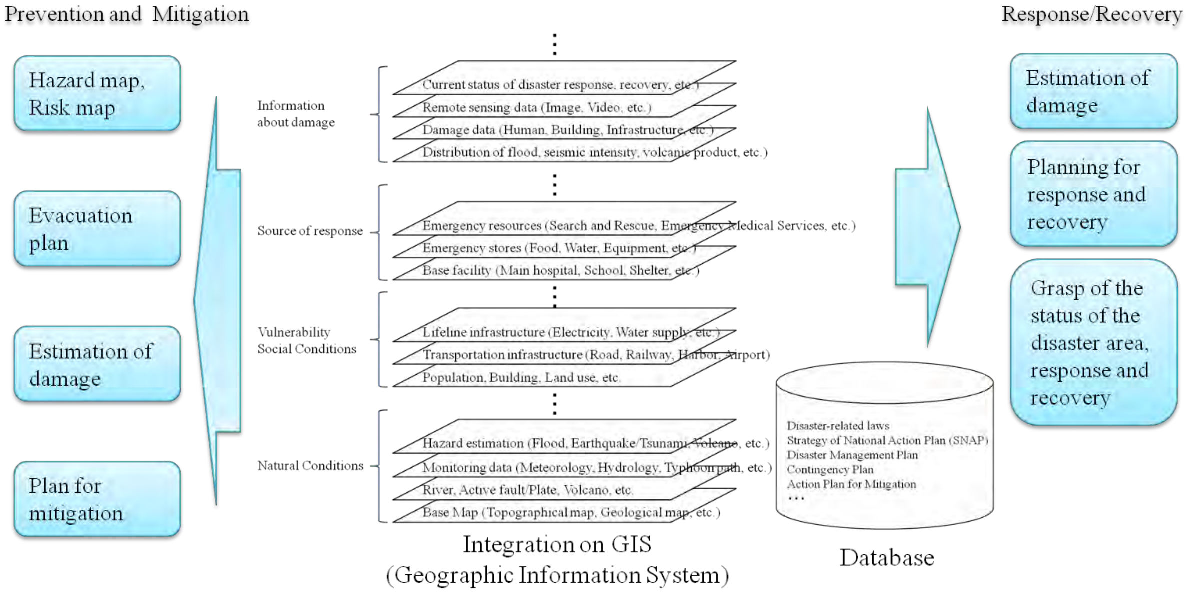
In order to materialize the disaster risk reduction, conducting disaster risk assessment should be a prerequisite condition. This will require various sets of information regarding past disaster records, socio-economic conditions, natural, and physical constitutions, and so on. Therefore, DMIS should be introduced to integrate such valuable information. The DMIS will also be utilized for formulation of disaster management plan, as a decision making tool when disasters occur as well as data accumulation of disaster related information. Though little autonomy of ASEAN countries has introduced such DMIS at present, it is expected for them to introduce soon the DMIS for disaster risk management.

The AHA Centre, as the coordinating body of ASEAN disaster management, should be linked to the DMIS of ASEAN member countries for smooth coordination with shared information. For this purpose, data type, accuracy, format, and so on of essential information will have to be standardized among the ASEAN member countries.

This proposed program will provide standard format of data, which will be stored as part of the database in DMIS of the ASEAN member countries. It will also build the DMIS for

[26] This issue is proposed by the JICA Study Team in this report.

targeted local autonomies such as megacities with information to be collected in the program, in accordance with the specifications to be proposed by this program.



Source: JICA Study Team

Figure 7.2.6 Conceptual Image of DMIS

(2) Alignment with the ASEAN's Effort in Disaster Management

The "Risk Assessment, Early Warning and Monitoring" is one of the four strategic components of the AADMER Work Program 2010-2015, proposing "GIS-based Disaster Information-Sharing Platform for Early Warning" as one of its flagship projects. Accordingly, the Daft AHA Centre Strategic Work Plan includes "monitoring for disaster alert and assessing potential disaster situation" as Function 2; and "ASEAN Strategy on Disaster Risk Assessment (the draft roadmap for risk assessment)" selected "ASEAN-wide Disaster Risk Assessment" as the subject in the executive summary.

As such, this program proposed aligned with the ASEAN efforts in disaster management

(3) Activities Proposed

- Propose ASEAN common data format for DMIS.
- Build disaster management systems for targeted cities that need special attention to multi-hazard disasters. The systems will also be equipped with data analysis system.
- Collect information necessary and store them to the disaster management systems built by this program. Consequently, the system will be a proto-type of disaster management systems to be introduced to other cities of the ASEAN member countries.

(4) Implementation Framework

- Targeted institutions/organizations:

Table 7.2.11 Targeted Institutions/ Organizations

Outputs	Target institutions/organization
Proposing ASEAN common data format of disaster management systems	ASEAN member countries through AHA Centre
Building DMIS with necessary data collection	Mega cities to be proposed

Source: JICA Study Team

- Coordination: AHA Centre
- Implementation: Consultants
- Funding Agency: JICA

(5) Period Required

- Formulation ASEAN Common data format : 6 months
- Data collection in targeted cities : 6 months
- Database design, data input and data analysis system : 9 months

7.2.7 Others Subjects for Collaborative Research

1) Research community based disaster, management with consideration of national/local cultures of ASEAN regions
2) Case studies of community disaster management exercised in the Great East Japan Earthquake and their applicability to the ASEAN region.
3) Research on psychology and reactions in cases of huge disaster, and its applicability to disaster management.
4) Research on effectiveness of mangrove forest against tsunami – case studies.
5) Research on effective promotion of evacuation exercise in ASEAN Countries
6) Research on disaster-proof infrastructure with optimized cost and benefits.
7) Research on comprehensive disaster risk assessment of megacities in ASEAN countries.
8) Research on worst case scenario simulation for disaster management in ASEAN region, leaning from the Great East Japan Earthquake.