Natural Disaster Risk Assessment and Area Business Continuity Plan Formulation for Industrial Agglomerated Areas in the ASEAN Region

Study Report 1

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CHAPTER 1 INTRODUCTION

Study Report 1 presents data and information required for assessment of natural disaster risks and formation of an Area BCP in the next stage of the Project. Data and information of 10 ASEAN Member States were collected from open sources available in Japan though mainly the Internet and JICA library.

Table 1.1 shows a composition of the Report, data and information collected and usage of these collected data and information. Chapters presenting data and information have the following sections and appendices, which contains basic data and information.

(i) Method and scope of data and information collection
(ii) Information included in the appendices
(iii) Outline of the collected data and information

Chapter 9, "Records of Natural Hazards" presents a preliminary result of analysis of predominant hazards of each ASEAN Member States. Chapters 11 contains "Design of GIS and Database" and 12 "Record of Study Trip 1" i.e. records of the first field trip conducted during February and March 2013.

Data and information collection continues for Chapters 2 "Industrial Agglomerated Areas", 3 "Social and Economic Infrastructure" and 4 "Legislative Systems". The final results will be prepared including results of outsourced investigations and field trips at the end of the study.

Table 1.1 Composition of Study Report 1, Data and Information Collected and their Usages

Chapter		Collected Data and Information	Appendix No.	Usage of Data and Information
1	Introduction	-	-	-
2	Industrial Agglomerated Areas	■ List of industrial estates compiled by ASEAN Member States, including basic information and position information	A2	Include in the risk assessment reports of country level. The reports will be utilized as basic information when local government, private company and others plan and implement actions for disaster management, BCP and Area BCP. Prepare database and presented on GIS.
3	Social and Economic Infrastructure	■ List of major distribution infrastructure, lifeline and facilities for disaster risk reduction compiled by ASEAN Member States, including basic information and position information	A3	Include in the risk assessment reports of country level. The reports will be utilized as basic information when local government, private company and others plan and implement actions for disaster management, BCP and Area BCP. Prepare database and presented on GIS.
4	Legislative Systems	Laws and regulations of ASEAN Member States for: ■ Disaster management ■ BCM and BCP	-	Include in the risk assessment reports of country level. The reports will be utilized as basic information when local government,

		■ Environment and pollution control ■ Land use, river management and building code		private company and others plan and implement actions for disaster management, BCP and Area BCP.
5	Existing Investigation and Studies	■ Existing projects, researches and maps of hazard, risk and vulnerability assessment carried out in ASEAN Region and ASEAN Member States ■ Listing up including position information	A5	Include in the risk assessment reports of country level. The reports will be utilized as basic information when local government, private company and others plan and implement actions for disaster management, BCP and Area BCP. Prepare database and presented on GIS.
6	Economy and Trade	■ Outline of economy and industry of ASEAN Member States ■ Outline of trade of ASEAN Member States ■ Economical relationship between ASEAN Member States, between ASEAN Member States and Japan, and between ASEAN States and major countries	-	Include in the risk assessment reports of ASEAN Region level and country level. Utilize to view effects on local to world economy when natural disaster hit an industrial agglomerated area. Prepare database and presented on GIS.
7	Lessons Learned from Catastrophic Natural Disasters	■ Experiences and lesson learned from catastrophic natural disasters that affected heavily supply chain and economy	A7	Include in the risk assessment reports of ASEAN Region level and country level. The reports will be utilized as basic information when local government, private company and others plan and implement actions for disaster management, BCP and Area BCP. Especially, utilized for developing strategy and measures.
8	Description of Natural Hazards	■ Review of hazards of ASEAN Region and ASEAN Member States, and highly affected areas	-	Based on the results of Chapters 8 and 9, assess risk of ASEAN Region and ASEAN Member States. Prepare database and presented on GIS.
9	Records of Natural Hazards	■ Database of natural disasters compiled by ASEAN Member States, including basic information of disasters ■ Analysis of predominant hazards based on the database for each ASEAN Member States	A9	
10	Measures Taken for Natural Disaster Risk Reduction	■ Summary of measures taken for natural disaster risk reduction by hazard and by ASEAN Member States	A10	Include in the risk assessment reports of country level. The reports will be utilized as basic information when local government, private company and others plan and implement actions for disaster management, BCP and Area BCP.
11	Design of GIS and Database	■ Result of survey of information system of AHA Centre ■ Concept of GIS and database	-	Use for development GIS and database, and for study of data transfer to AHA Centre.
12	Record of Study Trip 1	■ Coordination with AHA Centre ■ Coordination with focal points of AHA Centre of pilot and resource countries ■ Survey for selection of panel members	A12	-
13	Distribution Network	Following information of ASEAN Member States: ■ Current situation of supply chains ■ Current situation of distribution	-	Include in the risk assessment reports of ASEAN Region level and country level. The reports will be utilized as basic information when

		networks ■ Analysis of distribution networks ■ Impacts of natural disasters on distribution network (Case histories of Japan)		local government, private company and others plan and implement actions for disaster management, BCP and Area BCP. Prepare database and presented on GIS.
14	Information and Data to be Collected and/or Confirmed in the Next Study Trips	■ Items of survey and/or confirmation in ASEAN Member States and pilot countries	-	Use for planning investigation in ASEAN Member States and pilot countries in the next study trips.

CHAPTER 2 INDUSTRIAL AGGLOMERATED AREAS

The survey will reveal the relationship between industrial agglomerated areas and hazard in ASEAN member countries in component 1, which follows an approximate risk assessment of a natural disaster that may occur in the industrial agglomerated areas. In order to implement Area BCP, an approximate risk assessment of a natural disaster will be done in several industrial agglomerated areas in component 2. With the points considered above, information and data of industrial agglomerated areas are organized. Regarding three countries, selected for pilot Area BCPs, information should be organized to specify reasonable industrial agglomerated areas.

2.1 Methodology and Scope of Survey

The survey was implemented through the data collection using websites and official reports, reports of from public organizations and developers engaged in investments, constructions and operations of industrial parks. A unified format was provided to the organizations and companies deal with information of industrial park in ten ASEAN countries. If the site survey is possible, collected information will be supplemented mainly by interviewing with developers and tenants of industrial parks.

A local consultant was engaged to collect information, which will be finalized in component 1 for the list of industrial parks in the ten countries. Selecting ten industrial parks one from each country, fundamental information were organized to produce a long list, which provided five specified agglomerated industrial parks in a short list for searching further information on infrastructure and logistic networks and so on.

The survey covered general description on industrial parks, current status of investment by the Japanese companies and country information on the government offices and organizations for promoting investment. The scope of survey is summarized in a Table 2.1.1.

Table 2.1.1 Methodology and Scope of Survey

Information Collected	Methodology	Scope of Survey
Information Source of Industrial Parks	Information collection by publicized reports and web search	Source of ASEAN10 countries 1. Government Offices 2. Public Organizations 3. ASEAN-JAPAN Centre 4. Developer of Industrial Park Japan Source 5. JETRO 6. JBIC 7. Sumitomo Corporation 8. Mitsubishi Corporation 9. Sojitsu Corporation 10. Itochu Corporation
Organizations for Promotion of Investment	Information collection by publicized reports and web search	Source of ASEAN10 countries 1. Government Offices

		2. Public Organizations
Information of Industrial Parks	1) Information collection by publicized reports and web search 2) Question and Answer by Interview (planned) A local consultant is consigned for the said survey. Based on the information delivered from the local consultant, useful information is to be organized in order to implement BCP and risk appraisal.	<u>Survey items for long list</u> 1. Name of the Industrial Parks 2. Address and contact 3. General description 4. Name, address, main phone number of the Developer 5. Contributors, amount of capital/capital ratio 6. Year of establishment/foundation 7. Investment amount 8. Area <u>Survey items for short list</u> 9. Infrastructure: (Electrical power provision, Water supply, Industrial water service, Sewerage system, Gas, Communication: Separate public facilities and private facilities) 10. Available logistics network (Road, Railway, Port, Airport) 11. Available facilities (Restaurant and canteen, Hospital and or medical service station, Shopping centre and or shop, Housings) 12. Number of companies operating in the area and a list of such companies (list of companies by countries) 13. Amount of Tenant Rent 14. Association managing the area (Names, Contacts) 15. Tenants information (Capital, Number of employees, Amount of goods handled, Trade volumes, Supply chains)

Source: JICA Study Team

2.2 Information and Data Compiled in Appendix A2

The contents reviewed in Appendix A2 are as indicated in Table 2.2.1

Table 2.2.1 Information and Data Compiled in Appendix A2

Number	Information and Data Compiled in Appendix A2	Summary
A2.1	Information Source of Industrial Parks	Contacts and website of Government offices, Public organizations and private companies. Data of ASEAN-JAPAN CENTRE are described in A 2.3 and A2.4 of Industrial parks list. Regarding Vietnam, JETRO Reports deal with the detailed infrastructure information, e.g. Electricity and etc. For Cambodia and Lao PDR, the information of the government offices is useful. As ERIA's reports do not include information on industrial park, they are not referred in this report.
A2.2	Organizations for Promotion of	The main information is regal frameworks for investment. Not

	Investment	much information found, those information are not referred to industrial park list.
A2.3	Industrial Parks List (Long list)	One industrial park is selected from each country of five countries including three pilot countries referring to"A2.1 Information Source of Industrial Parks". (5 industrial parks listed in total) Among scope of survey indicated in "Table 2.1.1, Methodology and Scope of Survey", 3. General description, 4. Name, address, main phone number of the Developer, 5. Contributors, amount of capital contributions /capital contribution ratio of each contributor, 7. Investment amount are required to confirm with developers of industrial parks.
A2.4	Industrial Parks List (Short list)	Two industrial parks are selected from each country of three pilot countries. (6 industrial parks listed in total) Among scope of survey indicated in "Table 2.1.1, Methodology and Scope of Survey", 9. Infrastructure, 10. Logistics network 13. Amount of Tenant Rent 14. Association managing the area, 15. Various statistics of tenant companies operating are required to confirm with both of developers and tenant companies of industrial parks.

Source: JICA Study Team

2.3 Summary of Survey

Useful information on industrial parks were collected and sorted out by the survey to present "Information Source of Industrial Parks", "Organizations for Promotion of Investment", "Industrial Parks List (Long List)" and "Industrial Parks List (Short List)".

For the survey, JETRO and ASEAN-JAPAN CENTRE were generally selected as the main information sources. For the desk survey in Japan, overviews of the information on industrial parks were sorted out through the searched information from government organizations, Japanese trading houses and local companies, i.e. developers and operators.

The information referred above was reviewed and presented in Appendix. Summarized information are presented here in Table 2.3.1 for "Information Source of Industrial Parks", Table 2.3.2 for "Organizations for Promotion of Investment" and Table 2.3.3 for "Industrial Parks List" which show several names of objectives of industrial parks for Long List and Short List.

As data from ASEAN-JAPAN CENTRE is one of the information sources for a local consultant, information collection was conducted mainly with the data from developers and operators of industrial parks. Regarding Vietnam, JETRO Reports deal with the detailed infrastructure information, e.g. Electricity and etc., which are to be considered if they are useful or not in view of BCP. This is because the data of JETRO Reports were organized for sales promotion of industrial parks. For Cambodia and Lao PDR, under developing for industrial parks projects, the information of the government offices is more useful than private sectors'. As ERIA's reports do not seem to include information on industrial parks themselves, they are not referred in this report.

As referred previously, a local consultant was recruited to collect fundamental data of industrial parks. As mentioned in Chapter 13, the contract was signed on 9 April 2013. Therefore the output from recruited consultant's work is not reflected in Study Report 1. What Study Report 1 presents for industrial parks data is examples of the final views of deliverables.

Table 2.3.1 Information Source of Industrial Parks

Country	Organization	Information Source
Indonesia	Government offices Chamber of Commerce	1. Batam Industrial Development Authority (BIDA) 2. Indonesia Investment Coordinating Board (BKPM) 3. Indonesian Industrial Estate Association 4. National Team for Promotion of Export and Investment (Literal translation / Temporary) 5. Administration Office for Free Trade Zones (Literal translation / Temporary) 6. National Single Window for Investment (Literal translation / Temporary) 7. Indonesia Chamber of Commerce
Philippines	Public Organization Developers of Industrial Parks	1. ASEAN-JAPAN CENTRE 2. JETRO (Institute of Developing Economies) 3. JBIC 4. FPIP(First Philippine Industrial Park) 5. Ayala Group 6. Yulo Family + Belle Resources 7. Filinvesto Develop
Vietnam	Public Organization Government Offices Developers of Industrial Parks	1. ASEAN-JAPAN CENTRE 2. JETRO (Institute of Developing Economies) 3. JBIC 4. Hai Phong District Government 5. Nomura - Haiphong Industrial Zone 6. TLIP (Thang Long Industrial Park) 7. TLIP II (Thang Long Industrial Park II) 8. Sembcorp Development

Source: JICA Study Team

Table 2.3.2 Organizations for Promotion of Investment

Country	Organization	Organizations for Promotion of Investment
Indonesia	Government offices Chamber of Commerce	1. Batam Industrial Development Authority (BIDA) 2. Indonesia Investment Coordinating Board (BKPM) 3. Indonesian Industrial Estate Association 4. National Team for Promotion of Export and Investment (Literal translation / Temporary) 5. Regional Administration Offices for Free Trade (Literal translation / Temporary) 6. Administration Office for Free Trade Zones (Literal translation / Temporary) 7. National Single Window for Investment (Literal translation / Temporary) 8. Indonesia Chamber of Commerce
Philippines	Government offices	1. Board of Investment (BOI) 2. Philippine Economic Zone Authority (PEZA) 3. Clark Development Corporation (CDC) 4. Subic Bay Metropolitan Authority (SBMA) 5. Zamboanga City Special Economic Zone Authority (ZCSEZA) 6. Cagayan Economic Zone Authority (CEZA) 7. Aurora Special Economic Zone Authority

	Chamber of Commerce	8. Authority of the Freeport Area of Bataan 9. Bases Conversion and Development Authority (BCDA) 10. Phividec Industrial Authority (PIA) 11. Regional Board of Investments-ARMM (RBOI-ARMM :) 12. Public-Private Partnership (PPP) Center of the Philippines 13. Chamber of Commerce Philippine
Vietnam	Government offices	1. Ministry of Planning and Investment (MPI) 2. Ministry of Planning and Investment [Southern Vietnam Office] 3. Hanoi Authority of Planning and Investment, 4. Department of Planning and Investment of Ho Chi Minh City 5. Ministry of Industry and Trade 6. Department of Industry and Trade of Ho Chi Minh City 7. Hanoi City Export Processing Zone and Industrial Park Authority 8. Ho Chi Minh City Export Processing Zone and Industrial Park Authority (HEPZA)
	Chamber of Commerce Offices in Japan	9. Vietnam Chamber of Commerce and Industry (VCCI) 10. Vietnam Chamber of Commerce and Industry , Office in Japan 11. Hanoi Trade Representative Office in Tokyo (Literal translation / Temporary) 12. Da Nang City Representative Office in Japan (Literal translation / Temporary) 13. Vietnam Embassy in Japan

Source: JICA Study Team

Table 2.3.3 Industrial Park List

Country	**Industrial Park**	**Developer and Operator of Industrial Park**
Indonesia	Karawang (KICC) (Long List, Short List) Sruya Cipta (Short List)	Itochu Corporation Sumitomo Corporation
Philippines	Laguna Techno Park (Long List, Short List) Light Industry & Sc. Park (Short List)	Laguna Techno Park Inc., Mitsubishi Corporation Mitsui Corporation
Vietnam	Tang Long Industrial Park (Long List, Short List) Tang Long Industrial Park II (Short List)	Sumitomo Corporation Sumitomo Corporation

Source: JICA Study Team

CHAPTER 3 SOCIAL INFRASTRUCTURE AND ECONOMICS

3.1 Methodologies and Scope of Survey

Information on social infrastructure and economics necessary for Area BCP planning was collected by country. Collected information, methodology of collection and the data are summarized in Table 3.1:1. The information are consists of statistical data with locations, specifications etc. of each country. The detailed information would be investigated by a field survey or local sub-contracting.

Table 3.1:1 Information Collected, Methodology of Collection and Scope of Survey

Information Collected	Methodology	Statistical Data	Location/ Specification
Population	Internet search and bibliographic survey	Population, Area, Capital, Province, Population of Major Cities, and Urban Plan	
National Economics	Internet search and bibliographic survey	GDP, GDP per capita, Actual rate of growth, GNI, GNI per capita Major industries, PPP, International balance of payment and Employment	
Industrial Park	Internet search and bibliographic survey	Number of industrial parks	
Energy	Internet search and bibliographic survey	Proved reserves, Consumption, Production of oil, natural gas, coal and hydroelectricity	(hydroelectric and thermal) power plant
Communication	Internet search and bibliographic survey	Fixed-telephones, Mobile-cellar telephones and Internet use	
Transportation	Internet search and bibliographic survey	Road, Railways, Waterways, Aviation, Port, Logistic performance and the others	Road, railway, airport, port
Environment	Internet search and bibliographic survey	Precipitation, Improved water, Industry use, Foot print, Sanitation, Waste treatment, Large dams and CO_2 emission	Pipeline, dam

3.2 Outline of the Result of Survey

The condition of the collected information can be summarized as shown below.

Table 3.2:1 Situation of Data Collection

Collected Data	Item	Progress of Data Collection
Statistics	Data except the	Statistics data by country that are published by international

	numbers	organizations such as World Bank were already collected.
Infrastructure Facilities	Number of facilities	The number and dimension of infrastructure cannot be obtained easily through internet search. It is necessary to conduct detailed survey on a field or by local subcontracting if necessary.
	Details on Ports and Airports	47 ports designated by ASEAN were listed for port information. The Location and runway lengths of airports were collected with a limitation to international airports are selected because of large number. It is necessary to make detailed additional surveys of the items which are needed by BCP study for pilot areas.
	Relevant institutions for infrastructure management	As for the relevant institution for infrastructure management, general information such as names was available. However, detailed information required in BCP study is needed to be investigated in the following study stage for the pilot areas.
	Positioning with GIS	With regard to major roads, railways, airports and ports, the location information with coordinates were identified so that the data is assembled as a GIS data. Regarding major dams, power plants and power grids location maps from various reports etc were collected. However specifications such as the pipeline (oil, gas, etc.) water-purifying facilities in the whole country, water and sewerage facilities and those networks, river improvement facilities, etc are difficult to obtain by bibliographic survey. These are to be investigated by field surveys or local subcontracting if necessary.

3.3 Information and Data Compiled in Appendix A3

Information and data related to social infrastructures and economics are compiled in Appendix A3 and also summarized in Table 3.3:1 below

Table 3.3:1 Information and Data Compiled in Appendix A3

No	Compiled Information and Data	Description
A3.1	Population	Population 1990-2011, Area, Capital, Province names and these population, Population of Major 10 Cities
A3.2	National Economics	GDP, GDP per capita, Actual rate of growth, GNI, GNI per capita, GDP Share of Economy, PPP, International trade, Balance of payment, Employment and Direction of Exports 2000-2009

A3.3	Industrial Park	Number of industrial parks
A3.4	Energy	Proved reserves, Production, Consumption, Refinery capacity of oil, natural gas, coal, hydroelectricity and Renewable energy, Final energy consumption by sector, Share of hydroelectricity
A3.5	Communication	Subscription and Per 100 inhabitants of Fixed-telephone, Mobile-cellar telephones and Internet use in 2011
A3.6	Transportation	Paved and unpaved length of Road, Length of Asian Highway, Length and gauge of railways, Length of canals, Numbers of airports, paved runaway, unpaved runaways and heliports, Passengers Freight, Airlines, Parts and number of international flight in ASEAN, Ease of trading across borders, ASEAN designated 47 ports and these cargo tons, Type of Pipeline and those lengths, Trade matrix among AMSs, Logistic performance index, Prospective projects indentified in the CADP, Capacity of merchant fleets registered, tourist arrived in ASEAN 2010and the others
An 3.7	Environment	Precipitation, Water Resource, Share of Improved water in urban and rural area, Water use in agriculture, domestic and industry, Water foot print, Number of Sanitation facilities, Type of municipal waste consumption, Large dams and CO_2 emission

Moreover, location, specification and physical distribution of major infrastructures such as dam, power plant etc. are summarized in Table 3.3:2.

Table 3.3:2 Positions and Specifications of Major Facilities

No	Complied Information and Data	Description
A3.8	Dam	Major dam information has been collected as a location map focusing on the information from "List of dams and reservoirs – Wikipedia."It continues to be arranged as a GIS database.
A3.9	Power Plant	Power grid information by "List of power stations in each country – Wikipedia" and "Power: Statics in each country – Wikipedia" were collected. The locations are going to be arranged as a GIS database.
A3.10	Port	It compiled by the following data. 1. Mark E. Waters: World Port Source 2. ASEAN: REPSF Project No.04/001: Country Report 3. The Web: Cruise ASEAN 4. The Web of Each Port 5. Business-In-Asia. Com

		6. Nippon Foundation: Investigation about the marine-affairs industry of Indonesia 7. IPC: 2011 Annual Report 8. The Web of HPH 9. Pelabuhan Indonesia III (PERSERO) 10. Free Web Page: Information of Each Port 11. Wikipedia: Information of Each Port 12. Shipping Times The locations are going to be arranged as a GIS database.
A3.11	Airport	It compiled by "International Airport – Wikipedia." The locations are going to be arranged as a GIS database.

Furthermore, port, airport and plant were compiled in the following format for each country.

Table 3.3:3 Dam

NO.	Official Name	Type of Dam	Location								Capacity	Active Capacity
			Latitude				Longitude					
			°	′	″		°	′	″		(m^3)	(m^3)
1												
2												
3												
4												
5												
6												
7												

Table 3.3:4 Hydroelectric Plant

NO.	Official Name	Operator	Location								Installed Capacity	Annual Generation
			Latitude				Longitude					
			°	′	″		°	′	″		(MW)	(GWh)
1												
2												
3												
4												
5												
6												
7												

Table 3.3:5 Power Plant

NO.	Official Name	Operator	Location								Installed Capacity	Annual Generation	Type
			Latitude				Longitude						
			°	′	″		°	′	″		(MW)	(GWh)	
1													
2													
3													
4													
5													
6													
7													

Table 3.3:6 Port

Country Name	Port	Target in Data	Administration	Sub Administration	Channel			Number of Berths	Berths		Max Vessel Size
					Depth (m)	Width (m)	Length (m)		Total Length (m)	Depth (m)	(DWT)

Country Name	Port	Cranes					Cargo		Total	Container Terminal	Container Freight Station
		Quay nos	Gantry nos	Mobile nos	Shore nos	Stacker Handling nos	Capability or Performance teu (year)	tons		m2	

Country Name	Port	Empty Container Depot	Staking Yard	Conventional Terminal	Storage Area	Location							
						Latitude				Longitude			
			ma	m2	m2	°	′	″		°	′	″	

Table 3.3.7 Airport

No.	Airport Name	Type	Administration		Runways	Movement			Location							
			Ownwer	Operator		Passenger	Airfreight	Aircraft	Latitude				Longitude			
					(m)		(t)		°	′	″		°	′	″	
1																
2																
3																
4																
5																
6																
7																

3.4 Outline of the Result of Survey

The condition of the collected information can be summarized as shown below.

Table 3.4:1 Situation of Data Collection

Collected Data	Item	Progress of Data Collection
Statistics	Data except the numbers	Statistics data by country that are published by international organizations such as World Bank were already collected.
Infrastructure Facilities	Number of facilities	The number and dimension of infrastructure cannot be obtained easily through internet search. It is necessary to conduct detailed survey on a field or by local subcontracting if necessary.
	Details on Ports and Airports	47 ports designated by ASEAN were listed for port information. The Location and runway lengths of airports were collected with a limitation to international airports are selected because of large number. It is necessary to make detailed additional surveys of the items which are needed by BCP study for pilot areas.

	Relevant institutions for infrastructure management	As for the relevant institution for infrastructure management, general information such as names was available. However, detailed information required in BCP study is needed to be investigated in the following study stage for the pilot areas.
	Positioning with GIS	With regard to major roads, railways, airports and ports, the location information with coordinates were identified so that the data is assembled as a GIS data. Regarding major dams, power plants and power grids location maps from various reports etc were collected. However specifications such as the pipeline (oil, gas, etc.) water-purifying facilities in the whole country, water and sewerage facilities and those networks, river improvement facilities, etc are difficult to obtain by bibliographic survey. These are to be investigated by field surveys or local sub-contracting if necessary.

REFERENCES

1) ADB. Asian Development Outlook 2011
2) ADB, the Database.
3) AIT/UNEP.Municipal Waste Management Report 2010.
4) ASEAN-Japan Centre, the Web.
5) ASEAN. Respective National Tourism Offices and Statistical Offices in ASEAN Countries.
6) ASEAN. Strategic Transport Plan 2011-2015.
7) BP. Statistical Review of World Energy June 2012.
8) CIA. The World Factbook.
9) CLAIR (Council of Local Authorities for International Relations), the Web.
10) ERIA. Prospective Projects for Logistics and Economic Infrastructure 2010.
11) ESCAP. Review of Developments in Transit in Asia and the Pacific 2011.
12) ESCAP. Statistical Yearbook for Asia and the Pacific 2012
13) FAO. Database Query Results 2008-2012.
14) Foot Print Network. The water footprint of national production.
15) Global Trade. International Water Power and Dam Construction Yearbook 2004.
16) GTC Asia Corporation, the Web.
17) ICAO. Annual Report of the Council-2011
18) IMF. World Economic Outlook Database 2012
19) ITU. World Telecommunication/ICT Indicators Database.
20) JETRO. Asean Logistics Network 2nd Edition

21) JETRO, the Web.
22) Maggie Black and Jannet King. (2009). The Atlas of Water/Mapping of the World's Most Critical Resource 2009.
23) Ministry of Foreign Affairs of Japan, HP.
24) OECD. Southeast Asian Economic Outlook 2010.
25) unicef. Progress on Drinking Water and Sanitation 2012.
26) United Nations, the Database.
27) Wikipedia, the Web.
28) World Bank Indicator.

CHAPTER 4 LEGISLATIVE SYSTEMS

4.1 Methodologies and Scope of Survey

A survey on the legislative systems related to disaster and business continuity in the ASEAN region was conducted. Scopes of the survey were 1) the legislative systems for disaster management, 2) the regulations and standards for business continuity management (BCM) and BC plan (BCP), 3) the legislative systems for environment and pollution, and 4) the legislative systems for development including land use, river and building regulations. In this section, brief reviews of the provisions and the supervisory authorities of regulations are outlined.

Table 4.1.1 Information Collected, Methodology of Collection and Scope of Survey

Information Collected	Methodology	Scope of Survey
Legislative Systems for Disaster Management	From the internet, report which is published by international agencies such as ADRC and disaster management institutes in each country. And reports referred by JICA research team.	Disaster Policy and Disaster Management Organization. Law of the Disaster Management, Disaster Risk Mitigation Plan/Strategy and regulations.
Regulations and Standards for BCM / BCP	From the internet, report which is published by the Business Continuity Institute and institute of standardization et al. in each country.	Standards and regulations related to BCM. Policies and guidelines in order to develop BCP.
Legislative Systems for Environment and Pollution	From the web sites of ministries and agencies responsible for environment management.	Regulations, decrees and standards of the industrial activities for environmental conservation or pollution control.
Legislative Systems for Development including Land use, River and Building Regulations	From the web sites of ministries and agencies related to land use, river or development.	Law and regulations describing land use, river, development of town and regulations of building standards.

4.2 Summary of Collected Information and Data

The information about related legislative systems from each ASEAN member country and country-specific laws, regulations, standards and strategies are collected. The summary is presented in Table 4.2.1 below.

Table 4.2.1 Summary of Collected Information and Data

No.	Compiled Information and Data	Description
1	Laws, Regulations and Standards in Brunei	Disaster management policy and organization, Disaster management law and Disaster mitigation plan, Regulations for environment and pollutions, Regulations for town development and land use. The regulations for BCM have not been developed yet.
2	Laws, Regulations and Standards in Cambodia	Disaster management policy and organization, Disaster management bill and Disaster mitigation plan, Environmental management and related laws and decrees, Land law, Forest law, Laws for rivers. The regulations for BCM have not been developed yet.
3	Laws, Regulations and Standards in Indonesia	Disaster management policy and organization, Disaster management law and Disaster mitigation plan, BCP standards for banks, Environmental Management Law and Regulations and decrees related to pollutions, Law on land acquisition, Law related to forestry and rivers.

4	Laws, Regulations and Standards in Lao PDR	Disaster management policy and organization, Regulations related to disaster management and Disaster mitigation plan, Environmental conservation law, Land law, Law related to forestry and rivers. The regulations for BCM have not been developed yet.
5	Laws, Regulations and Standards in Malaysia	Disaster management policy and organization, Disaster mitigation plan(Climate change / flood), BCP standards and guideline for banks, Law on Environmental management and regulations for pollution control, Regulations related to development and land use and law for building standards.
6	Laws, Regulations and Standards in Myanmar	Disaster management policy and organization, Disaster management bill and Disaster mitigation plan, Environmental conservation law and regulations for water quality, Factory law, Laws on forest and Natural area. The regulations for BCM have not been developed yet.
7	Laws, Regulations and Standards in Philippines	Disaster management policy and organization、Law related to disaster prevention and Disaster mitigation plan, BCP standards for banks, Law and regulations for pollution control, Law for land use and development and Law for building standards.
8	Laws, Regulations and Standards in Singapore	Disaster management policy and organization、Civil defense law and Emergency plan, BCM standards and BCP guideline, Environmental control law and public health law and related regulations, Laws related to land acquisition and Law for building standards.
9	Laws, Regulations and Standards in Thailand	Disaster management policy and organization, Disaster management law and Disaster mitigation plan, BCM standards and regulations, Environmental conservation law, Factory law, Public health law and regulations and standards related to pollution control
10	Laws, Regulations and Standards in Vietnam	Disaster management policy and organization, law for disaster management and Disaster mitigation plan, Environmental conservation law, Regulations for pollution control, Land law, Law on management for structures of river and water resources. The regulations for BCM have not been developed yet.

4.3 Summary of Survey

The results of the survey on the laws and regulations for disaster management, BCM, environmental conservation and provisions of development in ASEAN region are summarized.

It is difficult to evaluate the situations of substantive implementation of the provisions for BCM/BCP in relevant laws and regulations in order to encourage the development of BCP through this survey among the BCM/BCP. The additional research in this field is required.

4.3.1 Legislative systems for Disaster Management

The survey for the establishment of laws and regulations for disaster management and the disaster mitigation plan/strategy was conducted. In addition, the information about laws and regulations describing national or local disaster management were collected. Most countries have developed the laws or decrees enacting the integrated disaster management policies. Furthermore disaster mitigation plans/strategies are established; however some of these plans/strategies in particular countries have not been implemented. Moreover no stipulation that directly indicates the policies of BCM/BCP has been verified in the laws and regulations for disaster management.

Table 4.3.1 Laws, Regulations, Standards for Disaster Management

Countries	Laws / Decrees	Regulations / Plans, Strategies	Standards
Brunei	• Disaster Management Order, 2006	• Strategic National Action Plan for Disaster Risk Reduction 2012-2025 • RBPF (Royal Brunei Police Force) Standard Operating Procedures	–
Cambodia	• Law on National Disaster Management (Draft) • Sub-decree No.35 ANK • Sub-decree No.61 ANK	• National Policy on Emergency Management, 1997 • National Contingency Policy for Flood, 2011 • NCDM Institutional Development Strategy in 2001 • Strategic National Action Plan for Disaster Risk Reduction 2008-2013 • National Strategy Development Plan 2009-2013	–
Indonesia	• Law of the Republic of Indonesia concerning disaster management, (Law No.24), 2007	• National Disaster Management Plan 2010-2014 • National Action Plan for Disaster Risk Reduction 2010-2012 • Regional governments' action plans	–
Lao PDR	• The Prime Minister's Decree No.158, 1999 • NDMC Decree No.097, 2000	• Strategic Plan on Disaster Risk Management in Lao 2020, 2010 and Action Plan (2003-2005) • National Disaster Management Plan 2012-2015 • National adaptation plan for action - NAPA (2009)	–
Malaysia	• National Security Council Directive No.20	• Climate Change Adaptation Policy • National Slope Master Plan 2009-2023 • Integrated River Basin Management Plan • Federal Haze Action Plan	–
Myanmar	• Disaster Management Bill (to be enacted) • Rehabilitation Board Act, 1950 • Standing Order, 2009	• Myanmar Action Plan on Disaster Risk Reduction (MAPDRR) 2009-2015 • Regional / State Flood Protection Plans	–
Philippines	• Republic Act 101211 on Disaster Risk Reduction, 2010 • Republic Act 9729 (Climate Change Act, 2009)	• Strategic National Action Plan 2009-2019 • Mindanao declaration on disaster risk reduction priorities	–
Singapore	• Civil Defense Act, 1986 • Civil Defense Shelter Act, 1997 • Fire Safety Act, 1986	• Operations Civil Emergency (Ops CE) Plan • National Tsunami Management Plan	–
Thailand	• Disaster Prevention and Mitigation Act, 2007	• National Civil Defense Plan 2005 • Strategic National Action Plan for Disaster Risk Reduction 2010-2019 (SNAP) • National Disaster Prevention and Mitigation Plan 2010-2014 (NDPMP) • Flood, storm and landslide prevention master plan for natural disaster prevention and relief of affected people (2008-2012)	–
Vietnam	• Disaster Management Law (Draft) • Decree No.168 - HDBT, 1990 • Statutes on Dike Management, and Flood and Typhoon Mitigation • Ordinance on Flood and Storm Control	• National Strategy for Natural Disaster Prevention, Response and Mitigation to 2020 (2007 - 2020) • Implementation Plan of the National Strategy for Natural Disaster Prevention, Response and Mitigation to 2020, 2009 • Plan of operations of Vietnam National Committee on International Decade for Natural Disaster Reduction (IDNDR)	–

4.3.2 Regulations and Standards for Business Continuity Management

The survey on the regulations and standards regulating corporate BCM and BCP was conducted. The importance of BCM or BCP has not been enough recognized in ASEAN member countries, thus many countries have no regulations or standards for BCM/BCP. In addition, most of the established regulations have assumed banks as the intended stakeholders in the regulations.

Table 4.3.2 Laws, Standards, Guidelines for BCM / BCP

Countries	Laws	Standards	Regulations / Guidelines
Brunei	–	–	–
Cambodia	–	–	–
Indonesia	–	–	• Regulation No 9/15/PBI/2007 (Bank of Indonesia) • Regulation no. 6/8/PBI/2004 (Bank of Indonesia) • Indonesia BCP (Bank Indonesia (Central Bank)) • Manual: business continuity planning
Lao PDR	–	–	–
Malaysia	–	• MS (Malaysian Standards) 1970, Business Continuity Management Framework, 2007	• Guidelines on Management of ITEnvironment, 2004 (Bank Negara Malaysia) • Guidelines on Business Continuity Management, 2008 (Bank Negara Malaysia)
Myanmar	–	–	–
Philippines	–	• CircularNo.268 (Philippines Central Bank) • CircularNo.269 (Philippines Central Bank) • CircularNo.542 (Philippines Central Bank)	• Manila Bank BCP (Bank of Central Philippines)
Singapore	–	• Singapore Standard 540:2008 (SPRING: Singapore productivity and innovation) • Singapore Standard 507:2004 (SPRING: Singapore productivity and innovation)	• MAS Business Continuity Management Guidelines, June 2003 • MAS Consultation Paper On Business Continuity Planning (BCP) Guidelines, 2003 • Guidelines for Company Emergency Response Plan • Business Continuity Management Requirements for SGX members
Thailand	–	• TIS 22301-2553, Business Continuity Management Systems	• 118/2550 – Policy on BCM and BCP for Financial Institutions
Vietnam	–	–	–

4.3.3 Legislative systems for Environment and Pollution Control

The survey on the laws and regulations regulating environmental conservation and pollution control especially related to industrial activities was conducted. Among the legislative systems for environment and pollution, in most countries, the regulations for "water resources", "Air pollution", "Soil", "industrial effluent", "industrial waste" and also the regulations of "environmental assessments" are established based on the integrated laws of environmental management. The laws and regulations for environmental pollution control have a direct impact on prevention of second disaster caused by

industrial activities in a time of natural disaster. Therefore, the provisions should be considered in the BCM/BCP.

Table 4.3.3 Laws, Regulations, Standards for Environment and Pollution Control

Countries	Laws / Decrees	Regulations / Plans	Standards
Brunei	• Proposed Environmental Protection and Conservation Order, 2010	• Strategic National Action Plan for Disaster Risk Reduction 2012-2025 • RBPF (Royal Brunei Police Force) Standard Operating Procedures	–
Cambodia	• Law on Environmental Protection and Natural Resources Management, 1996 • Law on the Water Resources Management, 2007 • Sub-Decree No.72 Anrk.bk on Environmental Impact Assessment Process, August 1999 • Sub-Decree No.27 Anrk.bk on Water Pollution Control, April 1999 • Sub-Decree No.42 Anrk.bk on Air Pollution Control and Noise Disturbance, July 2000 • Sub-Decree No.36 Anrk.bk on Solid Waste Management, April 1999	–	–
Indonesia	• Environmental Basic Law, No.04, 1982 • Environmental Management Act, No.23, 1997 • Environmental Protection and Management Act, No.32, 2009 • Law on Water Resources, No.7, 2004 • Ministerial Decree No.51/MENLH/10/1995 (Effluent Standard for Industry) • Ministerial Decree No.48/MENLH/11/1996 (Noise Standards) • Ministerial Decree No.49/MENLH/11/1996 (Vibration Standards) • Government Regulation No.18 and No.85 (Hazardous Waste Management) • Ministry of Environment Decree No.11, 2006	• Government Regulation No.82/2001 (Water Quality Management and Waste Water Control) • Government Regulation No.41, 1999 (Air Pollution Management) • Government Regulation No.74/2001 • Government Regulation No.27, 1999 (Environmental Impact Assessment (EIA))	–
Lao PDR	• Environmental Protection Law, 1999	–	–
Malaysia	• Environmental Quality Act, 1974 (revised in 2006)	• Environmental Quality (Clean Air) Regulations, 1978 • Environmental Quality (Industrial Effluent) Regulations, 1979 • Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979 • Environmental Quality (Scheduled Wastes) Regulation, 1989	–
Myanmar	• National Environmental Conservation Law, 2012 • Factory Act, 1951 • Conservation of Water Resources and Rivers Law, No.8/2006	–	–
Philippines	• Environmental Policy Law • Presidential Decree No.1151 (Philippine Environment Policy of 1977) • Presidential Decree No.1152 (Philippine Environment Code of 1977) • Presidential Decree No.1586 (Environmental Impact Statement [EIS] System) • Clean Water Act (Republic Act No.9275)	–	• DENR Ambient Noise Quality Standards

	• Clean Air Act of 1999, (Republic Act No.8749) • Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990 (Republic Act No.6969) • Republic Act No.9003 (Ecological Solid Waste Management of 2000) • DAO No.2001-34 (Implementing Rules and Regulations of Republic Act No.9003) • DAO No.2003-30 (Implementing Rules and Regulations for the Philippine Environmental Impact Statement 〔EIS〕 System) • DAO No. 1993-14, Revised Air Quality Standards of 1992, Revising and Amending the Air Quality Standards of 1978 • DAO 1990-34, Revised Water Usage and Classification/Water Quality Criteria		
Singapore	• Environmental Pollution Control Act, 2002 • Environmental Public Health Act • Sewerage and Drainage Act	–	–
Thailand	• Environmental Pollution Control Act, 2002 • Enhancement and Conservation of National Environmental Quality Act B.E.2535, 1992 • Notification the Ministry of Science, Technology and Environment, No. 3, B.E.2539, 1996 • Factory Act B.E.2535 • Hazardous Substance Act B.E.2535	• Pollution Prevention and Mitigation Policy in accordance with the Policy and Perspective Plan for Enhancement and Conservation of the National Environmental Quality 1997-2016 (1992)	• Water Quality Standards • Air Quality and Noise Standards • Soil Quality Standards
Vietnam	• Law on Environmental Protection, revised in 2005 • Law on Water Resources, 1998 • Law on Chemicals (No.06/2007/QH12)	• QCVN 08 : 2008/BTNMT • QCVN 14 : 2008/BTNMT • QCVN 09 : 2008/BTNMT • QCVN 24: 2009/BTNMT, National Technical Regulation on Industrial Wastewater • QCVN 03 : 2008/BNMT • QCVN 19 : 2009/BTNMT, National Technical Regulation on Industrial Emission of Inorganic Substances and Dust • QCVN 20 : 2009/BTNMT, National Technical Regulation on Industrial Emission of Organic Substances • Law on Chemicals (No.06/2007/QH12)	–

4.3.4 Legislative systems for Development such as Land Use, River and Building Standards

As the laws and regulations related to BCM/BCP at the time of disasters, the regulations for land acquisition, the regulations for water and forestry development, and the regulations of building standards were considered in this survey. Although the basic laws for land and forestry development have been enacted in most of the countries, the status of the development of legal systems shows a large difference between the countries. Few laws or regulations have the definitive provision for the disaster response and rehabilitation.

No stipulation that directly indicates the policies of BCM/BCP has been verified in the laws and regulations regarding building code or town development such as land-use and river, forest. Since the regulations are inclusively related to disaster management and rehabilitation even in industrial sections, the assessment of the provisions prescribed in these regulations is required at the establishment of BCP in a company or a region.

Table 4.3.4 Laws, Regulations, Standards for Land use, River and Town Development

Countries	Laws / Decrees	Regulations / Plans	Standards
Brunei	• Law No.5, 1960 concerning Basic Agrarian Law • Presidential Decree No.36, 2005 • Presidential Decree No.65, 2006 • Forestry Act, 1999 • River Act, 1991	• National Land Use Master Plan 2006-2025	–
Cambodia	• Law on Land, 2001 • Law on Forestry, 2002 • Sub-Decree On Community Forestry Management • Sub-Decree on River Basin Management (Draft)	–	–
Indonesia	• Law No.5, 1960 concerning Basic Agrarian Law • Presidential Decree No.36, 2005 • Presidential Decree No.65, 2006 • Forestry Act, 1999 • River Act, 1991	–	–
Lao PDR	• Land Act • Forest Act,1996 • Water Act	–	–
Malaysia	• Town and Country Planning Act, 1976 (revised in 2005) • Land Conservation Act • National Forest Act, 1984 • Federal Forest Act • Road, Drainage and Building Act, 1974 (revised in 2000)	• Highland Slope Development Guidance	–
Myanmar	• Board of Development Affairs Act, 1993 • Forest Law, No.8/92 • Board of Development Affairs Act, 1993	–	–
Philippines	• Republic Act No.7586 • Republic Act No.7279 • Republic Act No.8974 • Board of Development Affairs Act, 1993 • Subdivision Law • Watershed Law • Republic Act No. 6541, the National Building Code of the Philippines	–	–
Singapore	• Planning Act, Chap.232, 1998 • Land Acquisition Act, Chap.152, 2007 • Building Control Act, Chap.29, 2007	• Building Control Regulations, 2007	–
Thailand	• Land Readjustment Act B.E.2547 • National Reserve Forest Act, 1964	–	–

	• Groundwater Act B.E. 2520, 1977 • Building Control Act, 1979		
Vietnam	• Law of Land, 2003	• Statutes on Dike Management, and Flood and Typhoon Mitigation • Ordinance on Water Resources Structures Protection	–

REFERENCES

1) Bank Negara Malaysia: Central bank of Malaysia (2004), "Guidelines on Management of IT Environment"
2) Bank Negara Malaysia: Central bank of Malaysia (2008), "Guidelines on Business Continuity Management"
3) Business Continuity Institute (2012), "Business Continuity Management, Legislations, Regulations and Standards," Version 0.7.
4) Japan International Cooperation Agency (2012), "Data Collection Survey on ASEAN Regional Collaboration in Disaster Management, Main Report", Draft final report.
5) Monetary Authority of Singapore (2003), "MAS Business Continuity Management Guidelines"
6) Monetary Authority of Singapore (2003), "MAS Consultation Paper On Business Continuity Planning (BCP) Guidelines"
7) Singapore Exchange (2009), "Business Continuity Management Requirements for SGX members – New Practice Note for Inclusion in SGX-ST Rules"

CHAPTER 5 EXISTING INVESTIGATIONS AND STUDIES

5.1 Methodologies and Scope of Survey

This section reviews studies and researches that have been conducted in the ASEAN region with a focus on natural hazards, risks and vulnerability assessments. The target hazards are; flood, earthquake, volcano, tsunami, cyclone (typhoon)/ meteorological disasters and landslide. Information and study reports were reviewed from those that are available for public and in internet. The purpose of this section is, firstly to grasp an overview of the existing study results regarding hazard trends, encountering risks and degrees of vulnerability of the entire ASEAN region as well as each member state of ASEAN. Secondly, to produce a compilation of assessment reports of the region that is accessible for those who wish to plan an Area BCP for reference.

Table 5.1.1 Methodology of Information Collection and Scope of Survey

Information Collected	Methodology	Scope of Survey
Existing Studies and Research	To collect existing studies and reports from public sources including internet	To summarize the studied hazards, area, contents of hazard and risk analysis, vulnerability assessment of existing studies and researches

5.2 Outline of Collected Information and Data

Table 5.2.1 shows the outline of collected information and data. The summary of existing studies and reports are compiled to data sheets in Appendix A5.

Table 5.2.1 Outline of the Collected Information and Data

Subdivision of Appendix A5	Hazards	Outline
A5.1	Flood	Flood hazard, risk assessments, hazard maps and vulnerability assessment have been conducted in ASEAN countries using data on rainfall, inundation area, affected population, and monetary assessment. Hazard maps were produced with GIS tools. The usage of GIS tools for assessments is widely recognized and explored its usage to produce hazard maps. Some runoff analyses were conducted for selected areas. Limited information and data available for Brunei Darussalam.
A5.2	Earthquake	Many of the earthquake hazard studies in the area are probabilistic seismic hazard analysis (PSHA), not scenario earthquake study. That is to quantify the probability of exceeding a specific ground-motion level at a site given all possible earthquakes. This methodology is descended from the Global Seismic Hazard Assessment Program (GSHAP). GSHAP was launched in 1992 by the International Lithosphere Program (ILP) with the support of the International Council of Scientific Unions (ICSU), and endorsed as a demonstration program in the framework of the United Nations International Decade for Natural Disaster Reduction (UN/IDNDR).

		Earthquakes are not equally distributed on the earth because of the generating mechanism. In the ASEAN region, many earthquakes are observed in and around Indonesia and Philippines located in the convergent boundary (subduction) zone and little fewer earthquakes are observed in and around Myanmar in the transform boundary zone. There are fewer or no earthquakes are observed in the other region. However, some regions are sometimes affected by the earthquakes which occur in the neighboring countries. The northern regions of ASEAN countries are sometimes affected by the earthquakes occur in Yunnan province of China. A number of investigations and studies reflect this trend.
A5.3	Tsunami	There are only few investigations and studies about tsunami hazard or risk in the region and most of them are compiling the disasters in the past. There is no probabilistic study unlike earthquake. There is a hazard map which is an envelope of several tsunami scenarios. There are studies targeting Asia-Pacific area because tsunami propagates in the sea. Large-sized tsunamis are caused by the huge earthquake in the ocean area. That is the reason why tsunamis are also not equally distributed on the earth. However, tsunami affects so wide area than ground-motion of earthquake as seen in the tsunami cause by the Sumatra earthquake on December 26th in 2004 that tsunami is sometimes studied in the countries with few or no earthquakes.
A5.4	Volcano	Most of volcanoes are also located along the convergent boundary (subduction) zone. That is the reason why volcanoes are also not equally distributed on the earth. The disasters caused by the volcanic eruption are lava flow, pyroclastic flow, lahar and ash fall. Ash is scattered widely by the prevailing westerlies, but others do not affect so widely. As for volcanic hazard, many of investigations and studies are compiling the affected area by lava flow, pyroclastic flow, lahar, and ash fall in the past volcanic eruption for each volcano.
A5.5	Cyclone	Research on cyclone and meteorological hazard, and risk assessments have been conducted in ASEAN countries using data on track, damaged area and rainfall of storm. The impact of climate is also included in this research. Limited information and data available for Brunei Darussalam and Singapore.

5.3 Summary of Survey

5.3.1 Flood

Some useful studies on flood hazard, risk and vulnerability are available for public which present assessment results, case studies of counter measures as well as different types of methodological approaches. There are a few options of methodologies to assess risks and vulnerability. For instance, risks involve exposure to flooding events and population density. Vulnerability can be defined as a function of exposure, adaptive or coping capacity, land-use etc. There are slightly different combinations of these factors with different studies for use. Therefore, these concepts have to be defined in advance to plan a methodology of an assessment, in terms of which definitions are to be used in a certain analysis.

The summary of existing studies and reports are shown in Table 5.3.1 by countries. The list of collected existing studies and reports is shown in Table 5.3.2.

Table 5.3.1 Summary of Existing Studies and Reports by Country: Flood

Country/Region	Summary of Existing Studies and Reports
ASEAN	There are a few reports that study natural disasters for ASEAN and the Pacific regions at large in recent years. Disaster risks are assessed by scenario, exposure, vulnerability, damage and loss. An assessment framework is also sought for to have an overview of risks, hazard and vulnerability.
Brunei	Information for public is rather limited and a comprehensive report is not available.
Cambodia	National Committee for Disaster Management and Ministry of Planning has recognized flood as one of the major disaster and drew a strategic plan. However hazard, risk and vulnerability assessments are limited to a level of a rough situation analysis. There is an identification of risky areas for the whole country. At some areas there are more exploratory studies to assess risks as well as implementation of counter-measures.
Indonesia	The analytical works for Indonesia are leaned to Jakarta regions. Both highly technical analysis using hydrologic models as well as community interview methods have been conducted to assess hazards and risks.
Lao PDR	There is a comprehensive disaster hazard, risk and vulnerability assessments using primarily existing secondary data and information. As to flooding, 8 major river inundation areas are taken for assessment. Scenario development and mapping are also included.
Malaysia	Ministry of Natural Resources and Environment is taking an initiative to work on flood management. Hazard significance of flood is high in terms of population affected, area extent, duration and social economic damage. The assessments are conducted with data which include monetary damage, flood frequency, magnitude. The Flood Management includes structural and non-structural measures.
Myanmar	Flood hazard maps are prepared for 50-year and 100-year return period scenarios by a project conducted by UNDP/ADPC for Rakhine State. 5 river basins are selected for analysis. Flood

	forecasting efforts are also implemented by the Department of Meteorology and Hydrology. Flood forecasting stations are installed at major rivers in Myanmar.
Philippines	Civil Defense, National Disaster Coordinating Council is taking a lead to formulate hazard mapping and assessment. There is a project implemented in 27 provinces out of total of 80 provinces in the country.
Singapore	The website of Singapore Government, PUB has extensive data information as to the flood situation and strategies to prepare for flooding.
Thailand	GISDA is producing GIS maps on flood. World Bank undertook an assessment of damage caused by the flood of Chao Phraya river in 2011 to estimate damages and losses. There is a flood risk assessment case study to evaluate susceptibility of hazard and risks. Reducing vulnerability is also a key to lower risks. Examples of non-structural risk reduction measures are also presented.
Vietnam	Relatively many studies and assessments are available for public for Vietnam. Hazard and risk assessments are conducted using MIKE11 for Hoang Long River basin. Simulations of magnitude of flood are elaborated for different return periods, 5, 10, 20, 50, 100 and 200 year return periods. For Thach Han River basin, an analysis was also made using hydraulic models with MIKE and socio economic data. This combination of statistical analysis and social surveys made flood vulnerability assessment possible.

Table 5.3.2 Existing Studies and Research: Flood

No	Country	Province/ City	Coordinate		Risk Assessment		Vulnera-bility Assess-ment	Organiza tion Produced	Document No. in Appendix A5.1
			Lati.	Longi.	Area	Popu-lation			
1	ASEAN	-	-	-	o	o	×	UNISDR/ WB	FL_001
2	Cambodia	Phnom Pehn	11.57489	104.9173	o	o	×	ADB	FL_002
3	Cambodia	Tonle Sap	12.99118	104.0703	o	×	×	NCDM/ ESCAP	FL_014
4	Indonesia	Surakarta	-7.55889	110.8159	o	o	×	ADB	FL_002
5	Indonesia	Palembang	-2.97733	104.7566	o	o	×	ADB	FL_002
6	Indonesia	Pekalongan	-6.87632	109.6692	o	o	×	ADB	FL_002
7	Indonesia	Tegal	-6.86303	109.1333	o	o	×	ADB	FL_002
8	Indonesia	Samarang	-6.95165	110.4152	o	o	×	ADB	FL_002
9	Lao PDR	Attapeu	15.79225	106.7798	×	o	×	UNDP/ ADPC	FL_024
10	Lao PDR	Borikhamxai	18.56816	104.4791	×	o	×	UNDP/ ADPC	FL_024
11	Lao PDR	Champassack	15.32657	105.813	×	o	×	UNDP/	FL_024

								ADPC	
12	Lao PDR	Khammouane	17.77484	105.2261	×	○	×	UNDP/ ADPC	FL_024
13	Lao PDR	LouangPhrabang	19.88717	102.1411	×	○	×	UNDP/ ADPC	FL_024
14	Lao PDR	Phongsaly	21.69827	102.2488	×	○	×	UNDP/ ADPC	FL_024
15	Lao PDR	Saravane	15.7184	106.4168	×	○	×	UNDP/ ADPC	FL_024
16	Lao PDR	Savannakhet	16.57302	105.5864	×	○	×	UNDP/ ADPC	FL_024
17	Lao PDR	Vientiane	17.97024	102.6171	×	○	×	UNDP/ ADPC	FL_024
18	Lao PDR	XaisombounSr	21.22794	101.358	×	○	×	UNDP/ ADPC	FL_024
19	Lao PDR	Xekong	15.6442	106.9981	×	○	×	UNDP/ ADPC	FL_024
20	Malaysia	Georgetown	5.364588	100.3109	○	○	×	ADB	FL_002
21	Myanmar	Mandalay	21.99017	96.08357	○	○	×	ADB	FL_002
22	Myanmar	Yangon	16.82163	96.14662	○	○	×	ADB	FL_002
23	Myanmar	Rakhine State	20.02497	93.96423	○	×	×	UNDP/ ADPC	FL_010
24	Philippines	Quezon City	14.68988	121.0418	○	○	×	ADB	FL_002
25	Singapore	Singapore	1.282547	103.8329	○	○	×	ADB	FL_002
26	Thailand	Bangkok	13.78207	100.4931	○	○	×	ADB	FL_002
27	Thailand	Hat Yai	7.021846	100.4533	○	×	×	Journal of Natural Disaster Science	FL_017
28	Vietnam	Ho Chi Minh	10.90074	106.6328	○	○	×	ADB	FL_002
29	Vietnam	Hanoi	21.03612	105.8498	○	○	×	ADB	FL_002
30	Vietnam	Quang Tri	16.68356	107.0074	○	×	○	Hanoi Univ. CietnamUniv.	FL_022

31	Vietnam	NihnBinh	20.25898	105.9741	○	○	○	NakhonPathomRajabhat Univ.	FL_021

Note: ○ indicates an existence of the information. ×indicates the information not found from public resources.

5.3.2 Earthquake

Useful information and studies on earthquake hazard, risk and vulnerability were collected from the resources which were available in the public domain as of websites. The information and studies include methodologies with analysis and assessment.

There is no standardized or authorized methodology of risk and vulnerability assessment. Therefore, the methodology should be taken or updated in accordance with the purpose when risk and vulnerability assessment are required.

The summary of existing studies and reports are shown in Table 5.3.3 by countries. The list of collected existing studies and reports is shown in Table 5.3.4.

Table 5.3.3 Summary of Existing Studies and Reports by Country: Earthquake

Country/Region	Summary of Existing Studies and Reports
ASEAN	There are natural hazard assessment reports for ASEAN region by international organization like World Bank etc. They summarize frequency, vulnerability, loss and others for each disaster. Some reports describe the methodology, assessment points and items.
Brunei	There is no record of historical earthquake disaster in Brunei and no investigation and study limited to this country and its regions is found.
Cambodia	There is no record of historical earthquake disaster in Cambodia and no investigation and study limited to this country and its regions is found.
Indonesia	Many organizations executed earthquake hazard related investigation and studies for Indonesia. There is a zoning map for earthquake insurance in this country. BNPB discloses seismic intensity maps and related damage information for the earthquakes occurred after 2009. However, descriptions are made in Indonesian and users are limited.
Lao PDR	There are few records of historical earthquake disaster in Lao PDR, but UNDP prepared multi-hazard risk profile for 18 provinces. Multi-hazard includes earthquakes, floods, landslides, epidemics, unexploded ordnances (UXOs), droughts and storms.
Malaysia	There is no record of historical earthquake disaster in Malaysia and no investigation and study limited to this country and its regions is found.
Myanmar	Many organizations executed earthquake hazard related investigation and studies for Myanmar. UNDP executed multi-hazard risk assessment for Rakhine State and 3 states of Ayeyarwady, Bago and Yangon State. Multi-hazard includes earthquake, tsunami, flood, cyclone, storm surge and climate change. Detailed methodologies are described in the reports.
Philippines	Many organizations executed earthquake hazard related investigation and studies for Philippines. PHIVOLCS discloses hazard maps of earthquake, liquefaction, tsunami, volcano, earthquake-induced landslide and ground rupture for 27 high risk states among 80 states in the country. The maps were prepared in the READY Project by the government.
Singapore	There is no record of historical earthquake disaster in Singapore and no investigation and study limited to this country and its regions is found.

Thailand	There are few records of historical earthquake disaster in Thailand and some organizations surveyed earthquake hazard.
Vietnam	There is no record of historical earthquake disaster in Vietnam and no investigation and study limited to this country and its regions is found.

Table 5.3.4 Existing Studies and Research: Earthquake

No	Country	Province/ City	Hazard Assessment			Risk Assessment		Vulnera-bility Assess-ment	Organi-zation Produced	Document No. in Appendix A5.2
			Scena rio	Probabi listic	Method ology	Human Loss	Econom ic Loss			
1	Worldwide	-	×	○	×	○	○	○	UNISDR	EQ_001
2	ASEAN	-	×	○	×	×	×	×	GSHAP, USGS	EQ_002
3	Indonesia	-	×	○	×	○	×	×	OCHA-ROAP	EQ_003
4	Indonesia	-	×	○	×	×	×	×	MAIPARK	EQ_004
5	Indonesia	-	×	○	×	○	×	×	USGS	EQ_005
6	Indonesia	-	×	○	○	×	×	×	USGS	EQ_006
7	Indonesia	Yogyakarta, Central Java	×	×	×	○	○	×	ADB	EQ_007
8	Indonesia	-	×	○	×	×	×	×	USGS, GSHAP	EQ_008
9	Indonesia	-	○	×	×	×	×	×	BNPB	EQ_009
10	Lao PDR	-	×	○	×	○	×	×	OCHA-ROAP	EQ_010
11	Lao PDR	18 Province	×	○	×	○	○	○	UNDP, GRIP	EQ_011
12	Malaysia	Kalimantan	×	○	×	×	×	×	GSHAP, USGS	EQ_012
13	Myanmar	-	○	○	×	○	×	×	USGS	EQ_013
14	Myanmar	-	×	○	×	○	×	×	OCHA-ROAP	EQ_014
15	Myanmar	Rankin State	×	○	○	○	○	○	UNDP, GRIP	EQ_015
16	Myanmar	Ayeyarwady, Bago, Yangon State	×	○	○	○	○	○	UNDP, GRIP	EQ_016
17	Philippines	-	×	○	×	○	×	×	OCHA-ROAP	EQ_017
18	Philippines	-	○	×	×	×	×	×	PHIVOLCS	EQ_018
19	Philippines	-	×	○	×	×	×	×	USGS, GSHAP	EQ_019
20	Philippines	27 Provinces	○	×	×	×	×	×	PHIVOLCS	EQ_020
21	Philippines	Metro. Manila	○	×	○	○	○	○	PHIVOLCS	EQ_021
22	Philippines	Metro. Manila	○	×	×	×	×	×	PHIVOLCS	EQ_022
23	Thailand	-	×	○	×	○	×	×	OCHA-ROAP	EQ_023
24	Thailand	-	×	○	○	×	×	×	USGS	EQ_024
25	Vietnam	-	×	○	×	○	×	×	OCHA-ROAP	EQ_025

5.3.3 Tsunami

Useful information and studies on tsunami hazard, risk and vulnerability were collected from the resources which were available in the public domain as of websites. The information and studies include methodologies with analysis and assessment.

There is no standardized or authorized methodology of risk and vulnerability assessment. Therefore, the methodology should be taken or updated in accordance with the purpose when risk and vulnerability assessment are required.

The summary of existing studies and reports are shown in Table 5.3.5 by countries. The list of collected existing studies and reports is shown in Table 5.3.6.

Table 5.3.5 Summary of Existing Studies and Reports by Country: Tsunami

Country/Region	Summary of Existing Studies and Reports
ASEAN	Tsunami induced by the Sumatra earthquake on December 26th, 2004 caused huge damage to ASEAN countries and the disaster is summarized by the organizations like ADB.
Brunei	There is no record of historical tsunami disaster in Brunei and no investigation and study limited to this country and its regions is found.
Cambodia	There is no record of historical tsunami disaster in Cambodia and no investigation and study limited to this country and its regions is found.
Indonesia	There are some materials summarized tsunami hazards. There is a report of tsunami disaster on May 27th, 2006 affected in and around Jogjakarta. BNPB discloses damage information of tsunami caused by the earthquakes occurred after 2010. However, descriptions are made in Indonesian and users are limited.
Lao PDR	There is no record of historical tsunami disaster in Lao PDR and no investigation and study limited to this country and its regions is found.
Malaysia	There is no record of historical tsunami disaster in Malaysia and no investigation and study limited to this country and its regions is found.
Myanmar	There are few records of historical tsunami disaster in Myanmar and it is recognized as one of the damaging hazards in the country. UNDP executed multi-hazard risk assessment for Rakhine State and 3 states of Ayeyarwady, Bago and Yangon State. Multi-hazard includes earthquake, tsunami, flood, cyclone, storm surge and climate change. Detailed methodologies are described in the reports.
Philippines	PHIVOLCS and other organizations are executing several investigations and studies. PHIVOLCS discloses tsunami hazard maps for 49 states. In addition, PHIVOLCS discloses hazard maps of earthquake, liquefaction, tsunami, volcano, earthquake-induced landslide and ground rupture for 27 high risk states among 80 states in the country. The maps were prepared in the READY Project by the government.
Singapore	There is no record of historical tsunami disaster in Singapore and no investigation and study limited to this country and its regions is found.
Thailand	There are few records of historical tsunami disaster in Thailand. The inundation area by the Sumatra earthquake on December 26th, 2004 is summarized.
Vietnam	There is no record of historical tsunami disaster in Vietnam and no investigation and study limited to this country and its regions is found.

Table 5.3.6 Existing Studies and Research: Tsunami

No	Country	Province/ City	Hazard Assessment			Risk Assessment		Vulnera-bility Assess-ment	Organi-zation Produced	Document No. in Appendix A5.3
			track record	Scena rio	Metho dology	Human Loss	Economic Loss			
1	Indonesia, Sri Lanka and India	-	○	×	×	×	×	×	DFO	TN_001
2	ASEAN	-	○	×	×	○	○	×	ADB	TN_002
3	Indonesia	-	×	○	×	×	×	×	Firewaves	TN_003
4	Indonesia	Yogyakarta and Central Java	○	×	×	○	○	×	ADB	TN_004
5	Indonesia	Sumatra – Aceh Province	○	×	×	×	×	×	DFO	TN_005
6	Indonesia	-	○	×	×	○	×	×	BNPB	TN_006
7	Myanmar	Rankin State	×	○	○	○	○	○	UNDP, GRIP	TN_007
8	Myanmar	Ayeyarwady, Bago,Yangon State	×	○	○	○	○	○	UNDP, GRIP	TN_008
9	Philippines	-	×	○	×	×	×	×	PHIVOLCS	TN_009
10	Philippines	27 Provinces of Philippines	×	○	×	×	×	×	PHIVOLCS	TN_010
11	Philippines	49 Provinces of Philippines	×	○	×	×	×	×	PHIVOLCS	TN_011
12	Thailand	Southern area	○	×	×	×	×	×	DFO	TN_012

5.3.4 Volcano

Useful information and studies on volcanic hazard, risk and vulnerability were collected from the resources which were available in the public domain as of websites. The information and studies include methodologies with analysis and assessment.

There is no standardized or authorized methodology of risk and vulnerability assessment. Therefore, the methodology should be taken or updated in accordance with the purpose when risk and vulnerability assessment are required.

The summary of existing studies and reports are shown in Table 5.3.7 by countries. The list of collected existing studies and reports is shown in Table 5.3.8.

Table 5.3.7 Summary of Existing Studies and Reports by Country: Volcano

Country/Region	Summary of Existing Studies and Reports
ASEAN	UNOCHA summarized the scale of explosion of volcanoes around Asia-Pacific region using Volcanic Explosivity Index (VEI).
Brunei	There is no record of historical volcanic disaster in Brunei and no investigation and study limited to this country and its regions is found.
Cambodia	There is no record of historical volcanic disaster in Cambodia and no investigation and study limited to this country and its regions is found.
Indonesia	The governmental organization BNPB discloses volcanic hazard maps on the website. Some maps use satellite images.
Lao PDR	There is no record of historical volcanic disaster in Kao PDR and no investigation and study limited to this country and its regions is found.
Malaysia	There is no record of historical volcanic disaster in Malaysia and no investigation and study limited to this country and its regions is found.
Myanmar	There is no record of historical volcanic disaster in Myanmar and no investigation and study limited to this country and its regions is found.
Philippines	The governmental organization PHIVOLCS is preparing volcanic hazard maps. The maps are prepared for the active volcanoes and possible expanding area of pyroclastic flow, lava flow, lahar and ash fall are summarized on the maps. PHIVOLCS discloses hazard maps of earthquake, liquefaction, tsunami, volcano, earthquake-induced landslide and ground rupture for 27 high risk states among 80 states in the country. The maps were prepared in the READY Project by the government. However, there are few states with volcanic hazard.
Singapore	There is no record of historical volcanic disaster in Singapore and no investigation and study limited to this country and its regions is found.
Thailand	There is no record of historical volcanic disaster in Thailand and no investigation and study limited to this country and its regions is found.
Vietnam	There is no record of historical volcanic disaster in Vietnam and no investigation and study limited to this country and its regions is found.

Table 5.3.8 Existing Studies and Research: Volcano

No	Country	Province/ City	Hazard Assessment			Risk Assessment		Vulnera-bility Assess-ment	Organi-zation Produced	Document No. in Appendix A5.4
			track record	Scena rio	Metho dology	Human Loss	Economic Loss			
1	ASEAN Asia-Pacific	-	○	×	×	×	×	×	OCHA -ROAP	VE_001
2	Indonesia	Each volcano	○	×	×	×	×	×	BNPB	VE_002
3	Philippines	Each active volcano	×	○	×	×	×	×	PHIVOL CS	VE_003
4	Philippines	Southern Leyte Province	×	○	×	×	×	×	PHIVOL CS	VE_004

5	Philippines	Mt. Pinatubo	○	×	×	×	×	×	USGS	VE_005

5.3.5 Cyclone (Typhoon) and Meteorological Hazard

"Cyclone" is a term to describe all kinds of low pressure systems, of which tropical cyclones/typhoons mainly create disasters in the ASEAN region. Under the framework of WMO, the leading countries implement monitoring/detection of tropical cyclones on a regional basis. Table 5.3.9 indicates the responsible territory allocated to ASEAN members and its leading country.

Table 5.3.9 Members of WMO Tropical Cyclone Committee

	Warning Zones	Members (ASEAN)	Leading Country
Western North Pacific Ocean and South China Sea	0° - 60°(N) 0° - 100°(E)	Cambodia, Lao PDR, Malaysia, Philippines, Singapore, Thailand, Vietnam	Japan
Bay of Bengal and the Arabian Sea	5°S - 45°(N) 30°E - 90°(E)	Myanmar, Thailand	India
South Pacific and South-East Indian Ocean	0°-50°(S) 90° - 170°(E)	Indonesia	Fiji

The date and information utilized in this report have been acquired from various reports of the studies and researches conducted on tropical cyclone and meteorological hazard published in the Internet. Collected documents include the evaluation result of hazard/risk as well as its evaluation method. With regards to tropical cyclone/typhoon, a meteorological organization of each country compiles the situation of damage, such as the number of casualties or loss of human lives, the estimated amount of damage, etc.

The summary of existing studies and reports are shown in Table 5.3.10 by countries. The list of collected existing studies and reports is shown in Table 5.3.11.

Table 5.3.10 Summary of Existing Studies and Reports by Country: Cyclone and Meteorological Hazard

Country/Region	Summary of Existing Studies and Reports
ASEAN	Study reports on Natural Disasters in the whole ASEAN region are available.
Brunei	There is no indication on tropical cyclone and meteorological hazard.
Cambodia	Typhoon landing on the center of Vietnam sometimes approaches and brings heavy rain to Cambodia. Meteorological Doppler Radar System was introduced in 2012 for the improvement of accuracy of weather forecasting.
Indonesia	There is no indication on tropical cyclone/typhoon as Indonesia is located on the equator. Heavy rain can continue for several days due to El Nino. Down scaling forecast experiment in the tropical meteorology by the high resolution regional NWP model has been implemented.

Lao PDR	Typhoons generated around the Philippines sometimes affect Laos after landing on Vietnam. 87,403 in 362 villages located in 36 regions of Vientiane、Bolikhamsai, Xiengkhouang and Xayaboury Provinces were directly affected by Typhoon HAIMA in June, 2012.
Malaysia	Malaysia is not directly affected by tropical cyclone. However, the storms which are associated with typhoons generated in the Western Pacific and the South China Sea occur in the northern area of Malaysia. In the tropical region, the convective activity is intensified at approximately a few ten days intervals, which sometimes bring a large amount of precipitation.
Myanmar	An enormous cyclone such as Cyclone Nargis brought about unprecedented damage is occurred in several decades.
Philippines	Approximately, 20 typhoons / year are generated in the Pacific near the Philippines and 5-7 typhoons are landed on the Philippines. Typhoon BOPHA passed in the Philippine island of Mindanao back in December 2012 and created more than 1,000 casualties and 5.47 million victims.
Singapore	There is no indication on tropical cyclone and meteorological hazard.
Thailand	A typhoon, occurring between October and December and landing on Central Vietnam, can create damage even in Thailand. Abnormal weather due to the Climate Change is occurred.
Vietnam	Vietnam comes second in terms of the occurrence of large storms after the Philippines. National Strategy of Natural Disaster Prevention and Action & Adoption Plan for Natural Disaster by 2020 have been approved in November 2007. Development of the enormous disaster risk financial solution (including insurance) for disaster risk supplement has been recommended.

Table 5.3.11 Existing Studies and Research: Cyclone and Meteorological Hazard

No	Country	Province/ City	Coordinate		Risk Assessment		Vulnera-bility Assess-ment	Organiza tion Produced	Document No. in Appendix A5.5
			Lati.	Longi.	Area	Popu-lation			
1	Cambodia							ADPC	CM_001
2	Indonesia							ADPC	CM_001
3	Indonesia							ADB	CM_002
4	Indonesia							UNDP	CM_003
5	Lao PDR							ADPC	CM_001
6	Lao PDR	Borikhamxai	18.56816	104.4791	×	×	×	GFDRR/ WB	CM_004
7	Lao PDR	Vientiane	17.97024	102.6171	×	×	×	GFDRR/ WB	CM_004
8	Lao PDR	Khammouane	17.77484	105.2261	×	×	×	GFDRR/ WB	CM_004
9	Lao PDR	Xayaboury			×	×	×	GFDRR/ WB	CM_004
10	Philippines							ADPC	CM_001

11	Philippines							ADB	CM_002
12	Philippines							WB	CM_005
13	Singapore							ADB	CM_002
14	Thailand							ADB	CM_002
15	Thailand							UN	CM_006
16	Vietnam							ADPC	CM_001
17	Vietnam							ADPC	CM_002
18	Vietnam	ThuaThien Hue	21.03612	105.8498	×	×	×	ADPC	CM_007
19	Vietnam	Quang Tri	16.68356	107.0074	×	×	×	ADB	CM_007
20	Vietnam	Quang Nam	21.03612	105.8498	×	×	×	WB	CM_007

5.3.6 Landslide

The summary of existing studies and reports are shown in Table 5.3.12 by countries. The list of collected existing studies and reports is shown in Table 5.3.13.

Table 5.3.12 Summary of Existing Studies and Reports by Country: Landslide

Country/Region	Summary of Existing Studies and Reports
ASEAN	There are a few reports that study landslides for ASEAN and the Pacific regions at large in recent years. Disaster risks are assessed by scenario, exposure, vulnerability, damage and loss. An assessment framework is also sought for to have an overview of risks, hazard and vulnerability.
Brunei Seri Begawan	Only three Landslide events are identified in this country. Hazard map of LS-08 indicates small and low level distribution near the border with Malaysia. Although 1/3 of prior disasters are landslide, assessment of risk and vulnerability are very low level.
Cambodia	The occurrence of landslide disaster in Cambodia has been unconfirmed. Hazard map of LS-08 indicates low level hazard distributes in the mountain area near coast, but no hazard is distributed Mekong low land area around the capital city of Phnom Penh. There is no assessment of landslide in LS-008, but some weak exposure is recognized near border with Thai by LS-013. There are on-going projects about early warning system and hazard mapping in connection with DHRW.

Indonesia	High level hazard distributes near volcanic area, which concentrates in the Indian Ocean side of archipelago, and some potion of Celebes and West Papua New Guinea, there is no hazard in the Java Sea side where metropolis locates. Exposure distribution is almost similar to hazard, number of landslide/year and deaths/year are highest level of ASEAN. About vulnerability index, deaths /year/million is the second, average annual economic loss is the top. Statics among 2003-2005 indicated by LS-004 amount of events, number of deaths, amount of damaged farmlands and roads are most prone in east Java region, the second about number of landslide is central Java region and about number of deaths is north Sumatra region. There are so many landslide disaster event before, some disaster studies and risk assessment projects were conducted by Japan, Australia and the World Bank. LS-016 reports a study of Flashflood (Bansir-Pandang), which contains assessment methodology using relationship with landslide and hazard map of some areas. Improvement projects about landslide are conducted mainly by BNPB. Hazard maps are prepared in entire country even some of those scale are not large enough. SATLAKPB has been organized as a main body of disaster emergency command, actual situation of that has been reported in terms of framework, responsibility and roll in some pilot provinces (LS-017).Significant subsidence of the ground in metropolitans (such as Jakarta, Bandon, Semarang) shall be assessed as a disaster of soils.
Lao PDR	Hazard covers all over the country consisted mainly hills and mountains without Mekong River low land where Capital Vientiane stands. According to the result of nationwide hazard and vulnerability assessment is by UNDP (LS-008), flashfloods in the northern mountainous region is common and those areas are susceptible to landslide. Some exposure distributes around mountain areas in the north of Capital and the south part of the country near the border. Laws and governmental organizations are not yet developed. The project for early warning system is ongoing.
Malaysia	Hazard distributes in the center of the peninsula where includes the suburbs of Capital Kuala Lumpur. Level of number of landslide/year and total number of deaths are high, deaths /year is the third in ASEAN, economic loss data is unconfirmed. In spite of that, amount of damage of Selangor disaster in November 2003 recorded 836 million RM (almost 13.7 billion yen). Exposure distributes northeastern part of the peninsula and eastern part of Borneo. As large-scale hazard map has been prepared, awareness to landslide is relatively high. Preparedness of early warning system is ongoing even main target is flood.
Myanmar	High level hazard distributes in the border area with India and some hazard distributes the Andaman Sea coastal area. According to the LS-001 studied risk assessment of Rakhine state, hazard map of landslide caused by rainfall and earthquake is analyzed and there is no hazard around townships. Number of landslide/year is high level, deaths/year and average annual economic loss are low level. Exposure distributes in the border with India at high level and in the border with Thai. Vulnerability of Building, Household and Livelihood in Rakhine state are studied. Laws and organization about disaster is poor. Even MGS prepared hazard maps, experience storage and technical education are locking because of poor organization.

Philippines	Hazard distributes in entire country, high level hazard areas even including Capital Manila suburbs are common. Number of landslide/year, total number of deaths, deaths/year, deaths/year/million are the highest, average annual economic loss is the second in ASEAN. Exposure distributes in entire country, the area along Philippines fault is notably high. Assessment of vulnerability to landslide is equivalent to flood. As number of landslide is continuously increasing in the past two decades, so declining forest simultaneous with urbanization is deemed to be concerning with it. Large-scale hazard map are available in most areas. Rainfall prediction is conducting in entire country, no monitoring system about landslide is conducted yet. UNDP assesses vulnerability in nationwide scale. Project of early warning system, hazard assessment and landslide monitoring system are implementing by mainly NDCC, which crosses government organizations.
Singapore	There is no record and assessment about landslide in Singapore.
Thailand	High level hazard distributes in the border area with Lao, there is no hazard in the low land where Capital Bangkok and other main cities stand. Vulnerability indicated by occurrence of landslide and deaths is medium to low level. Exposure distributes in a narrow area near border with Myanmar. Large-scale hazard maps are developing and early warning system for flashflood has been preparing. Countermeasure for road side slopes also has been conducting.
Vietnam	High level hazard distributes in the northern area and the central area. Frequency of landslide, deaths and economic loss are the third in ASEAN. Exposure distributes in the northern mountain area widely, near the border area with Lao and in the coastal area in the central region. Although many mitigating activities to the damaged regions has been conducted by ADB and other donors, preparedness about Hazard, such mapping or risk assessing, has not been developed yet. A early warning system project in pilot regions was conducted, but that does not perform well at present. Several Projects about early warning system, landslide hazard analysis and management for landslide risk are on-going.

Table 5.3.13 Existing Studies and Research: Flood

No	Country	Province/ City	Coordinate		Risk Assessment		Vulnera-bility Assess-ment	Organization Produced	Document No. in Appendix A5.6
			Lati.	Longi.	Area	Popu-lation			
1	ASEAN				○	○	X	UNISDR/World Bank	LS-006
2	ASEAN				○	○	X	EEPSEA	LS-013
3	Cambodia	Entire Country	11.566	104.918	X	X	○	UNISDR	LS-008
4	Indonesia	Entire Country	-6.199	106.848	○	X	X	BAKOSURTANAL	LS-003
5	Indonesia	Entire Country	-6.199	106.848	○	X	X	MEMR	LS-004
6	Indonesia	Entire Country	-6.199	106.848	X	○	X	JICA	LS-014
7	Indonesia	Entire Country	-6.199	106.848	X	○	○	BNPB/AIFDR/GFDRR	LS-015

8	Indonesia	Entire Country	-6.199	106.848	X	○	X	JICA	LS-016
9	Indonesia	Jemberka bupaten	-8.103	113.692	○	○	X	JICA	LS-017
10	Indonesia	Pariaman kabupaten	-0.624	100.119	○	○	X	JICA	LS-017
11	Indonesia	Preaman City	-0.624	100.119	○	○	X	JICA	LS-017
12	Indonesia,	Entire Country	-6.199	106.848	X	X	○	UNISDR	LS-008
13	Lao PDR	Entire Country	17.970	102.616	○	X	X	UNDP	LS-002
14	Lao PDR	Entire Country	17.970	102.616	X	X	○	JICA	LS-008
15	Malaysia	Entire Country	3.148	101.689	○	○	X	JICA	LS-018
16	Myanmar	Rakhine State	20.025	94.010	○	○	○	UNDP	LS-001
17	Philippines	Entire Country	14.619	120.987	○	X	X	PHIVOLCS	LS-005
18	Philippines	Entire Country	14.619	125.106	X	X	○	UNISDR	LS-008
19	Philippines	Guinsaug on	10.333	125.106	○	X	X	ADB	LS-009
20	Vietnam	Entire Country	21.085	105.856	X	X	○	UNISDR	LS-008
21	Vietnam	Entire Country	21.085	105.856	X	○	X	ADB	LS-010
22	Vietnam	Yen Bai	21.974	104.562	X	X	X	ADB	LS-011
23	Vietnam	QuangNg ai	15.327	108.787	X	X	X	JICA	LS-012
24	World				○	○	○	WB	LS-007
			Indicate Captal						

REFERENCES

Flood

1) ADPC (2010) Developing a National Risk Profile of Lao PDR, Part1: Hazard Assessment, Vientiane, UNDP
2) ADPC (2010) Developing a National Risk Profile of Lao PDR, Part2: Exposure, Vulnerability and Risk Assessment, Vientiane, UNDP
3) ArriefAnshory Yusuf &Herminia Francisco (2009). Climate Change Vulnerability Mapping for Southeast Asia, Singapore: EEPSEA
4) Asian Disaster Preparedness Center (2011) Program for Hydro-Meteorological Disaster Mitigation in Secondary Cities in Asia (PROMISE) 2005 to 2010: Bangkok

5) Asian Urban Disaster Mitigation Program (2011). Coping with Flood in Cambodian communities, Enhancing Community Solidarity. Pathumthani: Asian Disaster Preparedness Center
6) Brinkman, JanJaap et al (2009) Jakarta Flood Hazard Mapping Framework: Jakarta
7) ĐangĐinhKha et al (2010) Flood Vulnerability Assessment of Downstream Area in Thach Han River Basin, Quang Tri Province: Hanoi University of Science, Vietnam National University, Hanoi
8) Department of Meteorology and Hydrology (2010). Flood Forecasting and Mitigation in Myanmar, Department of Meteorology and Hydrology
9) EngRinbo (2008) Cambodia: Mainstreaming Flood and Drought Risk Mitigation in East Mekong Delta: Bangkok
10) Ministry of Natural Resources & Environment, (2007) Flood and Drought Management in Malaysia: Ministry of Natural Resources & Environment: Kuala Lumpur
11) Ministry of Natural Resources & Environment, (2010) Flood Management – Programme and Activities: Ministry of Natural Resources & Environment: Kuala Lumpur
12) Mohd. SafieMohd. et al, (2009) GIS Analysis for flood Mapping: Case Study; Segamt, Johor West MalaysiaUniversiti Indonesia, Jakarta . (Unpublished)
13) National Disaster Coordinating Council (2010) Strategic National Action Plan 2009-2019, Strengthening Disaster Risk Reduction in the Philippines: Philippines
14) Renato Solidum (2009) Hazards Mapping and Assessment for Effective Community-based Disaster Risk Management or 'READY' Project: Philippines
15) Royal Haskoning, Deltares, Unesco-IHE. (2009) Flood Risk Management in the Border Zone between Cambodia and Vietnam: The Mekong River Commission Secretariat
16) Shigenobu Tanaka et al (2010). Progress Report on Flood Hazard Mapping in Asian Countries. PWRI.
17) TanavudCharlchai et al, (2004) Assessment of flood risk In Hat Yai Municipality, Southern Thailand, using GIS: Journal of Natural Disaster Science, Volume 26, Number 1, 2004, pp1-14
18) TawatchaiTingsanchali (2010) Flood Hazard and Risk Assessment of Hoang Long River Basin, MIKE by DHI
19) UNDP/ADPC (2011). Multi Hazard Risk Assessment in the Rakhine State of Myanmar.
20) Velasquez, Jerry et al (ed.) (2012). Reducing vulnerability and exposure to disasters: Asia-Pacific disaster report 2012, ESCAP/UNISDR AP
21) World Bank (2011) Thailand Flooding 2554 Rapid Assessment for Resilient Recovery and Reconstruction Planning: Bangkok
22) World Bank (2011). Advancing Disaster Risk Financing and Insurance in ASEAN Countries: Framework and Options for Implementation, Washington: Global Facility for Disaster Reduction and Recovery
23) World Bank, UNISDR (2010). Synthesis Report on Ten ASEAN Countries Disaster Risks Assessment.

Earthquake

1) ADPC, PTI, (NDMO, UNDP (2010). DEVELOPING A NATIONAL RISK PROFILE OF LAO PDR
2) BAPPENAS, the Provincial and Local Governments of D.I.Yogyakarta, the Provincial and Local Governments of Central Java, and international partners, (2006). Preliminary Damage and Loss Assessment: Yogyakarta and Central Java Natural Disaster: The 15th Meeting of The Consultative Group on Indonesia Jakarta, June 14, 2006
3) JICA, MMDA, PHIVOLCS (2004). Metro Manila Earthquake Impact Reduction Study
4) Mark Petersen et al. (2007). , Documentation for the Southeast Asia Seismic HazardMaps, USGS
5) OCHA-ROAP (2011). Indonesia: Natural Hazard Risks
6) OCHA-ROAP (2011). LAO PDR: Natural Hazard Risks
7) OCHA-ROAP (2011). MYANMAR: Natural Hazard Risks
8) OCHA-ROAP (2011). PHILIPPINES: Natural Hazard Risks
9) OCHA-ROAP (2011). THAILAND: Natural Hazard Risks
10) OCHA-ROAP (2011). VIET NAM: Natural Hazard Risks
11) PT. Asuransi MAIPARK (2010). Earthquake Risk Zone Map of Indonesia
12) UNDP (2011). Multi-hazard Risk Assessment in the Rakhine State of Myanmar
13) UNDP (2012). Multi-hazard Risk Assessment in Nargis Affected Areas, Myanmar
14) UNISDR (2009). Global assessment report on disaster risk reduction, Risk and poverty in a changing climate
15) USGS (2009). Seismic Hazard of Western Indonesia
16) USGS (2012). Poster of the Burma Earthquake of 11 November 2012 - Magnitude 6.8

Tsunami

1) ADB (2005). From Disaster to Reconstruction: A Report on ADB's Response to the Asian Tsunami
2) BAPPENAS, the Provincial and Local Governments of D.I.Yogyakarta, the Provincial and Local Governments of Central Java, and international partners, (2006). Preliminary Damage and Loss Assessment: Yogyakarta and Central Java Natural Disaster: The 15th Meeting of The Consultative Group on Indonesia Jakarta, June 14, 2006
3) UNDP (2011). Multi-hazard Risk Assessment in the Rakhine State of Myanmar
4) UNDP (2012). Multi-hazard Risk Assessment in Nargis Affected Areas, Myanmar

Volcano

1) Newhall, C.G., Punongbayan, R.S. (eds.), (1997). Fire and mud: Eruptions and lahars of Mt. Pinatubo, Philippines, Philippine Institute of Volcanology and Seismology, Quezon City and University of Washington Press, Seattle, 1126 p.
2) OCHA -ROAP (2011). Holocene Eruption and Selected Volcanoes in Asia-Pacific

Cyclone (Typhoon) and Meteorological Hazard

1) Country Assessment Report for the Philippines. "Strengthening of Hydrometeorological Services in Southeast Asia", Draft for consultation (22 April 2012)
2) ESCAP/WMO Typhoon Committee. (http://www.typhooncommittee.org/)
3) JMA/WMO Workshop on Quality Management in Surface, Climate and Upper-air Observations in RA II (Asia) 2011
4) Status of Implementation and Program/Project Evaluation and/or Assessment Reports (PAGASA) (http://www.pagasa.dost.gov.ph/PBB/PBB/StatusoIaP.pdf)
5) National Environment Agency (Singapore). Annual Weather Review 2011 (http://app2.nea.gov.sg/annual_review_new.aspx)
6) PAGASA. Status of Implementation and Program/Project Evaluation and/or Assessment Reports (http://kidlat.pagasa.dost.gov.ph/PBB/PBB/StatusoIaP.pdf)
7) Typhoon Committee Expert Mission 23-27 April 2012 (2012). Assessment Report of the damages caused by Tropical Storm Washi and Introduction to the Typhoon Committee Disaster Information System
8) Vulnerability, Risk Reduction, and Adaptation to Climate Change Philippines (http://sdwebx.worldbank.org/climateportalb/doc/GFDRRCountryProfiles/wb_gfdrr_climate_change_country_profile_for_PHL.pdf)
9) WMO National Meteorological or Hydrometeorological Services of Members (http://www.wmo.int/pages/members/members_en.html)
10) WMO (2010). First Meeting of the Task Team on "Meteorological, Hydrological and Climate Services for Improved Humanitarian Planning and Response", WMO Headquarters, Geneva, Switzerland (31 August - 2 September, 2010)

Landslide

1) World Bank, UNISDR (2010). Synthesis Report on Ten ASEAN Countries Disaster Risks Assessment
2) World Bank, UNISDR (2011). Disaster Risk Management Programs for Priority Countries- 2nd edition

CHAPTER 6 ECONOMY AND TRADE

6.1 Methodologies and scopes of survey

A survey has been conducted in order to estimate what extent of impact will affect an industrial park in the ASEAN region and other regions in the world once the industrial park is suffered from a large-scale disaster. The following sections show the result of surveying the economic relationships within the ASEAN region, between the ASEAN region and Japan, and between the ASEAN region and major countries in the world.

Specifically, the following items were included in the survey and the survey was conducted through internet search, literature review, etc.:

- General conditions of economies and industries in the ASEAN region
- General conditions of trade in the ASEAN region
- Impact analysis of damage by a large-scale disaster in the ASEAN region

6.2 Information collected

In order to understand the current status of economy and trade in the ASEAN region, related information were collected and analyzed, as shown in the table below.

Table 6.2.1 Summary of Collected Information

No.	Reference	Remarks
1	ASEAN-JAPAN CENTRE website http://www.asean.or.jp/	Statistical data on economy, industry and trade of ASEAN
2	JETRO 2009, "ASEAN Economic Community (in Japanese)"	Regional corporation framework in East Asia
3	Yamagata et al. 2011, "New ASEAN (in Japanese)"	History of ASEAN establishment
4	Umezaki 2011, "Recent trend regarding ASEAN Economic Community" (in Japanese)	History of ASEAN establishment
5	ASEAN website (2013), "Key basic ASEAN indicators in 2011, Last update 14 January 2013"	Key basic indicators of ASEAN
6	International Monetary Fund, World Economic Outlook Database	Macroeconomic indicators of ASEAN
7	ASEAN Stats database http://aseanstats.asean.org/	Trade values of ASEAN by commodity and partner country, etc.

6.3 Survey results

The current situation on economy and trade of ASEAN countries were surveyed and the survey results are shown in the following paragraphs.

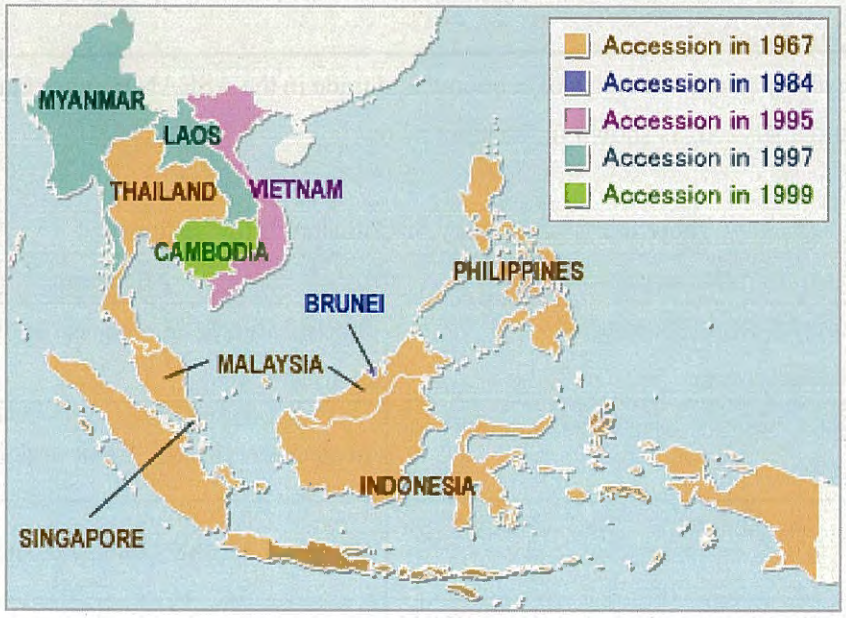
6.3.1 Economic and industrial trends in ASEAN countries

(1) Outline of ASEAN

"Association of South East Asian Nations(ASEAN)" was established on August 8, 1967. The aims of the ASEAN establishment are as follow:

- Promote economic growth and social and cultural development in the region
- Maintain political and economic security in the region
- Solve various problems in the region

In the beginning, ASEAN has started from five member countries, including Indonesia, Malaysia, Philippines, Singapore, and Thailand. After that, Brunei Darussalam in January 8, 1984, Vietnam in July 28, 1995, Cambodia in April 30, 1999, have joined as new member countries.



Source: ASEAN-JAPAN CENTRE website (http://www.asean.or.jp/)

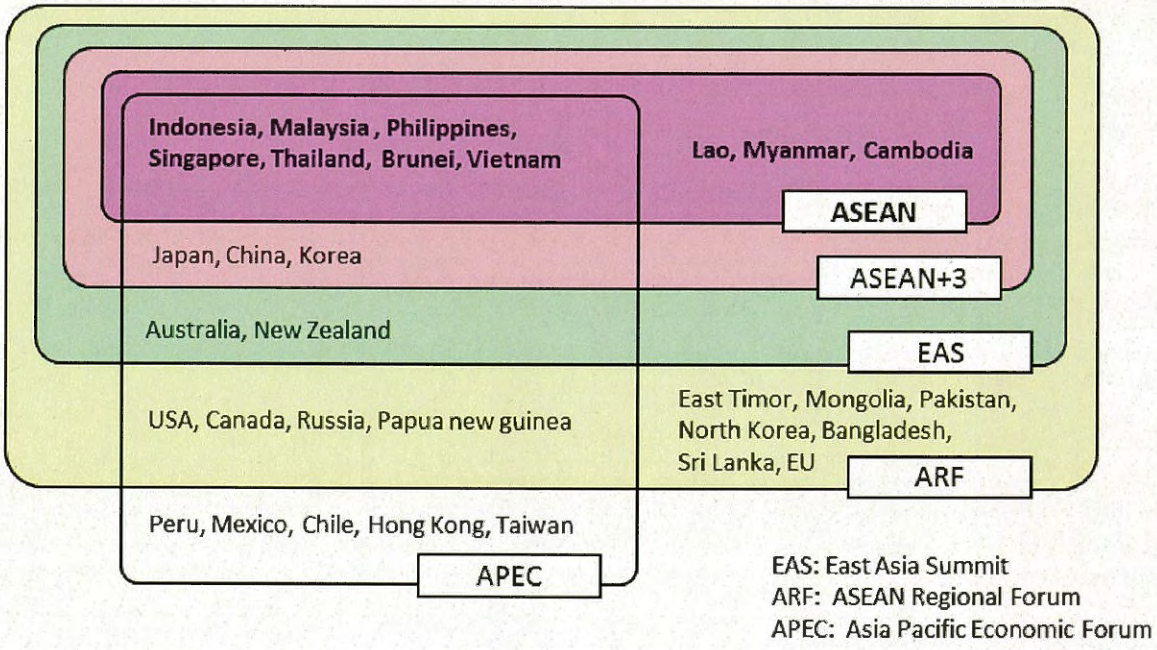
Figure 6.3.1 Outline of ASEAN

On December 18, 1997, in the meeting of the ASEAN summit, which was held in Kuala Lumpur, ASEAN countries agreed to release "ASEAN Vision 2020," and declared to aim at "creating ASEAN economic region with stability, prosperity, and competitiveness where freer transport of goods, services and investments, freer movement of capital, equal economic development and correction of imbalance between poverty and social economy."This is the starting point of the "ASEAN Economic Community: AEC," which currently draws attention (Yamagata et al. 2011, "New ASEAN (in Japanese)").

Initially, the AEC was planned to establish in 2020. However, due to the changing situation of accelerated globalization and emerging economies such as China and India, the ASEAN countries agreed that the AEC would be established by 2015 when the twelfth meeting of the ASEAN summit was held in January, 2007. (Umezaki 2011, "Recent trend regarding ASEAN Economic Community" (in Japanese)).

Also, due to the Asian currency and financial crisis happened in Thailand in 1997, various kinds of regional economic cooperation framework in the East Asia region have been expanded as a measure for addressing the crisis.

As it is shown below, regional economic cooperation has been carried forward in multilayered ways. ASEAN countries aim to collect foreign investments and supports from countries outside the ASEAN region, by initiating various kinds of regional economic cooperation framework (JETRO 2009, "ASEAN Economic Community (in Japanese)").



Source: JETRO 2009, "ASEAN Economic Community (in Japanese)"

Figure 6.3.2 Regional Corporation Framework in East Asia

6.3.2 Economic trends in ASEAN countries

In order to understand economic conditions in ASEAN countries, major indicators in ASEAN countries were surveyed, including Gross Domestic Product (GDP), Population etc. The results are shown below.

(1) Basic data of ASEAN

Major indicators which show economic conditions in ASEAN are summarized below.

Table 6.3.1 Key indicators of ASEAN Countries in 2011

Country	Total land area	Total population[1/]	Population density[1/]	Annual population growth[1/]	GDP at current prices	GDP per capita at current prices	Growth rate of GDP at constant prices	Inflation rate	Unemployment rate
	km^2	thousand	persons per km^2	percent	US$ million	US$	percent	percent	percent
Brunei Darussalam	5,765	422.7	73	2.0	16,359.6	38,702.5	2.2	2.0	2.6
Cambodia	181,035	14,521.3	80	1.5	12,766.2	879.1	6.4	5.5	0.2
Indonesia	1,860,360	237,670.7	128	1.5	846,821.3	3,563.0	6.5	3.8	5.0
Lao PDR	236,800	6,385.1	27	2.1	8,163.3	1,278.5	8.0	7.6	1.3
Malaysia	330,252	28,964.3	88	0.2	287,922.8	9,940.6	5.1	3.2	3.1
Myanmar	676,577	60,384.0	89	1.0	52,841.5	875.1	10.4	5.0	4.0
The Philippines	300,000	95,834.4	319	1.9	224,337.4	2,340.9	3.9	4.6	6.4
Singapore	714	5,183.7	7,257	2.1	259,858.4	50,129.9	4.9	5.2	2.9
Thailand	513,120	67,597.0	132	0.4	345,810.8	5,115.8	0.1	3.8	0.7
Viet Nam	331,051	87,840.0	265	1.0	123,266.9	1,403.3	6.0	18.6	3.6
ASEAN	**4,435,674**	**604,803.1**	**136**	**1.3**	**2,178,148.1**	**3,601.4**	**4.7**	**n.a.**	**n.a.**

1/ Refers to/based on mid-year total population based on country projections

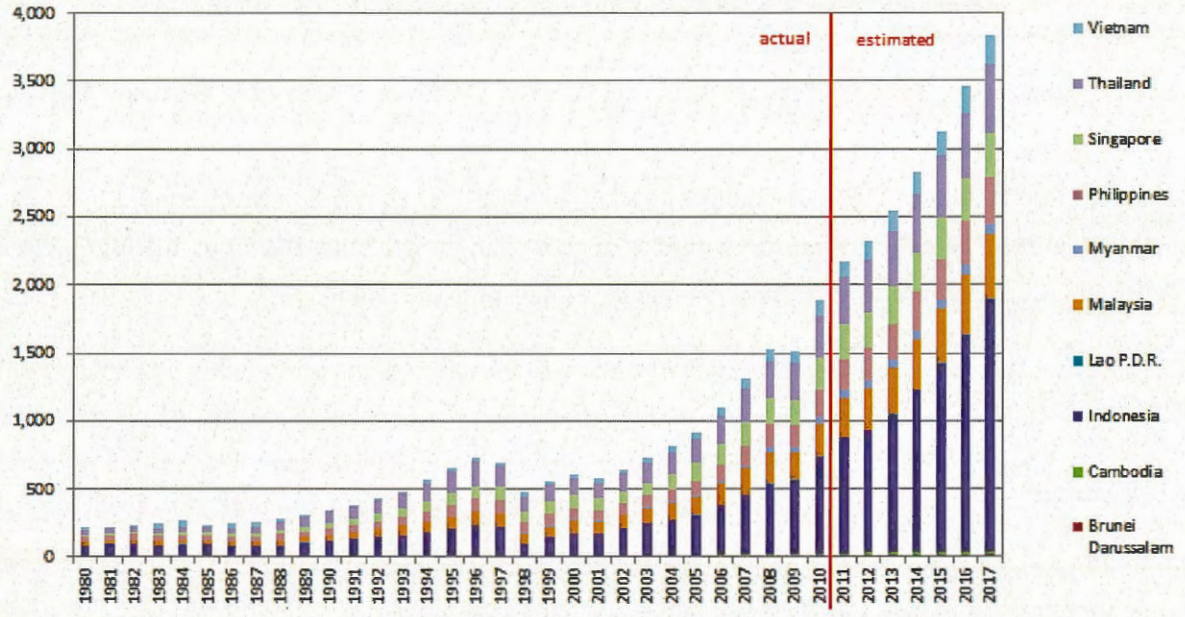
Source:ASEAN website (2013), "Key basic ASEAN indicators in 2011, Last update 14 January 2013"

(2) Major economic indicators in ASEAN countries

1) Nominal GDP

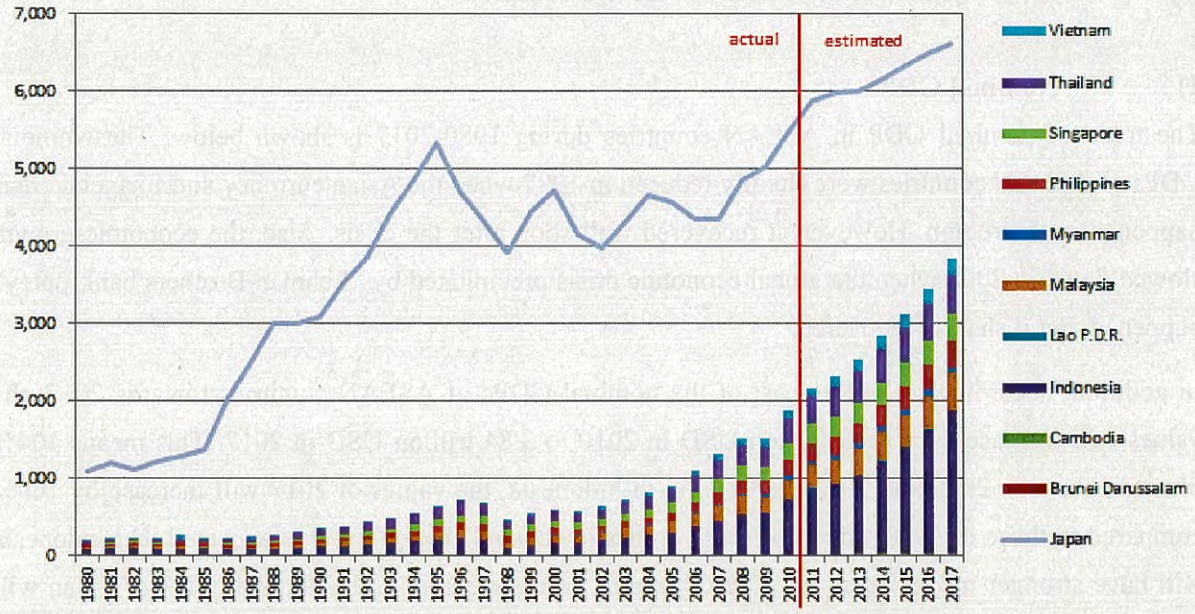
The trend of nominal GDP in ASEAN countries during 1980-2017 is shown below. The Nominal GDPs of ASEAN countries were sharply reduced in 1997 when the Asian currency and financial crisis happened in the region. However, it recovered well soon after the crisis. Also, the economic growth slowed down in 2008 when the global economic crisis precipitated by "Lehman Brothers bankruptcy" happened, but it sharply recovered.

In addition, according to the forecast of the nominal GDPs of ASEAN countries towards 2017, the values will increase from 1.88 trillion USD in 2010 to 3.84 trillion USD in 2017. This means 104% increase between 2010 and 2017. Especially, in Indonesia, the values of 2017 will increase by 160% compared to those of 2010, due to the high domestic demand. Therefore, it is expected that Indonesia will have stronger influence in the ASEAN region. In the meantime, the nominal GDP of Japan will increase by 20.4% from 2010 till 2017. So, the ASEAN countries will have a stronger presence in the global market.



Source: International Monetary Fund, World Economic Outlook Database, October 2012

Figure 6.3.3 Gross Domestic Product in ASEAN countries (1980-2017), current prices (Estimation starting from 2011: only Myanmar starting from 2010)



Source: International Monetary Fund, World Economic Outlook Database, October 2012

Figure 6.3.4 Gross Domestic Product in ASEAN countries & Japan (1980-2017), current prices (Estimation starting from 2011: only Myanmar starting from 2010)

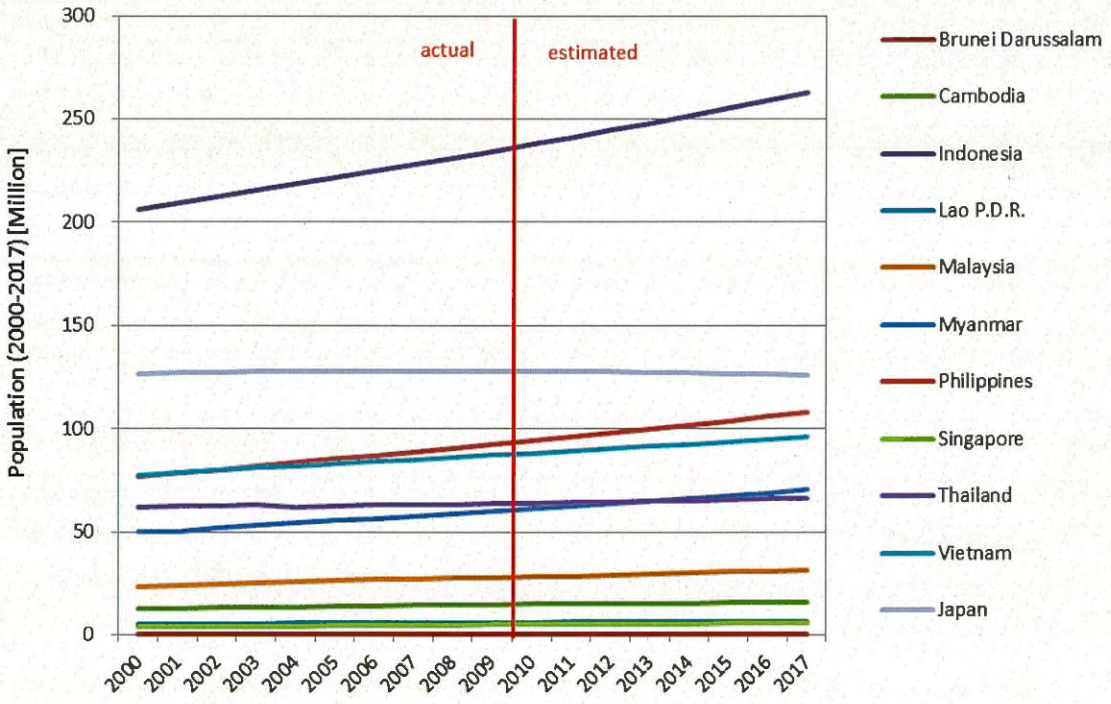
2) Population

The trend of population in ASEAN countries during 2000-2017 is shown below. In general, the trend of population has a strong relationship with that of economic growth, and, therefore, the high rate of population growth endorses the future economic development in the region.

In Indonesia, who has the biggest population among the ASEAN countries, the population has continuously increased with the rate of 1.4% per year since 2000. The number of population increased from 206 million in 2000 to 234 million in 2009. From now, the rate of population growth is expected to be a higher rate of 1.43% per year. The number of population will reach 262 million in 2017.

The future average rate of population growth in the ASEAN region is expected to be around 1.45% during 2010-2017, and therefore the trend will remain at a high level.

For reference, in Japan the trend of population has started to decline. The rate of population during 2000-2009 was 0.11% per year and it will be -0.21% per year during 2010-2017.



Source: International Monetary Fund, World Economic Outlook Database, October 2012

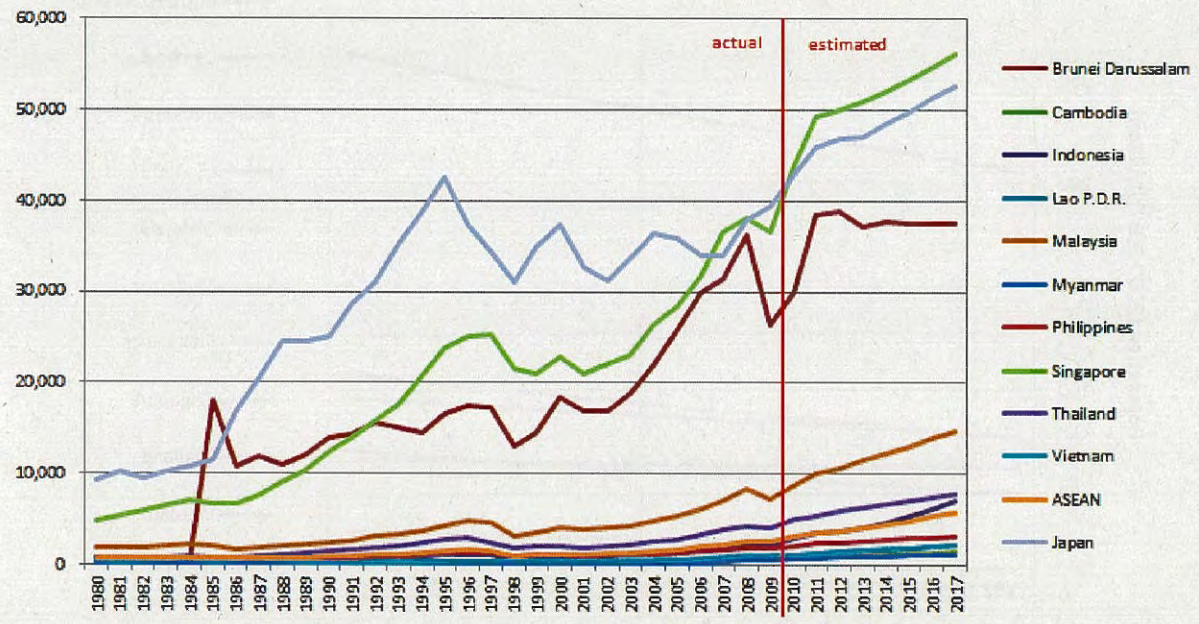
Figure 6.3.5 Population (2000-2017)[Million]

(Estimation in Myanmar starting from 2006; in Cambodia starting from 2008; in Lao P.D.R. and Thailand starting from 2011; in others starting from 2010)

3) Per capita GDP (Nominal GDP)

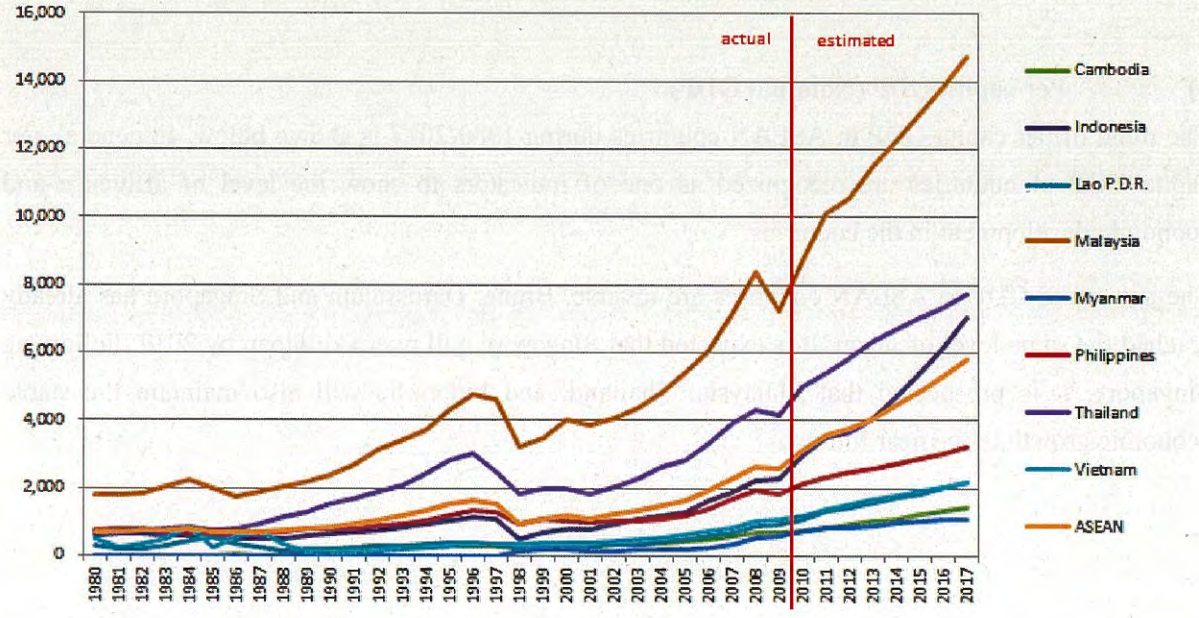
The trend of per capita GDP in ASEAN countries during 1980-2017 is shown below. In general, per capita GDP of countries are recognized as one of indicators to show the level of affluence and economic development in the countries.

The per capita GDP in ASEAN countries are diverse. Brunei Darussalam and Singapore has already reached the same level of Japan. It is expected that Singapore will overtake Japan by 2017. Following Singapore, it is prospected that Malaysia, Thailand, and Indonesia will also maintain the stable economic growth in the near future.



Source: International Monetary Fund, World Economic Outlook Database, October 2012

Figure 6.3.6 Gross Domestic Product per capita in ASEAN countries and Japan (1980-2017), current prices (Estimation in Myanmar starting from 2006; in Cambodia starting from 2008; in Lao P.D.R. and Thailand starting from 2011; in others starting from 2010)



Source: International Monetary Fund, World Economic Outlook Database, October 2012

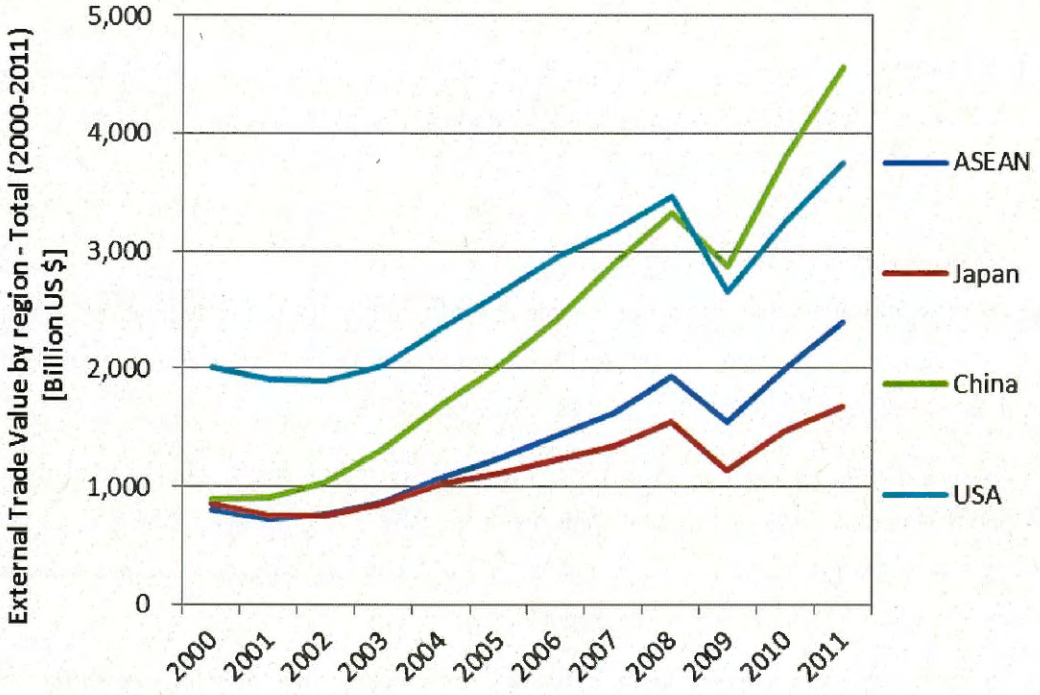
Figure 6.3.7 Gross Domestic Product per capita in ASEAN countries except Brunei Darussalam and Singapore (1980-2017), current prices (Estimation in Myanmar starting from 2006; in Cambodia starting from 2008; in Lao P.D.R. and Thailand starting from 2011; in others starting from 2010)

6.3.3 Trade trends in ASEAN countries

In order to understand the economic relationships between the ASEAN region and other countries, the external trade values and the main trade partner countries and/or regions of ASEAN are surveyed. The survey results are shown in the following paragraphs.

(1) External trade value of ASEAN

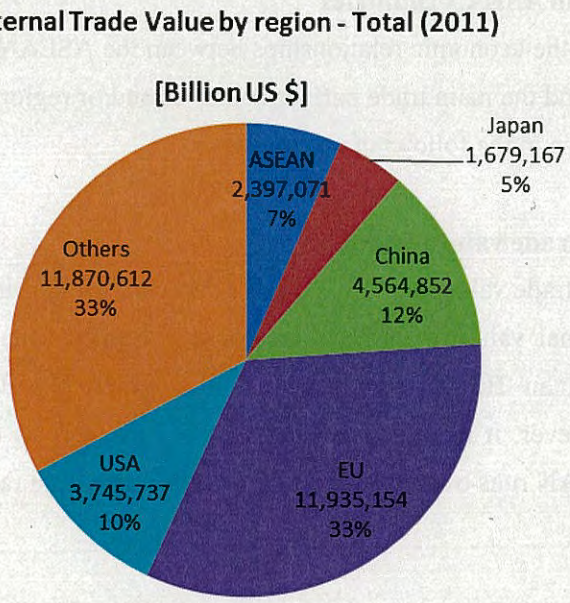
The trends of external trade values of ASEAN and other countries during 2000-2011 are shown below. Since 2000, the external value of ASEAN has grown steadily. Due to the global economic crisis precipitated by "Lehman Brothers bankruptcy," the external trade value of ASEAN declined temporarily, and, however, it recovered rapidly in the same way as other counties. After 2006, the external value of ASEAN runs over that of Japan and maintains high rate of growth.



Source: International Monetary Fund e-Library (http://elibrary-data.imf.org/DataExplorer.aspx), Direction of Trade Statistics (DOTS)

Figure 6.3.8 External Trade Value by region - Total (2000-2011) [Billion US $]

Next, the share of external trade value by major country and region in 2011 is shown below. The share of external trade values of ASEAN accounts 6% in the world. It is more than the share of Japan (5%). In other places of the world, the share of external trade of EU is very high and it accounts 33% in the world.



Source: International Monetary Fund e-Library (http://elibrary-data.imf.org/DataExplorer.aspx), Direction of Trade Statistics (DOTS)

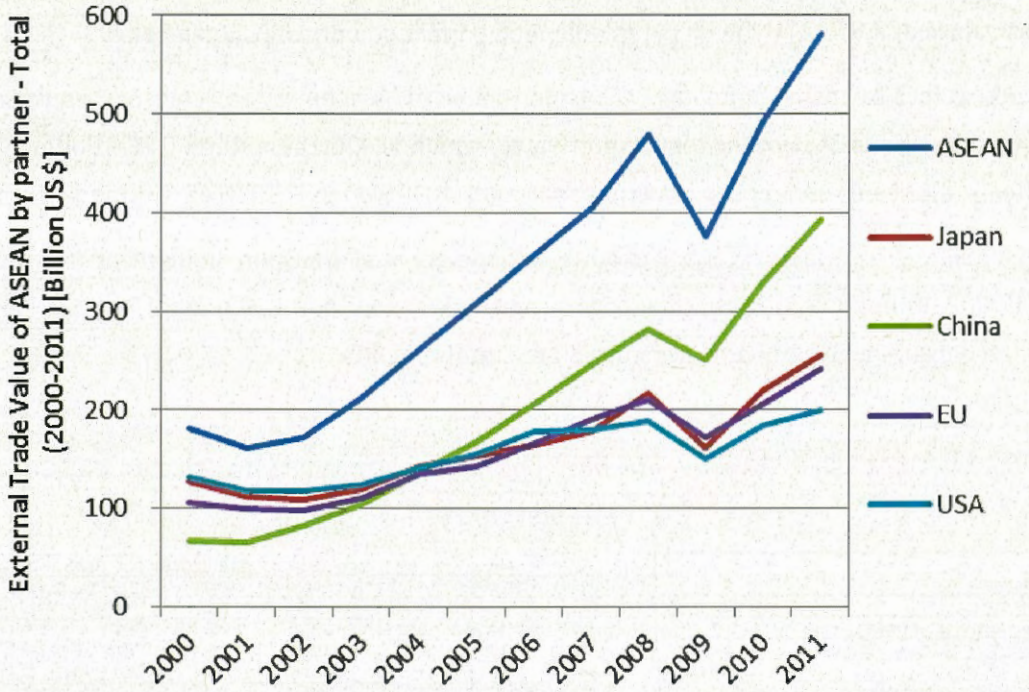
Figure 6.3.9 External Trade Value by region - Total (2011) [Billion US $]

(2) Main trade partners of ASEAN

The trend of external trade value by partner countries during 2000-2011 is shown below. Here, due to the global economic crisis in 2008, the external trade value of ASEAN also declined temporarily, and, however, it recovered rapidly in the same way as other counties.

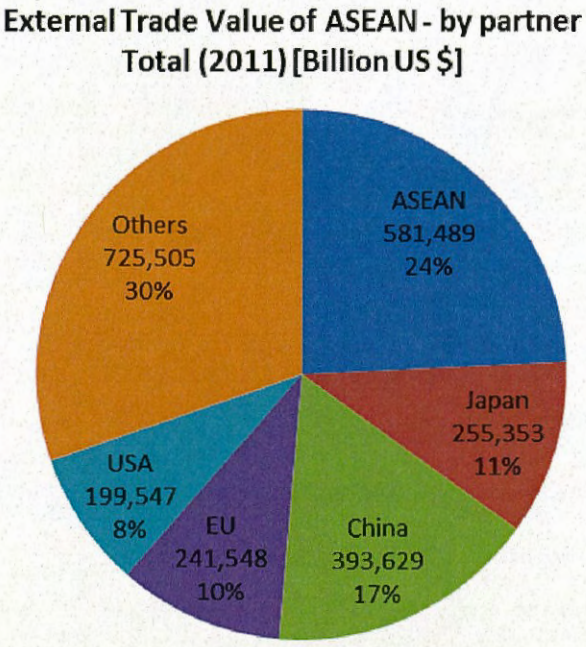
In 2011, the largest trade partner of ASEAN is the ASEAN region itself. The internal trade value within ASEAN accounts 24% of the total trade value of ASEAN. Following ASEAN, China is the second largest trade partner of ASEAN and accounts 17%. Japan becomes the third and accounts 11%. EU and United States account 10% and 8% respectively.

Focusing on the trend in the recent years, the external trade values have increased in all the countries and regions. However, the growth rates of external trade values in ASEAN and China are higher than those of developed countries including Japan, EU, and United States.



Source: International Monetary Fund e-Library (http://elibrary-data.imf.org/DataExplorer.aspx), Direction of Trade Statistics (DOTS)

Figure 6.3.10 External Trade Value by partner - Total (2000-2011) [Billion US $]



Source: International Monetary Fund e-Library (http://elibrary-data.imf.org/DataExplorer.aspx), Direction of Trade Statistics (DOTS)

Figure 6.3.11 External Trade Value by partner - Total (2011) [Billion US $]

(3) Main trade commodities of ASEAN

The export values of ASEAN by main commodity and partner country are shown below.

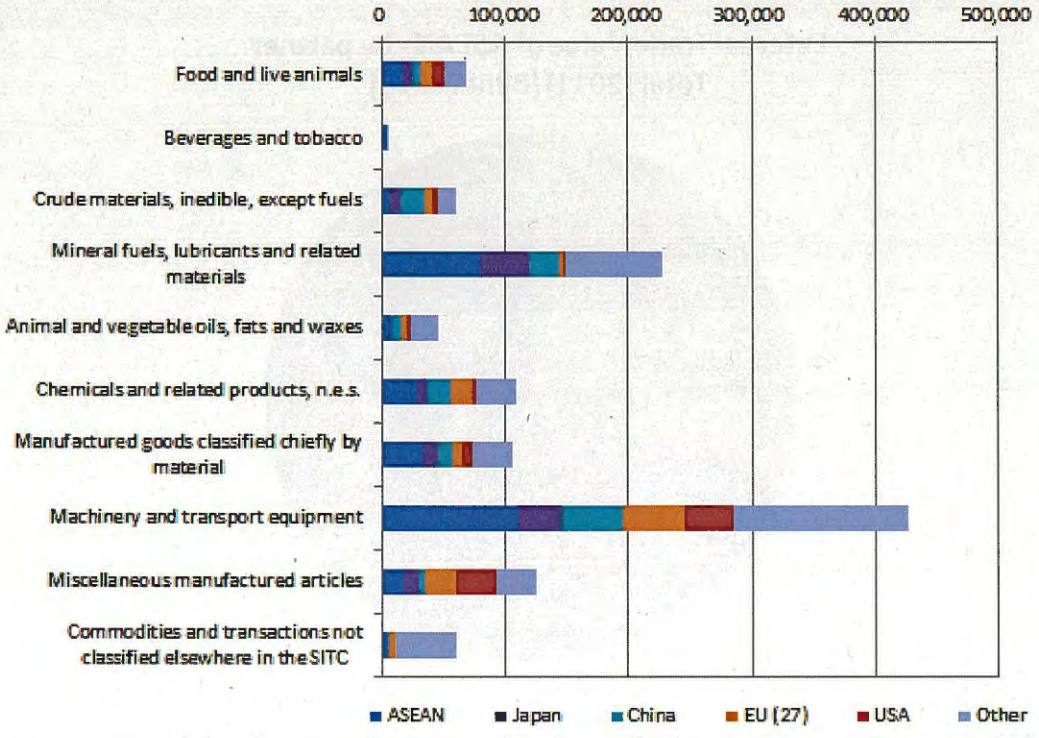
As for export values by main commodity, the export value of "machinery and transport equipment" is the largest and accounts 34% of the total export value, which is 426,188 million USD. Following that, "mineral fuels, lubricants and related materials" accounts 18%, which is 228,148 million USD.

The main countries to which ASEAN exports "machinery and transport equipment" are ASEAN region (110,569 million USD) itself, then come China (49,925 million USD) and EU (49,886 million USD). As for Japan, the export value accounts 34,632 million USD.

Table 6.3.2 Trade values (exports) of ASEAN by commodity and partner country (2010-2011)
[Million US $]

Category	ASEAN	Extra-ASEAN	Japan	China	EU (27)	USA	Other	WORLD
Food and live animals	17,324	52,168	8,519	5,823	9,292	9,675	18,859	69,492
Beverages and tobacco	3,911	2,482	268	398	208	86	1,522	6,393
Crude materials, inedible, except fuels	6,859	53,305	8,223	19,288	6,918	4,608	14,268	60,164
Mineral fuels, lubricants and related materials	80,237	147,911	40,383	23,056	3,412	2,558	78,503	228,148
Animal and vegetable oils, fats and w axes	6,759	38,996	1,001	7,508	6,090	2,349	22,047	45,755
Chemicals and related products, n.e.s.	29,334	79,026	7,818	19,400	16,493	4,460	30,855	108,360
Manufactured goods classified chiefly by material	33,043	73,020	13,284	10,851	9,203	7,233	32,449	106,063
Machinery and transport equipment	110,569	315,619	34,632	49,925	49,886	40,328	140,848	426,188
Miscellaneous manufactured articles	17,575	108,167	12,630	5,551	24,340	33,539	32,107	125,742
Commodities and transactions not classified elsew here in the SITC	4,051	57,367	1,017	738	5,158	479	49,976	61,419
TOTAL	309,661	928,062	127,774	142,539	131,000	105,315	421,434	1,237,723

Source: ASEAN Stats database (http://aseanstats.asean.org/)



Source: ASEAN Stats database (http://aseanstats.asean.org/)

Figure 6.3.12 Trade values (exports) of ASEAN by commodity and partner country (2010-2011)
[Million US $]

Next, the import values of ASEAN by main commodity and partner country are shown below.

As for import values by main commodity, the import value of "machinery and transport equipment" is the largest and accounts 37% of the total export value, which is 424,319 million USD. Following that, "mineral fuels, lubricants and related materials" accounts 22%, which is 251,534 million USD.

The main countries to which ASEAN imports "machinery and transport equipment" are ASEAN region (93,076 million USD) itself, then come China (75,616 million USD). Japan come the third, and the import value accounts 65,583 million USD.

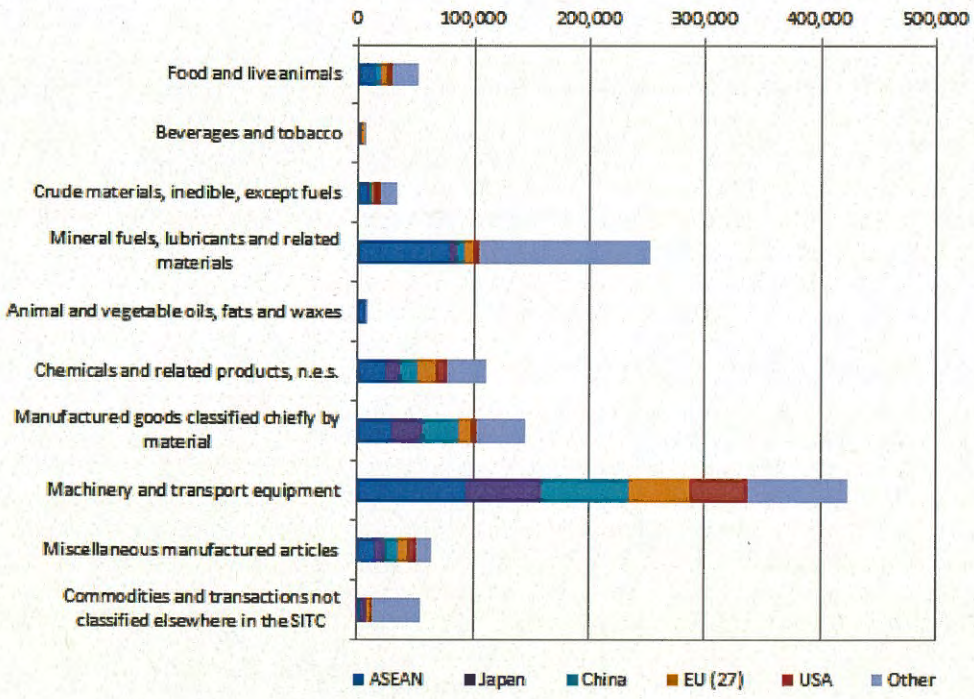
In the ASEAN region, production network based on the division of labor has been prevailed in general, which is endorsed by the statistical data.

Table 6.3.3 Trade values (imports) of ASEAN by commodity and partner country (2010-2011)

[Billion US $]

Category	ASEAN	Extra-ASEAN	Japan	China	EU (27)	USA	Other	WORLD
Food and live animals	14,767	37,729	651	4,837	3,912	5,768	22,561	52,496
Beverages and tobacco	1,540	4,202	53	563	2,496	156	934	5,742
Crude materials, inedible, except fuels	7,826	26,317	1,629	1,945	2,452	6,466	13,825	34,142
Mineral fuels, lubricants and related materials	79,574	171,961	5,505	6,644	8,008	5,096	146,707	251,534
Animal and vegetable oils, fats and waxes	6,150	944	15	72	123	34	700	7,094
Chemicals and related products, n.e.s.	24,389	86,036	12,882	14,596	16,114	10,221	32,223	110,425
Manufactured goods classified chiefly by material	28,791	115,894	27,380	30,404	11,045	4,897	42,167	144,685
Machinery and transport equipment	93,076	331,244	65,583	75,616	54,093	48,626	87,326	424,319
Miscellaneous manufactured articles	14,762	49,518	9,152	12,009	7,869	7,699	12,789	64,280
Commodities and transactions not classified elsewhere in the SITC	3,716	50,427	4,426	450	3,136	2,223	40,191	54,143
TOTAL	274,590	874,271	127,274	147,137	109,248	91,187	399,424	1,148,861

Source: ASEAN Stats database (http://aseanstats.asean.org/)



Source: ASEAN Stats database (http://aseanstats.asean.org/)

Figure 6.3.13 Trade values (imports) of ASEAN by commodity and partner country (2010-2011)

[Million US $]

6.3.4 Impact analysis by natural disaster in ASEAN countries

According to the results of statistical survey above, it becomes clear that the trends of economic growth and trade values in ASEAN are significantly high. In particular, it is apparent that the internal economic relationship within the ASEAN region makes stronger than before.

From now, after agglomerated areas and industrial parks are identified and main industries are selected in the region, the detailed study will be conducted. In parallel, the more detailed survey will also be conducted, focusing the economic and trade relationship inside/outside the ASEAN region.

REFERENCES

1) ASEAN-JAPAN CENTRE website (http://www.asean.or.jp/)
2) ASEAN Stats database (http://aseanstats.asean.org/)
3) ASEAN website (2013), "Key basic ASEAN indicators in 2011, Last update 14 January 2013"
4) International Monetary Fund, World Economic Outlook Database
5) JETRO 2009, "ASEAN Economic Community (in Japanese)"
6) Umezaki 2011, "Recent trend regarding ASEAN Economic Community" (in Japanese)
7) Yamagata et al. 2011, "New ASEAN (in Japanese)"

CHAPTER 7 LESSONS LEARNED FROM EXTREME NSTURAL DISASTERS

7.1 Methodologies and Scope of Survey

In this Chapter, some major disasters that occurred in Southeast Asian countries in the past (especially in the 1990s and later) are examined. Information on the description of occurrences of the disasters and the impact on supply chains and economic activities are analyzed, and lessons are derived therefrom, especially from the point of view of designing efficient Area Business Continuity Plans (Area BCP).

Table 7.1.1 Methodologies and Scope of Survey

Information obtained through survey	Methodologies of Survey	Scope of Survey
Information on major disasters that occurred in South East Asian countries and lessons derived therefrom	Collect information from open-source materials available on the internet, etc.	Search information from the websites, etc. listed below: ・ Asian Disaster Reduction Center (ARDC) ・ The International Centre for Water Hazard (ICHARM) ・ Other open source materials

Natural disasters covered under this survey include, geo-hazards such as earthquakes, volcanic activities and eruptions, and landslides; tsunamis; and hydro-meteorological hazards such as floods, hurricanes/typhoons, and high tides. Droughts and forest fires, and biohazards such as outbreak of infectious diseases and incidences of infection in animals and plants are not covered by this survey.

In particular, the four most recent and significant disasters in the ASEAN countries, namely, 2013 Jakarta flood (Indonesia), 2011 Thailand floods (Thailand), 2004 Sumatra Earthquake/Tsunami (Indonesia) and 1991 Eruption of Mount Pinatubo (Philippines) are selected to represent each type of extreme natural disaster described above and are examined.

7.2 Information and Data Compiled in Appendix A7

In Appendix A7, information and data regarding the description of occurrence and impacts on supply chains and economic activities with respect to the four extreme natural disasters described above are presented.

Table 7.2.1 Information and Data Compiled in the Appendix

Number	Information and Data Compiled in the Appendix	Summary
A7	Description of occurrence of past disasters and their impact on the supply chains and economic activities	Detailed information on 2013 Jakarta flood (Indonesia), 2011 Thailand floods (Thailand), 2004 Sumatra Earthquake/Tsunami (Indonesia) and 1991 Eruption of Mount Pinatubo (Philippines), including the description of occurrence and impact on economic activities, etc. are provided here, as well as the description of source of information.

7.3 Summary of Survey

7.3.1 2013 Flood in Jakarta (Indonesia)

Items	Contents
1. Time of occurrence	January, 2013
2. Place of occurrence	The entire city of Jakarta
3.State and scale of the disaster	● Major floods and submergence occurred all across Jakarta, due to heavy rainfall continuing from early dawn of January 17, 2013. Water depths of the flood areas ranged between 50 cm and 150 cm.
4.Economic damage	● According to the figures announced by Asosiasi Pengusaha Indonesia (Apindo), the economic damage suffered by the entire capital reached approx. 15 trillion rupiah (approx. 140 billion yen).
5.Human damage	● 20 people or more dead; 6,000 people or more evacuated.
6.Impacts on supply chain and business activities	● Logistics in Pulo Gadung Industrial Park in east Jakarta and in industrial parks in north Jakarta including Sunter, Marunda, and Cakung were disrupted due to flooding. ● Approximately 300 plants were shut down in the Pulo Gadung Industrial Park region where companies such as Dai Nippon Printing Co., Ltd. have their plants. Water immersion between 30 to 100 cm continued and electric power supply was also disrupted. In addition, operation hours of the plants of Toyota Motor Corporation and Daihatsu Motor Co., Ltd. were delayed by one to two hours because plant workers were stranded during their commute. ● Most of the suburban industrial parks in which foreign manufacturers are agglomerated, continued most part of their operations. However, it is reported that in some suburban industrial parks, delivery of parts and export of completed products from ports and inner-city area were disrupted. ● In Tanjung Priok Port in north Jakarta which is the largest seaport in Indonesia, amount of inbound freight reaching the port decreased to one half of the normal level. Also, trucking business delivering freights to Tanjung Priok Port suffered a loss of 7.5 billion rupiah (approx. 69 million yen) per day. ● Furthermore, daily sales in public transportation and general cargo sector were reduced by 40 to 60 %.
7.Lessons derived	● The disruption of operation and power supply which occurred in some industrial parks due to flooding, indicate the importance of anticipating flood risks in industrial parks and the necessity of adopting countermeasures such as securing back-up power sources. ● Even industrial parks that were not directly hit by the flood suffered indirect impacts caused by delays in delivery of parts and export of completed products at the port. Also, commuters were stranded by paralyzed traffic. These facts show the necessity of adopting appropriate preparation/measures based on the assumption that transport infrastructure and public transportation can be disrupted even when they are not directly damaged by the flood.

7.3.2 2011 Flood in Thailand (Thailand)

Items	Contents
1. Time of occurrence	July, 2011 – January 2012
2. Place of occurrence	Northern and central Thailand
3. State and scale of the disaster	● Heavy rain brought by several tropical storms including Nock-ten, continued to pour across northern and northeastern Thailand causing floods in fifteen provinces. ● Precipitation in 2011 was 145 % above normal. In the middle and downstream basin of Chao Phraya and in the peripheral area of Ayutthaya, the flood started in early September, and the floodwaters breached the dikes between mid to late September. Waters from the breached dikes flowed into Ayutthaya region and caused massive flooding in the industrial parks in the periphery of Ayutthaya. The volume of water flowing through the breached dike is considered to be 5 billion m^3 or more. The total flood volume was estimated to be 15 billion m^3.
4. Economic damage	● The World Bank estimates 660 billion baht in damage to property such as real estate, and 700 billion baht in opportunity losses, for a total economic damage of 1.36 trillion baht (approx. 3.5 trillion yen). ● According to the announcement of the Ministry of Interior of Thailand, the area of damaged agricultural land throughout Thailand was 18,291 km^2 (about the same size as the Kanto plain). In the industrial sector, 804 companies in seven industrial parks suffered flood damages, and among them were 449 Japanese companies.
5. Human damage	● Number of death : 753 ● Number of people missing : 3 ● Number of people affected by the disaster : 4,176,763 (all of the information contained in this column is current as of December 2011)
6. Impacts on supply chain and business activities	● Companies that suffered from flood damage were mainly located in the industrial parks on the periphery of Ayutthaya (including many Japanese companies). Also, it is pointed out that some of the industrial parks were located in places prone to flood and exposed to flood risks such as areas near the narrow upstream section of the river. ● Thailand was the center of manufacturing of Hard Disk Drives (HDD) in the world with a 30 percent of the global market share. Major HDD manufacturers such as Western Digital Corporation and Seagate Technology and parts supplier for HDD productions such as Nidec Corporation have their manufacturing base in Thailand. Therefore, the flood caused spike in HDD prices, and affected the production of computers inside and outside of Thailand. ● Not all of the industrial parks were hit by the disaster, but it is reported that global supply chain and production activities in other industrial parks were widely affected. The area stretching from Ayutthaya to northern Bangkok where electronic and electrical product factories are agglomerated was worst hit by the disaster, but automobile factories in other regions where they were not submerged by floodwater, were also forced to stop production. This was due to the fact that automobile parts supply was heavily dependent on the electronic and electrical factories in Ayutthaya which suffered the flood damage. ● In Bangkok, flood control measures such as building an outer dike

	(King's Dike) and regulating land use, were implemented. However, because part of the construction of King's Dike was unfinished, and the land use regulation was insufficient, flood waters spilled over the dike and poured into the city of Bangkok. By mid-November, the flooded area extended from central Bangkok up to approx. 5 km north, reaching the Bang Sue Canal. To add further explanation, the flood control measure for Bangkok is made to drain floodwater from the upstream by means of waterways running east and west through the city. This measure is primarily aimed at protecting the important facilities located in the downstream side of the region.
7. Lessons derived	● In Bangkok, problems including land use issues were left unaddressed in some parts of the outer dike (King's Dike), especially in certain part of the dike in the north side. It is pointed out that these untreated portions of the dike allowed floodwater to pour into the city of Bangkok. Through this experience, it can be suggested that it is important to prepare for future floods by completing the flood control plan without flaw. ● It is reported that some of the industrial parks on the peripheral area of Ayutthaya were located in areas prone to flood, which means that they were exposed to flood risks from the beginning. In the future, locations of industrial parks should be reviewed and carefully determined based on the possibility of natural disaster risks, such as floods and submergence. ● In addition, as an efficient method to prepare for the disaster, it is encouraged to gain better understanding of the supply chain (to visualize the supply chain). By identifying which products/parts depend on which primary and secondary suppliers, and where those products/parts are being manufactured, better understanding on the scale of the damage (including indirect damage) will be achieved and will lead to better preparedness and response to disasters.

7.3.3 The Great Sumatra Earthquake and the tsunami in 2004 (Indonesia)

Items	Contents
1. Time of occurrence	December, 2004
2. Place of occurrence	The earthquake occurred in the Indian Ocean in the offing of the Sumatra northwest in the western Republic of Indonesia. Moreover, Tsunami generated over about 1,500-km area from the sea near Andaman and Nicobar Islands to the sea near northwestern Sumatra. (In particular, Thailand, Malaysia, Indonesia, Myanmar, Sri Lanka, India, the Maldives, African countries, etc.)
3. State and scale of the disaster	● The earthquake of magnitude 9.3 which is about 160km of west in Sumatra in Indonesia, and is an epicenter at a depth of about 10km occurred. Then, aftershock occurred in the epicentral area which amounts to 1,200-1,300km. Aftershock over magnitude 5 occurred 26 times. ● Moreover, tsunami which amounts to 10m in height on an average rolled on to the Indian Ocean coast several times. Although tsunami arrived at the west coast of the epicenter with the above-mentioned speed, it rolled on at comparatively late speed to the east coast of the epicenter. It speculates that the seabed was raised about 2-3m at

	tsunami developmental time, and tsunami spread at about 700 km/h. ● In Aceh Province, Indonesia, tsunami arrived at 4-5km inland. It has been reported that it was the power which speed amounts to 7.7m/s at the point of about 2km of inland, and pours a house within an instant by the pressure of 4t per square meter.
4. Economic damage	● According to the announcement of the United Nations, the total damage amounted to 977 million dollars.
5. Human damage	● The dead and a missing person were 300,000 or more people, and there were about 5 million disaster victims. Except for Aceh Province, Indonesia, most damage was depended on tsunami.
6. Impacts on supply chain and business activities	● So serious damage had not come out there because the Japanese company of Indonesia, Thailand, and Malaysia had placed manufacture/sales base on Jawa or the inland of each country distant from the epicenter. ● Although the Arun LNG Terminal which is an export base of liquefied natural gas (LNG) for Japan was located at the north end of Sumatra and was close to the epicenter, fortunately it did not have damage. Also in the Strait of Malacca which is an important place for resource import, such as crude oil for Japan, there was no big trouble in the cruise of a tanker or a ship. ● However, a port could not be used in some area, so there was also an example to which physical distributions such as parts-transportation are delayed. For example, although Chennai of the east coast in India is a landing base to the inland which IT enterprise and a car-related company concentrate, a part of port function stopped it under the influence of tsunami. Therefore, since the local factory of Denso which is a subsidiary of Toyota could not unload the associated parts of the radiator supplied from Japan, they had to consider of the alternative means of transport.
7. Lessons derived	● Although there was fortunately little influence on the business activity and the supply chain of a Japanese company, in preparation for the case where transport infrastructures such as port facilities suffer damage, considering beforehand the alternative means of transport of important parts or a product is required. ● Since many of disaster areas were the areas which have encountered neither an earthquake nor tsunami, the alarm and cautions about tsunami are seldom carried out, so it is regarded as having made personal suffering expand. ● It is said that in the offing earthquake of Sumatra, each country in the Indian Ocean and residents are vulnerable and non-looked out for tsunami, and the shortage of practical use of disaster information and the shortage of the information infrastructure have made the tsunami damage caused by an earthquake expand. For this reason, in order to suppress an earthquake and tsunami damage, it can point out that it is important to transmit urgent disaster information correctly and quickly.

7.3.4 The eruption of Mt. Pinatubo in 1991 (Philippines)

Items	Contents
1 Time of occurrence	June, 1991
2 Place of occurrence	The western part of Luzon , Commonwealth of the Philippines
3 State and scale of the disaster	● The magma eruption occurred in Mount Pinatubo on June 9, 1991.Although the eruptive activity itself was ended in about one week, in the surrounding area, in addition to a pyroclastic flow and volcanic ashes, the volcanic mud flow which rain water sinks in and mobilizes to a volcanic sediment occurred, and this damage reached the farmland and residence of circumference 5 states. ● Moreover, a lot of air aerosol particles were emitted to the stratosphere by the eruption. Thereby, the average temperature of the earth falls by about 0.5 ℃, and it is said that depletion of the ozone layer also continued.
4. Economic damage	● Although the Gross Regional Product (GRP) around Mount Pinatubo area grew 5% respectively every year before the eruption, it fell 3% or more from 1990 to 1991. ● Infrastructures such as a road and transportation around a volcano, suffer damage from a pyroclastic flow and volcanic mud flow, and the rehabilitation expense is estimated at 3,800 million pesos. ● It is said that there are many examples which the aircraft caused the engine trouble with volcanic ashes, and the amount of damage exceeds 100 million US dollars. ● The amount of damage in agriculture is presumed to be about 1,500 million pesos.
5. Human damage	● This eruption is called the biggest scale in the 20th century, but since the peak of the eruption was predicted in advance, surrounding residents were able to escape and personal suffering was able to be suppressed. ● The dead and the missing person by eruption are presumed to be about 900 persons. Many of causes of death are depended on that a pumice stone and volcanic ashes pour into a surrounding area as mud-rain, it deposits on the roof and so on, and a house collapses with the weight. ● The victim total is presumed to be about 1,200,000 people.
6. Impacts on supply chain and business activities	● There are no report and information that the eruption of Mount Pinatubo had big influence directly to the business enterprise and supply chain of major companies including a Japanese company.
7. Lessons derived	● Although there was little influence on the active conduct of business and the supply chain of a Japanese company, once a volcanic eruption occurs and depending on the situation, it suggests that it causes serious damage to all over a surrounding area, and the rehabilitation itself is difficult, moreover it takes great cost and time. Therefore, the development of the area where the risk of a volcanic eruption exists can point out that it is necessary to make it fairly prudent. ● Even if there is no hub near a volcano, transport infrastructures such as a highway and a railroad can suffer damage from an eruption, or the trouble of an airplane occurs with volcanic ashes. It can consider a possibility that trouble will occur in the domestic and foreign physical distribution. In preparation for such a case, it is required to

	check up beforehand the means of transport and supplier which are substituted.

REFERENCES

1) Asian Disaster Reduction Center（ADRC） Website http://www.adrc.asia/top_j.php (in Japanese)
2) Global Hydrology and Water Resources Engineering Institute of Industrial Science , the University of Tokyo. Related information regarding the Thailand Floods in 2011. http://hydro.iis.u-tokyo.ac.jp/Mulabo/news/2011/ThaiFlood2011.html (in Japanese)
3) Guzman, Emmanuel M. de. (2004). Eruption of Mount Pinatubo in the Philippines in June 1991. Asian Disaster Reduction Center.
4) ICHARM The International Centre for Water Hazard Website http://www.icharm.pwri.go.jp/index_j.html (in Japanese)
5) Kawada, Yoshiaki. (2005). The Earthquake and Tsunami in the Indian Ocean off Sumatra. Annuals of Disaster Prevention Research Institute, No. 18 A. Kyoto University. (in Japanese)
6) Komori, D. (2012). Factor analysis on the 2011 Chao Phraya River flood. Japanese Chamber of Commerce, Bangkok. (in Japanese)
7) The International Federation of Red Cross and Red Crescent Societies(IFRC), Disaster relief emergency fund (DREF) Website http://www.ifrc.org/

CHAPTER 8 DESCRIPTION OF NATURAL HAZARDS IN ASEAN REGION

8.1 Flood

The following Figure 8.1.1 shows the frequency of flood occurrences. The records of average flooding occurrences during the period from 1980 to2001 were available. The average of annual incidents is shown in color. Data in the form of a grid map are accessible on the website of PREVIEWUNEP.

http://www.grid.unep.ch/activities/earlywarning/preview/data/preview/index_about.php.

The flood hazard conditions of ASEAN countries were overviewed referring Figure 8.1.1 and Chapter 9-"Records of Natural Hazards".

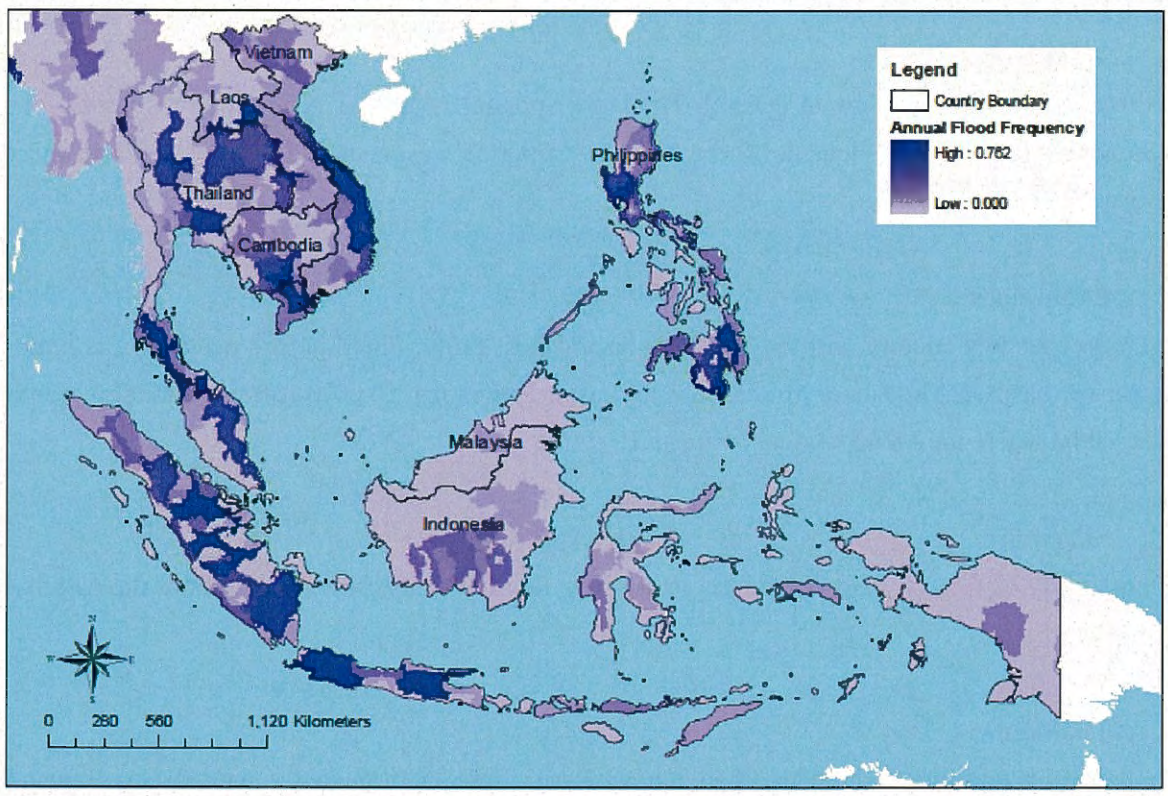


Figure 8.1.1 Annual Frequencies of Flood Events (1980-2001, high 0.762 times, low 0 times)

(1) Brunei

Flood hazard is rare throughout the country. Reported damage are limited to only a few cases in the database.

(2) Cambodia

Flood hazard possibility is high through the Mekong River from the Tonle Sap Lake area to Vietnam. The basin includes Kampong Channang, Kandal, Prey Vengprovinces. Reported cases of damage in Cambodia are about 20 cases in the database.

(3) Indonesia

Flood hazard possibility is the highest among ASEAN countries. The hazard is not so much at the coastal areas, whereas higher areas include Barito River, Banjarmasin City, southern areas of Kalimantan and River Martapura .

(4) Lao PDR

Flood hazard possibility is generally not high. The vicinity of Muang Pakxan in Bolikhemsxai shows higher flood hazard possibility.

(5) Malaysia

Malaysia has relatively high flood hazard possibility especially in the river basin of Pandaruan River that flows through the border with Brunei.

(6) Myanmar

Flood hazard possibility is low in general. The higher possibility area is Ayeyarwady River basin in which Myitkyina city is situated. There are few reported cases in the region downstream of Ayeyarwady River.

(7) Philippines

The Philippines is a country with higher flood hazard possibility. Flood hazard possibility is high at Agusanriver basin in Mindanao, Mindanao river basin, Pampanga River in national capital region on Luzon Island where the Metro Manila is situated.

(8) Singapore

The possibility of flood hazard is low. There are very few reported disaster damages in the data base as well.

(9) Thailand

Flood hazard possibility is high in Chao Phraya River flowing through the capital city Bangkok. Flooding is likely to occur at the periphery of Tapi River in the southern Tapie. Thailand has the fourth highest flood hazard possibility in ASEAN countries after Indonesia, the Philippines and Vietnam.

(10) Vietnam

Northern and southern coastal areas are high with flood hazard possibility. In the north, there shows high frequency of flood hazard occurrence in Thi Binh river basin where the city of Haiphong is situated. Vietnam has the third highest flood hazard possibility followed by Indonesia and the Philippines in the ASEAN countries.

8.2 Earthquake

The Global Seismic Hazard Assessment Program (GSHAP) is the representative project of Probabilistic Seismic Hazard Analysis (PSHA) which covers all over the world.The goal of probabilistic seismic hazard analysis (PSHA) is to quantify the probability of exceeding a specific ground-motion level at a site given all possible earthquakes. Peak Ground Acceleration (PGA) and Seismic Intensity in MMI are often used as the ground-motion level and 10% in 50 years (475 years in recurrence time) is often used as the probability. The result of the analysis is expressed as "The probability of the PGA exceeds ***gal (cm/sec^2) is 10% in 50 years".

GSHAP was launched in 1992 by the International Lithosphere Program (ILP) with the support of the International Council of Scientific Unions (ICSU), and endorsed as a demonstration program in the framework of the United Nations International Decade for Natural Disaster Reduction (UN/IDNDR). The project terminated in 1999; however the produced hazard maps are widely used in the world even at present.

The earthquake hazard conditions of ASEAN countries were overviewed referring Figure 8.2.1, Earthquake Hazard Map of ASEAN Region by GSHAP and the result of "Chapter 9 Records of Natural Hazards" in below.

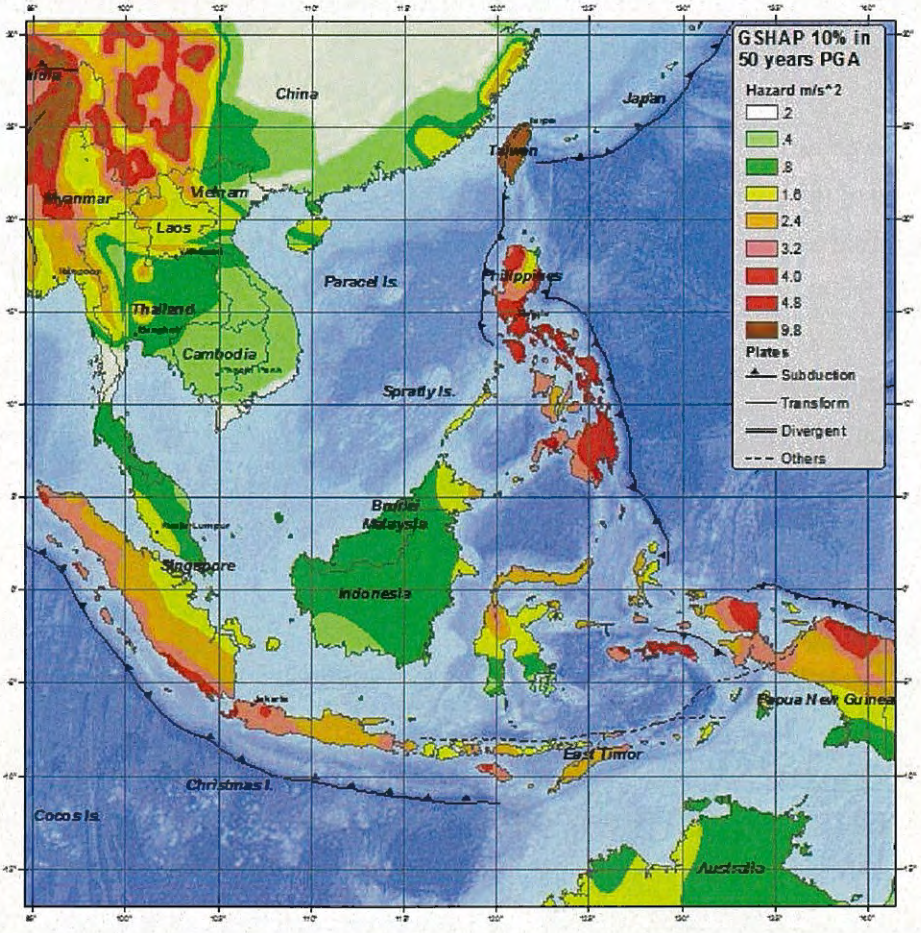


Figure 8.2.1 Earthquake Hazard Map of ASEAN Region (GSHAP)

(1) Brunei

Earthquake hazard level in Brunei is low. No earthquake disaster is recorded in the database.

(2) Cambodia

Earthquake hazard level in Cambodia is low. No earthquake disaster is recorded in the database.

(3) Indonesia

Indonesia is one of the countries with highest earthquake hazard level in ASEAN countries. Many earthquake disasters are recoded in the database. The Indian Ocean side of Sumatra Island and Java Island and the Pacific Ocean side of New Guinea Island are higher level in earthquake hazard.

(4) Lao PDR

Earthquake hazard level in Lao PDR is low in general. However, northern region near Yunnan Province of China is higher in the earthquake hazard level.

(5) Malaysia

Earthquake hazard level of the most of Malay Peninsula and Kalimantan Island is low. However, Sumatra Island side of Malay Peninsula is relatively higher in the earthquake hazard level. Few earthquake disasters are recorded in the database.

(6) Myanmar

Myanmar is one of the countries with highest earthquake hazard level in ASEAN countries. A number of earthquake disasters are 3rd after Indonesia and Philippines. The earthquake hazard level of the northern region facing India and China is high.

(7) Philippines

Philippines is one of the countries with highest earthquake hazard level in ASEAN countries. A number of earthquake disasters are 2nd after Indonesia. Sulu Sea and Celebes Sea side, a far side from the plate boundary, is lower in earthquake hazard level.

(8) Singapore

Earthquake hazard level in Singapore is low. No earthquake disaster is recorded in the database.

(9) Thailand

Earthquake hazard level in Thailand is low in general. However, northern region near Yunnan Province and north-eastern region neighboring to Myanmar are higher in the earthquake hazard level.

(10) Vietnam

Earthquake hazard level in Vietnam is low in general. However, northern region near Yunnan Province of China is higher in the earthquake hazard level.

8.3 Tsunami

The Tsunami hazard conditions of ASEAN countries are overviewed referring the result of "Chapter 9 Records of Natural Hazards" in below.

(1) Brunei

A tsunami hazard level of Brunei is low. No tsunami disaster is recorded in the database.

(2) Cambodia

Tsunami hazard level of Cambodia is low. No tsunami disaster is recorded in the database.

(3) Indonesia

Indonesia is one of the countries with highest tsunami hazard level in ASEAN countries. After the 17th century, over 200 tsunami disasters are recoded in the database.

(4) Lao PDR

Lao PDR is inland state and no effect of tsunami.

(5) Malaysia

The tsunami disaster caused by the Sumatra earthquake of December 26 in 2004 is reported. However, no other tsunami disaster is recorded in the database.

(6) Myanmar

After the 18th century, 4 tsunami disasters are recorded in the database.

(7) Philippines

Philippines is one of the countries with highest tsunami hazard level in ASEAN countries. After the 17th century, about 100 tsunami disasters are recoded in the database.

(8) Singapore

Tsunami hazard level of Singapore is low. No tsunami disaster is recorded in the database.

(9) Thailand

After the 20th century, 2 tsunami disasters are recorded in the database. However, one was caused by the earthquake occurred offshore of India and one was by the Sumatra earthquake of December 26 in 2004.

(10) Vietnam

Tsunami hazard level of Vietnam is low. No tsunami disaster is recorded in the database.

8.4 Volcano

The volcano hazard conditions of ASEAN countries were overviewed referring Figure 8.4.1, prepared by United Nations Office for the Coordination of Humanitarian Affairs, Regional Office for Asia Pacific (OCHA –ROAP), and the result of "Chapter 9 Records of Natural Hazards" in below.

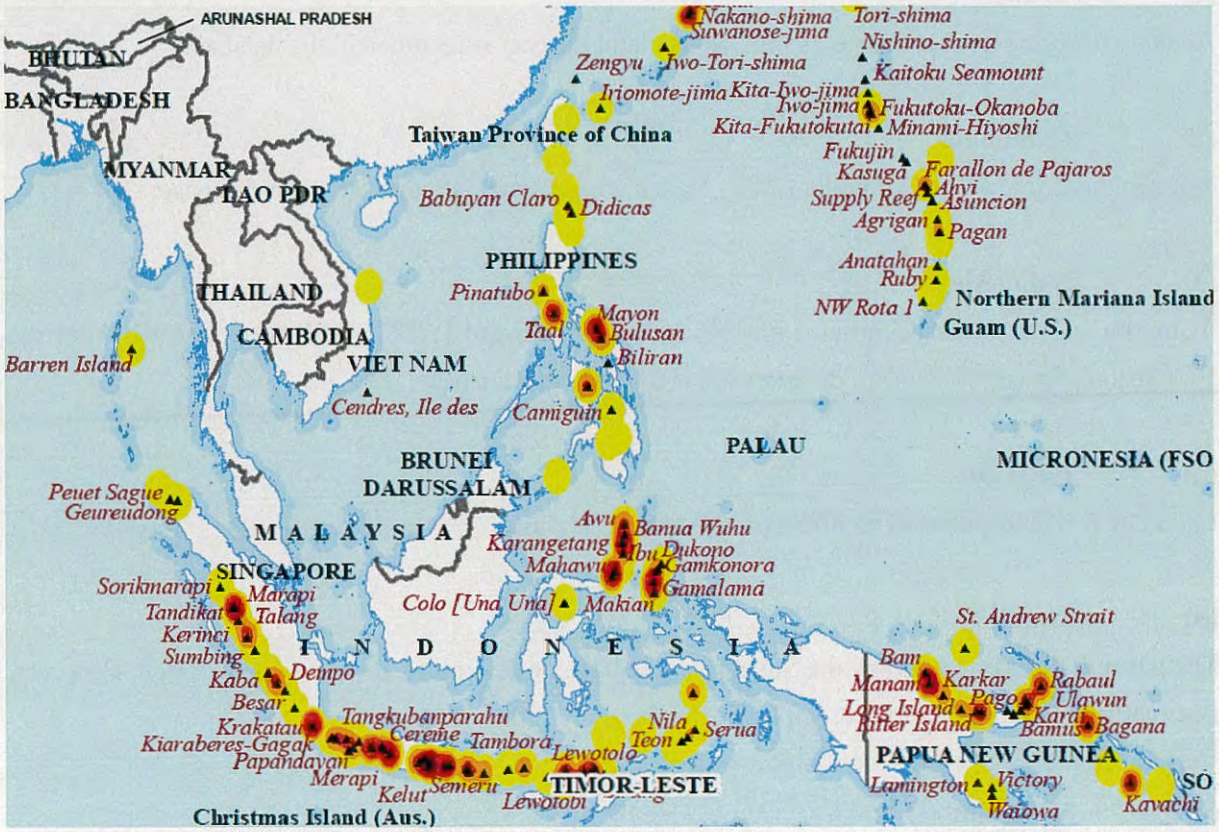


Figure 8.4.1 Holocene Eruption and Selected Volcanoes in Asia-Pacific (OCHA-ROAP)

(1) Brunei

Volcano hazard level of Brunei is low. No volcanic disaster is recorded in the database.

(2) Cambodia

Volcano hazard level of Cambodia is low. No volcanic disaster is recorded in the database.

(3) Indonesia

Indonesia is one of the countries with highest volcanic hazard level in ASEAN countries. After the 14th century, about 200 volcanic disasters are recoded in the database. Mt. Merapi, Mt. Kelute and Mt.

Semeru in Java Island and Mt. Awu in Sangihe Island which is north to Sulawesi Island are the representative volcanoes which repeatedly caused volcanic disaster in the past.

(4) Lao PDR

Volcano hazard level of Lao PDR is low. No volcanic disaster is recorded in the database.

(5) Malaysia

Volcano hazard level of Malaysia is low. No volcanic disaster is recorded in the database.

(6) Myanmar

Volcano hazard level of Myanmar is low. No volcanic disaster is recorded in the database.

(7) Philippines

Philippines is one of the countries with highest volcanic hazard level in ASEAN countries. After the 18th century, over 50 volcanic disasters are recoded in the database. Mt. Pinatubo, Mt. Taal, Mt. Mayon and Mt. Bulusan in Luzon Island are the representative volcanoes which repeatedly caused volcanic disaster in the past.

(8) Singapore

Volcano hazard level of Singapore is low. No volcanic disaster is recorded in the database.

(9) Thailand

Volcano hazard level of Thailand is low. No volcanic disaster is recorded in the database.

(10) Vietnam

Volcano hazard level of Vietnam is low. No volcanic disaster is recorded in the database.

8.5 Cyclone (Typhoon) and Meteorological Hazard

Figure 8.5.1 below shows the annual tropical cyclone frequency in all of the ASEAN countries produced and mapped out by the Economy and Environment Program for Southeast Asia (EEPSEA). Based on the frequency and degree of impact resulting from cyclone hazards (chapter 9), an overview of the influence of cyclone in this specific area was carried out.

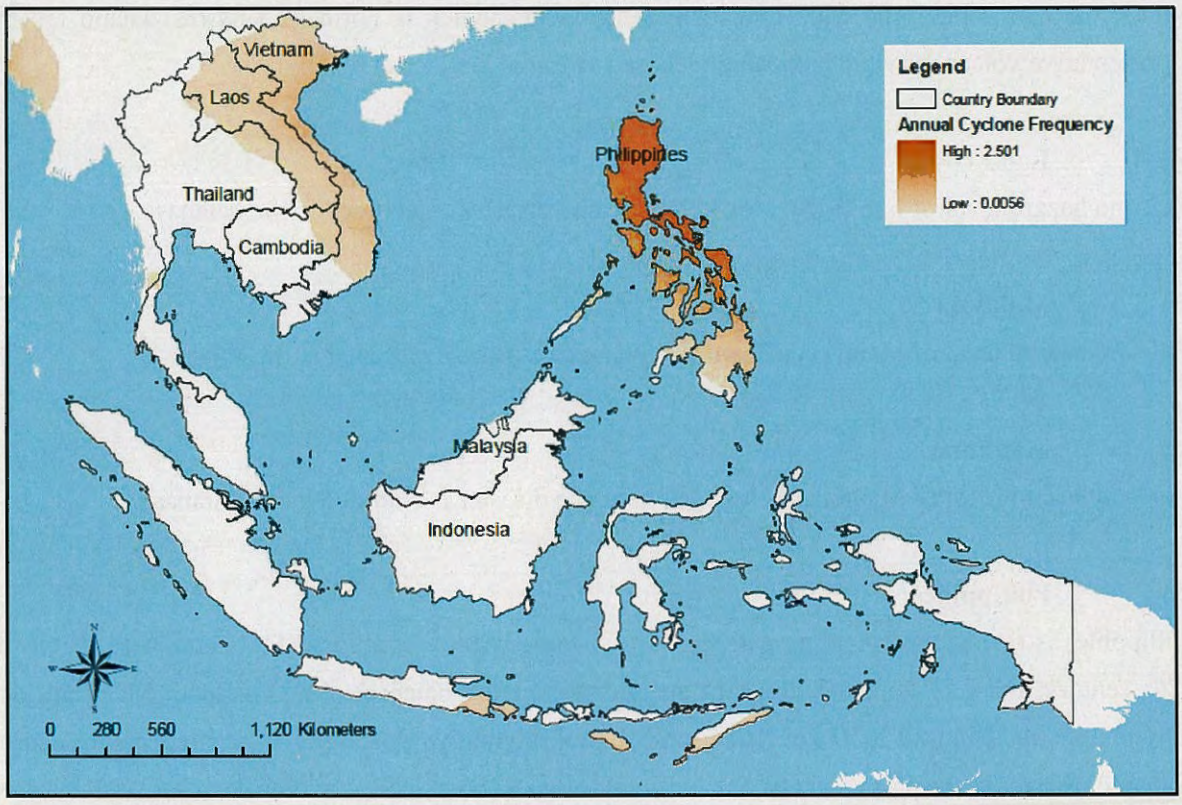


Figure 8.5.1 Tropical cyclone frequency (event per year from 1980-2003),
Source: UNEP-PREVIEW

(1) Brunei

The impact of cyclone hazard on whole the country is low. According to 1980 - 2012 records, no storm has devastated Brunei.

(2) Cambodia

The impact of cyclone hazard on whole the country is not so high. Typhoons sometimes affect Cambodia after landing on Vietnam. According to 1980-2012 records, four storm disasters have occurred in the country.

(3) Indonesia

The impact of cyclone hazard on whole the country is low. The region in southern hemisphere, i.e. Java Island and Timor Island, is affected by storms. According to 1980-2012 records, seven storm disasters have occurred in the country.

(4) Lao PDR

The impact of cyclone hazard on whole the country is not so high. Typhoons generated around the Philippines sometimes affect Lao PDR after landing on Vietnam. According to 1980-2012 records, five storm disasters have occurred in the country.

(5) Malaysia

The impact of cyclone hazard on whole the country is low. According to 1980-2012 records, seven storm disasters have occurred in the country.

(6) Myanmar

The impact of cyclone hazard in south western area in the country is a little high. According to 1980-2012 records, six storm disasters have occurred in the country. Cyclone Nargis, back in 2008, brought about unprecedented damage killing 138,371 people, affecting over 2.4 million people and dealing a total amount of damage estimated to be worth around 4 billion dollars.

(7) Philippines

The impact of cyclone hazard in the Philippines is the highest in ASEAN countries. The hazard of northern part in the country is higher than that of southern part in the country. According to 1980-2012 records, 228 disasters have been caused by storms in the Philippines.

(8) Singapore

The impact of cyclone hazard on whole the country is low. According to 1980 - 2012 records, no storm has devastated Singapore.

(9) Thailand

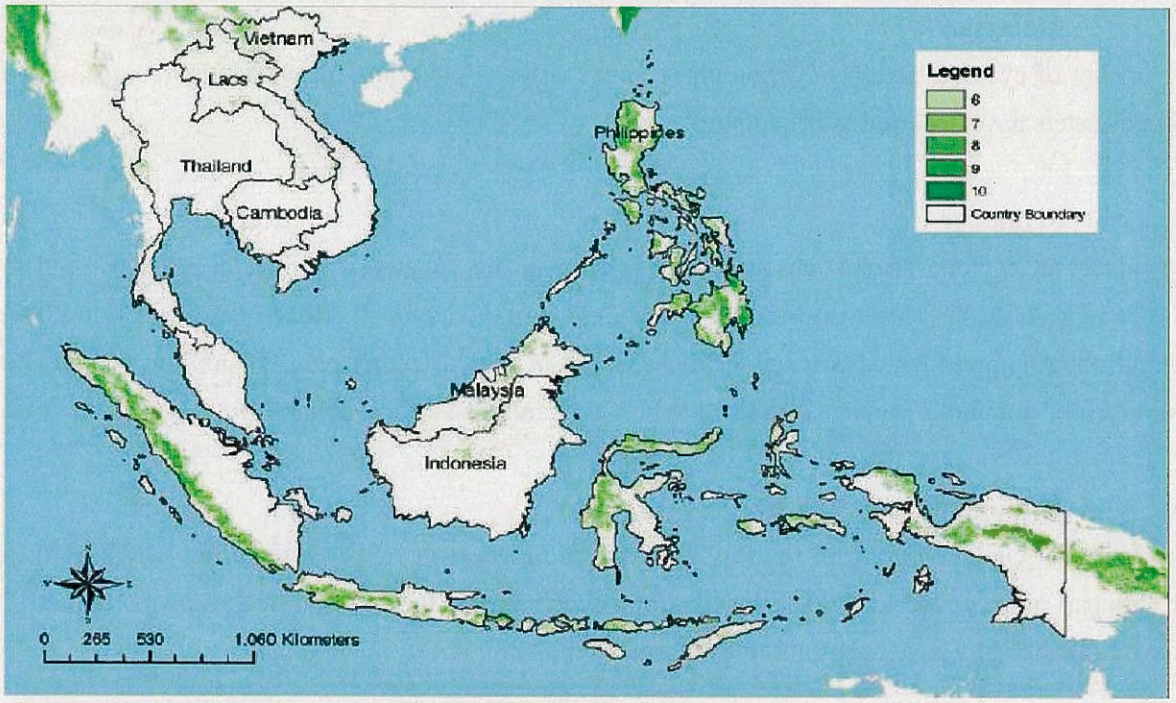
The impact of cyclone hazard on whole the country is not so high. A typhoon, occurring and landing on Central Vietnam, can create damage even in Thailand due to its geographical proximity. According to 1980-2012 records, 35 storms have devastated Thailand.

(10) Vietnam

After the Philippines, Vietnam comes second in terms of the occurrence of large storms. In general, a typhoon, which occurs between June to September, typically approaches Northern Vietnam while a typhoon occurring in May and between October to December approaches Southern-Central Vietnam. According to 1980-2012 records, an estimated number of 93 storms have devastated Vietnam.

8.6 Landslide

Based on the landslide exposure in Southeast Asia region by "Climate Change Vulnerability Mapping for Southeast Asia (Economy and Environment Program for Southeast Asia (EEPSEA) 2009) " and result of Chapter 9 (Records of Natural Hazards), landslide hazard distribution in the ASEAN countries overview is summarized below.



Landslide exposure (2005), Source: UNEP-PREVIEW

Figure 8.6.1 Landslide Exposure (EEPSEA 2009)

(1) Brunei

Only a few hazards distribute near the border with Malaysia.

(2) Cambodia

Some hazards distribute in the mountain area near coast, however, no hazard is distributed in Mekong low land area around the capital city of Phnom Penh.

(3) Indonesia

High hazard possibility distributes near volcanic area, which concentrates in the Indian Ocean side of archipelago and some portion of Celebes and West Papua New Guinea. There is no hazard in the JavaSea side region where metropolis locates.

(4) Lao PDR

Hazard possible area covers all over the country consisted mainly hills and mountains without Mekong River low land where Capital Vientiane stands.

(5) Malaysia

Hazard distributes in the center of the Malay Peninsula where contains the suburbs of Capital Kuala Lumpur.

(6) Myanmar

High hazard possible area distributes in the border with India and some hazard distributes in the Andaman Sea coastal area.

(7) Philippines

Landslide hazard distributes over entire country. Several areas including the suburbs of Metro Manila show high hazard possibility. The area along Philippines Fault is notably high hazard possible zone.

(8) Singapore

There is no record and assessment about landslide in Singapore.

(9) Thailand

High hazard possibility area distributes in the border area with Lao PDR. There is no hazard in the low land where Capital Bangkok and other main cities stand.

(10) Vietnam

High hazard possibility zone distributes in the northern area and the central area.

CHAPTER 9 RECORDS OF NATURAL HAZARDS

9.1 Collected Data on Natural Hazards

9.1.1 Flood

A flood inventory was prepared using EM-DAT managed by CRED at first. The PRCC and GLIDE are also used to gather information in order to complement for a better analysis.

The criteria of data selection for EM-DAT are as follows.

< Selecting Criteria of EM-DAT >

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

- Ten (10) or more people reported killed.
- Hundred (100) or more people reported affected.
- Declaration of a state of emergency.
- Call for international assistance.

9.1.2 Earthquake

Based on the inventory database prepared from EM-DAT, the lacking information such as coordinates of epicenter, magnitude, maximum seismic intensity (MMI: Modified Mercalli Intensity) etc. were added to the inventory using the database managed by NOAA (National Ocean and Atmosphere Administration).

The criteria of data selection for NOAA database are as follows.

< Selecting Criteria of NOAA database>

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

- Moderate damage (approximately $1 million or more).
- 10 or more deaths.
- Magnitude 7.5 or greater.
- Modified Mercalli Intensity X or greater.
- The earthquake generated a tsunami.

The data of EM-DAT is limited after AD 1900. However, the recurrence time of large earthquakes is so long such as several hundreds, thousands or ten-thousands years, that older historical event data from NOAA database were added to the inventory.

The earthquakes which occurred in neighboring countries or off-shore are included in the database because seismic wave propagates far from the source and sometimes affects to the distant area.

9.1.3 Tsunami

The historical tsunami inventory is prepared using EM-DAT at first. Then lacking information in EM-DAT such as coordinates of epicenter, magnitude, maximum tsunami height etc. were added to the inventory using the database managed by NOAA (National Ocean and Atmosphere Administration).

The data of EM-DAT is limited after AD 1900. However, the recurrence time of tsunami caused by large earthquakes is so long such as several hundreds, thousands or ten-thousands years, that older historical event data from NOAA database were added to the inventory.

The data include the events which caused by earthquakes occurred at neighbor country or off-shore because tsunami wave propagates far from the source and sometimes affects to the distant area.

9.1.4 Volcano

The historical volcanic eruption inventory is prepared using EM-DAT at first. Then lacking information in EM-DAT such as coordinates of volcano, magnitude of eruption, deadly factor of volcanic activity etc. were added to the inventory using the database managed by NOAA (National Ocean and Atmosphere Administration).

The criteria of data selection for NOAA database are as follows.

< Selecting Criteria of NOAA database >

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

- caused fatalities
- caused moderate damage (approximately $1 million or more)
- with a Volcanic Explosivity Index (VEI) of 6 or larger (ref. 9.2 for definition of VEI)
- caused a tsunami
- associated with a major earthquake

The data of EM-DAT is limited after AD 1900. However, the recurrence time of volcanic eruption is so long such as several hundreds, thousands or ten-thousands years, that older historical event data from NOAA database were added to the inventory.

9.1.5 Cyclone (Typhoon) and Meteorological Hazard

Information on cyclone (storm) disasters was collected from EM-DAT at first. The information was supplemented by the database of Dartmouth (Global Active of Large Flood Events).

The EM-DAT includes disaster events from the 1900s. "Storm" was selected among the type of disaster categories. These data was checked and combined with Dartmouth events, except flood. Dartmouth events were derived from a wide variety of news and governmental sources.

9.1.6 Landslide

The data and information for landslide disaster were compiled from the EM-DAT database and also used PRCC and GLIDE to gather information in order to complement for a better analysis.

9.2 Compiled Data in Appendix A9

Collected and compiled information are presented in Appendix A9.1 to A9.6. The items of each database are shown in the following tables.

Table 9.2.1 Information and Data compiled in Appendix A9.1 (Flood)

Items		Contents
No.		2 digits number
Country		country name
Disaster Type		"Flood"
Disaster Name (if any)		No. given by the data sources: EM-DAT, PRCC, GLIDE
Cause		The reason for flooding
Disaster Start	Year	2 digits number, in the year the Christian Era
	Month	2 digits number
	Day	2 digits number
Disaster End	Year	2 digits number, in the year the Christian Era
	Month	2 digits number
	Day	2 digits number
Damage	Killed	a number of killed people
	Affected People	a number of affected people
	Amount (Million US$)	amount of economic loss
	Amount (Million US$)/GDP PPP	amount of economic loss divided by GDP PPP
Affected Region		Name of affected regions
Map		No. of associated map
Reference		EM-DAT, PRCC, GLIDE
Origin/ Source	North	latitude of affected area
	East	longitude of affected area
Hazard Situation (Flood magnitude)		M = log (duration × gravity × affected area km^2)

Table 9.2.2 Information and Data compiled in Appendix A9.2 (Earthquake)

Items	Contents
No.	3 digits number
Country	country name
Disaster Type	"Earthquake"
Disaster Name (if any)	name of epicenter region

Disaster Start	Year	2 digits number, in the year the Christian Era
	Month	2 digits number
	Day	2 digits number
Damage	Killed	a number of killed people
	Affected People	a number of affected people
	Amount (Million US$)	amount of economic loss
	Amount (Million US$)/GDP PPP	amount of economic loss divided by GDP PPP
Map		No. of associated seismic intensity map
Origin/ Source	North	latitude of epicenter in degree
	East	longitude of epicenter in degree
	Mag.	magnitude of the earthquake
Hazard Situation (max. MMI)		maximum seismic intensity

Table 9.2.3 Information and Data compiled in Appendix A9.3 (Tsunami)

Items		Contents
No.		3 digits serial number
Country		country name
Disaster Type		"Tsunami"
Disaster Name (if any)		epicenter region
Disaster Start	Year	2 digits number, in the year the Christian Era
	Month	2 digits number
	Day	2 digits number
Damage	Killed	a number of killed people
	Affected People	a number of affected people
	Amount (Million US$)	amount of economic loss
	Amount (Million US$)/GDP PPP	amount of economic loss divided by GDP PPP
Map		No. of associated tsunami inundation map
Origin/ Source	North	latitude of epicenter in degree
	East	longitude of epicenter in degree
	Mag.	magnitude of the earthquake
Hazard Situation (Max. Water Height)		maximum water height of tsunami

Table 9.2.4 Information and Data compiled in Appendix A9.4 (Volcano)

Items	Contents
No.	3 digits serial number
Country	country name
Disaster Type	"Volcano"

Disaster Name (if any)		name of volcano
Disaster Start	Year	2 digits number, in the year the Christian Era
	Month	2 digits number
	Day	2 digits number
Damage	Killed	a number of killed people
	Affected People	a number of affected people
	Amount (Million US$)	amount of economic loss
	Amount (Million US$)/GDP PPP	amount of economic loss divided by GDP PPP
Map		No. of associated map
Origin/ Source	North	latitude of location of volcano in degree
	East	longitude of location of volcano in degree
	Volcanic Explosivity Index (VEI)	value of "Volcanic Explosivity Index"
Hazard Situation (Agent)		codes of "Agent"

The magnitude of volcanic eruption is described as Volcanic Explosivity Index (VEI) and Hazard Situation is described as "Agent" . VEI is commonly used for describing magnitude of volcanic eruption. It is defined accordance with an amount of volcanic product or volume of volcanic sediment. Agent means the deadly factor of volcanic activity. The definitions of VEI and Agent are shown in Table 9.2.5 and Table 9.2.6 as well.

Table 9.2.5 Volcanic Explosivity Index (VEI)

VEI	General Description	Cloud Column Height (km)	Volume (m^3)	Qualitative Description	Classification	How often	Example
0	non-explosive	<0.1	$1x10^4$	Gentle	Hawaiian	daily	Kilauea
1	Small	0.1-1	$1x10^6$	Effusive	Haw/Strombolian	daily	Stromboli
2	Moderate	1-5	$1x10^7$	Explosive	Strom/Vulcanian	weekly	Galeras, 1992
3	Moderate-Large	3-15	$1x10^8$	Explosive	Vulcanian	yearly	Ruiz, 1985
4	Large	10-25	$1x10^9$	Explosive	Vulc/Plinian	10's of years	Galunggung, 1982
5	Very Large	>25	$1x10^{10}$	Cataclysmic	Plinian	100's of years	St. Helens, 1981
6		>25 km	$1x10^{11}$	paroxysmal	Plin/Ultra-Plinian	100's of years	Krakatau, 1883
7		>25 km	$1x10^{12}$	colossal	Ultra-Plinian	1000's of years	Tambora, 1815
8		>25 km	$>1x10^{12}$	colossal	Ultra-Plinian	10,000's of years	Yellowstone, 2 Ma

Table 9.2.6 Code for the Primary Factor of Casualty Damage (Agent)

Agent Code	Agent
A	Avalanche (Debris and landslides)

E	Electrical (lightning)
F	Floods (& Jokulhlaups)
G	Gas (emission from eruptive craters as well as fumarolic/solfataric activity)
I	Indirect deaths (disease, starvation, exposure, desolation)
L	Lava flows
M	Mudflows/Lahars
m	Secondary (post-eruption) mudflows
P	Pyroclastic flows, surges, & direct blasts
S	Seismic, or volcanic earthquake (tectonic earthquake deaths excluded)
T	Tephra (ash, bombs, lapilli, steam blasts. Killing either by ballistic impact, or with finer-grained ash, by suffocation, collapse of ash-covered roogs, etc.
W	Waves or tsunami

Table 9.2.7 Information and Data compiled in Appendix A9.5 (Cyclone)

Items		Contents
No.		3 digits number
Country		country name
Disaster Type		"cyclone", "tropical cyclone", Typhoon", "storm", "tropical storm", "local storm"
Disaster Name (if any)		No. given by the data sources: EM-DAT
Cause/ Sub Type (name)		the name of Typhoon (cyclone)
Disaster Start	Year	4 digits number, in the year the Christian Era
	Month	2 digits number
	Day	2 digits number
Disaster End	Year	4 digits number, in the year the Christian Era
	Month	2 digits number
	Day	2 digits number
Damage	Killed	a number of killed people
	Affected People	a number of affected people
	Amount (Million US$)	amount of economic loss
	Amount (Million US$)/GDP PPP	amount of economic loss divided by GDP PPP
Origin/ Source*1	Latitude (degree)	latitude of affected area
	Longitude (degree)	longitude of affected area
Hazard Situation *2		Hazard Situation = log (duration × severity × affected area km^2)
Affected km^2		the area of affected
Affected Region		Name of affected regions

*1: from Dartmouth

*2: from Dartmouth

Hazard Situation =log (Duration × Severity × Affected Area)

Duration: Duration in days

Severity

Class 1: large flood events: significant damage to structures or agriculture; fatalities; and/or 1-2 decades-long reported interval since the last similar event.

Class 1.5: Very large events: greater than 20 years but less than 100 year recurrence interval, and/or a local recurrence interval of at 10-20 years.

Class 2: Extreme events: with an estimated recurrence interval greater than 100 years

Table 9.2.8 Information and Data compiled in Appendix A9.6 (Landslide)

Items		Contents
No.		2 digit Number
Country		Country name
Disaster Type		Mass movement dry, mas movement wet
Disaster Name (if any)		No. given by the data sources: EM-DAT, ADRC, PRCC, etc.
Cause		The trigger of landslides
Disaster Start	Year	4 digits number, in the year the Christian Era
	Month	2 digits number
	Day	2 digits number
Disaster End	Year	4 digits number, in the year the Christian Era
	Month	2 digits number
	Day	2 digits number
Damage	Killed	Number of killed people
	Affected People	Number of affected people
	Amount (Million US$)	Amount of economic loss
	Amount (Million US$)/GDP PPP	Amount of economic loss divided by GDP PPP
Affected Region		Name of affected provinces
Reference		Link to KMZ file for Google Earth
Map		Link to map with affected area (if any)
Reference		Source of data (EM-DAT, ADRC, PRCC, etc.)
Origin/ Source	North	latitude of affected area
	East	longitude of affected area
Hazard Situation		URI to reports on internet

9.3 Summary of Collected Data on Natural Disaster

9.3.1 Flood

The data were collected for the period of 30 years from 1983 to 2012. The data are divided by every five years and the number of flood occurrences, number of flash floods, death toll, number of evacuees, and the amount of damage were totalized. The graphs below show that all these parameters clearly increasing. The incompleteness of the old data may be one reason of this tendency, global warming may be affecting the disaster by the flood.

The amount of damage for 2008 - 2012 is excessively large (40,000 million US$). The reason is attributed to the massive flood disaster of Chao Phraya River that hit the central flood plain area in Thailand which occurred in August 2011 to January 2012.

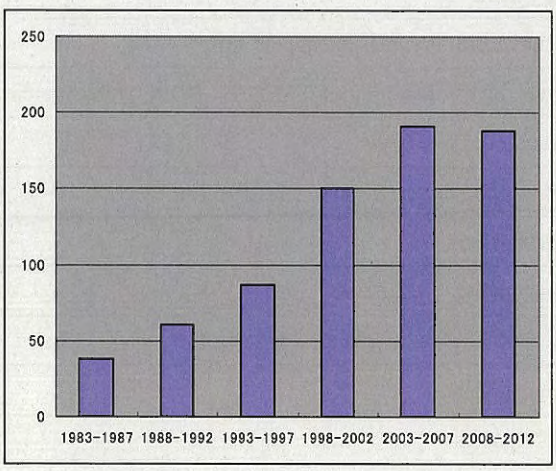


Figure 9.3.1 Number of Flood

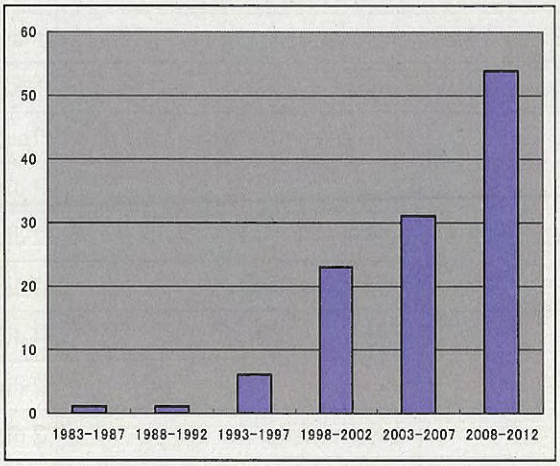


Figure 9.3.2 Number of Flash Flood

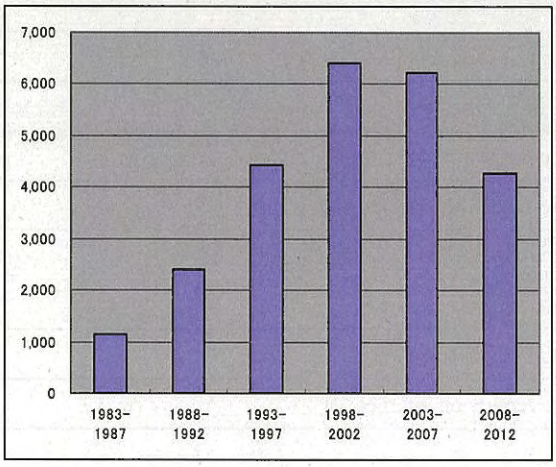


Figure 9.3.3 Death Toll

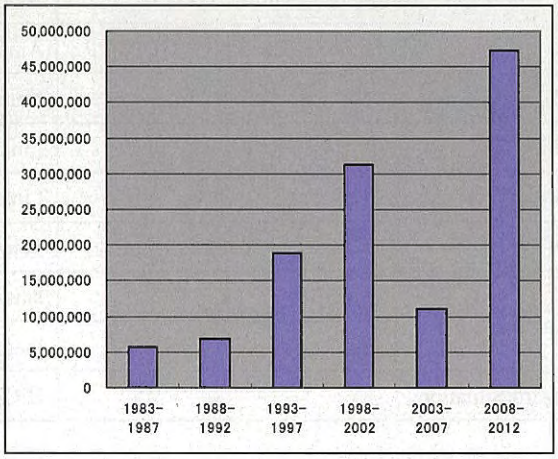


Figure 9.3.4 Number of Affected People

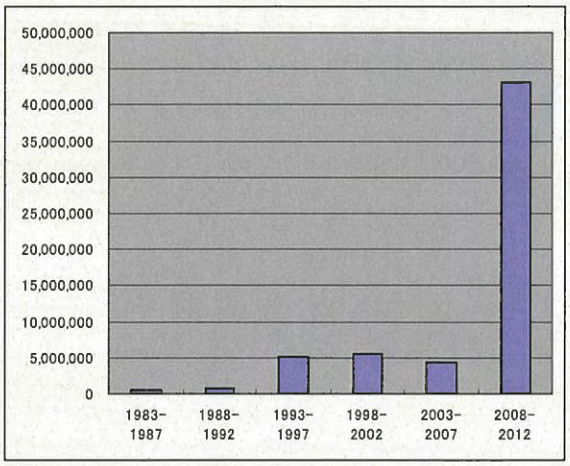


Figure 9.3.5 Amount of Damage (million US$)

Southeast Asia is situated in a tropical climate with the maximum monthly average temperatures 18 degrees in Celsius or more in winter. There are three subdivided climate zones within the area. The typical climate features are usually high temperatures with a lot of rainfalls. An annual mean temperature under the equator is 23.2 degrees, and a maximum temperature is 28.4 degrees. The annual average rainfalls are in the range of 2000 to 6000 mm.

Af: Tropical rainforest climate -A minimum precipitation of rainy month is 60 mm or more, and its climate zone ranges from the Malay Peninsula to Sumatra, Java Barat, Kalimantan, Mindanao, Sulawesi, and New Guinea.

Am: Tropical monsoon climate - A minimum precipitation of rainy month is 60 mm or less. It has a dry season and a rainy season, and is scattered around from central Vietnam, southern Cambodia, and western Myanmar.

The Savanna climatic zone occupies the continent part, and the rainy season and its dry season are clear.

Aw: Savanna climate - A minimum precipitation of rainy month is 60 mm or less. It has a distinguished dry season. Its climate zone ranges from west Java to Timor Island, and in turn from southern Vietnam to Cambodia, Thailand and Myanmar.

In Southeast Asia, the monsoon wind occurs from south or southwest in the rainy season (May to October), and it brings a lot of rain to the continent side. In the dry season (November to April), the monsoon wind occurs from north, and it brings a lot of rain to islands parts, such as Java Island. These bring the flood to Southeast Asia.

(1) Brunei

The scale of a flood is small and damage is also small.

(2) Cambodia

Although there are few flood events, the killed person per an activity is the maximum in ASEAN region. The number of affected people per an activity is almost same as Vietnam, which is the 2nd place in ASEAN countries. It shows that the measures against the flood are insufficient.

(3) Indonesia

The flooding events are frequent and number of flood is large because of the large territory.The number of floods is increasing every year. However, as for the casualty per flood event, the number of affected people, and the amount of damage are not so large, and the extent of the impact per flood is smaller. The number of floods in Java is the maximum, Sumatra and Sulawesi are the second. There are few floods in Kalimantan.

(4) Lao PDR

Although there are only few flood events, the number of affected person in one event is larger. The floods occur from the central to northern part in the country. No floods are reported in southern part.

(5) Malaysia

The number of flood is increasing every year. However, the numbers of killed or affected person per flood event are very small. The amount of damage is also small. The floods mainly occurred in the Malay Peninsula and there are only a few events in Kalimantan.

(6) Myanmar

Flooding is a regular event and they occur with the same frequency almost every year. The number of killed or affected people per one even is comparatively small. Flooding usually occurs in the central and western part, and they may be related to the monsoon.

(7) Philippines

The number of floods is increasing every year. The killed person at the time of flood is the 3rd place in ASEAN, and the number of affected people is also large. The number of foods in Mindanao is the maximum in the country. Luzon and Central archipelago are the next.

(8) Singapore

Almost no floods occur because the territory is small and formed by one island.

(9) Thailand

The number of flood is increasing every year. The killed person and the amount of damage in one event are the maximum in ASEAN. Only a few floods happenin Lao PDR sides (northeast side).Many floods occur from the northern to central parts in the country along the Chao Phraya River and around the north Malay Peninsula to the south.

(10) Vietnam

The number of floods is increasing every year. The killed person and the number of affected per event are 2nd in ASEAN countries. Many floods occur from the central to northern part, and there are few in southern part.

9.3.2 Earthquake

A number of historical events are summarized in Table 9.3.1 for each database and country. "Combined" is prepared from the events from EM-DAT and NOAA database by eliminating overlapping events. The difference in event numbers between EM-DAT and NOAA database was derived from the differences in selecting criteria and period. EM-DAT focuses after AD 1900 and NOAA database includes pre-Christian data. However, most of data from NOAA database are after 17th century in the ASEAN region.

65 seismic intensity maps are associated with the event list.

Table 9.3.1 Number of Events: Earthquake

Country Name	Number of Events			Associated Map
	EM-DAT	NOAA	Combined	
Brunei	0	0	0	0
Cambodia	0	0	0	0
Indonesia	98	349	354	48
Lao PDR	0	1	1	1
Malaysia	0	2	2	0
Myanmar	6	30	32	4
Philippines	23	199	200	11
Singapore	0	0	0	0
Thailand	2	3	5	1
Vietnam	0	1	1	0
Total	129	585	595	65

The data condition of each country is as follows

Table 9.3.2 Data Condition for Each Country: Earthquake

Country Name	Data Condition
Brunei	No records of damaging event was found
Cambodia	No records of damaging event was found
Indonesia	98 events are searched from EM-DAT and 349 events are searched from NOAA database. 354 events are obtained after eliminating overlapping events. 48 seismic intensity maps from USGS are associated with the

	events.
Lao PDR	One M6.3 event in 2007 is searched.
Malaysia	Two events occurred in Kalimantan Island.
Myanmar	32 events are searched. 2 events are by the earthquakes occurred in Yunnan province of China.
Philippines	23 events are searched from EM-DAT and 199 events are searched from NOAA database. 200 events are obtained after eliminating overlapping events. 11 seismic intensity maps are associated with the events. 5 from USGS, 6 from PHIVOLCS.
Singapore	No damaging event is searched.
Thailand	5 events are searched. 1 event is by the earthquakes occurred in Yunnan province of China, another 1 event is by the earthquakes occurred in Myanmar.
Vietnam	One M4.5 event in 2005 is searched.

9.3.3 Tsunami

A number of historical events are summarized in Table 9.3.3 for each database and country. "Combined" is prepared from the events from EM-DAT and NOAA database by eliminating overlapping events. The difference in event numbers between EM-DAT and NOAA database was derived from the differences in selecting criteria and period. EM-DAT focuses after AD 1900 and NOAA database includes pre-Christian data. However, most of data from NOAA database are after 17th century in the ASEAN region.

The inundation maps of the Sumatra Earthquake on December 26th, 2004 were collected.

Table 9.3.3 Number of Events: Tsunami

Country Name	Number of Events			Associated Map
	EM-DAT	NOAA	Combined	
Brunei	0	0	0	0
Cambodia	0	0	0	0
Indonesia	9	239	240	1
Lao PDR	0	0	0	0
Malaysia	1	0	1	0
Myanmar	1	3	4	0
Philippines	1	93	94	0
Singapore	0	0	0	0
Thailand	2	0	2	1
Vietnam	0	0	0	0
Total	14	335	341	2

The data condition of each country is as follows

Table 9.3.4 Data Condition for Each Country: Tsunami

Country Name	Data Condition
Brunei	No records of damaging event were found
Cambodia	No records of damaging event were found
Indonesia	9 events are searched from EM-DAT and 239 events are searched from NOAA database. 240 events are obtained after eliminating overlapping events. The inundation map of the Sumatra Earthquake on December 26th, 2004 is associated.
Lao PDR	No records of damaging event were found
Malaysia	1 event is searched. It is the Sumatra Earthquake in 2004.
Myanmar	4 events are searched. One event is the Sumatra Earthquake in 2004.
Philippines	1 event is searched from EM-DAT and 93 events are searched from NOAA database. 94 events are obtained because there is no overlapping event. 1 event from EM-DAT is Chile Earthquake in 1960.
Singapore	No records of damaging event were found
Thailand	2 events are searched. 1 event is caused by the tsunami generated at offshore of India in 1955 and another 1 event is caused by the Sumatra Earthquake in 2004. The inundation map of the Sumatra Earthquake is associated.
Vietnam	No records of damaging event were found

9.3.4 Volcano

A number of historical events are summarized in Table 9.3.5 for each database and country. "Combined" is prepared from the events from EM-DAT and NOAA database by eliminating overlapping events. The difference in event numbers between EM-DAT and NOAA database was derived from the differences in selecting criteria and period. EM-DAT focuses after AD 1900 and NOAA database includes Holocene (since 10,000 – 12,000 years ago) data. There are events in AD 416 for Indonesia and in BC 3580 for Philippines.

Table 9.3.5 Number of Events: Volcano

Country Name	Number of Events			Associated
	EM-DAT	NOAA	Combined	Map
Brunei	0	0	0	0
Cambodia	0	0	0	0
Indonesia	52	155	185	0
Lao PDR	0	0	0	0
Malaysia	0	0	0	0

Myanmar	0	0	0	0
Philippines	25	38	54	0
Singapore	0	0	0	0
Thailand	0	0	0	0
Vietnam	0	0	0	0
Total	77	193	239	0

The data condition of each country is follows

Table 9.3.6 Data Condition for Each Country: Volcano

Country Name	Number of Events			Associated
	EM-DAT	NOAA	Combined	Map
Brunei	0	0	0	0
Cambodia	0	0	0	0
Indonesia	52	155	185	0
Lao PDR	0	0	0	0
Malaysia	0	0	0	0
Myanmar	0	0	0	0
Philippines	25	38	54	0
Singapore	0	0	0	0
Thailand	0	0	0	0
Vietnam	0	0	0	0
Total	77	193	239	0

9.3.5 Cyclone (Typhoon) and Meteorological Hazard

Table 9.3.7 below shows the total number of cyclone disasters which occurred in ASEAN countries from 1900 to 2012 based on the data from EM-DAT and Dartmouth. It also indicates the combined number of cyclone disasters, except for duplicated data, from the two databases. The difference in the number of events between EM-DAT and Dartmouth is caused by the difference in the period of record and in the criteria of hazards to be recorded. The start of registration in the EM-DAT is in 1900 while that of Dartmouth is in 1985.

Table 9.3.7 Number of Storm (Cyclone) Disaster (1900-2012)

Country Name	Number of Events		
	EM-DAT	Dartmouth	Combined
Brunei	0	0	0
Cambodia	3	2	4
Indonesia	10	2	12
Lao PDR	5	0	5
Malaysia	8	0	8
Myanmar	17	0	17
Philippines	209	80	230
Singapore	0	0	0
Thailand	32	10	36
Vietnam	90	27	101
Total	374	121	413

Figure 9.3.6 shows the damages caused by storm disasters to ASEAN members. These storm disasters consist mostly of heavy rain and storm generated by cyclones/typhoons. With regards to the number of casualties or loss of human lives, Myanmar accounts for approximately 80% of the total casualties of the whole ASEAN region and is followed by the Philippines and Vietnam. The main cause for this high percentage is Cyclone Nargis, which hit Myanmar back in 2008, and caused 138,373 deaths, an overwhelming number for just one cyclone.

In terms of the number of people affected by storms, the Philippines and Vietnam jointly account for 94% of the total number for the whole ASEAN region. Both countries also account mostly for the estimated amount of damage (76%) and are followed by Myanmar (18%). No storm occurred in Brunei and Singapore.

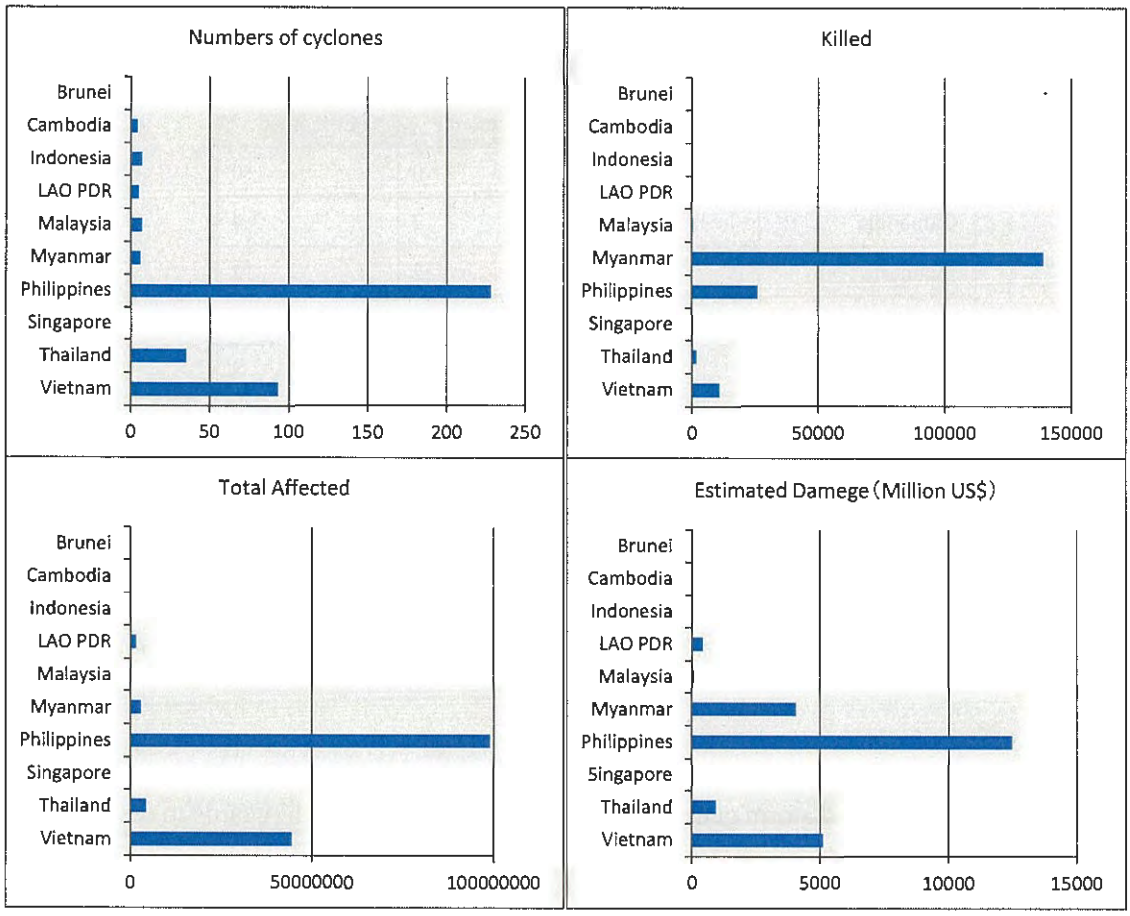


Figure 9.3.6 Storm (Cyclone) Disaster in the ASEAN Region (1980 - 2012)

(1) Brunei

Brunei is located in the subtropical region between the equator and the northern latitude of 10 degrees and is not usually affected by storms.

(2) Cambodia

According to 1980-2012 records, four storm disasters have occurred in the country.

(3) Indonesia

As Indonesia is located in the subtropical region on the equator, it is not usually affected by storms. Seven storm disasters have occurred in the country according to 1980-2012 records.

(4) Lao PDR

According to 1980-2012 records, five storm disasters have occurred in the country. Typhoons generated around the Philippines sometimes affect Lao PDR after landing on Vietnam.

(5) Malaysia

Malaysia is located in the subtropical region between the equator and the northern latitude of 10 degrees. According to 1980-2012 records, seven storm disasters have occurred in the country.

(6) Myanmar

According to 1980-2012 records, six storm disasters have occurred in the country. Cyclone Nargis, back in 2008, brought about unprecedented damage killing 138,371 people, affecting over 2.4 million people and dealing a total amount of damage estimated to be worth around 4 billion dollars. Typically, most of the cyclones generated in the Bay of Bengal land in Bangladesh or in the east coast of India. However, Cyclone Nargis continued to move eastward on the Bay of Bengal and hit Myanmar directly. The tremendous damage caused by the storm in Myanmar is mainly attributed to an inadequate disaster prevention system and the lack of awareness of disaster prevention in the country.

(7) Philippines

According to 1980-2012 records, 228 disasters due to storms occurred in the Philippines with 5-7 tropical depressions (typhoons) visiting the country annually. The Philippines accounts for high percentages of the total number of disasters (60%), disaster victims (65%) and total estimated damage (54%) for the whole ASEAN region. Figure 9.3.7, "Frequency of Tropical Cyclone Occurrence in the Philippines," and Figure 9.3.8, "Track of Tropical Storm WASHI – Philippines Local Time", are attached hereunder. As tropical depressions (typhoons) are not usually generated in areas close to the equator, the probability of damages brought about by tropical depressions (typhoons) in the Philippine island of Mindanao is quite low. Unusually, tropical storm WASHI passed by this southern island back in 2011.

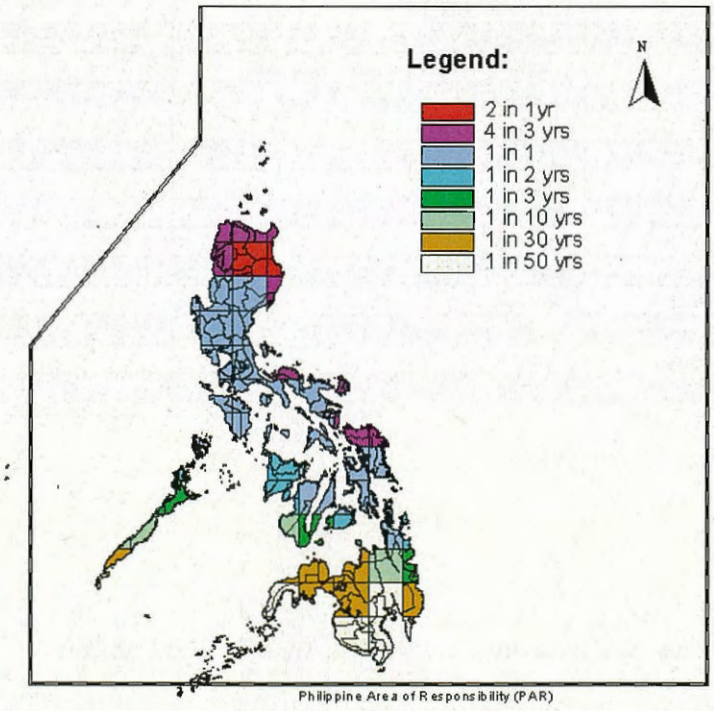


Figure 9.3.7 Frequency of tropical cyclones occurrence in the Philippines

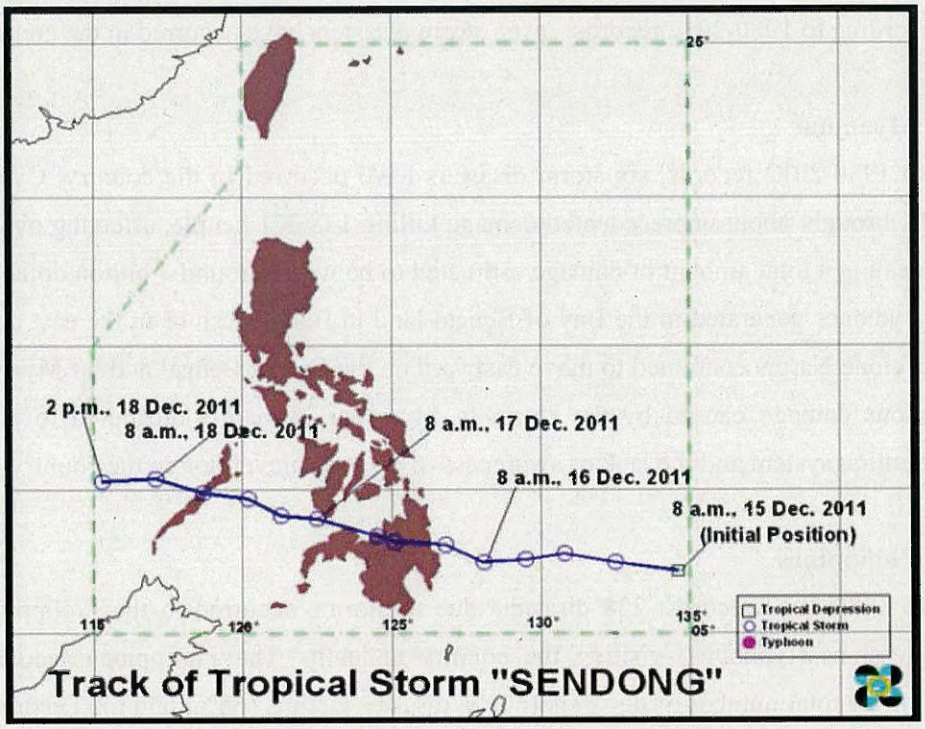


Figure 9.3.8 Track of Tropical Storm WASHI – Philippines local time

Table 9.3.8 Disastrous Typhoons in Terms of Damage

Year	Name	Areas Affected	Damages in Million US$
1990	Mike	Central Visayas	235.86
1995	Angela	Southern Luzon	202.17
1993	Flo	Central Luzon	190.22
2006	Xangsane	Luzon	143.70
1988	Ruby	Southern Luzon	122.61
2006	Durian	Southern Luzon	118.48
1984	Ike	Northeastern Mindanao/Visayas	82.80
2001	Utor	Luzon	78.04
1991	Ruth	Northern Luzon	75.43
2001	Nanang	Visayas	70.65
2003	Imbudo	Luzon	70.22
1995	Sybil	Visayas	60.87
1988	Skip	Visayas	59.78
2004	Mindulle	Southern Luzon	53.26
2006	Chanchu	North & South Luzon	52.83
2008	Fengshen	Visayas and Luzon	293.48
2009	Ketsana	Luzon	241.30
2009	Parma	Luzon	426.74

Source: Office of Civil Defense

Source: Office of Civil Defense

(8) Singapore

Since Singapore is located on the equator, it is not usually affected by storms.

(9) Thailand

According to 1980-2012 records, 35 storms have devastated Thailand (approximately, one storm annually). A typhoon, occurring between October and December and landing on Central Vietnam, can create damage even in Thailand due to its geographical proximity.

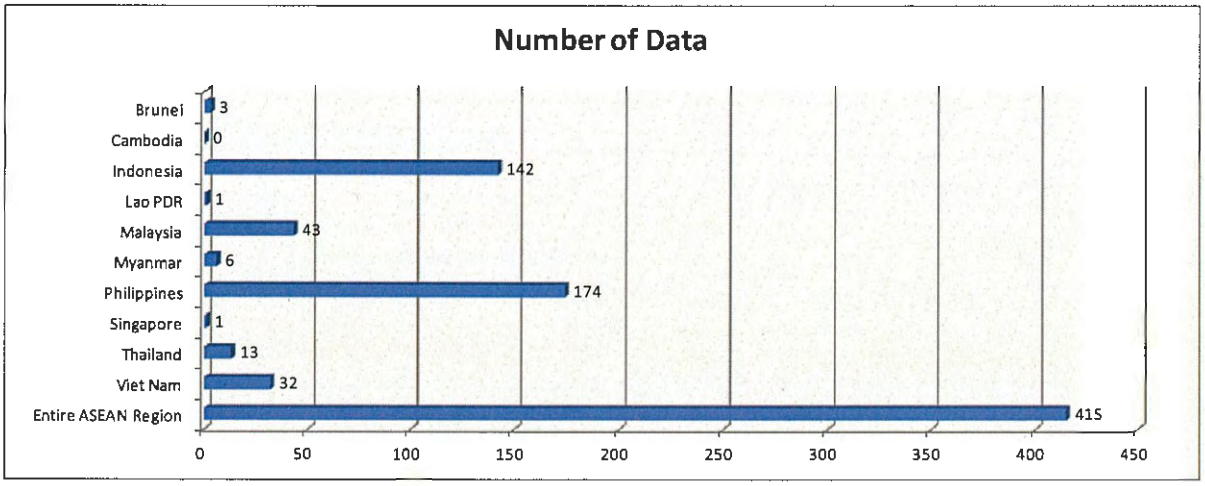
(10) Vietnam

According to 1980-2012 records, an estimated number of 93 storms have devastated Vietnam. After the Philippines, Vietnam comes second in terms of the occurrence of large storms with an average of 3 storms, mainly tropical depressions (typhoons), visiting the country annually. Based on the country's storm disaster history, Typhoon LINDA had the largest number of casualties (3,682) back in 1997. In general, a typhoon, which occurs between June to September, typically approaches Northern Vietnam while a typhoon occurring in May and between October to December approaches Southern-Central Vietnam.

9.3.6 Landslide

Information and data of Landslides occurred in ASEAN countries were collected from EM-DAT, Asian Disaster Reduction Center (ADRC), Pacific Rim Coordination Center (PRCC), etc. and listed in Appendix A9.6. Summary of the data are shown in Figure 9.3.9. Indonesia and Philippines show very high number of affected and killed people.

Table 9.3.9 shows the share of causes of landslides in ASEAN region. Most of the landslides are caused by heavy rain. Graphs in Figure 9.3.10 show the share of causes in each country. Countries under the route of cyclones such as Philippines, Thailand and Viet Nam have larger share of rain caused landslides.



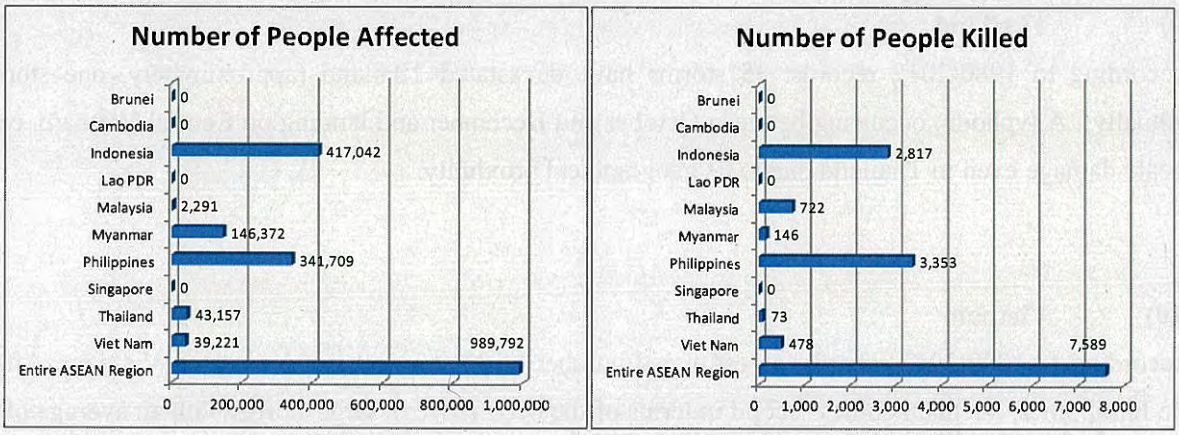


Figure 9.3.9 Summary of Landslide by Country (1980 - 2013)

Table 9.3.9 Share of disaster cause (1980 - 2013)

Cause		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Viet Nam	Entire ASEAN Region
Rain /	Typhoon	0.0%		0.0%	0.0%	0.0%	0.0%	8.0%	0.0%	0.0%	12.5%	4.3%
	Tropical Storm	0.0%		0.0%	0.0%	0.0%	0.0%	8.5%	0.0%	0.0%	0.0%	3.6%
	Tropical Depression	0.0%		0.0%	0.0%	0.0%	0.0%	17.0%	0.0%	0.0%	6.3%	7.6%
	Monsoon	0.0%		0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	15.4%	3.1%	1.0%
	Other LS Caused by Rain	100.0%		54.9%	100.0%	46.5%	33.3%	40.9%	100.0%	61.5%	50.0%	48.2%
	Total in Rain											64.7%
Occurred at Mining/Quarrying		0.0%		2.8%	0.0%	4.7%	0.0%	3.4%	0.0%	0.0%	6.3%	3.3%
Flash Flood		0.0%		0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
Other Reasons		0.0%		0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
Unkown		0.0%		41.0%	0.0%	48.8%	66.7%	21.6%	0.0%	23.1%	21.9%	31.5%

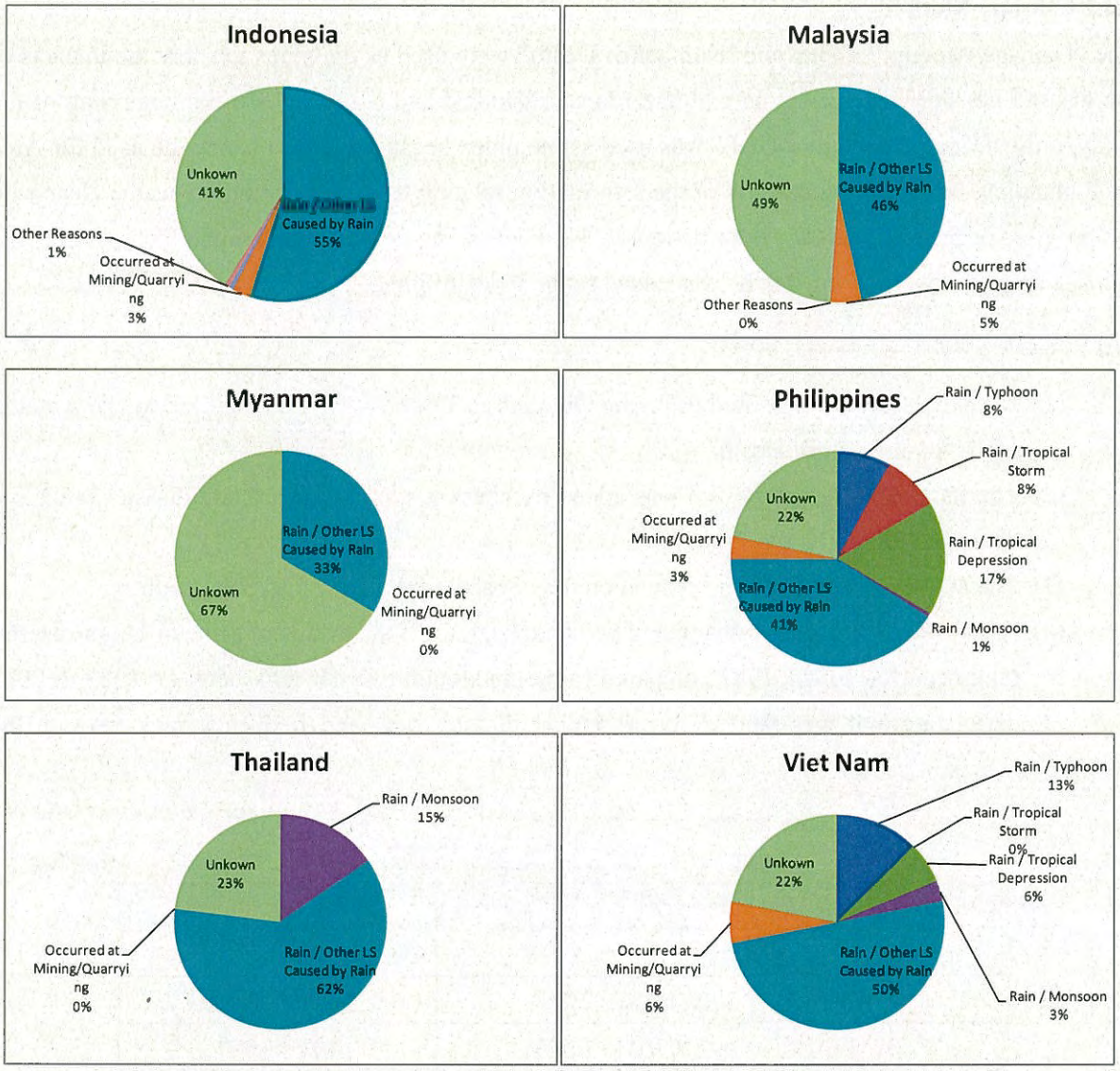


Figure 9.3.10 Share of disaster cause in each country

9.4 Study of the Prevailing Hazards in ASEAN Countries

The disaster records based on the natural hazards that affected ASEAN countries were classified based on the impacts and frequency of occurrence. The results were plotted on the impacts - frequency matrix and the prevailing hazards of each ASEAN countries and studied.

9.4.1 Employed Data

The disaster records compiled in the Appendix A9 were employed in the study. The records for recent 30 years, namely from 1983 to 2012, were used because the number of the events included in the database before 1980 is significantly smaller than after 1980. The records of large disaster by earthquake, tsunami and volcano eruption before 1983 were also used because the frequencies of occurrence of these hazards are significantly low than flood, cyclone and landslide.

9.4.2 Study Method

The "Damage Amount / GDP" and 'Number of Death" were used as the index to show the impacts of the disaster considering that six natural hazards were studied and compared. At the beginning of the study, only "Damage Amount / GDP" was used as the index because the results may be used for Area BCP planning, however, the scarcity of the information relating to damage amount became clear with the progress of the study. As the information of "Number of Death" was found higher compared to the damage amount, "Number of Death" was added as the index of impact.

The process of the study is as follows;

(1) Each disaster was classified following the rank in Table 9.4.1 based on the Damage Amount / GDP or Number of Death,
(2) The number of disaster event was added by country, type of hazard and disaster rank, and classified following the Table 9.4.2,
(3) The above information were plotted on the impacts - frequency matrix by country,
(4) As for the earthquake, tsunami and volcanic hazards, if the events of same or larger disaster rank occurred before 1983 compared to the maximum disaster rank between 1983 to 2012 period, a point was plotted corresponding disaster rank and frequency rank (=1) on the matrix.

Table 9.4.1 Disaster Rank and Damage

Disaster Rank	Damage Amount /GDP[1]	Number of Death
5	1.0% -	10,001 -
4	0.1% - 1.0%	1,001 - 10,000
3	0.01% - 0.1%	101 - 1,000
2	0.001% - 0.01%	11 - 100
1	- 0.001%	- 10

Table 9.4.2 Frequency Rank and Number of Events

Frequency Rank	Number of Events from 1983 to 2012	Average Frequency (Events / Year)
5	7 or more	1/5 -
4	4 to 6	1/10 - 1/5
3	2 to 3	1/15 - 1/10
2	1	1/30
1	Large Events occurred before 1983	-

[1]Gross domestic product based on purchasing-power-parity (PPP) valuation of country GDP, International Monetary Fund, World Economic Outlook Database, October 2012

9.4.3 Study Results

The following results are based on the available existing information. Not all the information relating the impacts by the disaster were collected, and the purpose of this study is not intended to evaluate the precise damage amount or number of death. The purpose of this study is to show the order of impacts by six natural hazards.

(1) Brunei

Only three small disasters by flood are recorded in the last 30 years, but no one was killed by these events. No other disasters were recorded.

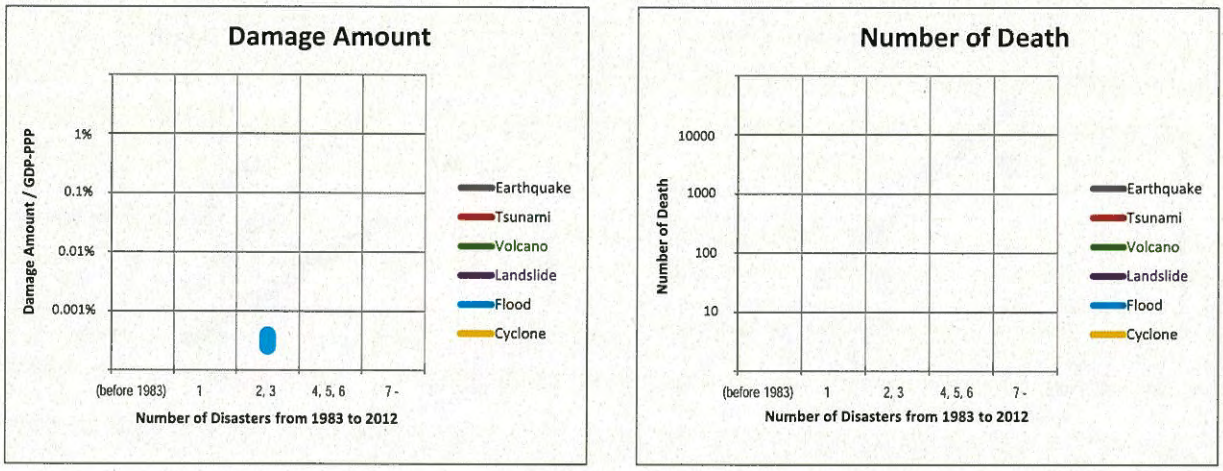


Figure 9.4.1 Impact of hazards in Brunei

(2) Cambodia

Several disasters by flood with more than 100 dead or more than 1% damage amount of GDP were recorded. If smaller disasters were included, the flood disaster with loss of life occurred every 2 years in average. The disasters by cyclone were recorded but the impact was smaller than flood.

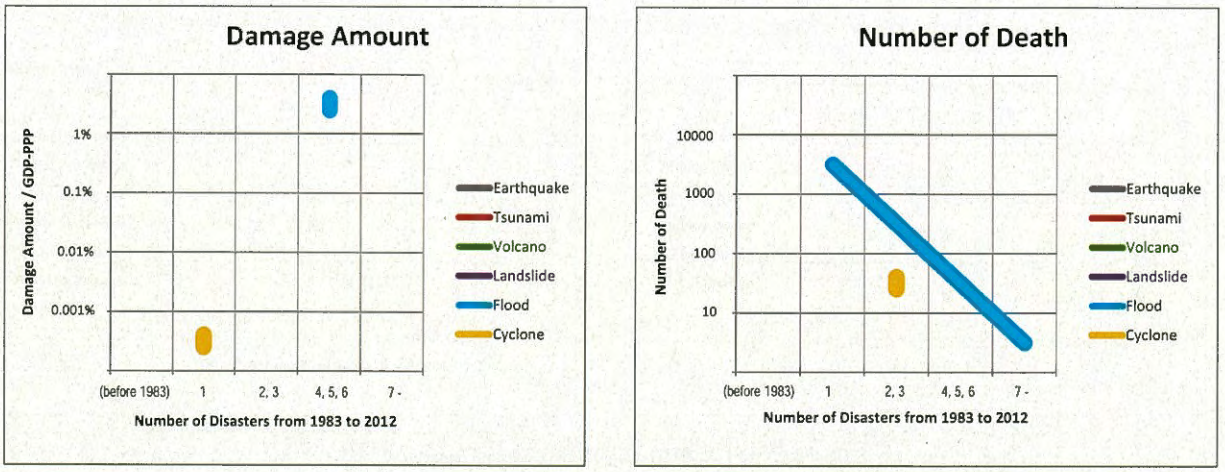


Figure 9.4.2 Impact of hazards in Cambodia

(3) Indonesia

The disasters by all six hazards were recorded along with Philippines. Tsunami caused the largest impact in the view of death number. The largest damage was caused by 2004 Indian Ocean Tsunami, besides that seven tsunamis caused more than 1000 death after 17th century. The number of death by the earthquakes is smaller than tsunami but occurred frequently. Seven earthquakes caused more than 1000 death after 19th century. The number of death by one event flood is smaller than tsunami or earthquake, but occurs more frequently. The amount of damage by flood is larger than earthquake in case of the events occurring every several years. The impacts by volcano and cyclone are small in last 30 years but the events with more than 1000 death are recorded before 1983.

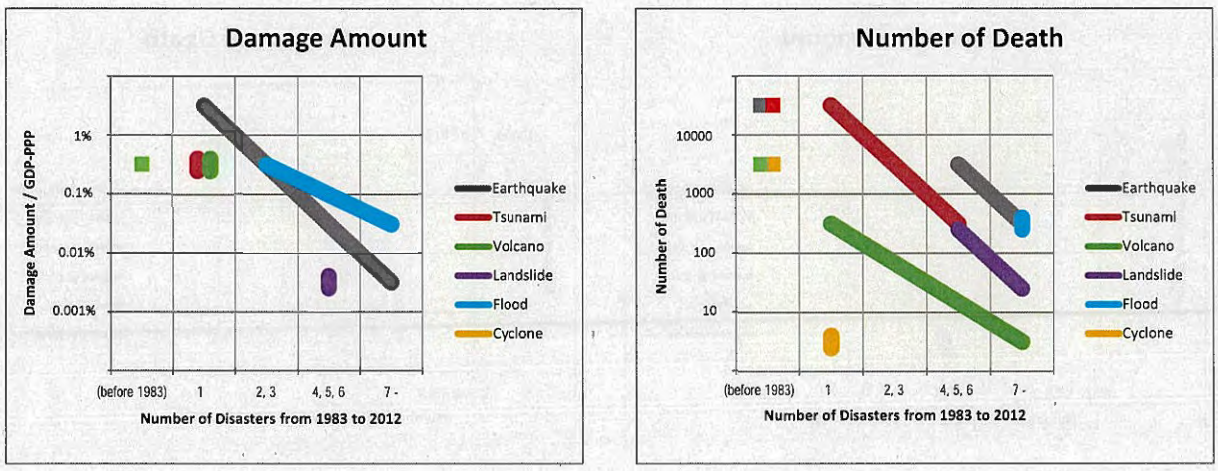


Figure 9.4.3 Impact of hazards in Indonesia

(4) Lao PDR

The disasters by flood and cyclone were recorded. The impacts of flood and cyclone in view of the death toll are same but flood is more frequent.

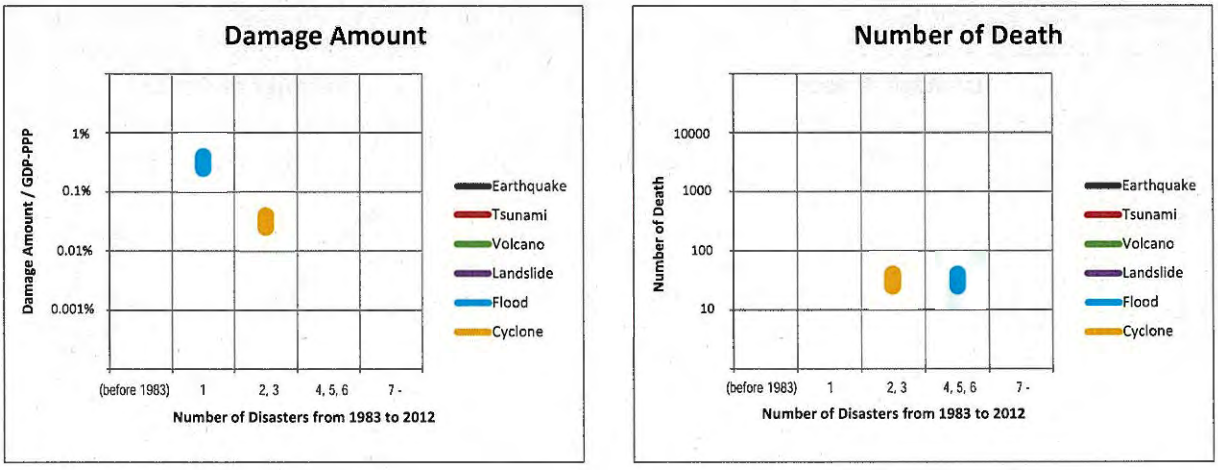


Figure 9.4.4 Impact of hazards in Lao PDR

(5) Malaysia

The impacts of landslide and flood were found same in view of the death toll. The maximum number of death by cyclone was in same order to landslide and flood, but frequency was low. The damage by tsunami was caused by 2004 Indian Ocean Tsunami and no older events were recorded.

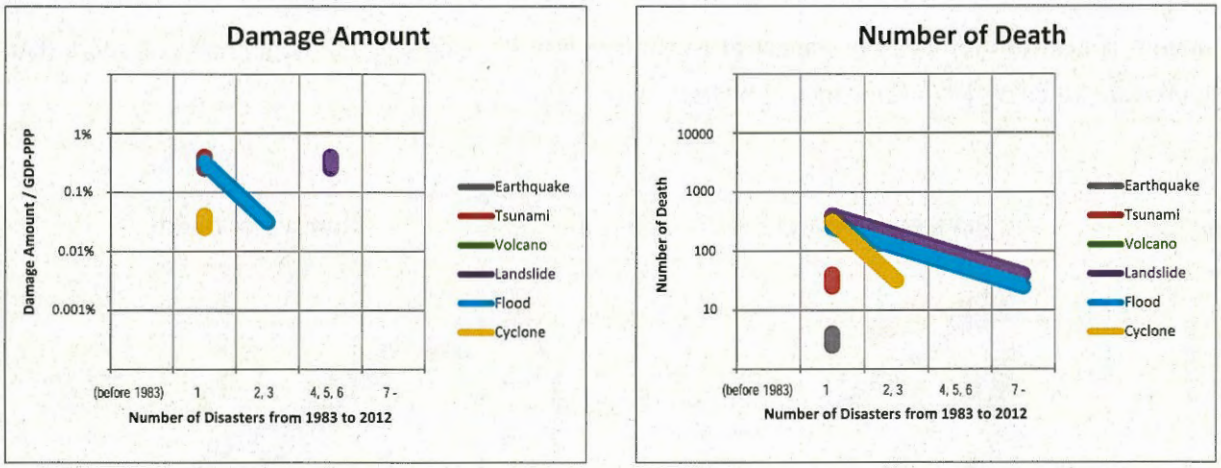


Figure 9.4.5 Impact of hazards in Malaysia

(6) Myanmar

The impact of 2008 Cyclone Nargis was far above the rest in view of the death toll (about 140 thousand), besides that three cyclones caused more than 1000 death in 20th century. The number of death by flood was smaller than cyclone but more frequent. The damage amount by 2004 Indian Ocean Tsunami was large; however no tsunamis and earthquakes that caused more than 1000 death were recorded in the history.

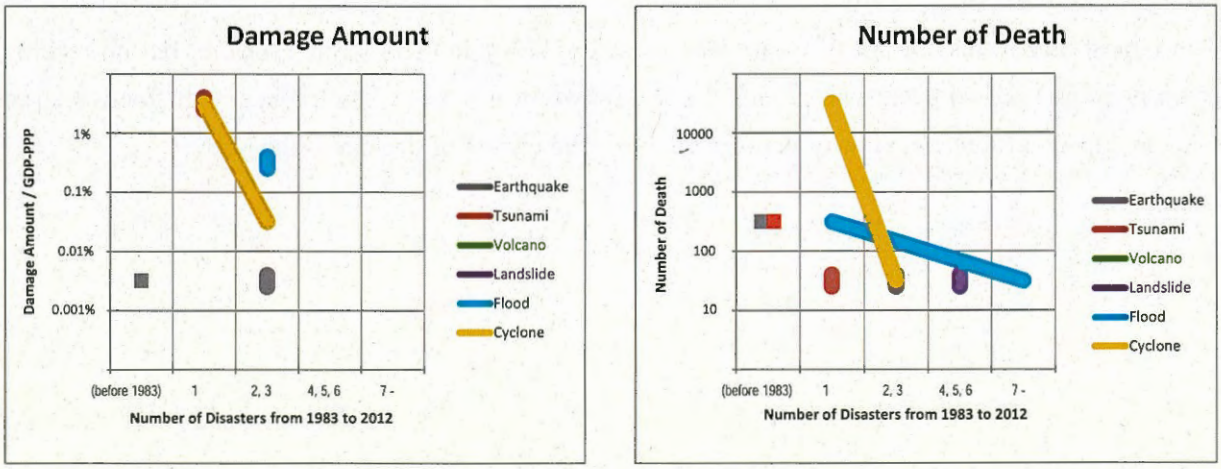


Figure 9.4.6 Impact of hazards in Myanmar

(7) Philippines

The disasters caused by all six hazards were recorded along with Indonesia. The most influential hazard was cyclone. In average five to six disasters by cyclone with death occurred every year. In view of damage amount, cyclone brings the largest impact also. Earthquake, volcano and landslide also caused at least one disaster with more than 1000 death in last 30 years. The number of death in one disaster by flood was smaller but the frequency was larger. The impact of flood in view of damage amount is next to cyclone. The impact of tsunami in last 30 years was not large, however more than 4000 were killed by 1976 Mindanao Tsunami.

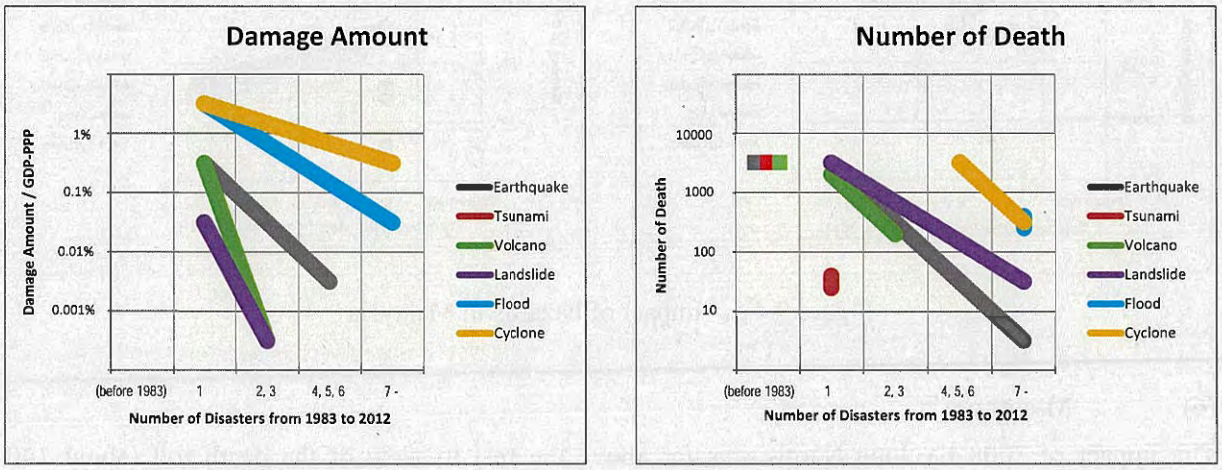


Figure 9.4.7 Impact of hazards in Philippines

(8) Singapore

No disasters with damage amount or death are recorded.

(9) Thailand

The largest human loss in last 30 years was caused by 2004 Indian Ocean Tsunami, but no records corresponding to 2004 event was recorded even in historical period. The frequency of flood is large and the impact is largest in view of damage amount. The impact of cyclone is the next

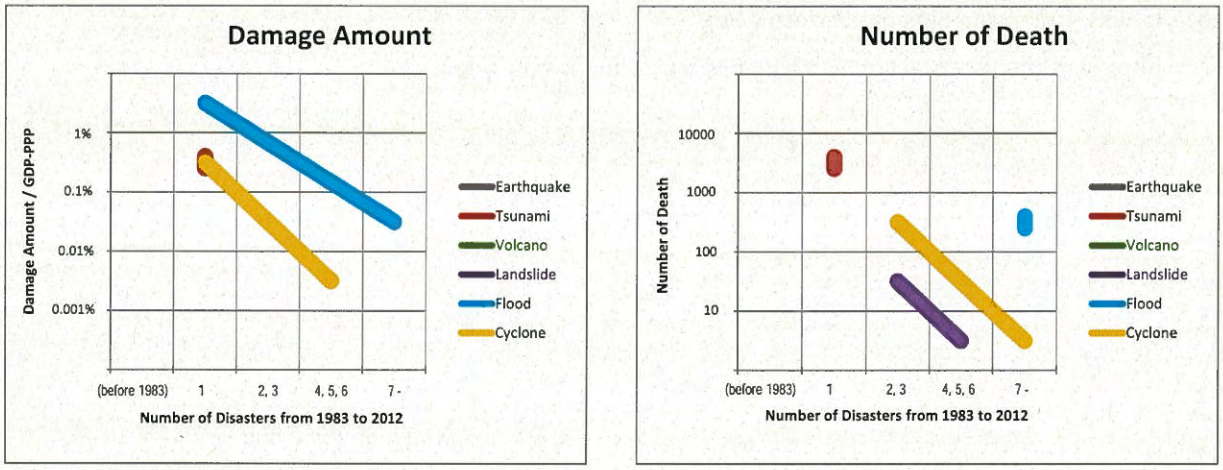


Figure 9.4.8 Impact of hazards in Thailand

(10) Vietnam

The impact of cyclone is the largest in view of death and flood is the next. The impacts of cyclone and flood are same in view of damage amount.

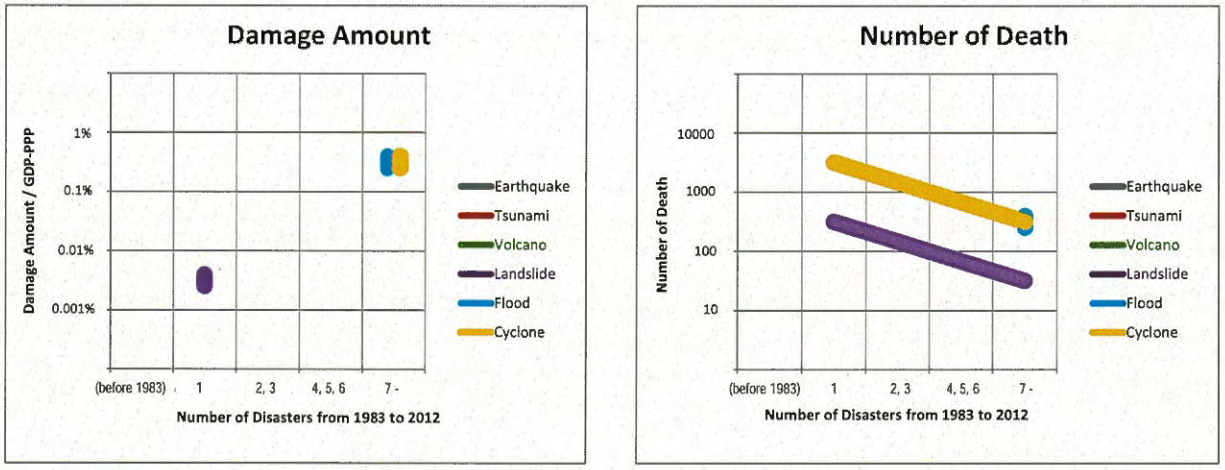


Figure 9.4.9 Impact of hazards in Vietnam

REFERENCES

1) Asia Disaster Research Center: "Disaster Information Archive: http://www.adrc.asia/"
2) GLIDE, GLIDE Search
3) "National Slope Master Plan 2009-2023", Public Works Department, Malaysia
4) OCHA –ROAP (2011). Holocene Eruption and Selected Volcanoes in Asia-Pacific
5) Pacific Rim Coordination Center: "Large Landslide Locations: http://data.pacificrimnetwork.org/"
6) PRCC, Disaster Data.

7) The International Disaster Database, EM-DAT Search Details Disaster List

8) USGS. Indonesia Seismic Hazard Map,
http://earthquake.usgs.gov/earthquakes/world/indonesia/gshap.php

CHAPTER 10 MEASURES TAKEN FOR NATURAL DISASTERS

10.1 Methodologies and Scope of Survey

This section reviews studies and research that have been conducted in the ASEAN region with a focus on counter-measures taken for natural disasters. Information available in English are collected from JICA's recent report published in 2012, "Data Collection Survey on ASEAN Regional Collaboration in Disaster Management" and internet. The purpose of this section is, firstly to grasp an overview of the counter-measures taken for disaster prevention and preparedness to reduce the extent of damage caused by disasters by each member country of ASEAN, and secondly to produce a compiled assessment report of the region that is accessible for those who wish to plan a BCP for reference.

Table 10.1.1 Information Collected, Methodology of Collection and Scope of Survey

Information Collected	Methodology	Scope of Survey
Structural and non-structural measures taken for disaster management.	To collect and compile information in English on measures from "Data Collection Survey on ASEAN Regional Collaboration in Disaster Management" (2012) and in internet	Information on counter measures from the JICA's report and in the following websites: · Asian Development Bank · Asian Disaster Reduction Center · Embassy of Japan in member countries · Government organization in member countries · JICA · Ministry of Foreign Affairs of Japan · Prevention Web · World Bank

10.2 Information and Data Compiled in Appendix A10

Collected information on counter-measures are listed by each member state of ASEAN in nine sections, namely 1) Organization and Institution, 2) Flood risk assessment, 3) Early warning, 4) Disaster management information, 5) Disaster management at community level and disaster education, 6) Research on disaster management, 7) Structural and non-structural measures, 8) Preparedness for effective response, and 9) Emergency response and recovery.

Table 10.2.1 Information and Data Compiled in Appendix A10

Section No.	Compiled Information and Data	Description
A10.1	Measures Taken for Natural Disasters – Flood	List of measures by country. Along with the detailed description, information source, target areas if available, and executing agencies are provided.
A10.2	Measures Taken for Natural Disasters – Earthquake	List of measures by country.
A10.3	Measures Taken for Natural Disasters – Tsunami	List of measures by country.
A10.4	Measures Taken for Natural Disasters – Volcano	List of measures by country.
A10.1	Measures Taken for Natural	List of measures by country. Along with the detailed description,

	Disasters – Cyclone (Typhoon) and Meteorological Hazard	information source, target areas if available, and executing agencies are provided. Included in A10.1 because many information is common with Flood.
A10.1	Measures Taken for Natural Disasters – Landslide	List of measures by country. Along with the detailed description, information source, target areas if available, and executing agencies are provided. Included in A10.1 because many information is common with Flood.

10.3 Summary of Survey

In keeping with the strategic goals of Hyogo Framework for Action (HFA), ASEAN countries have realized the importance of disaster risk management and placed their focus on prevention and mitigation of disaster risks and damages. Since disasters tend to hit the same regions, each ASEAN country is developing their counter-measures mainly against particular disaster types it is prone to. They are developing and updating disaster management policies, organizations and facilities overall, however, overall linkage and capacity development needs to be improved.

10.3.1 Flood

The monitoring and early warning systems are in place for flood in all ASEAN member countries. Early warning is disseminated by several communication media, such as television, radio, SNS, siren and websites. Although hazard maps are prepared in most countries, not all of them cover the whole country in a map scale enough to use for community level disaster management. Flood prone countries have traditionally developed organizational, structural and non-structural measures for flood risk prevention and reduction.

Table 10.3.1 summaries the findings regarding counter-measures taken for flood in ASEAN countries. Details are described in Appendix A9.1 Compiled Information and Data on Measures Taken for Natural Disasters – Flood.

Table 10.3.1 Summary of Findings: Flood

Country/Region	Summary of Findings
ASEAN	Basic monitoring and early warning systems are in place. However, it is suggested that technological improvement should be needed and that more effective disaster management system should be achieved by capacity improvement for every phase of the disaster management activities[1].
Brunei	Organizational and legal systems are established and activities to raise public awareness and preparedness are promoted.
Cambodia	Firstly, legal system to promote various disaster management activities is to be launched.
Indonesia	In particular strategic basins, watershed management offices have been established and guidelines on flood alert is updated every rainy reason.

[1] JICA (2012). Data Collection Survey on ASEAN Regional Collaboration in Disaster Management.

Lao PDR	Lao PDR is cooperating with Mekong River Commission Secretariat on flood risk reduction along Mekong River, which is the most flood prone area in Lao PDR.
Malaysia	Disaster management organizations seem to be relatively well organized and various technological and structural projects and non-structural programs have been conducted.
Myanmar	It is suggested to conduct flood risk assessments for major parts of the country and to accumulate data. It is also suggested that monitoring and warning systems should be improved[2].
Philippines	Early warning systems have been established for the strategic river basins. It is suggested that forecasting and early warning systems are strengthened[3].
Singapore	Since Singapore is rarely hit by flood, its measures mainly against fires and man-made disasters such as terrorism are considered to work for flood risk.
Thailand	After the large-scale flood in 2011, Thailand is taking actions to strengthen disaster management and to improve early warning systems.
Vietnam	Organizational linkage to community level and community-based preparedness seems to be relatively well. Military plays an important role in emergency response.

10.3.2 Earthquake

There are many records of historical earthquake disaster in Indonesia and Philippines and there are also some in Myanmar and Thailand. Therefore, these countries are taking several measures against the earthquake disaster. However, other ASEAN countries have experiences of no or limited historical earthquake disasters and such countries take no or few measures focusing on the earthquake.

Though Indonesia, Philippines, Myanmar and Thailand are taking measures against the earthquake, they are still on the process of making preparations and have many issues to be improved.

Table 10.3.2 summarizes the findings regarding counter-measures taken for earthquake in ASEAN countries. Details are described in Appendix A9.2.

Table 10.3.2 Summaries of Findings: Earthquake

Country/Region	Summary of Findings
Brunei	There is no historical earthquake disaster recorded and no measure is taken focusing on the earthquake.
Cambodia	There is no historical earthquake disaster recorded and no measure is taken focusing on the earthquake.
Indonesia	Seismic observation system in Indonesia is one of the most fulfilling systems among ASEAN countries. However, numbers of observation instruments are required for improving accuracy of earthquakes and tsunamis observations and speed of hypocenter and magnitude determinations.
Lao PDR	There are few historical earthquake disasters recorded and no measure is taken focusing on the earthquake.

[2] JICA (2012). Data Collection Survey on ASEAN Regional Collaboration in Disaster Management.

[3] JICA (2012). Data Collection Survey on ASEAN Regional Collaboration in Disaster Management.

	However, there is small-scale seismic observation system with assistance from the China Earthquake Administration (CEA).
Malaysia	There are few historical earthquake disasters recorded and no measure is taken focusing on the earthquake.
Myanmar	The number of historical earthquake disasters recorded is third largest after Indonesia and Philippines. However, a measure against earthquake is in early stage.
Philippines	Multi-hazard maps are prepared for 22 states by the READY project. Philippine has the seismic observation system and updating plan with assistance of JICA and JST. PHIVOLCS develops REDAS for determining hypocenters and magnitudes and anticipate damage automatically in case of an earthquake.
Singapore	There is no historical earthquake disaster recorded and no measure is taken focusing on the earthquake.
Thailand	Though there are not so many historical earthquake disasters recorded, the earthquake and tsunami observation network of Thailand has been implemented and strengthened after the catastrophe brought by the tsunami in 2004.
Vietnam	There are few historical earthquake disasters recorded and no measure is taken focusing on the earthquake.

10.3.3 Tsunami

There are many records of historical tsunami disaster in Indonesia and Philippines and there are also some in Myanmar and Thailand. Therefore, these countries are taking several measures against the tsunami disaster. However, other ASEAN countries have experiences of no or limited historical tsunami disasters and such countries take no or few measures focusing on the tsunami.

Though after the catastrophe damage brought by the Sumatra earthquake in 2004, many countries are trying to strengthen Tsunami Early Warning System

Table 10.3.3 summarizes the findings regarding counter-measures taken for tsunami in ASEAN countries. Details are described in Appendix A9.3.

Table 10.3.3 Summaries of Findings: Tsunami

Country/Region	Summary of Findings
Brunei	There is no historical tsunami disaster recorded and no measure is taken focusing on the tsunami.
Cambodia	There is no historical tsunami disaster recorded and no measure is taken focusing on the tsunami.
Indonesia	BMKG installs and operating Indonesia Tsunami Early Warning System (InaTEWS) BMKG plans to establish a monitoring network consist of broadband seismographs, accelerometers, GPSs, tide gauges and buoys for strengthening InaTEWS.
Lao PDR	Lao PDR is inland country and no measure is taken focusing on the tsunami.
Malaysia	Though there are not so many historical tsunami disasters recorded, Malaysia has already installed Tsunami Early Warning System called MNTEWS.
Myanmar	Possibility of tsunami disaster recorded is recognized, but measures do not catch up with the

	situation.
Philippines	Multi-hazard maps are prepared for 22 states by the READY project. PHIVOLCS and NAMRIA have already been observing tsunami. However, it is required that installing more tsunami detecting instrument called "WET sensor" and installing new tsunami detecting buoys or submarine
Singapore	There is no historical tsunami disaster recorded and no measure is taken focusing on the tsunami.
Thailand	There are few historical tsunami disasters recorded like the Sumatra earthquake in 2004. However, it is planned to strengthen the earthquake and tsunami observation network after the earthquake.
Vietnam	There is no historical tsunami disaster recorded. However, the tsunami monitoring and warning system in Da Nang is working.

10.3.4 Volcano

There are no active volcano except for in Indonesia and Philippines. Therefore, no measure focus on the volcano can be found except for those countries.

Pyroclastic flow, lava flow, lahar and ash-fall are the major volcanic disasters. Pyroclastic flow, lava flow and lahar cause a catastrophic damage locally; on the other hand, ash-flow affects wide area by the trade winds and the subtropical westerlies.

Table 10.3.4 summarizes the findings regarding counter-measures taken for tsunami in ASEAN countries. Details are described inAppendixA9.4.

Table 10.3.4 Summaries of Findings: Volcano

Country/Region	Summary of Findings
Brunei	There is no historical volcanic disaster recorded and no measure is taken focusing on the volcano.
Cambodia	There is no historical volcanic disaster recorded and no measure is taken focusing on the volcano.
Indonesia	80 volcanic hazard maps are prepared by CVGHM. CVGHM has been operating the early warning system for volcanic eruption. However, increasing number and type of observation instruments are requested for improving the accuracy of volcanic eruption observation and prediction.
Lao PDR	There is no historical volcanic disaster recorded and no measure is taken focusing on the volcano.
Malaysia	There is no historical volcanic disaster recorded and no measure is taken focusing on the volcano.
Myanmar	There is no historical volcanic disaster recorded and no measure is taken focusing on the volcano.
Philippines	PHIVOLCS has set up observatories for six volcanoes and installed observation systems to monitor volcanic activity. It is requested to strengthen the current observation network for accurate eruption forecast necessary for long-term forecast, exact prediction and warning and evacuation order.
Singapore	There is no historical volcanic disaster recorded and no measure is taken focusing on the volcano.
Thailand	There is no historical volcanic disaster recorded and no measure is taken focusing on the volcano.

Vietnam	There is no historical volcanic disaster recorded and no measure is taken focusing on the volcano.

10.3.5 Cyclone (Typhoon) and Meteorological Hazard

Under the current framework of the WMO, leading countries implement the monitoring/detection of tropical cyclones on a regional basis. In this section, the situation and issues of National Meteorological or Hydro Meteorological Services (NHMS) will be described and discussed. Table 10.3.5 below shows the NHMS from ASEAN member countries of the WMO.

Table 10.3.5 NHMS in ASEAN countries

Country/Region	National Meteorological or Hydrometeorological Services (NHMS)
Brunei	The Brunei Meteorological Service http://www.bruneiweather.com.bn/
Cambodia	Department of Meteorology http://www.cambodiameteo.com/map?menu=3&lang=en
Indonesia	Meteorological and Geophysical Agency http://www.bmkg.go.id/BMKG_Pusat/Depan.bmkg (in Indonesian)
Lao PDR	Department of Meteorology and Hydrology http://dmhlao.etllao.com/
Malaysia	Malaysian Meteorological Department (MMD) http://www.met.gov.my/index.php?option=com_content&task=view&id=744&Itemid=952&lang=english
Myanmar	Department of Meteorology and Hydrology (DMH) http://www.dmh.gov.mm/
Philippines	Philippine Atmospheric Geophysical and Astronomical Services Administration http://www.pagasa.dost.gov.ph/
Singapore	Meteorological Service Singapore http://www.weather.gov.sg/wip/c/portal/layout?p_l_id=PUB.1001.4
Thailand	Thai Meteorological Department (TMD) http://www.tmd.go.th/en/
Vietnam	National Hydro-Meteorological Service (NHMC) http://www.nchmf.gov.vn/web/en-US/43/Default.aspx

Table 10.3.6 below shows the situation and issues of NHMS(s) in ASEAN countries as described mainly from the Internet.

There are shortages on surface weather observation stations in many countries in the ASEAN region. In addition, the improvement of these facilities, such as automated observatory and data transfer to forecast centers for analysis and forecast, is required. Problems with the network design of observation facilities have also been considered difficult to solve. However, to address this matter, several

countries are preparing to install Doppler weather radars which would be an effective way of observation in understanding rainfall distribution and monitoring the position and movement of cyclones in real time.

Table 10.3.6 Summary of Findings : Cyclone (Typhoon) and Meteorological Hazard

Country/Region	Summary of Findings
ASEAN	To carry out weather forecast, some NHMS(s) make an effort in using satellite data as well as forecast data from overseas organizations. It is necessary to enhance their capability for data analysis and such support in such endeavor is an urgent task. A disaster (flood) hazard increases as a consequence of climate change, especially in the urban areas which are vulnerable to this issue. Therefore, vulnerability to disaster in these areas is a major issue.
Brunei	The annual movements of the ITCZ and the associated "Trade" wind fields produce two main seasons in Brunei separated by two transitional periods. As numerical weather prediction products, precipitation and ensemble forecasts have been carried out. Currently, one radar is in operation.
Cambodia	Current equipment is already aging and outdated. A meteorological Doppler radar system was installed in 2012 for the improvement of accuracy in weather forecasting.
Indonesia	Surface weather observations, upper air observation, ocean observation, weather radar observations have been carried out. Weather forecast includes a medium-range (3-month) forecast. Fourteen weather radars are currently in operation (according to the homepage).
Lao PDR	Almost all surface weather stations in the country are manned observatories while the number of automatic weather stations is limited. In 2007, a C-band Doppler weather radar was installed in Vientiane.
Malaysia	The Central Forecast Office (CFO) was established in Headquarters Office in 1997. The CFO issues a comprehensive range of forecasting services to the general public and the mass media. The severe weather warnings issued by the CFO can be divided into the following types: (a) Thunderstorm warning; and, (b) Heavy rainfall and strong wind warning over land areas.
Myanmar	The DMH issues weather, coastal and aviation forecasts. Forecasts include information on hazardous weather to aircrafts (SIGMET) and cyclone information. However, the frequency of update is only twice in a day. It is planed that the Chaukpyu old radar will be replaced and a new radar will be installed in Mandalay and Yangon through the JICA project.
Philippines	PAGASA issues the following products and provides various services: (a) Weather forecast and tropical cyclone warning; (b) Flood forecasting and warning services; (c) Climatological and farm weather services; and, (d) Astronomical Services.

	The terms of forecast include very short (24 hours), short range (72 hours), middle range (7 to 10 days), long range (30 days) and seasonal (three month) forecasts. Currently, PAGASA has seven Doppler radars and seven more new Doppler radars will be installed. Three Doppler radars are installed in Aparri, Virac and Guiuan under the grant aid from the Government of Japan. A total of fourteen Doppler radars are programmed to be operational by 2016.
Singapore	Currently, NEA issues the following products and provides various services: (a) Weather information; (b) HAZE / PSI; (c) Detected Lightning Areas; (d) Detected Rain Areas; (e) Wind and Tide Information; (f) Flood Information; and, (g) Seismic Information. For now, the terms of forecast include 3-hour forecast, 12-hour forecast, 3-day and weekly forecasts.
Thailand	The TMD issues routine weather forecasts, tropical cyclone warnings, aviation forecasts and shipping and ocean waves forecasts. The terms of forecast include very short (24 hours), middle range (7 days), and seasonal (three monthly forecast and summer forecast) forecasts. The TMD has been using operational numerical weather predictions with resolutions of 100 km for the whole globe, 50 km for Southeast Asia and 17 km for Thailand. The TMD has also provided daily wave analysis and 24-hour wave forecasting charts to the general public. The domain covers the Gulf of Thailand, Andaman Sea and South China Sea.
Vietnam	The NHCMF is responsible for weather, marine, severe weather and hydrological forecasts. The terms of forecast include short range, middle range, monthly and seasonal forecasts. Two weather radars, one wind profiler, a communication system, a number of rain gauges and an automatic weather observation equipment will be installed, especially in the northern part of Vietnam, under the grant aid from the Government of Japan this year.

10.3.6 Landslide

Hazard assessment as a base of landslide countermeasure in large scale is conducting mainly in countries like Indonesia and Philippines. However, prepared monitoring systems are mainly for flood, monitoring for EWS for landslide has not been established yet. There is no large scale physical countermeasure without prevention for collapse in road slope.

Table 10.3.7 summarizes the findings regarding cuter-measures taken for landslide in ASEAN countries. Details are described in Appendix A9.6 Compiled Information and Data on Measures Taken for Natural Disasters-Landslide.

Table 10.3.8 summarizes Laws, Government organizations, rainfall observing office, early warning conducting office, hazard map preparing office and countermeasures conducting office in each ASEAN country. Blank cell means to be unconfirmed.

Table 10.3.9 is a list of on-going project about landslide hazard and assessment.

Table 10.3.7 Summary of Findings: Landslide (1)

Country/Region	Summary of Findings
ASEAN	Laws and organizations concerning landslide are not yet developed in some countries. Despite the assessment of national scale hazard about landslide using GIS is conducted in most countries, hazard assessment in specified location or small region is not yet prepared. There is almost no hard and soft countermeasure about landslide.
Brunei Seri Begawan	Landslide events are very few in this country, assessment of risk and vulnerability are very low level. Organizations about natural hazards and EWS have been developed and education and training also have been conducted.
Cambodia	The occurrence of landslide disaster in Cambodia has been unconfirmed and hazard risk is supposed to be low. There are on-going projects about early warning system and hazard mapping in connection with DHRW.
Indonesia	Improvement projects about landslide are conducted mainly by BNPB. Hazard maps are prepared in entire country even some of those scale are not large enough. SATLAKPB has been organized as a main body of disaster emergency command, actual situation of that has been reported in terms of framework, responsibility and roll in some pilot provinces. Significant subsidence of the ground in metropolitans (such as Jakarta, Bandon, Semarang) shall be assessed as a disaster of soils.
Lao PDR	Laws and governmental organizations are not yet developed. The project for early warning system is on-going.
Malaysia	Large-scale hazard map and economic loss assessment have been prepared mainly by National Slope Master Plan. Preparedness of EWS is on-going recently.
Myanmar	Laws and organization about disaster is not yet in place. Even MGS prepared hazard maps, experience storage and technical education are locking because of poor governance.
Philippines	Large-scale hazard map are available in most areas. Rainfall prediction is conducting in entire country, monitoring system about landslide movement is not yet conducted. Project of early warning system, hazard assessment and landslide monitoring system are implementing by mainly NDCC.
Singapore	There is no record and assessment about landslide in Singapore.
Thailand	Large-scale hazard maps are developing and early warning system for flashflood has been preparing. Countermeasure for road side slopes also has been conducting.
Vietnam	Hazard maps have not been prepared. Althougb EWS project in pilot regions was conducted, that does not perform well at present. Several Projects about EWS, landslide hazard analysis and

	management for landslide risk are on-going.

Table 10.3.8 Low and Organization concerning Landslide (2)

Country	Law & Responsible Organizations		Monitoring		Hazard Map
	Law	Organization	Rain	Warning	Province Level
Brunei	Disaster Management Order 2006	NDC	BDMS	PWD	
Cambodia	No.35 ANK 1995	CDM	DHRW	NCDM	
Indonesia	Disaster Management Law No.24 2007.4	BNPB BPBD	MBMKG	PU	ESDM
Lao PGR	2013?	DMCs	MNRE	DMH	
Malaysia	Water Act 1989	DMRC	MOSTI	MET	JKR
Myanmar	2012?	MDPA	DMH		MGS
Philippines	DRRM 2010	NDRRMC	PAGASA	PAGASA	DENR
Singapore		SCDF	NEA	NEA	
Thai	Disaster. Prevention and Mitigation Act 2007	DDPM	TMD	TMD	DMR
Vietnam	2013?	MARD	MONRE	MONRE	

Table 10.3.9 On-going project for landslide

Country	Targert	Indicative Program for GFDRR Funding	Partner	Area
Cambodia	Early Warning	Capacity building of Hydmet agencies for early warning and weather forecast systems	MOWRaM, NCDM	Entire Country
	mapping Early Warning	Consolidate Phase i gFDRR activities in Svay Rieng and Prayveng provinces/expand to 3 provinces of eastern Mekong Delta	various relying on comparative advantage	Rieng and Prayveng provinces
Lao PDR	Early Warning	Capacity building of Hydmet agencies for early warning and weather forecast systems	DMH, WREA, NDMO	Entire Country

Philippines	Mapping and assessment	National geo-hazard Mapping and assessment	DENR; PHIVOLCS, PAGASA	Entire Country
	Early Warning	Upgrading the forecasting capability of the Philippine atmospheric, geophysical and astronomical services administration (PAGASA) and the Philippine institute of volcanology and seismology (PHIVOLCS)	MMDA	Metro Manila
Indonesia	Disaster Reduction	Australia Indonesia Facility for Disaster Reduction	various relying on comparative advantage	Entire Country
	Disaster Reduction	support for the establishment and capacity building of national, provincial and local disaster management agencies, leveraging government and other donor programs	BNPB	Entire Country
	Disaster Reduction	technical assistance for the development of national and regional risk and impact assessment frameworks, tools and methodologies	BAPPENAS,BNPB	Entire Country
Vietnam	Disaster Reduction	strengthening institutional systems and processes to enhance coordinated and integrated DRR actions and adaptation to global climate change, at national and provincial level	various relying on comparative advantage	Entire Country
	Disaster Reduction	Collection of relevant existing hazard, vulnerability and exposure data	MONRE	Entire Country
	Early Warning	Strengthen the hydrological and meteorological capability	MONRE	Entire Country

Data Source Disaster Risk Management Programs for Priority Countries World Bank, UNISDR (2011)

REFERENCES

1) JICA (2012). Data Collection Survey on ASEAN Regional Collaboration in Disaster Management.
2) Website of the following institutions and reports accessible from them. URLs and accessed date are given in Appendix A9, "URL" and "Year", respectively.
   Asian Development Bank
   Asian Disaster Reduction Center
   Embassy of Japan in ASEAN member countries
   Government organization in member countries
   JICA
   Ministry of Foreign Affairs of Japan
   PreventionWeb
   World Bank
3) World Bank, UNISDR (2011). Disaster Risk Management Programs for Priority Countries, 2nd edition

CHAPTER 11 DESIGN OF GIS AND DARABASE

11.1 Overview

In order to organize systematically, various types of data were collected in this project. To investigate the information system and the database of AHA Centre a survey was conducted. In this chapter, the concept of the database is built, and a detailed design of GIS databases is described.

11.2 Survey on the Information System of AHA Centre

11.2.1 Overview of information system

As the role of the AHA Centre, there are disaster response and disaster monitoring facilities to serve the ASEAN region. Systems to support those operations are being introduced or deployed.

(1) Disaster Monitoring Response System (DMRS)

It is a disaster monitoring system through Web, which was introduced from the United States. It is a mechanism for data to display the world disaster map on the monitor. The map is updated from time to time. In the ASEAN region, the disaster information originating from (PDC) Pacific Disaster Center is a major one. The data is distributed through internet and DMRS, the AHA Centre receives these information by the Web Streaming technology. These information are not stored in the database. It is also not equipped with downloading capability, the ability to output file format or the information displayed on the monitor..

(2) Web EOC

This is a Web system for information sharing that is being introduced by the (share) NTT Learning systems in Japan. It is equivalent to the package and system which corresponds to the operation command system on the Web site of the United States (Incident Command System, ICS). Messages that you have written on the window of the system by introducing this branch of the international system is shared by all branches. In addition, phone instructions to the staff can also be sent to rush in case of any emergency. The AHA Centre is expected to be completed in June, 2013.

(3) GIS

ArcGIS10.0 of ESRI has been installed. ArcView, the basic type has three licenses and ArcEditor, the standard type, has one license. ArcEditor has been installed on the server machine. Although AHA Centre would like to proceed with the construction of the geo-database in the future, they are working for establishing a clear policy for the database at present.

11.2.2 Equipment in AHA Centre

There are 20 PCs, printers, plotter, and Fax in the centre. A list of the equipment is presented in Table 11.2.1.

Table 11.2.1 List of major information and communications equipment

Category	Number	Specification
Main Server	1	CPU: Xeon Memory: 6GB DDR HDD: 6TB
PC	20	(Example of high end machine) Manufacturer: Dell Model: Studio XPS 9100 Rating: 5.9 (Windows Experience Index) Processor: Intel® Core™ i7 CPU 3.2GHz Memory (RAM): 12.0GB HDD:925 GB System type:64-bit Operation System OS: Windows 7 Home Premium
Printer	Color: 3 B/W: 1	
Plotter	1	
Fax	1	

11.2.3 Technical Staff in AHA Centre

13 staff are working in the AHA Centre. Six of them are technical. Table 11.2.2 shows a summary of the technical staff. Three of the technical staff are responsible for the duty in the sites in the event of a disaster. (No.4-6 in the table)

Table 11.2.2 List of Technical Staff in AHA Centre

No	Specialty	Position
1	Civil Eng. (Hydrology)	Senior Disaster Monitoring and Analysis Officer
2	Comp. Science (Geo informatics)	Disaster Monitoring and Analysis Officer
3	IT	Technology Officer
4	Emergency Assessment	
5	Logistic Support	
6	Emergency Response	

11.2.4 The current state of information sharing with AHA Centre and focal points of the ASEAN

It cannot be said that sharing information with AHA Centre and its focal points is progressing enough. For example, It was confirmed that BNPB (Badan Nasional Penanggulangan Bencana, National Disaster Management Agency), a focal point in Indonesia did not share national hazard risk data with the AHA Centre.

11.3 Concept of GIS and Database in the Project

Although the AHA Centre has GIS software, a clear policy specifically how to use them is still under development. Therefore, it may be possible to propose some design of database with a certain degree of initiative.

Main Server in the AHA center, where ArcEditor is installed, may be constructed according to data "geodatabase". It is a database which has the GIS features based on coordinated information. The image that was built on Main Server geodatabase is shown in Figure 11.3.1.

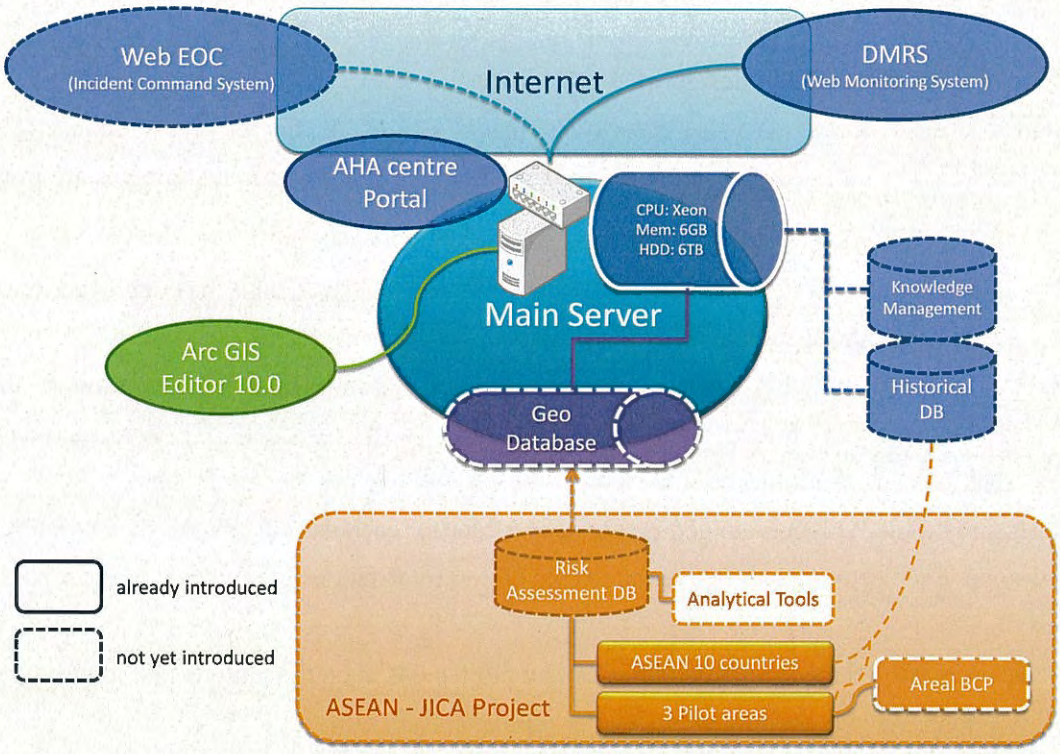


Figure 11.3.1 Concept of the Database and System in AHA Centre
(dotted line: Scheduled to introduce the future)

11.3.1 Challenges in the integration of information with the AHA Center case study

As mentioned in the introduction, database systems and AHA Center itself is in the stage of development, it is necessary to discuss the integration with the results of this project. A list of the proposals and issues is presented below.

- It was learnt that the AHA Centre will promote accumulation of data to prepare a disaster history database ("History DB" in the Figure 11.3.1). Although it is uncertain when the development of this database will start, it is considered to integrate it with the output of this project.

- Since Portal Site of the Internet has been completed at the AHA Centre, it is effective to open the results of this project through the web site.
- If Web EOC or DMRS were in conjunction with the risk assessment, it may be possible to develop such as real-time damage assessment tool.
- Since both systems are packaged applications, technical difficulties are expected to share information and develop some tools in collaboration with the output of the project.
- In order to develop in collaboration with described systems and the database, more specialized research and development are necessary. Specialized experts are expected to implement them.

11.3.2 Strategy of the detailed design of the database

The detailed design of the database has to be made as one of the project outputs. Thus the investigation will be continued. However, for the time being, the fundamental strategies are presented below.

- GIS software: ArcGIS Desktop will beused, because AHA Centre has deployed it and it is specified in the specification of the project.
- Database: It will be divided into two folders, "Natural_Hazards" according to the risk assessment and "Social_Conditions" according to the regional BCP. And, geo-database, data files, or sub folders will be placed immediately below the two folders.

Natural_Hazards folder will contain geo-database or folder for each natural hazard, such as earthquake, flood and so on. Each geo-database will contain data tables, total data tables and data tables separated by countries.

- ➢ Country, State level data tables can be plotted based on the latitude and longitude in GIS map.
- ➢ Other collected hazard maps will be copied in folders.

Social_Conditions folder will contain the following geo-database or folders. Additionally these data can be divided by industrial clusters for the output 2.

- ➢ Industrial cluster
- ➢ Social infrastructure
- ➢ Economic and trade

Remarks

- ✧ Geo-database format shall be Personal geo-database that is associated with MS Access.
- ✧ If some data distributes over a country, ASEAN will be entered in the file name.

11.3.3 Data Sharing with Focal Points

- If the shared data are files only, it is sufficient to use online storage services, such as N Drive, Google drive or Dropbox. If it should be shared on GIS mapping, ArcGIS Online can be considered.
- Meaning of open to the public through Web and data sharing is slightly different. If only the sharing of data is required, the above-mentioned method of Online Storage Service is sufficient. If they want to open the outputs through Web, it is considered to use the AHA Centre's Web Site for downloading files and ArcGIS Online for web mapping.
- Current coordination between AHA Centre and the focal points is not sufficient. However, such data sharing system as described above can be easily introduced among them.

CHAPTER 12 RECORDS OF THE STUDY TRIP 1

12.1 Outline of Study Trip 1

The study team visited six ASEAN countries: namely, Indonesia, Philippines and Vietnam as pilot countries, and Singapore, Malaysia and Thailand as resource countries for the following purposes. In addition, the study team visited Industrial parks in pilot countries and Thailand (Shown in Figure 12.1.1).

1) Coordination with AHA Centre (ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management)
2) Educational activities and coordination with relevant organizations in the pilot countries
3) Selecting panel members in pilot and resource countries
4) Carrying out survey on existing conditions of AHA Centre data network system

Figure 12.1.1 Visited Countries and Industrial Parks

The study trip was conducted from 10th of February to 9th of March, 2013. The detail schedule of study trip, participants and places visited are shown inA12.1, list of interviews is shown in Appendix12.2 and list of contact person is shown inAppendix12.3. Study findings of AHA Centre data network system are written in Chapter 10.

12.2 Coordination with AHA Centre

The study team visited AHA Centre on 11 and 15 of February, 2013 and got the following agreements.

1) AHA Centre would be a collaborative organizer of the Study.
2) Raw data, which were collected and used for processing shall be shared with AHA Centre.

3) The study team shall conduct trainings for the staff of AHA Centre and ASEAN member countries about risk assessment and area BCP based on the results of the study.
4) Junior researchers of ASEAN member countries shall participate in the study for developing their abilities.
5) Needs for Study trip in 10 ASEAN member countries shall be decided by 10 ASEAN member countries based on the results.
6) Study trip in 10 ASEAN member countries will consist presentations in the workshops of AADMER (ASEAN Agreement on Disaster Management and Emergency Response) and Risk Assessment Early Warning Working Group (RAEWM WG) which will be held on 24 – 25 April 2013, and get approval in the next ACDM Meeting in Hanoi by the end of May.

12.3 Educational activities and coordination with relevant organizations at the pilot countries

The study team introduced the study, conducted educational activities and called on assistance and cooperation for main government agencies, focal points of AHA Centre, and local administrative organs at pilot countries. The meeting result of study trip is shown in Appendix12.4.

12.4 Study for panel members in pilot countries and resource countries

The study team visited AHA Centre, main government agencies, focal points of AHA Centre, Universities, research institutions and received recommendations for candidates for the post of Panel members as shown in Appendix12.5.

CHAPTER 13 ANALYSIS ON ASEAN PHYSICAL DISTRIBUTION NETWORK

13.1 Understanding of Supply Chain Circumstances

13.1.1 General Matter

The system of supply chain has been planned and developed by each company as concrete measures of supply chain management which is governed by the company's development strategy.

The supply chain, therefore, has a matrix structure which is a connection of materials and goods distribution through distribution facilities in their flow channel, with kinds, numbers of those facilities in geographical arrangement are the key elements for keeping a company advancing.

The vertical channel is the process which consists of procurement of materials, manufacturing in a plant, goods shipment to physical distribution centers, delivery depot and stores in the end, where the goods are consumed.

These distribution facilities have been arranged to locate along with a corporate marketing strategy, as the world economy develops globally.

To a corporate department dealing with products distribution, the problem is how they achieve maximizing customers' satisfaction and increasing cash flow in confronting various changing conditions in terms of marketing, innovation of information technology, global environmental conservation movement and so on, which surround corporate management.

Nowadays, a bold challenging spirit and wide range of views in management ability are required for a physical distribution manager in order to promote a new logistics management.

Asia, ASEAN region is considered to play a new driving role to lead growth of world economy in place of such advanced economy countries/ regions as North America, EU and Japan.

These days, the progress speed of ASEAN countries in developing industrial parks, special economic zones (SEZ), which have so far been constructed by foreign and/or their own direct investment, has been accelerated in more accelerated rate.

As a result of the above movement along with ASEAN economic growth, middle class citizens are increasing mainly in big cities in which money, culture are accumulated by attracting peoples form outside.

Indices expressing the kind of general power of a city are given as follows:

Table 13.1.1 General Power of big city in ASEAN Countries

Name of Big City	City Area Population (x1000)	Per Capita GDP(US$)	Station Density of Mass Rapid Transit(Per km^2)	Shops Index [1] (0~100)	Number of Doctor (Per million population)
Jakarta	26,060	9,879	-	-	-
Manila	20,760	6,039	-	-	-

Ho Chi Minh	8,310	3,,161	-	-	-
Bangkok	7,150	11,420	0.04	54.6	282
Kuala Lumpur	6,090	16,486	0.32	76.2	991
Singapore	5,150	43,358	0.19	63.0	1,597
Reference:					
Tokyo	37,120	46,358	1.06	61.5	3,332
Shanghai	20,860	11,010	0.50	57.4	2,228
Hong Kong	7,100	31,575	0.09	83.3	2,655
Taipei	8,330	26,708	0.35	48.9	3,556
New Delhi	22,240	3,199	-	40.1	-
Mumbai	16,910	-	0.10	-	768

Source: Asia Business Map of Nikkei article dated on 19.Feb. 2013

1) Shops Index is developed by Global Blue Inc. who is one of biggest agent in providing duty free procedure services to customers, and the index represents how shoppers can enjoy shopping by using numbers of malls, integration of name brand shops, period of sales and forfeit items to genuine goods.

What should be considered in grasping a real status regarding supply chain is that analysis through past statistics can imply the direction of the interest to some degree, but through reading the past data it will be difficult to get present and to foresee future dynamism of supply chain management.

In addition, this investigation work is not able to go into individual companies for the purpose of understanding current and futuristic innovative trend in the field of supply chain management.

Therefore, this investigation work is executed to grasp as much current conditions of supply chain management as possible, by the following other information and data obtained in the same investigation works:

(1)Civil infrastructure

(2)Industrial agglomerated area, so called industrial park/estate

(3)Economic and industry analysis

(4)Industries and the products manufactured in selected industrial parks

(5)Existing published information/data

The term of "Physical distribution network" is defined to be a functional portion of supply chain management which is weighed more physical transportation activities in the process of materials and products distribution.

In general, risks arisen from natural disasters will be dependent on geological and topographical conditions in industrial agglomerated area and locations of infrastructures facilities, however, these factors are not discussed in this physical distribution network investigation, except for somewhat date related being available.

13.1.2 Relation to Industrial Agglomerated Area/Industrial Park Investigation

Industrial Agglomerated Area/Industrial Park is referred to be as an industrial park, hereinafter.

For the investigation purpose, typical industrial parks were selected by referring to web site of ASEAN-JAPAN CENTER (AJC)

The lists of AJC web-site have no specific time of investigation by year/month, but it is considered that the general current status of industry agglomeration can be obtained.

After the separate investigation of this theme is completed, the new information will be able to make this section work more exact and precise as situation requires.

The selection criteria of industrial parks are as follows:

(1) Distributing balance in the geographical locations.
(2) Ample operational experience
(3) Adequate industrial park scale and number of lessee companies
(4) Other specific features to be looked into, if any

The reason why Japanese affiliated companies were selected as an objective is the followings:

(1) The government of Japan has been contributed to economic development of ASEAN countries and regions by ODA.
(2) Coincidentally, Japanese companies have a lot of investment onto the ASEAN member countries.
(3) As the course of the investment activities has continued constantly, the Japanese affiliated companies have positioned to be top rank share or the equivalent, comparing with those companies from other western advanced countries.
(4) Therefore, it is considered reasonable that managerial activities by Japanese affiliated companies can represent and forecast whole actual states of supply chain by other foreign countries.

(1) Brunei

Table 13.1.2 Industrial Park in Brunei

Item	Industrial Park Name				
	Serasa	Lambak Kanan(west)	Pekan Belait	Serambangun	Muara SEZ
Features of location					
Place	Serasa	Lambak Kanan	Pekan Belait	Serambangun	Muara Port area
Topography, etc					
Access					
From City:Bandar Seri Bugawan	25km to east	15km to east	108km to west	48km to west	25km to east
Port					
Air port					
Infrastructures : Each industrial park are provided with fundamental infrastructures such as roads electric power, telecommunication facility, water supply, sewerage, and so on					
Road	• Roads network consisting of expressways, linking roads, transverse viaduct, and rotary-type interchange in whole area of Brunei has been developed. • One of the most advanced road networks in Muara district is 20 km length of the expressway along coastalline from Muara to Totonh through Jerdongh which is completed in 1983. • Road networks in Brunei extend to those of Sabah and Sarawak states in Malaysia				
Port: Muara Port	• Muara Port which is located in about 28 km distant from capital city of Bandar Seri Begawan, is a main gateway of international trade. 90% of export/import traffics is handled in Muara Port, except for oil and gas. • Facilities of Muara Port are utmost level in the region. It is noted that the Port facilities and operation services have been privatized in order to satisfy customers' needs by quality port operating services and advanced container terminals.				
Air port	• Brunei International Airport is a key airport of 15 minutes form City central and of international linkage of air transport which is fully equipped with state of the art technology and 24 hours operation services since 1974.				
Electric power					

Gas					
Water supply					
Sewerage					
Telecommunication	• Telecommunication in Brunei is in high grade, which use of ICT is ranked 52 of 180 countries of the world. • As far as mobile phone services are concerned, B. Mobile began 3.5 G high speed internet services, so as to provide continuing improved services to customers.				
Remarks	• No Japanese affiliated company as a lessee is available.				

(2) Cambodia

22 numbers of SEZ are registered, including developments under way.

Table 13.1.3 Industrial Park in Cambodia

Item	Industrial Park Name				
	Phnom PenhSEZ	Manhattan SEZ	Sihanoukville SEZ 1	Neang Kok Koh Kong SEZ	Muara SEZ
Features of location					
Place	National Road No. 4, Khan Dangkor, Phnom Penh	Bavet Commune, Chantrea District, Svay Rieng Province	Stung Hav District, Sihanoukville City	Neang Kok Village, Pakkhlong Commune,Mundul Seyma Destrict, Koh Kong Province	
Topography, etc.					
Access					
From City:	18km from central Phnom Penh	160km from Phnom Penh		297km from Phnom Penh 470km from Bangkok	25km to east
Port					
From Air port	8km	65km from Ho Chi Minh Airport	3km from Sihanoukville Airport 210km from Phnom Penh		
Infrastructures :					
Road	• Total extension length of roads network in Cambodia is 39,704 km, and that is divided into three categories, 5,263 km national road, 6,441 km state road and others. All roads are administered by Ministry of Public Works and Transport (MPWT). • National roads No.1 and No.5 are parts of the Asian-highwayNo.1, and Nos. 4, 6 and 7 are a part section of the Asian-highway No.11, and Nos.48, 3, and 33 are a part of Asian-highway No. 123. • National roads No. 66 and 78 form a part of a trunk route of expressway of GMS （Greater Mekong Sub-region） .				
Railway	• Railway in Cambodia is positioned as a part of GMS railway network. • This GMS railway network is planned to be connected with Vietnam, and further on from Kunming to Singapore in future, which is an essential subject of ASEAN • New construction projects of container yards in railway stations between Sihanoukville Port and Sihanoukville city, in order to cope with demand of container transport.				
Port	• Sihanoukville Port is only one deep sea port in Cambodia. The Port has been extended to have 12 berths with advanced cargo handling equipment and facilities. • Development of SEZ adjacent to container yards of the Port commenced in Oct. 2009 by aid of Japan.				
Air port	• Cambodia has 11 number of airports now. Of those, Phnom Penh International Airport (PPIA) and Siem Reap International Airport are only able to accommodate international airlines services. • Sihanoukville State-run international airport is planned to commence operation early in 2010.				
Electric power	• Government of Cambodia has already decided the Electricity Development Plan from 2008 through 2020, to meet increasing power demand. • Along with the Plan, transmission network is underway. • Import of electricity has still continued form neighbor countries.				
Gas					
Water supply	• Phnom Penh Water Supply Authority (PPWSA) and Siem Reap Water Supply Authority(SRWSA） provide water supply in Phnom Penh and Siem Reap, respectively since				

	1996.				
Sewerage					
Telecommunication	• 98.8% of subscriptions is user of mobile phone. • International telephone service by VoIP (Voice over Internet Protocol) is available over almost all countries in the world by every mobile service providers. • Internet services are operated by Cam Net which Ministry of Telecommunication introduced in 1997, by assistance of Canadian International Development Research Center (IDRC) . • Now, two thirds of land in Cambodia is covered by optical fiber cable network.				
Remarks	• 20 number of lessee Japanese affiliate companies operate.(food, apparel, miscellaneous daily life goods, mechanical parts, electrical parts)		• 2 number of lessee Japanese affiliate companies operate. (electrical appliances, etc.) • There exist another 5 SEZ in Sihanoukville area.	• 2 number of lessee Japanese affiliate companies (Yazaki and Mikasa) operate.(sport goods,byMikasa) • There exist another 2 SEZ in Koh Kong area.	

(3) Indonesia

Indonesia of which land area is 5 times as large as Japan's, has that many of 77 industrial parks in 18 states. Approximate 70 % of all industrial parks exist in Jawa Island.

Industrial parks in which many Japanese affiliate companies are operating, agglomerate in the region between Jakarta and Cikampek of west Jawa state.

Among these parks, Karawang International Industrial City (KIIC) is selected as typical one, which locates further down from Jakarta, but can represent developed level of infrastructures.

In Batam Island, there exist Batamindo Industrial Park (BIP) which has 39 Japanese affiliated companies. However, it supposed to belong to Singapore economic zone from supply chain point of view. Therefore, this BIP is excluded from the objective park under Indonesia.

Table 13.1.4 Industrial Park in Indonesia

Item	Industrial Park Name
	Karawang International Industrial City (KIIC)
Features of location	
Place	Karawang
Topography, etc	37~47m above sea level
Access	
From City:	56km (about 2 hours' drive) from central Jakarta
Port	60km (about 2 hours' drive or less) to Tanjung Priok Port
From Air port	80km (about 2 hours' drive or less) to Soekarno-Hatta International Airport
Infrastructures :	
Road	• An interchange of the Expressway between Jakarta and Cikampek which has 4 lanes on one direction, has already been constructed and in service at the vicinity of the KIIC entrance. • In KIIC, trunk roads are of 4lanes in both directions in 37~47 m wide road area, and general roads are of 2 lanes in both direction in 29m and 10 m road areas.
Railway	N/A
Port	Approximately 2 hours' drive to Tanjung Priok Port
Air port	Do. to Soekarno-Hatta International Airport
Electric power	PLN provides electricity with 3 substations with 60 MW of capacity.
Gas	PGN provides natural gas.
Water supply	Industrial-use water supply has capacity of 30,000ton/day in 24hrs service.

Sewerage	After each company treats waste water primarily, the waste water is secondarily treated in KIIV water treatment plant, and then discharged into Citarum River.
Telecommunication	1,000 external lines are provided by Telekom.
Remarks	• KIIC developer is Maligi Permata Industrial Estate who is equal shared joint company of Itochu and Sinarmas group. • Development area will be 1,139 ha in the end of Phase 3 scheme completion. • 49 Japanese affiliated companies are operating.

(4) Lao PDR

Lao PDR is geopolitically unique landlocked country, surrounded by China, Vietnam, Cambodia and Thailand.

Three industrial parks are listed at the investigation time.

Laos is expected to develop its economy in line with economic expansion of surrounding countries by horizontal international specialization and resulting progress of supply chain, toward ASEAN economic unity in 2015.

It is said that an agreement may be reached among Laos, Thailand and Vietnam by which they will liberalize physical transportation across the borders, and then their trucks can go over the borders with each other. This momentum will drive to develop supply chain of intermediate products manufactured in Lao PDR.

Table 13.1.5 Industrial Park in Lao PDR

Item	Industrial Park Name		
	Savan-Seno	PSEZ(Phoukhyo Specific Economic Zone)	VITA Park
Features of location			
Place	• Phetsalad Road, Khanthabouli District, Savannakhet Province, Lao P.D.R. • Government of Lao PDR has planned to develop SEZ Savan-Seno at the junction of the East-West Corridor (From Vietnam to Myanmar through Laos and Thailand) with North-South national road No. 13.		
Topography, etc			
Access			
From City:		5 km from Thakhek actual City	20 minutes from Vientiane by car, and also from No.1 Friendship Bridge
Port			
From Air port		350 km from Wattay International Airport	
Infrastructures :			
Road			
Railway			
Port			
Air port			
Electric power			
Gas			
Water supply			
Sewerage			
Telecommunication			

Remarks	• The plan of SEZ consists of Site A (305ha) and Site B (20ha), adjacent to No.2 Friendship Bridge • Logitem Laos GLKP Co. Ltd. (Japan Logistics Systems Corp. affiliated) deal with international cargo transport, forwarding, hozei warehouse, and truck terminal operation)	✓	

(5) Malaysia

Malaysia has that many of 296 industrial parks all over in 13 states.

The industrial parks in which Japanese affiliated companies have factories, are agglomerated in the regions of Selangor State in which Capital city Kuala Lumpur and Port Kelang locate, Penang State which has Penang Port, and Johor State facing Singapore.

Johor State is considered to belong to Singapore economy by connecting road on the causeway from supply chain point of view.

Therefore, industrial parks in Selangor and Penang States are selected.

Table 13.1.6 Industrial Park in Malaysia

Item	Industrial Park Name		
	Shah Alam Section 15, 15, 21, 22, 23	Hicom Industrial Valley, Shah Alam	Prai Industrial Park
Features of location			
Place	Shah Alam 40200	Shah Alam	13600 Prai, Penang
Topography, etc			
Access			
From City:	40km From KL by Federal Highway	7km from Shah Alam 30km from KL by Federal Highway	20km from George Town
Port	25km from Kelang Port	20km from Kelang Port	
Air port	50km from KL Airport	60km from KL Airport	25km from Penang Airport
Infrastructures : No significant problem regarding infrastructures of roads, electricity, telecommunication, and so on.			
Road			
Port:	Kelang Port is the biggest of ports in Malaysia, located on the west coast in Selangor State. The Port consists of North, South, and West Ports		
Air port			
Electric power			
Gas			
Water supply			
Sewerage			
Telecommunication			
Remarks	• Total development area:343ha • Features: High tech. IT industries • Japanese affiliated companies: 37 companies	• Features: High tech. IT industries • Japanese affiliated companies: 47 companies	• Total development area:934ha • Japanese affiliated companies:61compaies

(6) Myanmar

There are 32 so-called industrial parks in Myanmar, but information about foreign companies' embarkation is not available.

In 1988, the Government introduced open market economy policy for the purpose of inducing foreign direct investment, which intends driving domestic private sector economy activated. Consequently in November 1988, "Federal Foreign Investment Law" was legislated, whereby environment of foreign investment was further improved.

Stipulation in the law is very simple and the most advanced on openness to foreign investment among the equivalent laws of other foreign countries, by installing various grace measures.

As the Government was transferred from military to civil regime, USA lifted the economic sanction in July 2012.

Successively, the government of Japan changed the policy against Myanmar, resulting in accelerating economic cooperation by not only public sector, but also private sector.

Typical case is Thilawa SEZ Development Plan, close to Yangon, which has already implemented by public-private joint operation, upon Myanmar's request.

Until 2015, one fifth area of total development area of 2,400 ha will be completed, so that Japanese and other foreign companies may start operation.

Table 13.1.7 Industrial Park in Myanmar

Item	Industrial Park Name		
Features of location			
Place			
Topography, etc			
Access			
From City:			
Port			
Air port			
Infrastructures :			
Road			
Port:			
Air port			
Electric power			
Gas			
Water supply			
Sewerage			
Telecommunication	✓		
Remarks	✓	✓	✓

(7) Philippines

In Philippines there are 108 industrial parks in 17 regions, it is featured that Japanese affiliated companies operate conversely in the regions of Macati, Nynoi Aquino International Airport district, and Cebu.

Industrial Parks are selected from the above regions as follows:

Table 13.1.8 Industrial Park in Philippines

Item	Industrial Park Name		
	Cavite Economic Zone	Laguna Technopark	Mactan Export Processing Zone
Features of location			
Place	Cavite		
Topography, etc			
Access			
From City:		45km to south from Makati in Metro Manila	14km from Cebu city
Port			
Air port	40km from Nynoi Aquino International Airport		1km from Mactan International Airport
Infrastructures : From PEZA Information			
Road	As of 2010, length of expressway totaled to 296 km and national roads' was 29,898 km with pavement ratio of 75%.		
Port:	Manila Port is close to Cavite and Laguna, Cebu Port is for Mactan		
Air port	Ninoy Aquino International Airport is located at Pasay city in Metro Manila		
Electric power	Adequate, clean and uninterrupted power supply		
Gas			
Water supply	Adequate water supply		
Sewerage	Waste water treatment facilities		
Telecommunication	State-of-the-art telecommunications facilities Computer security and building monitoring system		
Remarks	96 Japanese affiliated companies of total foreign companies' of 382 operate.	51 Japanese affiliated companies operate.	120ha industrial estate with tax free preference

(8) Singapore

Singapore has 56 industrial parks in total, Jurong Industrial Estate overwhelms others in terms of scale, history, and administration services.

Singapore is an island country with population of 5.2 million in 712 km2 land area, which profess itself "Garden City". The whole area of the country is said to be the most advanced industrial agglomeration, having fully equipped with not only infrastructures, but also soft industry of various services

Jurong Industrial Estate is detailed below:

Table 13.1.9 Industrial Park in Singapore

Item	Industrial Park Name
	Jurong Industrial Estate
Features of location	
Place	Jurong Town
Topography, etc	
Access : Expressway network, MRT and bus lines are developed in high level	
From City:	15~20km to central area of city
Port	Port of Singapore is one of the foremost international hub ports in the world.
Air port	34km from Changi Airport
Infrastructure : Almost all infrastructures have been kept in high quality.	
Road	Very few traffic congestion due to well controlled traffic administration such as one way and CBD regulation.
Port:	As mentioned above.

Air port	First grade international airport with passenger terminals No. 1~No.3.
Electric power	Rare voltage fluctuation and power failure
Gas	City gas provided by Power Gas House delivery service available
Water supply	Good quality potable water provided by PUB (Public Utility Board)
Sewerage	PUB sewage system spreads over the whole land.
Telecommunication	Fixed subscription, mobile and internet services are provided by Singtel
Remarks	• Jurong district is an industrial complex of oil refinery, petrochemical, steel and machine manufacturing, and etc. • Recently, the district forms a center of excellence industries like bio-science related, medical and electronics devices. • 180 Japanese affiliated companies operate.

(9) Thailand

Thailand has 73 industrial parks in 23 prefectures/ megalopolises regions. The regions where Japanese affiliated companies operate, being enumerated in the order of the numbers, 209 in Chon Buri, 116 in Samut Prakan, 109 in Rayong, 103 in Ayuttahya, and 85 in Phathumthani prefectures and 62 in Bangkok megalopolis. Almost all those industrial parks are located along coastal area of Bight of Bangkok.

Of the above industrial parks, the following 4 parks are selected as listed below:

Table 13.1.10 Industrial Park in Thailand

Item	Industrial Park Name			
	Bang Poo Industrial Estate	Rojana Industrial Park	Amata Nakorn Industrial Estate	Eastern Seaboard Industrial Estate(Rayong)
Features of location				
Place	Samut Prakan	1 Moo 5, Rojana Road (Highway No. 309), Tambol Kanharm, Amphur U-Thai, Ayutthaya 13210.	Chon Buri	Pluak Daeng District, Rayong Province
Topography, etc			Land elevation offered to a minimum of 1.8 meters above MSL	
Access				
From City:	37km south from Bangkok	90km north from Bangkok 7 km to Ayutthaya City	114 km east of Bangkok	150 km driving from Bangkok
Port	Close to The Map Ta Phut Industrial Port		The estate is located close to a deep-sea port	45km from Laem Chabang Deep Sea Port and 49km to Map Ta Phut Deep Sea Port
From Air port				
Infrastructures :				
Road			Amata City Industrial Estate is located on Highway No. 331 in Rayong province, in the heart of the Eastern Seaboard of Thailand.	Access from Highways 331
Railway		5 km to Ayutthaya Railway Station		
Port		112 km to Laem Chabang Port		30 kilometers from the Laem Chabang port
Air port		43 km to Bangkok International and Domestic Airport and90 km to Suvarnabhumi		122km from Suvarnabhumi Airport

		Airport		
Electric power		Substation of PEA 80 MW, 22 kV and 115 kV	Provincial Electricity Authority(PEA) Substation in estate, 22KV	GHECO-One Co., Ltd. to supply power to Electricity Generating Authority of Thailand (EGAT).
Gas		Available from PTT Public Company Limited	Amata Natural Gas Distribution, Metering Regulation Station in the estate	Eastern Pipeline Services Company Limited provides piping distribution for, steam and industrial gases
Water supply		Average10 cu.m. per rai per day	Sri-Yad Dam, Capacity: 10 M.m3/ Year 2. Reservoirs and lakes at Amata Nakorn, Capacity: 9 M.m3/ Year Water treatment plant in estateCapacity: 44,000 m3/ Day	200,000 cubic meters per day
Sewerage		26,000 cu.m. per day	Treatment plant in estate, Capacity: 20,000 m3/ Day	100,000 cubic meters treatment of wastewater per day
Telecommunication	✓	✓	Provided by TOT (Telephone Organization of Thailand) and TT&T (Thailand Telephone and Telecommunications) fibre optic cables; ISDN available	High Speed Telecommunications Network: Constructed and managed by CAT Telecom Public Company Limited, the telecommunications infrastructure uses the Fiber To The Factory (FTTF) platform. Hemaraj is the first industrial estate developer in Thailand to provide FTTF service in industrial estates.
Remarks	• 74 Japanese affiliated companies operate.	• Total land area:1,164 ha • Major Target Industries: Electronic Products and Automotive Parts • 74 Japanese affiliated companies operate	• Total area to date:1,353ha • Major Industries: Automotive, Electronics, Consumer Goods, Light Industry • 188 Japanese affiliated companies operate	• See Note • Total area to date:2,799ha • 58 Japanese affiliated companies operate.

Source: For general information, web-sites of Industrial Estate Authority of Thailand and web sites of the above estates are referred.

Note: In Eastern Seaboard Industrial Estate (ESIE), General Motors and Auto Alliance Thailand (a joint venture between Ford and Mazda) are also ones of automotive manufacturers. They produce one-ton pickups and sedans both for the local market and for export to over 130 markets. The presence of these world-scale auto manufacturers has attracted first, second and third tier parts manufacturers to Hemaraj's automotive cluster for them so as to optimize logistics and supply chain management.

(10) Vietnam

Vietnam has a lot of industrial parks in 63 regions including 5 specially designated Cities (SDC), administered by the central Government.

In particular, the important industrial parks from supply chain point of view are the ones located in the above SDC, that is, Hanoi, Ho Chi Minh City, Haiphong, Da Nang and Can Tho.

The above five SDCs have 52 industrial parks in total, in which 1,040 foreign affiliated companies have been operating. Of that many number, 165 companies are Japanese ones.

The selected industrial parks have larger number of Japanese affiliated companies than others.

Table 13.1.11 Industrial Park in Vietnam

Item	Industrial Park Name		
	Thang Long IP	Tan Thuan EPZ	Nomura-Haiphong Industrial Park
Features of location			
Place	Dong Anh District, Ha Noi	Tan Thuan EPZ, Tan Thuan Dong Ward, District.7, Ho Chi Minh City	An Duong District, Hai Phong City
Topography, etc		Geology: Hard soil	
Access			
From City:	16km from central Ha Noi	To Ho Chi Minh Center: 4km	85 km East of Ha Noi.
Port	120km from Hai Phong Port	Sai Gon Port:	15 km from Hai Phong Port.
From Air port	14km from Noi Bai Internatinal Airport	To Tan Son Nhat International Airport : 13km	20 km from Cat Bi Airport
Infrastructures :			
Road	Highway connecting central Hanoi with Non Bai International Airport .	Main road system: Width: 30m Number of lanes : 6 lanes	Highway No.5 and Highway No.10, which are adjacent to NHIZ will make easy access to key international sea ports, airport, Ha Noi capital and other localities in North Vietnam.
Railway			
Port	Hai Phong Port	Thai Gon Port	Hai Phong Port.
Air port	Noi Bai Internatinal Airport	Tan Son Nhat International Airport	Cat Bi Airport
Electric power	Substation with capacity of 150MVA	The National grid : 22KV medium voltage lines Standby power plant	The tenants are provided with high quality and uninterrupted power by the 50 MW independent power plant
Gas			
Water supply	8,000m$^{3/}$day	35.000m3/day	13,500m^3/day.
Sewerage	3,000m$^{3/}$day	10.000m3/day	10,800m^3/day
Telecommunication	Hanoi Post and Telecom Company will ensure smooth communication with highspeed transmission of data.	Internet: ADSL high speed line Telecommunication: Installed in accordance with the Leasee's requirement	Phase 1: 1.000 lines; Phase 2: 2.000 lines.
Remarks	• Development Area: 275ha • Foreign investors: 61 in operation. (Of that, 52 Japanese)	• Total area : 300 hectares • A number of Japanese investors is 48 companies	• Total area: 153 hectares • The number of Japanese investors is 35 companies

Source: Web site of ASEAN-JAPAN CENTER and that of each Industrial Park is also referred, as a supplemental

13.1.3 Relation to Civil Infrastructures Investigation

Transportation mode share in ASEAN member states is given in "Physical Distribution Network 2008" published by JETRO as in the table below:

Table 13.1.12 Traffic Volume Share by Transportation mode (%)

Country	Road	Railway	Domestic Water Transportation	Marine Transportation	Air Transportation	Remarks
Brunei	N.A	N.A	N.A	N.A	N.A	
Cambodia	N.A	N.A	N.A	N.A	N.A	
Indonesia	N.A	1.32	25,16	73.46	0.06	2004, Road share not

						available
Lao PDR	79.44	0.00	20.56	0.00	0.00	2005
Malaysia	51.84	0.52	0.00	47.51	0.13	2005
Myanmar	17.02	35.46	42.97	4.53	0.01	2003
Philippines	N.A	N.A	N.A	N.A	N.A	
Singapore	N.A	N.A	N.A	N.A	N.A	
Thailand	88.11	2.11	5.17	4.59	0.01	2003
Vietnam	66.33	3.00	20.03	10.60	0.03	2004
Japan	90.0	1.0	9.0			Indicative, for domestic
				99.0	1.0	Do. For overseas

Source: WB Indicators, ASEAN Secretariat, and CIA "The World Fact book"

The above data are rather old ones with some lack, but general trend of transportation modes in ASEAN countries can be readable.

It is pointed out that transportation by truck has sorts of obstacles, and then the effective use of truck opportunity is limited in south-east Asia countries, in comparison with the one in advanced western countries/region like EU, US from the following reasons:

- There are many islands in and to/from which it is rather hard to use a truck geographically.
- Expressway and high grade general roads network have not been developed yet, enough for reducing transportation-wise lead time, except for Singapore, Malaysia and Thailand.
- In downtown of cities, streets have not been well developed, thus this makes the factor to lower transportation efficiency due to traffic congestion.
- Customs clearance, transshipment at a border causes the efficiency to reduce and bring up higher cost.

Notwithstanding the truck transportation has the above problems; railway use ratio is low except for Myanmar which has a particular situation of under-development of roads.

As far as transportation by air is concerned, the ratio is very low, while it is supposed that the ratio will go up when horizontal international specialization would steadily be established, and then goods of high time-wise value like electronics parts/devices will be produced more.

From the above situation being reviewed, traffic infrastructures which play more significant physical distribution role, are roads and ports, in the light of supply chain aspect.

Therefore, relation to roads and ports is dealt with in the section "13.3 ASEAN Physical Distribution Network Circumstances and Movement".

Thus, this section deals with social/civil infrastructures except for road and port.

(1) Road

Relation to Road is discussed as mentioned above.

(2) Port

Relation to port is discussed as mentioned above.

(3) Information/ Telecommunication

When a natural disaster breaks out, retrieval will be highly dependent on development level of information/ telecommunication infrastructures.

Subscriptions of fixed and mobile telephones, and of internet are as shown below:

Table 13.1.13 Spread of Telecommunication Facilities

Country	Fixed telephone in 2011		Mobile-cellar telephone in 2011		Internet in 2011			
	Subscriptions 000s	Per 100 Inhabitants %	Subscriptions 000s	Per 100 Inhabitants %	Fixed internet subscriptions 000s	Per 100 Inhabitants %	Individuals using Internet %	Fixed broad band subscription 000s
Brunei	79.8	19.67	443.2	109.17	27.6	6.76	56.00	23.2
Cambodia	530.1	3.70	13,757.0	96.17	47.0	0.33	3.10	22.0
Indonesia	38,617.5	15.94	249,805.6	103.06	5,240.2	7.01	21.00	1,772.9
Lao PDR	107.6	1.71	5,480.9	87.16			9.00	41.7
Malaysia	4,242.9	14.70	36,661.3	127.04			61.00	2,147.8
Myanmar	523.9	1.08	1,243.6	2.57	15.3	0.03	0.98	11.1
Philippines	3,556.0	3.75	94,189.8	99.30	5,184.0	5.47	29.0	1,791.0
Singapore	2,018.1	38.90	7,794.3	150.24	1,386.3	26.72	71.00	1,329.9
Thailand	6,661.2	9.58	77,604.7	111.63	3,846.0	5.53	23.70	3,496.0
Vietnam	10,174.8	11.46	127,318.0	143.39			35.07	3,838.2

Source: ITU World Telecommunication/ICT Indicators Database

Let alone the importance of the spread level regarding the telephone and internet subscription, the more importance is to construct relay and/or wireless base stations, because calls will converge at the time of a serious natural disaster and that situation will results in choke in the services.

(4) Railway

The ratio of railway transportation is nil or few percent over ASEAN countries, except for Myanmar of 35% high.

While modern mass rapid transit systems have been in operation in advanced cities and the suburbs like Singapore, Kuala Lumpur, Bangkok and Manila, these are all for passengers' use only.

From supply chain point of view, it is considered that the railway will not have a major role even in future.

(5) Air-transport/ Airport

Singapore, Bangkok, Kuala Lumpur Manila and other capital cities have their own airports with high quality which is ranked as top class in the world.

However, these airports are mainly for passengers' use, and are not terminals for cargo transport, because supply chains for cargos of time-wise high value such as high-tech. electronics and medical goods/devices have not been established in ASEAN region.

Even in Japan, air transportation share is approximately 1 % and 20% or less in terms of ton-km and monetary value, respectively.

Traffics by air in ton-km basis are listed as follows:

Table 13.1.14 Traffics by Air

Country	Freight ton-km
Brunei	186
Cambodia	-
Indonesia	2,433
Lao PDR	-
Malaysia	2,411
Myanmar	-
Philippines	460
Singapore	5,696
Thailand	3,730
Vietnam	528

Source: Annual Report of the Council 2011

(6) Electricity

Since this civil infrastructures investigation does not have total electric energy generating data for each country, detailed discussion about the redundancy cannot be made. When electric power supply fails at the time of a natural disaster, the recovery will greatly depend on not only electric generating capacity, but also transmission net development, and whether or not distribution centers in supply chain have stand-by generating plant as well.

As a matter of fact, in the case of the devastating earthquake and tsunami disaster on 3.11, 2011, wide coastal area in northeast Japan was obliged to have power failure during period of few months, nevertheless transmission line network was sufficiently equipped, let alone there was vital accident of Fukushima No.1 nuclear plant in other aspect.

Final energy consumption by sector is as shown below:

Table 13.1.15 Final Energy Consumption by Sector

Country	Total	Share (%)				
	Oil equivalent (Million ton)	Total	Industry	Transport	Residential Use	Others
Brunei	1.7	100	57.6	22.8	9.1	10.5
Cambodia	4.7	100	1.7	7.9	86.7	3.7
Indonesia	145.9	100	29.7	21.6	38.7	10.0
Lao PDR		100				
Malaysia	39.8	100	35.0	35.1	10.6	19.3
Myanmar	13.8	100	9.7	6.7	72.8	10.8
Philippines	23.1	100	24.7	35.0	27.3	13.0
Singapore	14.1	100	10.3	20.3	6.6	62.8
Thailand	75.8	100	32.1	25.1	13.7	29.1
Viet-Nam	55.6	100	24.6	17.3	51.6	6.5

Source: Statistical Yearbook for Asia and Pacific 2012, ESCAP

(7) Water Supply and Sewage

State of water use for drinking and industrial use is as listed in the following table:

Table 13.1.16 Improved Water and Ratio by Industrial Sector Use

Country	Drinking Water (%)			Water Use (%)			Total Consumption (billion. M^3)
	Urban	Rural	Total	Agriculture	Domestic	Industry	
Brunei	-	-	-	89.3	-	-	0.1
Cambodia	87	58	64	94.0	4.5	1.5	2.2
Indonesia	92	74	82	81.9	11.6	6.5	113.3
Lao PDR	77	62	67	93.0	3.1	4.0	4.3
Malaysia	100	99	100	34.2	29.5	36.3	13.2
Myanmar	93	78	83	89.0	10.0	1.0	33.2
Philippines	93	92	92	82.2	7.6	10.1	81.6
Singapore	100	-	100	-	-	4.9	-
Thailand	97	95	96	90.4	4.6	1.8	57.3
Vietnam	99	93	95	94.8	1.5	3.7	82.0

Source: UNICEF, Progress on Drinking Water and Sanitation 2012
Statistical Yearbook for Asia and Pacific 2012

In general, the spread of potable water supply is considerably high, but low in agriculture dominant regions in Cambodia and Lao PDR where water from well is supposed to be more popular.

Concerning water consumption, share of industrial use is rather low, in spite of advanced industrialization; except for Malaysia and Philippines each industrial park has its own functional water supply plant.

With regard to waste water treatment, situation will be the same as the water supply, that is, each industrial park has its own plant for treating waste water.

13.1.4 Relation to Economy and Industry Analysis

It is possible to understand supply-chain's actual circumstances from macro- economic data by "Economy and Industry Analysis Investigation" which suggest a certain kind of relation to actual supply chain system in each country.

"Civil Infrastructures Investigation" also provides basic economic data which relate somehow to supply chain.

The data which have relation to supply chain conditions, is given in the subsequent sub-sections

(1) National Economic Statistics Data by Civil Infrastructures Investigation

- Gross Domestic Product

  GDP=Personal expenditure +Private sector investment + Government expenditure + (Export –Import)

  From the above formula, general situation can be prospected about context and quantity of physical distribution
- GDP per capita

  Since this index suggests physical richness of national economy, increase of GDP per capita will lead to what physical distribution will change and increase.
- Real Growth Rate of GDP

  This index will imply increase and evolvement of physical distribution.

- GDP by Industrial Sector

  National economy structure can be expressed by this index, and then physical distribution circumstances can be prospected straightforwardly.

- International Balance of Payment

  Monetary balance in goods and services trade internationally will also show the physical distribution in terms of both quality and quantity

- Employment Structure

  This index will show manpower employment engaged in logistics industry.

(2) Statistics Data by Economy and Industry Analysis

(1) Foreign Direct Investigation

This data indicates attraction and interest of the country concerned from foreign investors in terms of its potential growth and investment value. The consequences of the investment will influence current situation of physical distribution in near future.

(2) In-out Domestic Shipping by Goods

(3) ASEAN Intra-Trade Value and ASEAN Extra-Trade Value

As the above three data show values of domestic and international transactions, current status of physical distribution will accordingly be thought about.

Data from economic and industrial related to physical distribution as mentioned above are summarized below

Table 13.1.17 GDP, per capita and the Growth Rate of ASEAN Member Country

Country	GDP (Mil.US$)	GDP Per Capita (US$)			GDP Growth Rate (In 2011 to previous year %)	Remarks
		National	Big City Area	City		
Brunei	16,360	40,301			2.2	
Cambodia	12,830	897			7.1	
Indonesia	846,832	3,495	9,879	Jakarta	6.4	
Lao PDR	8,298	1,320			8.0	
Malaysia	287,937	9,977	16,486	Kuala Lumpur	5.1	
Myanmar	42,000	869				
Philippines	224,754	2,370	6,039	Manila	3.9	
Singapore	239,700	46,241	46,241		4.9	
Thailand	345,672	4,972	11,420	Bangkok	0.1	Low growth rate by Flooding
Vietnam	123,600	1,407	3,161	Ho Chi Minh	5.9	
Total	2,147,983					

Source: World Bank for IMF,

The degree of socio-economic development will be prospected by GDP per-capita.

Since the GDP per-capita in the regions of the megalopolises is more than double as the country average values in Indonesia, Malaysia, Philippines, Thailand and Vietnam, it can be said that these areas have already realized a quasi-domestic demand economy as the advanced western countries.

Singapore is apparently exceptional, because it has gone into post-industrial economy, as the facts show that nowadays its economy depend on service industries such as international trade hub function, financial center, tourism and holding international conferences/events.

The above five countries are said to have established supply chain which consist of factories, distribution and delivery centers in conjunction with industrial agglomerated areas/ industrial parks.

Table 13.1.18 GDP Share by Industry

Country	GDP Share (Unit in %)									
	Manufacturing	Agriculture	Trade	Mining	Construction	Finance	Transport & Communication	Public administration	Electricity, Gas, and Water	Others
Brunei	13.7	0.8	2.7	57.2	2.6	2.9	2.6	10.6	0.6	6.4
Cambodia	14.5	30.5	12.6	0.4	5.8	13.0	7.0	1.7	0.5	8.0
Indonesia	26.4	15.3	13.4	10.5	9.9	7.2	6.3	5.7	0.8	4.5
Lao PDR	9.8	30.6	19.6	6.8	4.1	3.8	4.9	4.6	2.7	6.2
Malaysia	25.5	9.5	14.5	12.9	3.3	13.7	6.8	8.1	2.6	5.2
Myanmar	18.2	38.2	20.4	1.0	4.5	0.1	13.5	1.6	0.7	1.8
Philippines	20.4	14.8	14.5	1.6	5.1	5.8	6.7	7.5	3.2	20.5
Singapore	18.5	0.1	18.8	0.0	5.1	24.9	12.1	7.0	1.3	7.0
Thailand	34.1	11.6	14.1	3.4	2.7	6.4	7.2	4.7	3.2	12.7
Vietnam	20.1	20.9	14.8	10.0	6.6	1.9	4.4	7.8	3.5	10.0

Source: ADB 2009

Brunei is a unique country among ASEAN members with which economy is specialized in export of oil and natural gas products.

Singapore has been in post-industrial economy as mentioned above, pursuant to US/ EU/Japan economy model.

It is considered that the five countries, Indonesia, Malaysia, Philippines, Thailand and Vietnam have been going into transition phase of which economy is to some degree, from primary to secondary industrial economy.

It can be said that these countries are on the way to form an advanced supply chain which consists of stations of horizontal international specialization such as physical distribution and delivery centers, while global economy has been going on developing.

The remaining three countries of Cambodia, Lao PDR and Myanmar, are of economy with primary industries share of more than 30%. In the ASEAN region, these countries have been a center of attention as a base of horizontal international specialization, by meriting situation in light industries such as fishery processing, apparels, and sundry goodswhich are brought about from comparatively lower labor wage.

Table 13.1.19 Employment Share by Industrial Sector

Country	Labor Force (In Thousand)	Sector-wise Share (%)			Labor Force Participation Rate, aged 15~64 (%)	Unemployment Rate (%)
		Agriculture	Industry	Services		
Brunei	191	1.4	21.4	77.2	70.1	3.7
Cambodia	7,680	59.1	13.4	27.5	82.4	2.3
Indonesia	115,443	41.2	18.8	40.0	70.3	8.4
Lao PDR	2,964	82.2	9.3	8.6	81.9	1.4
Malaysia	11,867	14.8	28.5	54.1	65.5	3.6
Myanmar	28,361	62.7	12.2	25.1	79.3	4.0
Philippines	37,862	36.1	15.1	48.8	66.8	6.3
Singapore	2,411	-	22.6	76.2	71.2	3.2
Thailand	36,937	41.7	20.7	37.4	77.3	1.4
Vietnam	46,602	54.7	18.3	27.0	77.6	4.7

Source: ASEAN Strategic Transport Plan 2011~2015

Table 13.1.20 International Trade: Export by Industry

Country	Top 3 Items			Top 3 Counterparts		
Brunei	Crude oil	Natural gas	Methanol	Japan	Korea	Asean
Cambodia	Clothes	Rubber	Rice	US	Hong Kong	Singapore
Indonesia	Oil	Gas	Mineral fuel	Japan	China	Singapore
Lao PDR	Mineral	Electricity	Needle work	Thailand	China	Vietnam
Malaysia	Electric appliance	Palm olein	Chemical goods	China	Singapore	Japan
Myanmar	Natural gas	Pulse	Jade	China	Thailand	India
Philippines	Electric device	Electric equipment	Transport equipment	Japan	US	Singapore
Singapore	Miscellaneous Manufacturing	Commerce	Business service			
Thailand	Computer parts	Vehicle parts	Gem & Jewelry goods	China	Japan	US
Vietnam	Needle work	Crude oil	Cell-phone parts	US	China	Japan

Source: Ministry of foreign Affairs of Japan

Table 13.1.21 International Trade: Export Directions, 2000~2009

Country	Directions (%)					
	Developing Asia	China	Japan	United States	European Union	Others
Brunei	33.7	4.0	46.8	0.6	0.5	14.4
Cambodia	46.5	0.3	1.6	31.1	14.3	6.3
Indonesia	40.6	9.4	15.3	8.9	11.2	14.5
Lao PDR	44.3	20.0	1.6	2.7	11.4	20.0
Malaysia	41.6	11.8	9.6	10.7	10.6	15.8
Myanmar	71.0	9.8	5.2	0.0	3.3	10.7
Philippines	31.8	7.3	15.5	16.8	19.5	9.0
Singapore	52.1	9.6	4.5	6.4	9.4	18.0
Thailand	34.1	10.4	10.1	10.8	11.6	23.1
Vietnam	22.7	8.5	10.8	19.6	16.2	22.3

Source: Asian Development Outlook 2011

According to the above tables, each ASEAN country has high trade portion of 30~70% with Intra ASEAN and Developing Asian countries.

Beside the above Asian countries, trade counterparts are China, Japan, USA and EU in this order.

Table 13.1.22 International Trade: Import by Industry and Counterparts

Country	Top 3 Items			Top 3 Counterparts		
Brunei	Machine/ transport equipment	Industrial goods	Articles of food	ASEAN	US	EU
Cambodia	Fabric	Petroleum products	Vehicle	China	Thailand	Hong Kong
Indonesia	Oil	Gas	Machine	China	Singapore	Japan
Lao PDR	Vehicle parts	Electric appliance	Construction material	Thailand	China	Vietnam
Malaysia	Electric appliance	Manufacturing equipment	Chemical goods	China	Singapore	Japan
Myanmar	Oil	Machine parts	Palm olein	China	Singapore	Thailand
Philippines	Crude/Intermediate Material	Capital goods	Fuel	Japan	US	Singapore
Singapore	Machine/ Transport equipment	Mineral fuel	Goods of miscellaneous materials			
Thailand	Crude oil	Industrial machine parts	Electric machine /parts	Japan	China	Malaysia
Vietnam	Machine and parts	Petroleum products	PC and Electric goods/ parts	China	Korea	Japan

Source: Ministry of foreign Affairs of Japan

Regarding trade counterparts of ASEAN countries, the rise of China is outstanding. This trend of the rising will continue regardless of fluctuation of China's economic performances.

On the other hand, companies in western advanced countries as well as Japan are apt to consider it a kind of risks that their investments have been excessively converged on China.

They have been increasing to establish their factories and distribution centers mainly in ASEAN countries in cooperation with local counterparts companies, as a Post-China policy.

In fact, direct investments to ASEAN countries by Japanese companies have topped China for last four consecutive years.

It is noted that movement of foreign direct investment, particularly on Indonesia, Malaysia, Philippines, Thailand and Vietnam shall be paid attention to onwards.

Table 13.1.23 International Trade: Balance of Payment (Unit in Billion US$)

Country	Year				
	2008	2009	2010	2011	2012 (Estimated)
Brunei	7.06	4.31	5.62	7.94	8.27
Cambodia	-0.59	-0.47	-0.44	-1.04	-1.38
Indonesia	0.13	10.63	5.14	1.72	-18.86
Lao PDR	-0.98	-1.17	-1.26	-1.77	-2.03
Malaysia	39.44	31.42	27.35	31.74	23.07
Myanmar	-1.04	-0.99	-0.59	-1.34	-2.38
Philippines	3.63	9.36	8.92	7.08	7.15
Singapore	26.35	30.14	55.51	56.99	56.14
Thailand	2.16	21.9	13.18	11.87	-0.75
Vietnam	-10.79	-6.12	-4.29	0.2	0.46

Source: World Economic Outlook Database 2012

Table 13.1.24 International Trade: Foreign Trade Dependence Rate

Country	Directions						World Ranking
	Import Dependence (%)			Export Dependence (%)			
	2007	2008	2009	2007	2008	2009	
Brunei							
Cambodia							
Indonesia	27.3	27.3	22.1	21.5	25.0	17.2	26
Lao PDR							
Malaysia	94.5	94.4	82.1	78.8	74.0	64.4	6
Myanmar							
Philippines	34.9	29.3	23.8	39.9	36.0	28.4	24
Singapore	174.3	179.0	151.8	153.1	169.3	138.3	4
Thailand	61.9	64.3	57.5	56.9	65.6	50.9	8
Vietnam							
Japan	16.0	16.1	11.4	14.1	15.6	10.8	40
US	8.3	9.0	7.4	14.4	15.0	11.3	42
China	36.0	33.0	24.5	28.3	26.2	20.5	22
Korea	35.4	45.3	43.4	34.0	46.7	38.8	11
Germany	39.7	39.5	33.6	31.7	32.3	28.0	14

Source: Statistic Bureau, Ministry of Internal Affairs and Communication of Japan
Notes 1: Export prices are counted in FAS and import prices are in FOB.
2: Export of Oil is excluded.

It appears that the above five countries, Indonesia, Malaysia, Philippines, Thailand and Vietnam have positioned a part of the role in the international supply chain, because of their high dependency of exports and imports.

Singapore is one exception of ASEAN which has the top grade of international hub port and trade dependency exceed 150% over the GDP.

As a matter of fact, Singapore functions as a leading part of international supply chain for production and physical distribution.

13.1.5 Relation to Logistics Performance Index on International Physical Distribution in ASEAN Countries

World Bank publishes relative ranking of each country in terms of Logistics Performance Index (LPI).

The outline is as follows:

(1) LPI composes of categorized assessment scores by each country and it provides the world ranking by the scores.
(2) The scores are in the grade from 1 to 5.
(3) LPI is derived from questionnaire investigation results about the following six categories to more than 1,000 of logistics companies in major import counterparts' countries and their neighboring countries.
(4) Efficiency of the clearance process i.e. Speed, simplicity and predictability of formalities by border control agencies, including Customs
(5) Quality of trade and transport related infrastructure e.g. Ports, railroads, roads, information technology
(6) Ease of arranging competitively priced shipments

(7) Competence and quality of logistics services e.g. transport operators, customs, brokers

(8) Ability to track and trace consignments

(9) Timeliness of shipments in reaching destination within the scheduled or expected delivery time

Table 13.1.25 International LPI (Logistics Performance Index) Ranking 2012

Rank	Country	LPI	Customs	Infrastructure	International Shipment	Logistics Competence	Tracing & Tracking	Timeliness
2	Singapore	4.09	4.02	4.22	3.86	4.12	4.15	4.23
29	Malaysia	3.44	3.11	3.5	3.5	3.34	3.32	3.86
35	Thailand	3.29	3.02	3.16	3.27	3.16	3.41	3.73
44	Philippines	3.14	2.67	2.57	3.4	2.95	3.29	3.83
53	Vietnam	2.96	2.68	2.56	3.04	2.89	3.1	3.44
75	Indonesia	2.76	2.43	2.54	2.82	2.47	2.77	3.46
118	Lao PDR	2.46	2.17	1.95	2.7	2.14	2.45	3.23
129	Cambodia	2.37	2.28	2.12	2.19	2.29	2.5	2.84
133	Myanmar	2.33	1.94	1.92	2.37	2.01	2.36	3.29
	Brunei	N.A						
1	Germany	4.11	4	4.34	3.66	4.14	4.18	4.48
7	Japan	3.97	3.79	4.19	3.55	4	4.13	4.26
15	United States	3.86	3.68	4.15	3.21	3.92	4.17	4.19
23	Korea Rep.	3.64	3.33	3.62	3.47	3.64	3.83	3.97
27	China	3.49	3.16	3.54	3.31	3.49	3.55	3.91
47	India	3.12	2.7	2.91	3.13	3.16	3.14	3.61

Source: World Bank

In addition, World Bank classifies LPI into 3 grades in accordance with LPI scores. For ASEAN Countries, the classification is as follows:

Table 13.1.26 LPI Classification for ASEAN Countries

LPI	Country	LPI
3.23<=LPI<=5	Singapore	4.09
	Malaysia	3.44
	Thailand	3.29
2.75<=LPI<3.23	Philippines	3.14
	Vietnam	2.96
	Indonesia	2.76
2.48<=LPI<2.75	Lao PDR	2.46
	Cambodia	2.37
	Myanmar	2.33
	Brunei	N.A

Note: The maximum score is 5, and 1 is the lowest.

OECD also publishes time and cost-wise customs clearance processing.

Table 13.1.27 Ease of Trading across Borders by TEU

Country	Document to export (Nos.)	Times to export (days)	Cost to export (USD)	Document to import (Nos.)	Times to import (days)	Cost to import (USD)
Brunei	6	28	630	6	19	708
Cambodia	11	22	732	11	30	872
Indonesia	5	21	704	6	27	660
Lao PDR	9	50	1,860	10	50	2,040
Malaysia	7	18	450	7	14	450

Myanmar						
Philippines	8	16	816	8	16	819
Singapore	4	5	456	4	3	439
Thailand	4	14	625	3	13	795
Vietnam	6	22	756	8	21	940

Source: Southeast Asia Economic Outlook 2010, OECD

13.1.6 Features of Physical Distribution in Relation to Main Industries in Industrial Parks

Broad physical distribution can be inferred from the matrix of intermediate and final goods by industrial category, which is manufactured by companies in the industrial parks concerned.

Investigating degrees of industrial agglomeration for objective industrial parks would be able to assure more detailed and precise modes of physical distribution

This investigation limits to industries and products which Japanese affiliated companies manufacture, because those industries and products will be able to represent the whole physical distribution circumstances in the light of their share and roles in the industries.

The objective industries are classified into the following 13 categories:

Industries/ products are divided into the followings categories:

(1) Fishery/Foodstuff
(2) Textile/Apparel
(3) Pulp/Paper
(4) Chemicals, Oil, Rubber/Ceramic
(5) Steel/Nonferrous metal
(6) Transport machines (Cars)
(7) Electrical/Electronics/Precision apparatus
(8) Other industries
(9) Commerce (wholesale, retail)
(10) Real estate
(11) Logistics/Warehouse
(12) Finance/Insurance/Other services
(13) Information/Telecommunication

Investigation information/ data hereinafter are supposed to be of 2008~2009, and also, companies names are not up to dated.

(1) Brunei

Since no information about Japanese affiliated companies' operation is provided, features of physical distribution are inferred from the trade structure.

Top three share of export/import items are as follows:

- Export: Crude oil, Natural gas, Methanol

- Import; Machine/ Transportation Equipment, Industrial goods, Articles of food

Brunei exports oil, natural gas and the other oil industry related products, and imports commodities necessary for daily life. From this trade structure, daily life goods are supposed to be transported by roads from Maura Port, directly to consumers through some distribution and delivery centers.

(2) Cambodia

Main products are clothes, heat proof chemicals/ceramics, motor cycle parts, electric appliances parts and sundry goods including their wrapping and packaging materials.

Since there are no final goods manufactures, intermediate goods/parts are guessed to be exported to neighbor countries like Thailand, Vietnam.

Shipping will be by means of truck, or transported by sea from Sihanoukville Port.

(3) Indonesia

Indonesia cannot be discussed as a whole, because the land area is 5 times as large as Japan's, and the population is 240 million.

It is necessary to limit objective regions. Accordingly, It is considered reasonable that the objective region shall be district between Jakarta and Cikampek, West Jawa State in Jawa Island which has 80% of the national total population.

In the selected region, outline of physical distribution will be inferred from types of industries and kinds of goods manufactured in two major industrial parks, that is, Karawang International Industrial City (KIIC) and East Jakarta Industrial Park(EJIP)/ Bekasi.

Final products in the above two Industrial Parks as follows:

(1) Fishery/Foodstuff:
Meiji Seika, Fuji Oil
(2) Machinery/Transport machines (Cars):
Toyota Motor Co.
(3) Electrical/Electronics/Precision apparatus:
Matsushita Electric Industrial Co., SANYO Electric Co.
(4) Other industries: KAWAI
(5) Logistics/Warehouse: Sumisho Global Logistics Co. Japan Logistics Systems Co.

Since Toyota Motor's assembly plants is in operation in KIIC, diversified intermediate products such as car parts of textile, chemicals, electric devices and precision instrument and so on. It is considered that these intermediate products are distributed with each other in KIIC. Consumer goods by Meiji, Fuji, KAWAI will be distributed to such big cities as Jakarta, Bandon, and also exported to Japan and other foreign countries.

Refrigerator, television, lighting goods are manufactured. These items will be both for domestic use and for export by the applicable specifications.

Top three items of import goods are oil, gas and machine. Oil and gas are transported by line pipe, tank lorry and coastal tankers for domestic transport; therefore, the distribution mode differs from that of general cargo. Beside final product of cars, the breakdown of machinery goods/products is mother machine, dices, and manufacturing equipment of various parts for use within the industrial parks.

In Jakarta Metropolitan area, distribution of the above goods except for bulk cargos, are unloaded at Tanjung Priok Port, and transported by road to Jakarta City and/or each industrial park. It will be necessary to investigate location and arrangement of warehouses, distribution centers on the route between the Port and industrial parks, so that actual mode of distribution can be sought, as situation requires.

In Indonesia, Information/ data at the time of the investigation would show that physical distribution is mainly domestic and intra-ASEAN. From the development of the physical distribution point of view, that has not yet reach sphere of logistics management which needs high level of information technology.

(4) Lao PDR

Lao PDR is constructing Savan-Seno SEZ in Savannakhet Province at the junction of east-west corridor road, which passes from Vietnam to Myanmar through Thailand, with national road No.13 through north-south, which cross over Laos, near to border of Thailand.

At present, how far this SEZ development proceeds is not known. However, it is remarked that the affiliated company with Japan logistics Systems Co. has operated a bonded warehouse and a truck terminal at this important place of transport.

Final industrial products are limited to higher degree in Laos, because industrial park development has not yet advanced, therefore, physical distribution in Laos is surely by truck only within the country and to/from neighbor countries.

(5) Malaysia

Malaysia had impetus to industrial economy in early times by "Look east Policy". Lots of Japanese affiliated companies have been established factories and /or stations responding to this policy.

The companies said above and final products in industrial parks in Malaysia are as follows:

(1) Fishery/Foodstuff: Gaban Spice, MYOJO FOODS CO., Sugiyo Co., Kaminari Okoshi Foods Co. (Hicom)

(2) Machinery/Transport machines (Cars):Daihatsu Motor Co.(Shah Alam), Mitsubishi Motors Co.(Hicom)

(3) Electrical/Electronics/Precision apparatus:Sony Co.(Hicom), Canon Inc.(Hicom), Matsushita Electric Industiral Co.(Shah Alam)
(4) Japan Victor Co.(Shah Alam), TOSHIBA CO.(Prai)
(5) Other industries: Fumakilla Ltd., KYOWA Co., JALUX Inc.(Prai)
(6) Logistics/Warehouse: MITSUI & CO. LTD.(Coil center; Shah Alam),
(7) Finance/Insurance/Other services: Matsushita Electric Industiral Co.(Design;Shah Alam), IKEDA CO.(Region Head Office; Hicom), TOMEN Co.(Holding Company; Prai)

Since cars makers, Electric and Precision devices makers have operated in the industrial parks in Malaysia, much diversified parts in the fields of chemicals, nonferrous metal, machinery, and other industries are manufactured. Regional general management offices are also established in the above parks. These facts being overviewed, it is said that physical distribution has been developed well in areas of an intra-industrial park, domestic, intra and extra ASEAN.

Top three items of export/import are as follows:

- Export: Electric appliances, Palm oil, Chemical goods
- Import: Electric appliances, Manufacturing equipment, Chemical goods

When these items are looked into, it implies that physical distribution in Malaysia has already proceeded to a phase of international logistics management by which international horizontal specialization with main trade counterparts of China, Japan and Singapore can be made.

(6) Myanmar

Myanmar's economic relation with western countries has been almost nil until USA lifted the sanction in July 2012. After that, development plans and project are on the rush as represented by Thilawa, Dawe SEZs projects, in particular, Thilawa project had been developed by a joint venture with Singapore Company. Dawe project will be promoted by basis of Japanese public-private cooperation under agreement between the both Governments. No information/Data is available so that physical distribution circumstances may be prospected.

(7) Philippines

Circumferential environment about physical distribution in Phlippines is prospected by Japanese affiliated companies and their products in the three selected industrial parks of Cavite Economic Zone、Laguna Technopark and Mactan Export Processing Zone

Final products and the companies in the above Parks are as follows:

(1) Fishery/Foodstuff: Meiji Seika, Fuji Oil
(2) Textile/Apparel:Fox Knit Apparel, Taketora,(Knit sox; Cavite) Uchi Phils.(Wears;Cavite), KH Cebu, Karikawa Cebu Co. (Ladies wear;Mactan), Tokyo Dress Cebu Co.(Ladies wear; Mactan)

(3) Machinery/Transport machines (Cars): Honda Motor Co.(Laguna)

(4) Electrical/Electronics/Precision apparatus: Matsushita Electric Industrial Co.(Laguna), FUJITSU TEN LTD.(Laguna), Kubo Optical Phils., Philippine Kenko Co. (Binocular;Mactan)

(5) Other industries: Iwax Philippine(Disposable Lighter; Cavite),

In Laguna, various kinds of parts of textile, chemical, machinery, electric/precision devices and so on, are manufactured, because Honda assembly plant has been in operation. Matsushita, Fujitsu Ten manufactures overseeing TV camera, audio goods respectively, in Laguna, in this regard, parts related to these products are in wide ranges manufactured. Distribution of these intermediate and final goods is supposed to close almost within Laguna.

Apparel final goods are transported to consumers in Metro-Manila and/or to Japan and other foreign countries, possibly in the mode of OEM.

Audio goods and binoculars by FUJITSU TEN and Kubo respectively, the shipment will be diversified to domestic market or intra and extra ASEAN markets.

Top three items of export/import goods are as follows:

- Export: Electric devices, Electric equipment, Transport equipment
- Import: Crude, intermediate materials, Capital goods, Fuel

Electric devices, Electric equipment of export items mean that parts manufactured in each industrial park are to be exported to main trade counterparts, Japan, USA, Singapore, and to be shipped to industrial parks in ASEAN Regions through intra and extra ASEAN trade as well. Crude, intermediate materials and oil of import mean that fuel bulk cargo is transshipped at Manila Port and other major ports, and then transported to distribution depots in various islands.

There is no logistics company in the above three industrial parks, and location/ arrangement of warehouse/distribution centers between the ports and the parks are also not clear. By present information, it is considered from items of export goods that physical distribution would reach a sphere of some degree of logistics management which accompanies horizontal international specialization, even if it will mainly be of intra/extra-ASEAN basis.

(8) Singapore

Singapore manufactures intermediate and final products covering almost all fields of industries. Not only industrial products makers locate, but also regional head office of companies who deal with such industries as Commerce (wholesale, retail), Real estate, Logistics/Warehouse, Finance/Insurance/Other services like R&D and design, and Information/Telecommunication, are operating in major industrial parks other than the Juorong. There is no car assembly plant in Singapore, instead, lots of products related to ship building industry are to be remarkable. No pulp, paper and associated industries are operating.

Trade dependency of Singapore excess GDP outstandingly, to more than approximately 150%, this shows that facilities related to logistics are located in a well-organized manner, as well as high level of infrastructures. Logistics Performance Index by World Bank ranks Singapore at first or second , abreast of Germany. Besides sufficiency of facilities, Government Policy is worthy of noticing, by which institutional design is highly attractive to first class talents in the world, as well as the key role being expected to lead ASEAN members.

(9) Thailand

Intermediate and final products in Thailand are also diversified to wide range of industries

(1) Fishery/Foodstuff: Kingfisher (Canned foods; Ban Poo), Culbee Inc., Mitsubishi Co.,Nisshin Seifun Group Inc.,(processed foods; Bang Poo), Nipon Meet Packers,Inc., Mizkan Group Co.(Processed foods; Rojana)

(2) Textile/Apparel: Janto. Co.(Kids clothes; Rojana), Marukyu Co.(Knit wears; Rojana),

(3) Chemicals, Oil, Rubber/Ceramic: Bridgestone Co.,(Tire; Amara), Hoyu Cosmetics Co.(Hair coller; Amata), Three Bond Co.Ltd .(Adhesives; Amara), MEP Technical Center (Engineering plastics; Amata)

(4) Steel/Nonferrous metal: Sumitomo Metal Industries Co.(Electro-magnetic steel coil center;Rojana)

(5) Machinery/Transport machines (Cars): Honda Motor Co.(Compact car; Rojana), Hino Motors Ltd.(Truck;Rojana), MAZDA MotorCo.(Pickup truck; Eastern Seaboard), Kobe Steel Ltd.(Excavator; Eastern Seaboard), Kobelco Construction Machinery Co.,Ltd.(Excavator; Eastern Seaboard),Siam Tone Co.(Boring machine;Amata)

(6) Electrical/Electronics/Precision apparatus: Nikon Co.(Camera; Rojana), Oki Electric Industry Co.,Ltd.(Printer;Rojana), Pioneer Co.(Audio goods; Rojana), Sanden Co.(Industrial refrigerator; Rojana), Ai Phone Co.(Inter com; Amata), Daikin Industries Ltd., Mitsubishi Electric Co.(Air conditioner;Amata), Hitachi Ltd. Mitsubishi Electric Co. (Elevator; Amata),

(7) Other industries: Kokuyo Co., Inahata Industies Co.(Office supply; Bang Poo), Kao Co.(Sundry goods; Amata), Pigion Co.(Nursing Goods; Amata),

(8) Logistics/Warehouse: Mitsui O.S.K.Lines,Ltd.(Logistics;Bang Poo), Honda Logistics, Inc.(Cars logistics; Rojana), Nippon Package & Warehouse Co.(Car and Car parts transport; Rojana), NISSHIN CO.(Tour agency; Rojana), The Sumitomo Warehouse Co.,Ltd.(Forwarding, Logistics; Rojana), SANKYU INC.(Logistics;Amata), Obayashi Co.(Construction;Amata), Nippon Express Co.,Ltd (Logistics; Eastern Seaboard)

(9) Finance/Insurance/Other services: YAMAGATA Inc.(Printing; Bang Poo), Sumikin Bussan Co.(In-park generating plant operation; Rojana),

As the above diversified industries being overviewed, agglomeration of the industrial parks in Thailand can be said to be outstanding, in particular, so is in Rojana in Ayutthaya. Car assembly plants have been operated in Rojana and Amata, and in addition to Japanese makers affiliated, General Motors and Ford Motors have assembly plants as well. As far as car manufacturing is concerned, the numbers reaches 2.4 million productions of cars in 2012, and accordingly are ranked as top ten in the world.

The car export also increased to number of more than 1 million with accompanying exports of parts, and thus car industry can be said to contribute to develop physical distribution in Thailand into logistics management level. As to industries such as machinery, chemicals, electrical/ precision devices other than car manufacturing, a lot of final products companies have been operating, therefore, it is considered that many parts makers are to form supporting industries within each industrial parks.

In order to transport final and intermediate products, logistics companies also locate in the above parks, who bear integrated function of in-park, domestic, intra and extra-ASEAN logistics. It is inferred that some of the above companies have already worked to be a role of 3PL (Third Party Logistics), which proposes an optimum solution about shippers' logistics and trustees comprehensively.

Top three items of export/import goods are as follows:

- Export: Computer parts, Vehicle parts, Gem and jewelry goods
- Import: Crude oil, Industrial machine/parts, Electric machine /parts

It is considered that Thailand is one of top leading position in ASEAN members with respect to logistics industry as well as Singapore and Malaysia from the high agglomeration of industries.

(10) Vietnam

While total 52 numbers of industrial Parks/SEZs have been registered in Vietnam, industrial parks in big city regions like Hanoi, Haiphong and Ho Chi Minh City are to be noted among them.

Final products makers in the selected industrial parks are as follows:

(1) Fishery/Foodstuff: Tanaka Atsushi, SUN FOODS CO,Ltd.(Wine, foods;Tan Thuan)
(2) Textile/Apparel: Gunze Ltd, Life Co., PREMIER CO.,Ltd, Showa Dress CO., Ltd. Wonderful SG, YASUDA VIETNAM CO., Ltd.(Wears, Japanese clothes; Tan Thuan), LANCHESTON CO.,LTD.(Socks; Tan Thuan), Muraya Co.(Ladies underwears; Tan Thuan), THREE BANBI VIETNAM CO.,LTD(Baby wears:Tan Thuan)
(3) Steel/Nonferrous metal: Ha Noi Steel Center Co (Steel processing; Thang Long)
(4) Electrical/Electronics/Precision apparatus: Canon Inc.(Ink jet printer; Thang Long), Panasonic Co.(Electric appliances, telephone; Thang Long), Rorze Robotech Co.(Semi-conductor mother machine; Nomura Haiphong)
(5) Other industries: SATO Group.(Bar code printer; Thang Long), SEED CO., ltd.(Eraser, Mendingtape; Thang Long), TOTO LTD.(Sanitary ceramics; Thang Long), MITSUBISHI PENCIL CO.,LTD. (Stationary; Thang Long), COSMO BEAUTY CO.,LTD.(Cosmetics;

Tan Thuan), ASTY, INC.(Shoes; Nomura Haiphong), Nippon Kodo Co.,(Incense stick; Nomura Haiphong), Lihit Lab Inc.(Staionary;Nomura Haiphong), Korg Vuetnam Co.(Music instrument; Nomura Haiphong)

(6) Real estate: Sumitomo Co.(Industrial Park Developer, Operator; Thang Long), Nomura Holdings,Inc.((Industrial Park Developer, Operator; Nomura Haiphong)

(7) Finance/Insurance/Other services: Yabashi International Co.(Design center; Thang Long), NISHISHIBA ELECTRI CO.,LTD(Power plant maintenance; Nomura Haiphong)

Among the above industries, light industries which manufacture foods, clothes, and other goods, are overwhelming.

While three companies in the field of electric/precision devices industries are operating, Rorze Robotech whose products are semiconductor mother machine is unique lessee of three companies. It is considered that intermediate goods like parts will be supplied to final products makers in the same industrial park, as well as that electrical parts and apparel goods will be exported to USA and Japan, and car parts are to be shipped to Thailand and Malaysia of ASEAN neighbor countries.

The top three items of export/import are as follows:

- Export: Needle work, Crude oil, Cell-phone/Parts
- Import: Machine and Parts, Petroleum products, PC and electrical goods/Parts

From supply chain point of view, it is inferred that physical distribution will be in transition phase from primary stage to higher one of logistics management, by recognizing kinds of products in industrial parks and the export items, above.

13.1.7 Supply Chain Circumstances in ASEAN Countries

This chapter deals with the following items for the purpose of understanding circumstances of existing supply chain in ASEAN member countries

(1) General Matter
(2) Relation to Industrial Agglomerated Area/Industrial Park Investigation
(3) Relation to Civil Infrastructures Investigation
(4) Relation to Economy and Industry Analysis
(5) Relation to Logistics Performance Index on International Physical Distribution in ASEAN Countries
(6) Features of Physical Distribution in Relation to Main Industries in Industrial Parks

The additional surveys, such three items of investigations as Industrial Agglomerated Area/Industrial Park, Civil Infrastructures, and Economy/ Industry will be conducted in each country.

Accordingly, it is a matter of study whether reviewing of the additional survey results is necessary or not, in order to grasp circumstances of supply chain in more real terms.

This section is to summarize the supply chain circumstances concerned, in connection with both investigations for "international logistics performance index" and "features of industrial parks/SEZ in reflecting main industries"

(1) Relation to Logistics Performance Index Investigation

Logistics Performance Index by World Bank was evaluated under the following criteria with regard to physical distribution of materials and products as mentioned before.

(1) The efficiency of the clearance process (speed, simplicity, and predictability of formalities) by border control agencies, including customs.
(2) The quality of trade-transport-related infrastructure (ports, railroads, roads, information technology).
(3) The case of arranging competitively priced shipments.
(4) The competence and quality of logistics services (transport operators, customs brokers).
(5) The ability of track and trace consignments.
(6) The frequency with which shipments reach the consignee within the scheduled expected delivery time.

In accordance with World Bank criteria, LPI scores of each ASEAN country are categorized as reiterated in the table below.

Table 13.1.28 Grouping by LPI Score

Group	Country	LPI Score	World Ranking	Classification Criteria
A	Singapore	4.09	2	3.23<=LPI<=5
	Malaysia	3.44	29	
	Thailand	3.29	35	
B	Philippines	3.14	44	2.75<=LPI<3.23
	Vietnam	2.96	53	
	Indonesia	2.76	75	
C	Lao PDR	2.46	118	2.48<=LPI<2.75
	Cambodia	2.37	129	
	Myanmar	2.33	133	
D	Brunei	N/A	N/A	

Source: World Bank

(2) Relation to Featnres of Physical Distribution in Relation to Main Industries in Industrial Parks

The term of logistics is defined by JAPAN INSTITUTE OF LOGISTICS SYSTEMS (JILS) as follows:

The Logistics is the management for companies to synchronize their activities such as procurement, production, sales, and physical distribution, to market demands. What the logistics aim, is that companies should strengthen their competitiveness and increase companies' values by executing the following items:

(1) To satisfy customers
(2) To reduce wasteful inventory
(3) To minimize transports
(4) To decrease supplies costs

In addition, an opinion for the developing phases of materials/ products physical distributions is presented as follows: (Nakata Shinya, Introduction to logistics 2012)

(1) Firstly, physical distribution and the control is concept of materials/ products flow in narrow terms.
(2) Secondary, the physical distribution proceeds to logistics management by which the flow of materials/ products from procurement to sales is systemized and integrated as a whole company activity.
(3) Finally, the physical distribution go further into supply chain management phase in which company's own distribution activity is collaborated and integrated with outer logistics operators,

Taking into accounts the above opinions, Physical Distribution Development Phasing(PDDP) is categorized into three stages:

(1) Physical distribution control: Company's own sphere of materials/ products distribution (PDC).
(2) Logistics management: Company's own distribution management by the market-in strategy (LGM).
(3) Supply chain management: Integrated distribution management from company's own to systemized one by the collaboration with other logistics operator resources (SCM)

Apart from the above, other criteria can be considered applicable, so that the development phase may be justified, based on industrial categories and their products in the selected industrial parks/ SEZ of ASEAN each country.

(1) Kinds and diversity of products (intermediate or final products).
(2) Whether production of high valued goods like cars, electrical/ electronic/ precision devices or not, and the levels.
(3) Correspondence of export/import major items of goods to, classification of intermediate/ final products
(4) Existence of a regional head office of a company which power is vested from the headquarter, and the power strength in management term.
(5) Existence of logistics operator as a 3PL
(6) Inter dependency of industrial parks/ SEZ with megalopolises in the vicinity.

It will be appropriate that the above six criteria are scored in five grades as World Bank applies.

For the assessment purpose, PDDP is to be expressed in such a manner as being linearized, because PDDP extend without stepped progressing in terms of the time and the level.

The result of the assessment is summarized in the light of two aspects of criteria above as shown in the table below.

Table 13.1.29 Physical Distribution Development Phasing

Group	Country	PDDP								
					Criteria					
		PDC	LGM	SCM	Products diversified	High valued goods	Export/import	Regional head office	Logistics operator	Products diversified
A	Singapore				5	5	5	5	5	5
	Malaysia				4	4	4	4	4	3
	Thailand				4	4	4	4	4	3
B	Philippines				3	3	3	3	3	3
	Vietnam				3	2	3	2	3	3
	Indonesia				3	3	3	3	3	3
C	Lao PDR				2	2	2	1	1	1
	Cambodia				2	2	2	1	2	2
	Myanmar				2	2	2	1	2	1
D	Brunei				1	1	1	1	1	1

To complement the assessment, basic economic statistics for megalopolises which have interdependence with industrial parks/SEZs, are also listed below in comparison with those of the belonging counties.

Table 13.1.30 GDP, Per capita, and Monthly basic pay for general worker in Capital City

Group	Country				Capital or Mega City			
	Name	Population (x1000)	GDP (Mil.US$)	Per-Capita	Name	Population (x1000)	Per-Capita	Monthly Basic Pay (US$)
A	Singapore	5,188	239,700	46,241	Singapore	5,188	46,241	1,285
	Malaysia	28,859	287,937	9,977	Kuala Lumpur	1,645	16,486	344
	Thailand	69,519	345,672	4,972	Bangkok	6,876	11,420	286
B	Philippines	94,852	224,754	2,370	Manila	1,661	6,039	325
	Vietnam	88,792	123,600	1,407	Ho Chi Minh	7,163	3,161	130
	Indonesia	242,326	846,832	3,495	Jakarta	9,608	9,879	209
C	Lao PDR	6,288	8,298	1,320	Vientiane	783		118
	Cambodia	14,305	12,830	897	Phnom Penh	1,571		83
	Myanmar	48,337	42,000	869	Yangon	4,573		68
D	Brunei	406	16,360	40,301	Bandar Seri Begawan	27		

Source: 1. Monthly basic pay for general worker is derived from JETRO statistics.
2. GDP and Per-capita are transferred from the result of " Civil Infrastructure Investigation"

(3) Summary of Supply Chain Circumstances

It is concluded that the two indices of PDDP, which are derived from industrial agglomeration conditions and LPI by World bank, are applicable for grasping circumstances of supply chain in ASEAN countries, because the two indices tallies with each other in a practically real term

It goes without saying that more systematically detailed survey based on up to date statistics and/or survey in situ, would help to be able to understand more detailed realistic circumstances of the supply chain for each country.

13.2 Influences on Physical Distribution Network in Past Natural Disasters

13.2.1 Case Influences by Major Natural Disasters in ASEAN Region

The impact and measures of the major natural disasters in the ASEAN region has been described in the "Chapter 8: Description of Natural Hazard" and "Chapter 10: Measures taken for Natural Disasters".

13.2.2 Case Influences by Major Natural Disasters in Japan

Along with the recent economic development, ASEAN countries are becoming more aware of the possible damaging risks of infrastructure, production and distribution facilities of private sectors caused by the natural disasters.

In the circumstances under which the logistics network is internationally connected, if the supply chain were destroyed by natural disasters in the metropolitan and industrial agglomerated areas, economic losses would be immeasurable. This was well demonstrated in the past catastrophes in Japan and the recent floods in Thailand in 2011.

This section describes the actual damages caused and lesson leaned from the following natural disasters, while paying attention to their applicability to the ASEAN countries.

(1) Great Hanshin-Awaji Earthquake (Urban Earthquake; January, 1995)
(2) Tokai Heavy Rain (Wide Area Flooding; September, 2000)
(3) Great East Japan Earthquake (Wide Area Earthquake/Tsunami, March, 2011)

From the damages in those case studies, following four points are related to logistics.

(1) The availability of alternative means (redundancy) of transport infrastructure such as road, port, airport, railway, etc.
(2) The availability of alternative lifeline and industrial infrastructure such as water and sanitation, power, communications, etc.
(3) Lowering life motivation by the mental instability and insufficient supply of goods to the affected residents.
(4) Suspension and stagnation of production and shipment activities by the companies during the time of disaster to restoration.

Normalization of post disaster logistics depends on how fast the restoration of infrastructure facilities including life-lines can be realized.

(1) Great Hanshin-Awaji Earthquake

The following description is based on "White Paper on Disaster Management; Great Hanshin-Awaji Earthquake (Confirmed Report)" issued by the Fire Department (partly revised).

At 5:46 on 17th January, 1995, earthquake of magnitude 7.3 and an epicenter 16km depth occurred in the northern part of Awaji Island; at latitude 34°36' North and longitude 135°02' East,

From this earthquake, seismic intensity 6 was observed in Kobe and Sumoto (7 in some parts of Kobe city), 5 in Toyooka, Hikone and Kyoto and 4 in Osaka, Himeji and Wakayama. The earthquake could be felt in the wide range from Tohoku to Kyushu.

Since this earthquake occurred inland, tsunami was only 10 cm and no damage was observed.

Immediately after the earthquake, 285 cases of fire occurred which were approximately the same places where the houses are damaged. Causes of the fire were often electricity and gas related incidents right after the earthquake. The fires after several hours and after next day were related to electric appliances and combustion apparatus of gas and oil.

Overview of the damages such as logistics infrastructure facilities and buildings by the earthquake are as follows.

- In the coastal area, due to ground motion and liquefaction of the ground, significant lateral flow, inclination, subsidence occurred to the quay, revetment and shore protection facilities around the Kobe port.
- Subsidence of quay was beyond 2-3m, and resulted in derailing and deformation of container cranes.
- In respect of roads including highway, the viaducts concrete piers were destroyed and buckling was caused in the steel piers, and also many pile foundations were damaged by ground motion and the liquefaction.
- In respect of railway, operations of not only conventional lines but also bullet train and subway were affected by the structure damages, similar to the road.
  Concrete fallings off from the tunnel lining were observed in the Rokko tunnel for bullet train.
- Many of the infrastructure facilities and buildings were built before 1980; the construction was based on the Old Code of Earthquake Resistance. It is possible to say this caused the larger damage.
- Hazardous materials storage facilities in the coastal area received damages of lateral movement and/or liquefaction, but did not result in serious damage such as the collapse of tanks.
- In terms of the building, large number of damages to houses and public buildings stand out. The destruction and damage by the fires were recorded 520,000 houses, and around 5,800 of non-dwelling houses.

Table 13.2.1 Overview of Great Hanshin-Awaji Earthquake and Seismic Intensity in Each Cities

Overview	Occurrence date	5:46am on 17th January, 1995
	Epicenter	Northern part of Awaji Island(latitude 34°36' North and longitude 135°02' East)
	Depth of Epicenter	16km
	Magnitude	7.3 (Meteorological Agency)
Region above Seismic intensity 5	7	Part of Kobe city, Ashiya city, Part of Nishinomiya city, Part of Takarazuka city and Part of Awajishima
	6	Part of Kobe city and Sumoto city

	5	Toyooka, Hikone and Kyoto (Osaka closer to Kobe was 4)

Table 13.2.2 Damages on Human and Facilities from Great Hanshin-Awaji Earthquake

Damages on Human	Death		6,434 people	
	Missing		3 people	
	Casualty	Serious injury	10,683 people	
		Minor injury	33,109 people	
		Total	43,792 people	
Damages on Facility related	Housing damage	Complete destruction	104,906 houses	(186,175 household)
		Partial destruction	144,274 houses	(274,181 household)
		Some destruction	390,506 houses	
		Total	639,686 houses	
	Non-housing damage	Public building	1,579 buildings	
		Others	40,917 buildings	
	Educational facilities		1,875 locations	
	Road		7,245 locations	
	Bridge		330 locations	
	River		774 locations	
	Land slide		347 locations	
	Suspension of water supply		Around 1,300 household	At Peak (Unit in thousand; Ministry of Health and Welfare)
	Suspension of gas supply		Around 860 household	At Peak (Unit in thousand; Agency of Natural Resources and Energy)
	Power failure		Around 2,600 household	At Peak (Unit in thousand; Agency of Natural Resources and Energy)
	Telephone interruption		Over 300,000 lines	At Peak (Ministry of Posts and Telecommunications)

Source: "Great Hanshin-Awaji Earthquake (Confirmed Report)" by Fire and Disaster Management Agency, 19th May, 1995.

(2) Tokai Heavy Rain

Information below was based on the Disaster Information from Cabinet Office and also compiled from other sources including Wikipedia.

Due to the stagnation of a front near Honshu from 7th September, 2000 which were joined with warm moisture flow of Typhoon No. 14 during 11th to 12th, Tokaido area especially Aichi, Mie, Gifu prefecures recorded unpresidented torrential rain.

Rainfall;

- Tokai city in Aichi prefecture observed the intensity of 114 mm/hour in 11th September
- Nagoya city observed the total precipitation of 428mm/hour in 11th September (about twice the highest ever recorded)

This heavy rain disaster resulted in large amount of monerary loss of general assets. It was specified as the disaster of extreme severity, and special emergency countermeasures projects for the control of severe river disasters were conducted.

Overview of the damages is described in the following table.

Table 13.2.3 Damages on Human and Facilities by Tokai Heavy Rain

Damages on Human	Death		10 people	
	Missing		-	
	Casualty	Serious injury		
		Minor injury	115 people	
		Total	115 people	
	Evacuation instructions	No. of household	Around 220,000	Maximum
		No. of Citizens	Around 580,000	
		No. of Refugees	Around 65,000	The maximum number of evacuees in shelters
Damages on Facility	Housing and non-housing damage	Complete destruction	31 buildings	
		Partial destruction	172 buildings	
		Total	203 buildings	
		Inundation above floor level	22,894 buildings	
		Inundation lower than floor level	46,943 buildings	
Damages on Transportation infrastructure	railway	Bullet train	70	No, of regular scheduled train between Tokyo-Maibara
		Conventional train	1-2days	No. of days of suspended service and disturbance of schedule
		Subway	1～2 days	Same as above
	Road	In the city	Several days	Period of submerged road
		In the city		Heavy traffic congestion due to submerged road
River	Drain pump car		20 cars	Gathered from the whole country by Special emergency projects for the control of severe river disasters
Distribution	Supermarket, convenient store	In and outside the city		Food disappeared from the supermarkets for paralysis distribution. For fresh food,time limit was expired and then disposed as wastes...
Companies, Government office	Important data			Large numbers of computer were submerged, resulted in data loss and large amount of repair costs.
Main government support	Self-Defense Forces	Dispatch	Around 9,700 people	Total number
	Coastal Guard	Same as above	471 people	Total number
	Fire Department, Police Department,	Same as above		Conducted relief efforts including rescuing isolated people.

Ministry of Land, Infrastructure and Transport issues "Statistics of Flood Damage" by compiling the flood damages in the country each year. According to the statistics, the damage from Tokai Heavy Rain was 865.5 billion yen in Aichi prefecture alone.

The lawsuits were brought for the damages caused by Tokaido Heavy Rain against responsible administrative Authority. The whole story is as follow.

(Information below in from Asahi Newspaper 2008-03-13, but the data of damages differs from the above table.)

- In September, 2000, Tokai area experienced record breaking heavy rain. 75,000 houses were flooded, 10 people died around Aichi prefecture and total damage amounted 771.4 billion yen. 18,100 houses were flooded in Shinkawa river basin.

- In September, 2003, 38 residents in the affected region (later became 37) filed a lawsuit against the country and the prefecture authorities for their river management responsibility causing the destruction of dykes.
- In June, 2001, 672 residents and 54 companies in Nonami, Tenpaku ku, Nagoya City filed a lawsuit against the City for compensation from the damages.
- In January, 2006, first trial at the Nagoya District Court dismissed the claim by stating that "It was unprecedented heavy rain which would occur with a return period of once in 500 to 1000 years so that the prior measures were impossible to be taken".
- It was established that the residential side lost the case in the Supreme Court.

(3) Great East Japan Earthquake/ Tsunami

Followings are the extract from "Disaster Management White Paper 2011 (Summary version; as of May 2011)" and "Disaster Management White Paper 2012 (Summary version; as of May 2012)" issued by the Cabinet Office.

1) Overview of Earthquake (the Main Tremor) and Tsunami

At 14:46 on 11th March, 2011, the earthquake of magnitude 9.0 occurred at an epicenter of 130km east-southeast off Sanriku coast of the Oshika Peninsula. The source region was widely ranged off the coast from Iwate Prefecture to Ibaragi Prefecture.

The scale of this earthquake was of the largest recorded history in Japan and the forth largest earthquake occurred in the world after 1900.

From this earthquake, seismic intensities of 7 to 6 lower observed in northern Miyagi prefecture to southern Saitama prefecture and north-east of Chiba prefecture. In addition, seismic intensity 5 upper was observed in a wide range from Hokkaido to Kyushu regions of eastern Japan.

This was trench zone earthquake occurred at the boundary of continental plate and Pacific Ocean plate. According to the survey by the Japan Coast Guard, the seabed moved about 24m in the horizontal direction and was raised 3m in the vertical direction just above the epicenter, and that caused massive tsunami.

Meteorological Agency announced the Tsunami warning at 14:49. The highest tide was recorded 9.3m (in Souma city in Fukushima Prefecture). The Uprush of Tsunami was observed 40.5m, the highest in domestic recorded history and large tsunami was observed in various parts of Japan.

2) Overview of Damages on Human and Facilities

Since the damages on facilities covered broad areas, the table below mainly describes the damages in north eastern district.

Table 13.2.4 Damages on Human and Facilities by Great East Japan Earthquake

Damage on Human	Death		15,859 people	30th May, 2012 announced by National Policy Agency
	Missing		3,021 people	
	Casualty	Serious injury	666 people	
		Minor injury	5,190 people	
		Total	6,121 people	
Damages on Facility related	Housing damage	Complete destruction	130,000 houses	10 prefectures
		Partial destruction	260,000 houses	13 prefectures
		Some destruction		
		Total	639,686 houses	
	Non-housing damage	Public building	1,579 buildings	
		Others	40,917 buildings	
	Government building	Affected building	237	Total No. of municipality is 352 Issues on administrative services occurred such as distribution of relief supplies, data loss including the Basic Resident Register, and distribution of relief funds etc.
	Educational facilities		12,000 facilities	School, social educational facilities, cultural assets etc.
	Medical facilities			The medical institutions in Fukushima, Iwate and Miyagi prefectures were damaged. Hospital: 300 out of 380 were affected and 11 were completely destroyed. General clinics and dental clinics: 1,174 clinics out of 6,531were affected and 167 were completely destroyed. Social welfare facilities: 875 were damaged and 59 were completely destroyed
Infrastructure facilities	Railway	Operational Status		Many lines stopped operation including JR East Japan and private railways. Bullet train resumed operation in 29th April, 18days after the earthquake.
	Road			Highwayand National roads including Tohoku Expressway and Joban Expressway were closed. Especially, National road No. 45 along the coast of Pacific Ocean was disrupted in many places. Tohoku Expressway was opened for private vehicles in 24th March, 13days after the earthquake. Joban Expressway became operational except for the regulated section of the Fukushima First Nuclear Power Plant 30th March, 19days after the earthquake.
	Port			All ports between Hachinohe city in Aomori Prefecture and Ibaragi Prefecture along the shore of Pacific Ocean stopped the functioning due to the earthquake and tsunami. By 24th March, after 13days, some quay became available which enabled to carry emergency supplies, fuels and others to the affected areas.
	Flight related			Sendai Airport affected by tsunami started to operate 1,500m runway for the provisional use of limited rescue plane in 16th March which received many relief supplies. 13th April, 33days after the earthquake, operations for the private flight were resumed.
	Bridges			
	River related	Under National Government administration	2,115 location	No. of damaged dyke, revetment, etc.
		Local governments	1,360 location	Same as above

		management		
	Coastal facilities			Out of about 300km of coastal dyke at the three prefectures in Iwate, Miyagi and Fukushima, 190km was completely destroyed or partially destroyed and 561km^2 was damaged by inundation.
Lifeline	Electricity	Number of households out of power	About 8,910,000	After about 2.5 months later, reduced to about 300 households in Tohoku Electric Power area except the area where houses were flowed.
	Gas	Outage	About 410,000	With support from the urban gas operators in other regions, about 420,000 units were restored by 3rd May after 53 days except the area where houses were flowed. LPG was able to be supplied except the area where houses were flowed.
	Water	Outage	About 2,200,000	With support from the water supply operators all over the country, household units with water outage recorded 65,000 in the three prefectures about after 70 days on 20th May.
	Waste Water	Treatment plant	120	The 93 treatment plants in Tokyoand 12 prefectures districts were operated properly after about 80 days on 30th May except the nine plants unknown. Obvious outage plants were reduced to 18.
		Pump facility	112	Outage facilities were reduced to 29 after 80 days on 30th May except one facility unknown.
		Sewer, manhole		80 days later by the visual inspection up to 30th May, the damage was confirmed at the point of total 957km out of 66,086km of sewers in 137 municipalities. 21,504 places were confirmed as a damage of manhole.
	Industrial water	Outage	44	The water supply was resumed at the 43 operations after 81 days on 31st May.
	Communication	Fixed-line phone	About 1,000,000	The number shows those of subscribed phones and the stopped lines of ISDN. The number of stopped line was reduced to about 12,000 after 80 days on 30th May.
		Mobile phone	About 14,800	The number shows those of stopped wave at the wireless base stations, which reduced to about 440 stations on 30th May.
	Broadcasting			2 stations out of 56 TV stations in Miyagi Prefecture were stopped on 31st May. The Ministry of Internal Affairs and Communications allowed to set up the temporary disaster broadcasting station (FM broadcasting) in response to the request from the 23 cities affected, with their wishing to secure the broadcasting means.
	Oil facilities	Refinery	6	The three plants were re-operated after about two months on 14th May, and the shutdown continued at three plants including two where the fire occurred at shipping facilities, piers and storage tanks.
		Distribution	1,137	1,137 out of 3,070 major wholesaler gas stations in the Tohoku region stopped their operation which caused gasoline shortage. 2,937 gas stations began operating, with stable supply being kept at many areas after 80 days on 30th May.
	Landslide		122 areas	122 disasters happened in 11 prefectures with 19 people died.
Agriculture	Farm land		About 24,000ha	The coastal area was damaged with runoff, flooding, and extensive accumulation of rubble, sludge and intrusion of salt water. The

				inland area was damaged with land subsidence and liquefaction extensively.
Fishery				A wide range of damages to fishing port, loss of fishing boats and fish processing facilities were found mainly in 7 prefectures (Hokkaido, Aomori, Iwate, Miyagi, Fukushima, Ibaragi and Chiba) which accounts for 50% of fishery production volume across the country.

3) Response to the Damage of Infrastructure, Lifeline etc.

Immediately after the disaster, many of administrative facilities of municipalities lost their capabilities to function.

The central government, local governments, organizations in-charge of llifeline, and other private operators worked desperately to restore unprecedented damaged facilities.

- The government sent a total number of 16,879 people to the disaster areas through the emergency disaster force organization (TEC-FORCE) set up by the Ministry of Land, Infrastructure and Transport.
- TEC-FORCE carried out a quick survey to grasp the disaster situation, to secure communication network in the affected local governments, to ensure emergency transportation routes and to discharge flooding water. In addition, they assisted the quick recovery of the affected local governments toward the smooth operation of rescue and emergency goods transportation.

4) Situation of Restoration

The road restoration work is summarized as follows.

- First of all, the vertical axis line of Tohoku Expressway and National Road No.4, the main line running north-south direction, was specified as the emergency transportation for securing access to the Tohoku region on 12th March, the next day of the disaster.
- At the same time, 11 routes were secured and opened by removing the obstacles of the national road from inland vertical axis line to east-west direction towards the Pacific Ocean coast with so called "tooth comb operation"
- In addition, the obstacle removal work at National Road No.45 was almost completed by 18th March, seven days after the disaster.

The port restoration work is summarized as follows.

- The port functions at all of the ports in the Pacific Ocean coast from Hachinohe, Aomori Prefecture leading to Ibaragi had stopped by the earthquake and tsunami.
- The restoration work on clearing obstacles at navigation channels and basins was made at major ports from March 14th after the tsunami warning was released.

- As a result, some piers were possible to be used at major ports by 24th March, starting with the Kamaishi, Ibaragi/Hitachinaka Port which were made possible to carry emergency goods and fuel.
- In about two months later, 148 out of 373 berths of the public quays with more than 4.5m water depth at the affected port were temporarily possible to be used.

The airport restoration work is as follows.

- The damage was found in Sendai Airport, Hyakuri Airport (Ibaragi Airport) and Hanamaki Airport.
- Sendai Airport and Hyakuri Airport was closed, and Hyakuri Airport restarted operation after three days.
- After five days, Sendai Airport, affected by tsunami, became possible to transport a lot of rescue goods, since 1,500 m runway was temporarily opened, but limited to rescue planes.
- As a result, the continued emergency restoration work, the private aviation flight was resumed on 13th April.

The disaster waste is summarized as follows.

- The Great East Japan Earthquake had produced enormous amount of disaster waste in Iwate, Miyagi and Fukushima prefecture particularly by tsunami. According to the estimation by Ministry of Environment, industrial waste of 5.25 million ton in Iwate, 11.54 million ton in Miyagi, 2.01 million ton in Fukushima, totaling of 18.80 million ton had been generated at the coastal municipalities in the three prefectures.
- To dispose and dismantle disaster waste properly and quickly, the government set up the system to dispose industrial waste on behalf of the municipalities which administrative functions were damaged. At the same time, the government established guidelines for removal of the damaged houses which owners could not be contacted with, and the guideline for handling hazardous waste for notifying to each local government.
- In the fiscal aspect, the government has decided to increase the rate of national expenditure for disaster waste disposal projects, and to cover 95% of the project cost on average by the government expense. The rest should be covered by the earthquake reconstruction special allocation tax, so that the municipalities affected by the disaster could been escaped from spending.
- In addition, for the sake of assisting local governments, the government formulated "The treatment guidelines for disaster waste with regards to the Great East Japan Earthquake (Master Plan)", and sent resident staffs, related to industrial waste management of Ministry of Environment, to the three prefectures, and also sent patrol visit staffs, researchers and engineers to the coastal municipalities, as a team of

Ministry of Environment. In addition, the Ministry provided the unused state-owned land for free as a disaster waste temporary storage space.

- The removed disaster wastes were carried into the temporary shelter; firstly to be crushed and sorted, and then to be classified into recycle, incineration, cement burning, or landfill materials. The waste was planned to be treated and disposed in sanitary and safety manners, depending on the types.
- For disaster wastes scattered near residential areas, the waste was transported to temporary storage yards within six months except the municipalities' districts inside the Fukushima nuclear plant security control area.
- The storage volume rate in the temporary yards out of all industrial wastes reached 79% in about two months.

(4) Comparison of Three Major Disasters

The features of Great Hanshin-Awaji Earthquake, Tokai Heavy Rain and Great East Japan Earthquake are compared from the view point of the impact to the logistics, and summarised in the following table.

Table 13.2.5 Comparison of the damage of 3 major natural disasters

Item	Great Hanshin-Awaji Earthquake	Tokai Heavy Rain	East Japan Earthquake
Date of the disaster	1995.1.17	2000.9.11	2011.3.11
Magnitude (rainfall intensity)	7.3	(114mm/hr. @ Tokai City, Aichi Prefecture)	9.0
Land feature in the affected area	City center	City and suburb	City and agriculture, forestry and fishery area
Affected area wideness	Hyogo	Aichi, Gifu, Mie	8 Prefectures in Tohoku and North Kanto
Tsunami (inundation)	50-60cm	(inundation above floor level of 22,894 units)	More than 3～8m
Feature of the disaster	Collapse of buildings and large-scale fire	Wide area flood	Wide coastal areas damage by tsunami
Total number of dead/missing persons	6,437	10	23,769
Damage to house (destroyed)	104,906	31	102,923
Impacts to supply chain	・In particular, the damage of Kobe Port that boasted the Japan's largest container traffic volume at that time, was devastating, and thus the shippers did not return even after the recovery. ・For this reason, the rank declined to 40th from witbin 5th in the world, and the leading position of international logistics chain was replaced by other ports such as those of Hong Kong, Korea and Taiwan.	・Fresh foods and groceries disappeared from the store temporarily. ・The important corporate data was lost by the submerged damage to PCs.	・The disaster had a serious impact on the international logistics due to the wide range of damage to factories of automobile and electric and electronics parts. ・The damage to PCs by the tsunami was the same as the case of Tokai Heavy Rain.
Economic loss by the disaster	Yen 9,900,000 million	Yen 865,500 million (Only in Aichi Prefecture)	Yen16,900,000 million
Application of the Disaster Relief Act	25 Cities (2 Prefectures)	17 Cities (3 Prefectures)	241 Cities (10 Prefectures)

(5) Lessons in Three Major Disasters

From the disaster case of the "three major natural disasters", factors to affect the logistics network to a great extent are noted in the following three items.

(1) Presence of alternative means (redundancy) in transportation and communication infrastructure such as roads, ports, airports, railways and communications.
(2) Emergency supplies disruptions to residents affected by the disaster, in terms of outage of daily goods, shortage, delay etc.
(3) Not only the companies problems from damage to recovery in affected areas, but also the stop or delay of production or delivery at companies outside the affected areas that were connected by the supply chain.

With respect to the post-disaster logistics, the early restorations of infrastructure facilities including life-line power, water supply and waste water treatment are the keys to the normalization.

Phasing of the time flow is important during the course of recovering the disaster infrastructure.

- Within 72 hours: To place top priorities on providing minimum rescue goods by car, railway, ship, aircraft and helicopter to the shelter located at the affected area.
- To secure lifelines, coping with emergency
- Within 4 days to 1 week: To secure the key transport routes and set up an integrated delivery place of rescue goods around the affected area, so that the management of shelter can be set up, and then the evacuation life would be stabilized physically and mentally.
- To actualize these time frames, that is, for achieving an early operation, deciding the alternative bases for not only ports and airports in the vicinity of affected areas, but also for affected factories and logistics facilities, is necessary. Car transportation will be the main means for these countermeasures.
- Within one month: To recover original functions of transportation network and logistics centers for ensuring the goods to be delivered to the people affected. This would lead to the restoration and reconstruction of corporate activities including the employees' return to the works.

The situation and recovery condition of the affected area changes from place to place and from time to time, therefore, the information flow between the fields and the headquarters must be secured through the three stages as described above.

It is extremely important to take measures to share information through communication tools such as TV, radio, disaster radio and others, among the headquarters of the government, municipalities, companies in industrial parks and residents at the affected area.

13.3 Current Status and Trends of the ASEAN Logistics Network

13.3.1 Overview of the ASEAN Logistics Network

(1) General Overview of Logistics Sector

With the development of economic globalization in recent years, logistics sector is changing rapidly. This trend will be accelerating as the development of electronic information technology continues.

In the supply chain management, an important element of a corporate strategy is that a company cannot complete a series of materials flows in domestic market only, such as procurement of raw materials, production, storage, sorting, distribution, sales, collection and disposal.

The global economy has shown its strong attention to the continued stability and economic development in ASEAN countries in recent years.

It is clear that the three pillars of ASEAN, China and India will play a major role in the supply chain management of developed countries in relation to supply chains of Europe, US and Japan in the near future.

In the framework of international trade, in addition to the economic integration of ASEAN targeting in 2015, Regional Comprehensive Economic Partnership (RCEP) and Trans-Pacific Partnership (TPP) are expected to make a big step forward.

These frameworks are shown in the figure below.

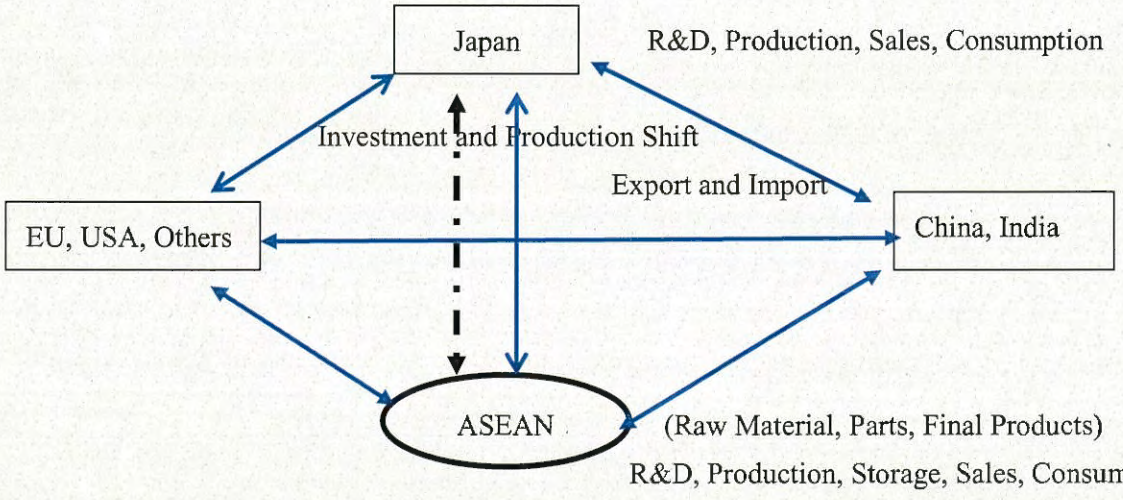
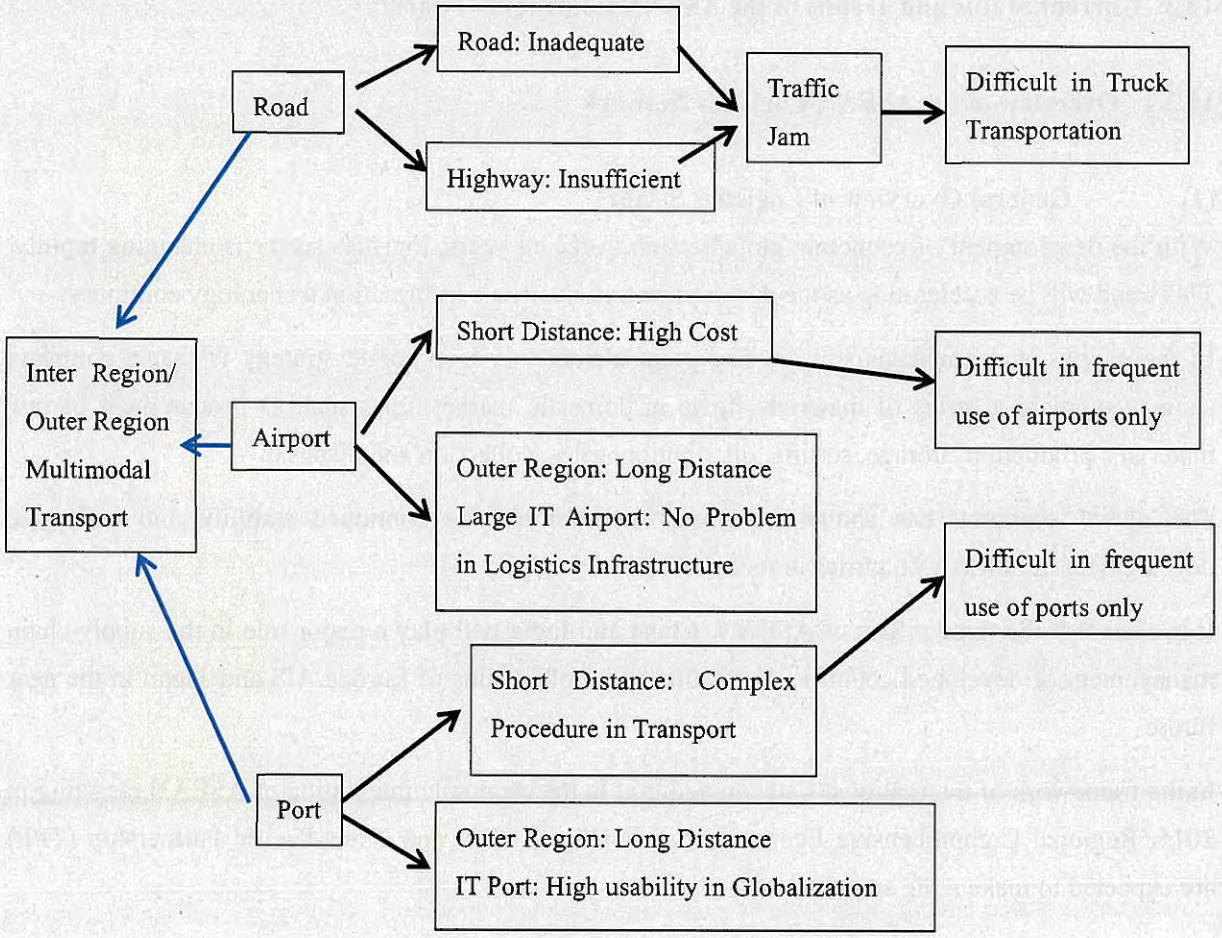


Figure 13.3.1 Trade Chart between ASEAN and Japan in Worldwide Physical Distribution Network

(2) Characteristics of the ASEAN Logistics Network

In global economic trend, regional cooperation and integration such as EU and NAFTA and bilateral cooperation such as FTA have been promoted. Logistics in ASEAN is at a crossroad in this trend.

The general challenges in logistics in ASEAN countries are as follows.



Source: The second edition of the latest trends of logistics, Kuninari Suzuki, Nikkan Kogyo Shimbun, Ltd.

Figure 13.3.2 General Issues Chart on Physical Distribution in ASEAN Countries

Table 13.3.1 The general characteristics of transportation modes in ASEAN countries

Transportation

Transportation Modes	Characteristics	Remarks
Truck	• Customs inspection and transshipment work are necessary at the border. • Traffic jam is regularly seen in urban areas due to the lack of road transportation network. • Highway has problems in efficiency due to the undeveloped sections.	• Three countries in Mekong region have been working towards liberalization of cross-border logistics as well as expansion of truck mutual entry
Port	• Despite the short distance, transportation cost is higher due to the cargo handling, customs inspection and bonded procedure require additional work. • Globalizing is possible by the IT international hub ports for long-distance transportation to outer regions being used.	Difficult in frequent use of only ports
Airport	• Transportation cost is higher as the short distance in ASEAN region cannot get benefit from the high-speed transportation. • In the global supply chain, handling of cargo, advantageous in shortening the lead time, such as precision electric components, is still limited.	Difficult in frequent use of only airports

13.3.2 Overview of the ASEAN Logistics Infrastructure

As mentioned, the infrastructures that play a leading role in logistics in ASEAN countries are roads and ports.

(1) Roads

The general trends of Asian Highway and general roads by country based on the civil infrastructure investigation are shown in the following table.

Table 13.3.2 Road Extension by Grade Classification (Unit in km and ratio % in parenthesis)

Country	Road General (km)			Asian Highway					
	Paved	Unpaved	Total	Primary	Class I	Class II	Class III	Under Class III	Total
Brunei	2,492 (6.3)	37,126 (93.7)	39,618 (100) In 2009	0	0	0	0	0	0
Cambodia	2,425 (80.1)	604 (19.9)	3,029 (100) In 2010	0	0	510	835	0	1,345
Indonesia	258,744 (59.1)	179,015 (40.9)	437,759 (100) In 2008	409	603	3,045	0	0	4,057
Lao PDR	530 (1.3)	39,038 (98.7)	39,568 (100) In 2007	0	0	244	2,307	306	2,857
Malaysia	80,280 (81.3)	18,441 (18.7)	98,721 (100) In 2004	795	61	817	0	0	1,673
Myanmar			34,377 (--) In 2010	0	147	0	1,798	1,064	3,009
Philippines	54,481 (25.6)	158,670 (74.4)	213,151 (100) In 2009	0	17	27	2,872	451	3,367
Singapore	3,356 (100)	0 (0)	3,356 (100) In 2009	11	8	0	0	0	19
Thailand	-- (--)	-- (--)	180,053 (100) In 2006	182	3,049	1,723	155	2	5,111
Vietnam	133,899 (74.2)	48,650 (25.8)	180,549 (100) In 2008	0	382	1,847	104	264	2,597
Total (km)				1,397	4,267	8,213	8,071	2,087	24,035

Source: For road general, The World Fact book by CIA is referred; for Asian Highway, Statistical year book for Asia and Pacific 2012 is referred.

Notes: Lane criteria of the Asian Highway are as follows;

- Primary, and ClassI; More than 4 lanes,
- Class II and III; More than 2 lanes

The objectives of Asian Highway are to connect Asian countries by highway network, and then to promote economic and cultural exchange and friendship nationally and internationally, and moreover to promote the peaceful development of all Asian countries.

The Asian Highway Project has been promoted mainly by United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) in cooperation with 32 countries and Japan.

The classification criteria of Asian Highway are as follows.

Table 13.3.3 Classification Criteria of Asian Highway

Criteria	Justification
Road network between the capitals	Promotion of international logistics and regional integration
Connection between major industrial areas as well as agricultural produce trading center	Promotion of transportation network between economic activity areas
Connection between ocean, river and ports	Integration of land and maritime transportation network
Connection of major container terminals	Integration of train and road transportation network
Connection of major tourism facilities	Promotion of using Asian Highway Network by tourists

Based on these criteria and justification, extending Asian Highway road network and upgrading the road level may directly lead to the improvement of supply chain.

(2) Ports

There are two aspects in ASEAN countries with regards to domestic and international shipping in port logistics:

- Both domestic and regional port logistics are short distance despite their time-consuming.
- Countries in the region have started to develop the hub ports with IT being equipped; however, it is not sufficient to match the corporate strategic level of supply chain management.

With ASEAN economic integration in 2015 approaching, it is a big challenge for both inner and outer region in ASEAN to upgrade their international logistics for sustainable development in the future.

Table 13.3.4 Traffic of Asian Designated Ports

Country	Port Name	Cargo (Ton)	Container (TEU)	Total		
				Nos of Port	Cargo (Ton)	Container (TEU)
Brunei	Muara	948,033	90,372	1	948,033	90,372
Cambodia	Phnonpenh	119,645	47,349	2	2,177,611	73,124
	Sihanoukville	2,057,966	25,775			
Indonesia	Belawan	20,094,000	590,069	14	252,520,351	7,257,096
	Dumai	6,168,000	0			
	Tanjung Priok	69,053,516	3,984,278			
	Palembang	15,314,929	78,469			
	Pangjang	15,314,929	104,142			
	Pontianak	4,233,845	132,732			
	Tanjung Perak	12,011,157	1,119,353			
	Tanjung Emas	6,784,097	373,644			
	Makassar	10,147,382	353,247			
	Balikpapan	53,383,910	82,961			
	Bitung	3,971,338	134,756			
	Jayapure	882,834	42,563			
	Sorong	909,442	9,339			
	Bajarmasin	38,601,118	251,543			
Lao PDR						
Malaysia	Port Klang	152,348,519	7,973,117	10	373,579,338	10,740,901
	Penang	25,999,896	929,639			
	Johor	25,312,782	936,000			
	Tanjung Pelepas	88,000,000	--			

	Kuantan	9,405,465	127,061			
	Kemaman	3,913,410	0			
	Bintulu	40,470,300	290,167			
	Kuchin	11,460,182	291,063			
	Sandakan	9,910,000	0			
	Kota Kinabalu	6,758,793	193,854			
Myanmar	Yangon/Thilawe	12,003,103	189,690	2	12,024,730	189,690
	Kyauk Pyu	21,627	0			
Philippines	Manila	40,303,151	2,997,022	9	80,068,318	4,146,142
	Batangas	606,626	497			
	Subic Bay	3,135,870	29,370			
	Cebu	26,348,803	495,829			
	Iloilo	2,236,789	81,936			
	Cagayan de Oro	327,623	13,636			
	Davao	3,597,396	349,006			
	General Santos	1,936,854	113,886			
	Zamboanga	1,575,208	64,950			
Singapore	Singpore	515,415,000	29,918,000	1	515,415,000	29,918,000
Thailand	Bangkok	17,767,818	1,460,713	3	74,435,741	6,841,144
	Laem Chabang	54,837,542	5,240,075			
	Songkhla	1,830,381	140,356			
Vietnam	Ho Chi Minh	64,591,118	3,433,621	4	95,170,357	4,996,217
	Hai Phong	25,054,027	1,398,654			
	Da Nang	2,784,517	61,881			
	Cai lan	2,740,700	102,061			
Total				47	1,406,339,479	64,252,686

Source: ASEAN Strategic Transport Plan 2011-2015

The rough ratios and shares of cargo handling amount in the ASEAN Designated Ports by each country are listed as Singapore (40%), Malaysia (24%), Indonesia (16%), Thailand (7%), Vietnam (7%) and Philippines (6%), and these correspond to LPI (Logistics Performance Index) announced by World Bank.

The adequacy of supply chain can be estimated from these figures.

The distance between major ports in the country is shown below

Table 13.3.5 Inter-distance between ASEAN Major Ports (Unit in km)

	Thailand Leam Chabang	Singapore	Malaysia Port Klang	Indonesia Tanjung Priok	Philippines Manila	Cambodia Phnom Penh	Lao PDR	Vietnam Hai phong	Vietnam Ho Chi Minh City	Myanmar Yangon	Brunei Muara
Thailand Leam Chabang		1,430	1,793	2,441	2,567	1,187		2,371	1,091	3,452	1,906
Singapore	1,430		367	1,070	2,543	1,300		2,471	1,174	2,025	1,356
Malaysia Port Klang	1,793	367		1,393	2,904	1,661		2,778	1,537	1,882	1,717
Indonesia Tanjung Priok	2,441	1,070	1,393		2,847	2,148		3,124	2,011	3,045	1,704
Philippines Manila	2,567	2,543	2,904	2,847		1,993		1,735	1,685	4,563	1,511
Cambodia Phnom Penh	1,187	1,300	1,661	2,148	1,933			1,724	402	3,322	1,424
Lao PDR											
Vietnam Haiphong	2,371	2,417	2,778	3,124	1,735	1,724			1,474	4,437	2,435
Do. Ho Chi	1,091	1,174	1,537	2,011	1,685	402		1,474		3,198	1,182

Minh City											
Myanmar Yangon	3,452	2,026	1,882	3,045	4,563	3,322		4,437	3,198		3,376
Brunei Muara	1,906	1,356	1,717	1,704	1,511	1,424		2,435	1,182	3,376	

Source: http://www.searates.com

The advantage of Singapore and Brunei in comparison with other ports is clear when comparing to the distance as an indicator. On the other hand, the disadvantage of the existing port in Myanmar is noticeable by the same indicator.

(3) Projects and planning of logistics infrastructure

"ASEAN Logistics Network Map 2008" by JETRO shows the projects and planning of logistics infrastructure.

The survey was conducted five years ago, and identifying new developments would directly lead to the prediction of future trends of logistics network such as the development progress of the planning and the relevance of the newly established projects.

In addition, getting information on the current progress of these projects is essential to develop the corporate logistics network as the completion period of these project plans were undetermined or unknown.

Table 13.3.6 Infrastructures Development Plan by ASEAN Country

Transportation Mode	Project Name	Outline	Schedule to Completion	Current Status
Cambodia				
Road	National Road No.1 (NR1) Neak Loeung Bridge Construction Project	Phnom Penh~Vietnam NR1 rehabilitation connecting to the border and the Mekong Bridge construction	2010	
	NR5 between Poi Pet and Sisophon	Rehabilitation of NR5 between Poi Pet and Sosophon at the Thailand border	2008	
	Road rehabilitation in GMS Cambodia	Part of GMS Highway road rehabilitation project connecting Bangkok~Phnom Penh~Ho Chi Minh~VungTau including rehabilitation of NR5 and NR6, and replacement of 45 bridges. This would complement the missing part of GMS Highway No.1.	2009	
	Road rehabilitation in GMS Cambodia	Rehabilitation of 250km between Siem Reap~Stung Treng (Lao border)	2007~2009	
Railway	Emergency rehabilitation between Phnom Penh~ Sihanoukville	Emergency rehabilitation of 248km of railway	2008	
	Emergency rehabilitation between Poi Pet and Sinophon	Construction of unfinished 48km section among "Southeast Asia Longitudinal Railway" linking Singapore and China's Yunnan Province	2004~2008	
	Railway between Battambang~Vietnam border	Extension of 255km as an Asian railway related project	Not Available	
Indonesia				
Road	North Java Highway Congestion Relief Project	Highway grade separation at the major congestion point of the national road running through the northern part of the Java island from east to west between	2008	

		Jakarta~Surabaya and the major alternate road.		
	Road and bridge construction between Samalinda~Balikpapan	The two-lane road (435km) and the bridge (1.2km) construction between Samalinda~Balikpapan in East Kalimantan	Undecided	
	Tanjung Priok port access road construction	Construction of a 12km highway connecting the Jakarta outer ring road and the port. Relaxing the traffic congestion around the Tanjung Priok Port is especially expected.	2008	
Port	Tanjung Priok port urgent rehabilitation project	Solving the underdeveloped port functions such as channel and basins dredging, breakwater relocation, road development and waiting of the vessels to enter. The implementation schedule is expected from April 2004 to June 2011.	2011	
	Tanjung Perak port expansion	Tanjung Perak Port expansion project near Surabaya (JBIC fund)	Not Available	
	The first phase of Bojonegara port development	Construction of deep sea port at Bojonegara in Banten State of 100km west of Jakarta as a new hub port to replace the Tanjun Priok Port	2013	
Airport	New Medan port construction project	New airport development with a set of facilities (JBIC fund)	Not Available	
Railway	North Java main railway doubling track project	Railway doubling track project between Cikampek~Cirebon	Commenced, but unknown to completion	
	South Java railway doubling track project	Starting from Feb 2005, 64km of doubling track between Kutoarjo~Yogyakarta	2009 Sep..	
Lao PDR				
Road	The third Mekong international bridge construction	The bridge construction with 650~700m between NakhonPhanom (Thailand) ~ Thakhek (Laos). The construction was agreed by the both governments in April 2006 and the logistics environment between Vietnam~Laos~Thailand will be improved after completion.	Undecided	
	The fourth Mekong international bridge construction	The bridge across Mekong river connecting from Houei Sai(Laos) to Chiang Khong(Thailand), part of the route to China via National Road No.3 (250km) from Thailand to Laos	Undecided	
Railway	Railway construction near the Friendship Bridge	The Phase 1 is to construct 3.5km from the Friendship Bridge to Dongphosy, and the Phase 2 is to construct 9km from Dongphosy to Sokkham. The Thai government grants 30% of the project budget.	April 2009	
Malaysia				
Road	Exclusive highway construction between KL~KL international airport	Construction of a 42km highway connecting directly to the KL city central and the KL international airport	2008	
	East Johor bypass road construction	Construction of a 10km highway connecting the new customs facility in Johor and the major North-South peninsula road.	Not Available	
Port	West Port Klang terminal expansion	The berth extension of 600m, expansion of the 60 acres container yard, and the addition of two Gantry Cranes have been progressed. The expansion to a total length of 3,600m, 18 Berths, and an annual container handling capacity to 8.4 million TEU have been planned in the long-term.	2010	
	Tanjung Pelepas port terminal expansion	Expansion of 8 Berths, the annual handling capacity to 10MillionTEU and the navigation channel width from 250m to 420m.	2008	
	Kuantan Port terminal expansion	Development of an privately operated container terminal and a pier for petrochemical products	Not Available	
Airport	Kuala Lumpur international airport long-term expansion project	In the future, development of the five 4,000m class runway and the expansion of cargo handling capacity from 1Million ton/year to 5~6Million ton/year are planned.	2020	
Railway	Railway double track between	The doubling track project is in progress by yen loan and the transport capacity is expected to be improved	2008	

	Rawang~Ipoh	significantly.		
Myanmar				
Road	Road construction between Thaton~Myawaddy	Road construction between Thaton and Myawaddy at the Thailand border	Undecided	
	Road construction between Muse~Bhamo	Road construction of 100km between Muse at Chinese border to Bhamo connecting Irrawaddy river. Chinese assistance project.	Unknown	
	Road expansion between Meiktila~Canton	634km, Two lanes, Project Cost is 15.2MillionUS$	Undecided	
	Road construction between Loilen~ Thi Baw	Road construction between Loilen and Thi Baw in the north region with two lanes and 253km. Project cost is estimated to be 46.9MillonUS$.	Undecided	
	Road construction between Dawei~Thailand Border	Underconstruction with the joint investment from Thailand private company (70%) and Myanmar government (30%).	2008	
Port	Irrawaddy river container transport project	Construction of container termninal at Bhamo, upstream of Irrawaddy river, to facilitate the transportation from Yunnan province of China to Yangon port, and to the Andaman sea The project is currently under discussion with the Chinese Government.	Undecided	
Airport	Construction of Hanthawaddy international airport	Currently under construction at the 80km east from Yangon, the suburb of Bago	Unknown	
Railway	Doubling track railway between Rawang~Ipoh	Construction in progress with Yen loan	2008	
	Railway construction between Thambyuzayat~Thail and border	260km between Thambyuzayat and Three Pagodas (Thailand). KOICA (Korea) completed F/S study in 2005	Undecided	
	Railway construction between Lashio~Chinese border	Railway extension project of 585km between Northern Lashio to Chinese border. Chinese side requires extend from the border to Dali	Undecided	
Philippines				
Road	Rehabilitation and expansion of North Luzon expressway	Rehabilitation of Highway connecting Manila to Clark Special Economic Zone (82.6km). The project includes 14 ICs and 24 bridges, 31 Overpass constructions.	Unknown	
Railway	New construction and rehabilitation of national railway	Rehabilitation of 5 locations in the existing lines and construction of 3 new lines	Unknown	
Singapore				
Port	Construction of Pasir Panjang new container terminal	Overall plan is to construct 49 berths in 30 years. 1st phase of 8 berths is already in operation. The completion of the 2nd phase is expected in 2009.	Completion of the whole 4 phases will take 30 years	
Airport	Expansion of Changi international airport	Construction of the 3rd passenger terminal to handle additional 20 million passengers. Started construction in October, 2000. There are concept for the 3rd runway and the 4th passenger terminal development.	2008	
Thailand				
Port	Expansion of Laem Chabang port	Construction of additional 6 Berth to increase annual cargo handling capacity by 70%	2012	
	Songkhla Port expansion	To accommodate projected increase of Break Bulk and Containerized Cargo	Unknown	
Railway	Railway construction between Nam Tok~Three Pagodas	Railway construction of 153km from Nam Tok in the Central-west part of Thailand to Three Pagodas at the Thailand/Myanmar border. KOICA completed F/S in December, 2006	Unknown	
	Railway construction	Railway extension of 16km	Undecided	

	between Map Ta Phut~Rayong			
	Doubling track railway between Chachoengsao~Laem Chabang	Railway Doubling track of 78km. Ministry of Transport intends to develop with PPP scheme. The public announcement was made in 2006.	2009	
Vietnam				
Road	Construction of expressway between Noi Bai international airport~Cai Rang port	Construction of toll expressway connecting Hanoi and Cai Rang port, parallel to the existing National Road 18. Start construction in 2010	2015	
	Construction of expressway between Hanoi~Hai Phong	Construction of toll expressway connecting Noi Bai airport in Hanoi and Haiphong, parallel to the existing National Road 5.	Undecided	
	Haiphong~Kunming corridor project: Noi Bai~LaoCai Highway Construction	244km Highway from Noi Bai, the suburb of Hanoi, to Lao Cai at the Chinese border. The project involves developing 10 ICs and toll stations. High priority for both countries. The completion of the highway will provide modern access road to the road network in China which considered as the high priority project in both countries.	2012	
	Improvement of logistics network in central Vietnam	Road pavement of about 1,200km connecting Major cities of 19 district in the Central region and surrounding areas to improve efficiency and safety of the transportation.	2010	
Port	Expansion of New Saigon port Cat Lai Container Terminal	Expansion of Cat Lai Container Terminal locates at the opposite shore of VICT (Vietnam International Container Terminal) in Ho Chi Minh City. The total extension will be 1,187m in length, development of Container berth and additional 15 Panamax cranes	2010	
	Rehabilitation and Expansion of Hai phong Port	The expansion project that corresponds to the increased cargo demand. Phase 2 is now under construction.	Unknown	
	Cai Mep-Thi Vai International Port Construction Project	Cai Mep Port (Container Terminal 2 Berths: Annual Handling Capacity 600,000TEU), Thi Vai Port (General Cargo Terminal 2 Berths: Capacity 1.3 MillionTEU). Total Project Cost: 42.9BillionUS$ (36.4MillionUS$ is Yen Loan) Construction period: Aug, 2004 to Nov, 2011	2011	
	Construction of Van Phong International Port	Construction of Container port at the Van Phong Bay with the annual cargo handling capacity of 2.4 Million TEU. The port can dock large size of container vessels. The location is 60 km north from Nha Trang in Khan Hoa Province. The investment cost is 550MillionUS$. The port aims to be of an international logistic hub. The capacity of Phase 1 will be 500,000 TEU.	First Phase : 2010 Completion : 2020	
Airport	Ho Chi Minh New Port Development	Construction of new international airport as an alternative to the existing Tansonnhat International Airport	2015	
Railway	Railway Development between Ho Chi Minh~Loc Ninh	Construction of the missing link of "Trans Asian Railway" which links Singapore and Yunnan Province of China, and to connect the section between Vietnam and Cambodia. F/S is completed by KOICA (Korea)	2010	
	Doubling track railway between Lao Cai~Yen Vien	Transport capacity can increase about 2.5 times by the doubling track. Assisstance from ADB is already confirmed. The project improves the cargo transport capacity of the route fromYunnan province of China~Hanoi~Cai Rang Port/Haiphong Port	Unknown	
	Construction of shortcut line from Hanoi~Cai Rang Port route	Construction of double track line between Yen Vien and Coh Thanh. Upon completion, transport time can be shortened from Lao Cai, the border to Yunnan province, to Cai Rang Port, the major port at the north part of Vietnam	2008	

	Construction of High-speed railway between Hanoi~Ho Chi Minh	After completion, the travel time between two cities is expected to be 9 hours.	2020	

Source: Compiled by JETRO (from ADB, UNESCAP and Web site source of each countries)

"Civil Infrastructures Investigation" in this study focused on the physical distribution infrastructure development plan. Although the content of the individual project are not provided, the overview of the projects are shown as follow.

Table 13.3.7 Prospective Projects Identified in CADP:1/2

Country	Total	Priority			Tier			Type	
		Top	Priority	Normal	Tier 1	Tier 2	Tier 3	Public	PPP
Brunei	2	1	0	1	0	1	1	2	0
Cambodia	103	15	19	69	0	58	45	95	8
Indonesia	169	33	53	83	45	60	64	121	48
Lao PDR	77	1	6	70	0	26	51	71	6
Malaysia	23	3	7	13	7	10	6	21	2
Myanmar	26	8	6	12	0	22	4	25	1
Philippines	52	25	17	10	18	27	7	45	7
Singapore	0	0	0	0	0	0	0	0	0
Thailand	60	26	7	27	22	34	4	54	6
Vietnam	188	57	48	83	65	110	13	125	63
All ASEAN	700	169	163	368	157	348	195	559	141

Table 13.3.8 Prospective Projects Identified in CADP:2/2

Country	Sector								
	Logistics				Other Economic			Urban and Social	Other (Soft)
	Road/ Bridge	Railway	Port/ marine	Airport	Industrial Estate/SEZ	Energy /Power	Telecomm unication		
Brunei	1	0	1	0	0	0	0	0	0
Cambodia	37	6	8	6	8	17	8	11	0
Indonesia	54	9	34	4	0	45	1	18	0
Lao PDR	43	3	1	7	7	13	2	0	0
Malaysia	2	5	5	1	0	7	0	3	0
Myanmar	6	2	9	1	3	3	2	0	0
Philippines	21	0	18	3	0	3	0	3	0
Singapore	0	0	0	0	0	0	0	0	0
Thailand	10	19	7	2	8	11	2	0	0
Vietnam	49	19	23	8	28	47	3	10	0
All ASEAN	223	63	108	32	54	146	18	45	0

13.3.3 Intra-ASEAN Physical Distribution Network

(1) Problems and Countermeasures of Intra-ASEAN Physical Distribution Network

According to the "ASEAN Logistics Network Map 2008" of JETRO, problems and countermeasures are summarized as follows.

There is a need to investigate to what extent the problems are solved at this stage and the prospects of countermeasures to the unresolved challenges.

1) South-North Route

Land Route : Thailand・Malaysia・Singapore

Sea Route : Singapore・Jakarta

- Application of speedy custom clearance procedure, implementation of one-stop service; electronic system and common customs tariff code, etc. are partly introduced.
- Improvement of issues on returnable containers; transport containers are principally tax free in the global standard.
- Transport time; especially in case of truck, because the transshipment and customs clearances time are not shortened, and considering the traffic congested situation, time loss is a major problem.
- Cost; the percentages of fuel cost and vehicle cost are high and labor cost is low in case of the container transport by truck. Therefore, there are large differences in freight and charge between foreign and local logistic carriers.
- Transportation quality; further strengthening of security is required with respect to the track jack and pirates.
- Tanjung Priok Port; improvement of port operation system such as cargo handling capacity and development of the port access road is necessary.

2) East-West Route

Land Route : Thailand・Lao PDR・Vietnam、Vietnam・China

Sea Route : Thailand・Vietnam

- Issues identified in the previous survey; for truck transport, 1) no consolidated transportation, 2) cost for transshipment and time loss, 3) restriction on night driving, 4) time loss at the custom clearances and etc.
- Measures for cost reduction; cost reduction is the key to the commercialization. Followings are the main issues to be solved.
  - Single load issue; in particular, the trade volume between Bangkok and Hanoi is extremely unbalanced.
  - Possibility of consolidated cargo; at present, there are no clear measures for this issue.
  - Cooperation with the local carrier; the urgent issue is that mutual cooperation with Japanese shippers and Japanese logistic companies is more efficient than the excessive competition.
- Measures for shortening the required time ; It is important to promote the application of GMS/CBTA (Greater Mekong Sub-region/ Cross Border Transport Agreement) for the prior entry system, shortening the time of transshipment and customs clearance.
- Transport quality; there are mixed traffic sections of vehicles and livestock carts, and subsidence and parts of the road and vibration problem in under-construction sections. Proper road management and maintenance is required.
- For the ocean route, promotion of development of ports and access road in Vietnam is necessary.

(2) Problems on Logistics toward Formalization of ASEAN Union

Countermeasures for materializing the seamless economic zone towards the formalization of ASEAN Union are shown in the table below.

Table 13.3.9 Countermeasures for Materializing Seamless Economic Zone

Issue	Countermeasures	
	Private Sector	Public Sector
Investment environment	● Deployment of horizontal international specialization	● Improvement of investment environments from developed countries to ASEAN region
Physical distribution development	● Development of distribution center ● Cooperation between logistics companies	● Development of transportation infrastructure, in particular ports and roads ● Training of logistics operators ● Development of transport related legislating

The challenges in logistics sector in CLMV (Cambodia, Lao PDR, Myanmar and Vietnam) are to promote ease of international horizontal specialization. For this purpose, it is necessary to implement measures that consist of three stages.

i) Strengthen the economic cooperation between CLMV countries and ASEAN advanced countries of Thailand, Malaysia and Singapore.
ii) Strengthen the intermediary economy between China and Vietnam as well as India and Myanmar.
iii) Strengthen the economic cooperation with Lao PDR and Cambodia, which potentially have function as the intermediary hub of the East-West route

In addition to the above, bilateral economic cooperation among Lao PDR, Thailand, Cambodia and Vietnam shall be promoted alongside with ASEAN economic integration.

13.3.4 Extra-ASEAN Physical Distribution Network

Physical distributions to and from ASEAN are either by sea and air. At present, marine transportation is the most commonly used means of transportation on both weight and value basis.

In the marine transport, containerized cargo is a typical form of transport at this moment among the general cargo, except bulk cargo.

Global transport performances of containerized cargo are shown below.

According to these tables, among ASEAN countries, Thailand, Indonesia, Malaysia and Vietnam ranked in the top 20 both in import and export.

Table 13.3.10 Top 20 Exporters of Containerized Cargo, 2009 and 2010

Rank	EXPORTER	2009 TEUS (Millions)	2010 TEUS (Millions)
1	China	26.1	31.3
2	United States	10.2	11.2
3	Japan	4.8	5.7
4	South Korea	4.5	5.2
5	Taiwan, China	2.9	3.4
6	Thailand	3	3.4
7	Germany	2.6	3
8	Indonesia	2.7	3
9	Malaysia	2.2	2.5

10	Brazil	2.3	2.3
11	India	1.6	1.9
12	Vietnam	1.3	1.6
13	Saudi Arabia	1.1	1.6
14	Italy	1.5	1.6
15	Turkey	1.4	1.6
16	Netherlands	1.4	1.6
17	Canada	1.4	1.5
18	United Kingdom	1.4	1.5
19	France	1.2	1.3
20	Hong Kong	1.2	1.3
	World Total	99.8	114.3

Source: IHS Global Insight, World Trade Service

Table 13.3.11 Top 20 Importers of Containerized Cargo, 2009 and 2010

Rank	IMPORTER	2009 TEUS (Millions)	2010 TEUS (Millions)
1	United States	15	17.6
2	China	11.2	12
3	Japan	5.4	6.1
4	South Korea	3.9	4.5
5	Germany	2.4	2.8
6	Other Arabian Gulf	2.3	2.7
7	United Kingdom	2.3	2.5
8	Indonesia	2.1	2.5
9	Taiwan	2.2	2.5
10	Hong Kong	2.3	2.5
11	Western Africa	2.5	2.4
12	United Arab Emirates	2	2.1
13	Malaysia	1.7	2.1
14	Thailand	1.6	2
15	Vietnam	1.8	2
16	India	1.7	2
17	Brazil	1.3	1.9
18	Australia	1.5	1.8
19	Italy	1.6	1.8
20	Netherlands	1.3	1.7
	World Total	99.7	114.3

Source: IHS Global Insight, World Trade Service

Table below shows trading partner of ASEAN countries in value basis.

Table 13.3.12 ASEAN Trade by selected Partner Country/Region, 2011

Partner country/region	Value (US$ million)			Share to total ASEAN trade (%)		
	Exports	Imports	Total trade	Exports	Imports	Total trade
ASEAN	327,531.8	270,710.4	598,242.2	26.4	23.6	25.0
China	127,908.5	152,497.1	280,405.5	10.3	13.3	11.7
Japan	145,197.7	128,149.4	273,347.1	11.7	11.2	11.4
EU-27	126,593.5	108,182.6	234,776.2	10.2	9.4	9.8
USA	106,305.6	92,480.3	198,785.9	8.6	8.1	8.3
Republic of Korea	54,468.0	70,002.9	124,470.9	4.4	6.1	5.2
India	42,754.7	25,674.1	68,428.8	3.4	2.2	2.9
Australia	37,253.9	22,220.5	59,474.4	3.0	1.9	2.5
Russia	2,689.4	11,278.5	13,967.9	0.2	1.0	0.6
Canada	5,292.7	5,478.4	10,771.1	0.4	0.5	0.5
New Zealand	4,569.3	3,667.5	8,236.7	0.4	0.3	0.3
Pakistan	6,001.8	765.7	6,767.4	0.5	0.1	0.3
Total selected partner countries/regions	986,566.9	891,107.3	1,877,674.2	79.4	77.7	78.6
Others2/	255,719.5	255,198.6	510,918.0	20.6	22.3	21.4

Total ASEAN	1,242,286.4	1,146,305.9	2,388,592.3	100.0	100.0	100.0

From those macro data, the distribution network outside the ASEAN region seems to form the trunk route with regular services between major ports of above mentioned countries/region and ASEAN countries.

13.4 Analysis on ASEAN Physical Distribution Network

This section evaluates the vulnerability of logistics network to natural disasters in consideration of the actual situation of supply chain and also survey items related to "Hyogo Framework for Action 2005-2015/AADMER Work Programme" and formulation of wide area BCP.

13.4.1 Assessment Criteria on Risk Management

Recognizing that there is a high risk of natural disasters in the region, each country in ASEAN established various inter-regional agreements since "Declaration of ASEAN Concord; Mutual Support on Natural Disasters (1976)".

On 24th December, 2009, ASEAN Agreement on Disaster Management and Emergency Response (AADMER) was enforced which implies that the Hyogo Framework for Action will be implemented by the joint effort of ASEAN.

To consolidate the Agreement and to make it operations, AADMER work program was formulated.

Next table shows Strategic Components proposed in the AADMER Work Program.

Table 13.4.1 AADMER Work Program (2010-2015) Strategic Components

Strategic Component	Sub Component
1. Risk evaluation, Early warning and Monitoring	1.1 Risk Evaluation
	1.2 Early warning
	1.3 Monitoring
2. Disaster Prevention and Mitigation	2.1 Implementation of the national project, Strengthening of the legal framework
	2.2 Disaster prevention to the mainstream in National Development Plan
	2.3 Disaster prevention to the mainstream in education sector and health sector
	2.3.1 Disaster prevention education to school education
	2.3.2 Disaster proof educational facilities
	2.3.3 Disaster proof hospital facilities
	2.4 Public education and Awareness raising
	2.5 Disaster management in urban areas
	2.6 Community disaster management
	2.7 Establishment of the disaster prevention partnership with climate change adaptation program
	2.8 Financial support to the disaster risk including micro-finance
3. Preparedness for disaster and the emergency response	
4. Rehabilitation	

Source : JICA Study Report "Study on ASEAN Regional Cooperation for Disaster Reduction"

Strategic components of AADMER work program mainly defines the framework of measures on the policy and social aspect, yet detailed measures on economic and industrial aspect appear to be negligibly considered.

In this study, focus was made on counter-measures from the point of disaster reduction in industrial clusters and the associated supply chain as the industrial supporting infrastructure.

In this regard, hard infrastructure was particularly weighed for the evaluation of vulnerability in logistic network.

The scope of evaluation is summarized in the following table.

Table 13.4.2 Scope of evaluation in logistic network

			Core business	Business assets	
Industrial complex (Industrial park)	Industries	Company A,B,C …	Manufacturing	Buildings and facilities	Internal resources
		Company L,M,N …	Logistics service	Logistics in the park and management	
		Company U,V,W …	Other services	Common infrastructure in the park (power, water supply, internal roads, telecommunication, heat supply, waste management etc.)	
	Social lives (expatriate)	Residential area		Expatriate (residence)	
		Commercial facilities			
Industrial complex (Other than industrial park)	Social lives (employee)	Residential area		Employee (residence)	
		Commercial facilities		Lifeline (power, water supply, telecommunication, heat supply, waste management etc.)	External resources
	Industrial function	Logistics facilities		Transportation infrastructure (road, railway, port, airport etc.)	
	Public administration			Other (Government buildings, educational buildings, health center, police, fire fighting facilities, etc.)	

Source: 「Area-BCP」 Mitsubishi Research Institute

Another functional linkages table of supply chain and logistics network mentioned above is summarized as follows.

Table 13.4.3 Matrix tables by function of logistic network and related facilities

Core business facilities an Infrastructure facilities	Resources		Procurement and shipping of goods			Transportation/Distribution			
	Internal	External	Raw material and machinery	Inter-mediate	Final	Internal	External	Raw material and machinery	Inter-mediate
Industrial complex									
Site and internal roads									
Factory									
Logistics center									
Distribution center									
Wholesale depot									
Shops									
Transportation infrastructure									

Road									
Railway									
Port									
Airport									
Lifeline (power, water supply, telecommunication etc.)									
Residential area/residence									
Public facilities									

Of the logistics network facilities, facilities belonging to the internal resources should be maintained in accordance with BCP management strategy of each company.

However, the facility being internal resources would have a dependency on external resources facility from the perspective of supply chain management.

Therefore, when analyzing the logistics network vulnerability to natural disasters, it is not possible to distinguish internal resources from external resources.

In logistics network vulnerability analysis, the target field is evaluated as follows.

Table 13.4.4 Items evaluated for vulnerability analysis on logistics network related facilities against natural disasters

Boundary of responsibility in disaster prevention and mitigation measures		Evaluation items	
Company/ employee	Government/ employee/ resident	Items	Facilities
•	•	Strengthening foundation and reinforcing ground	Company facilities (factories, distribution centers, residence), public facilities (transportation infrastructure, lifeline etc.), residential, commercial facilities, business facilities
•	•	Seismic degree level	Facility structures of the above
•	•	Level of waterproof	Inundation, waterproof and water pressure measures on the structures of the above facility
•	•	Level of fireproof	Fire protection facilities (green space, water facilities)
•	•	Ground elevation of the facility site	Raising corporate and public facilities, showing ground elevation of transport infrastructure
•	•	Decentralization of the function	Company facilities and public facilities
•	•	Presence of alternative facilities	Replacement of facility of the above, detour network facilities of roads, railways, and the lifeline
•	•	Necessity of new offices	Base at the time disaster occurs
•	•	Enactment of the transfer of authority	Business and the government emergency response when disaster occurs
•	•	Presence of a stockpile emergency supplies	Emergency and medical supplies by Government, residents (and their council organization)
•		Spares of raw materials, parts, etc.	Parts required for production companies, distribution activities, machinery, tools, etc.
•	•	Establishment of the ad hoc	Hierarchy of command /instructions in organization at the time

		organization during the disaster	of disaster
•	•	Establishment of manual	BCP manual at enterprise level and the administrative level
•	•	Education and training	Disaster prevention and mitigation training based on the BCP manual
•	•	Implementation and agreements of cooperation between central and regional governments, business-to-business, etc.	Organization partnership and its cooperation contents
	•	Disaster area designation	Regional and district areas of high risk from natural disaster, based on scientific assessment on the risk of natural disasters
	•	Shelter designation	Shelter for residents
	•	Request emergency rescue responders	Firefighting, police, military, corporations (construction companies, rental companies, etc.) NPO, foreign aids

13.4.2 elation to Performance/ Redundancy/ Complement of Physical Distribution Network

In the "Table 13.4.4 Items evaluated for vulnerability analysis on logistics network related facilities against natural disasters", evaluation criteria associated with the performance of network, complementary and alternation of logistics network are decentralization of functions, the presense of alternative facilities and necessity for new offices.

As macroeconomic research related to these findings, LPI (Logistics Performance Index) prepared by World Bank was presented

With regard to LPI, the performance is evaluated using the following six performance indicators as described above.

i) Efficiency of customs clearance (Efficiency of the clearance process i.e. Speed, simplicity and predictability of formalities by border control agencies, including Customs)
ii) Trade and logistics infrastructure (Quality of trade and transport related infrastructure e.g. Ports, railroads, roads, information technology)
iii) Easiness to ensure appropriate transport means (Ease of arranging competitively priced shipments)
iv) Capacity and quality of transportation services (Competence and quality of logistics services e.g. transport operators, customs brokers)
v) Management capabilities for tracking packages (Ability to track and trace consignments) Arrival time in the delivery (Timeliness of shipments in reaching destination within the scheduled or expected delivery time.)

When disaster occurs, six (6) indicators shown above are affected more or less, and the magnitude of the damage on the logistics and trade infrastructure in the second, and the degree of destruction or degradation on the capacity and quality of transport services in the fourth would be considered the dominant element in relation to the subsequent recovery after disaster.

Index of both "capacity and quality of transport services" and "trade and logistics infrastructure" are considered to embrace the transportation infrastructure and lifeline facilities as a whole.

Scores of the above two index for countries are as follows.

Table 13.4.5 International LPI Ranking 2012 by World Bank

Rank	Country	LPI	Trade and logistics infrastructures	Capacity and quality of transportation services
2	Singapore	4.09	4.22	4.12
29	Malaysia	3.44	3.5	3.34
35	Thailand	3.29	3.16	3.16
44	Philippines	3.14	2.57	2.95
53	Vietnam	2.96	2.56	2.89
75	Indonesia	2.76	2.54	2.47
118	Lao PDR	2.46	1.95	2.14
129	Cambodia	2.37	2.12	2.29
133	Myanmar	2.33	1.92	2.01
	Brunei	N.A		

These two metrics above is obtained by evaluating the level of transport infrastructure like road communication, ports and airports, and lifeline functionality of electrical power, water and sewage in the normal condition.

It is also assumed that the degree of maintaining the level of service and maintenance can be suggested from those indices figures, as well as preparedness for alternative and bypass facilities concerned at the time when disaster occurs, to some extent.

For LPI, it needs to be incorporated in more explicit way in the form of indicators of vulnerability against natural disasters in the future.

In addition, the level of alternative and complementary logistics infrastructure and lifeline facilities is to be clarified in the future, such as through field survey.

13.4.3 Assessment on Vulnerability of Physical Distribution Network

During natural disasters, in order to minimize the damage on the supply chain in its regional industrial clusters as well as in the whole country, and even outside and within the ASEAN region, it is a pressing issue for both business entities in industrial clusters and local government who has jurisdiction over the business and the industrial clusters, to strengthen measures on the disaster prevention and mitigation for logistics network

In distribution network vulnerability analysis at the time of disaster, the item being evaluated is as shown in Table 13.4.4.

Disaster prevention and mitigation measures can be divided into two areas of responsibility, that is, the management of the private company should take care, and the other area should be taken care of by government and utility companies.

In this section, the vulnerability of lifeline facilities, which hold the key to early recovery of the affected residents and businesses, and that of logistics infrastructure which public administrator and utility companies should take countermeasures against disaster, shall be examined in more detail,

The basis of the evaluation study is the lessons learned from past overcoming cases at the time of disasters, in the region of ASEAN as well as in Japan as under mentioned.

The Government:

- To conduct risk assessment based on scientific analysis and forecasting of natural disasters; floods, earthquakes and tsunamis, volcanic eruptions, landslides and other natural disasters.
- To form counter-measures and the enactment of the necessary laws and institutions, based on a scientific risk assessment, and vulnerability assessment of existing infrastructure and equipment structure,
- To develop new facilities or alternatives to the existing infrastructure
- To conduct public relations and to implement appropriate peacetime evacuation drills, and to specify the location/place of evacuation for residents
- To practice stockpiling of emergency supplies, medical and first aid supplies
- To conduct BCP development for regional cooperation with industrial clusters of businesses and companies, residents' autonomy bodies

The Company:

- To perform clarification of internal and external resources
- To predict the scale of damage and its impact on business activities by the type of natural disaster
- To set up the emergency response headquarter for creating full awareness of the chain of command at the time of disaster
- To create an organization-wide BCP which penetrates factories in industrial parks, logistics centers, headquarters and business offices in both domestic and overseas strongholds.
- To create disaster prevention and mitigation manual and to implement regular training based on the BCP
- To implement joint logistics with other companies or to operate decentralized - organized factories and distribution centers

Following tables show systematic analysis results of vulnerability on industrial parks/SEZ of each country, by checklist.

(1) Brunei

Table 13.4.6 Industrial Park in Brunei: Features and vulnerability Assessment against Natural Disasters **(Only for Example Purpose)**

Industrial Park (IPK) Name	Serasa	Lambak Kanan(west)	Pekan Belait	Serambangun	Muara SEZ
Features					
• Place	Serasa	Lambak Kanan	Pekan Belait	Serambangun	Muara Port area
• Operation Commencement Date					
• Nos of Operating Enterprises					
• Total IPK Annual Turn-over (Mill.US$)					
• Remarks					
Vulnerability Assessment for Each Industrial Park (IPK)					
Industrial Park Name:	Serasa	Lambak	Pekan Belait	Serambangun	Muara SEZ

		Kanan(west)			
Natural Disaster Risk(NDR)					
■ Flooding	Low	Low	Low	Low	Low
■ Seismic intensity/ Tsunami	Low	Low	Low	Low	Low
■ Volcano	Low	Low	Low	Low	Low
■ Cyclone, Meteorological Disaster, Landslide	Medium	Medium	Medium	Medium	Medium
Brief Descriptions on Counter-measures (CMS) for NDR					
1) Private sector facilities					
• Land, In-park Roads	Done	Done	Not yet	Not yet	Not yet
Countermeasures features/Remarks	Boundary dyke and Drainage Well water supply system under planning	Soil improvement			
• Plant facilities	Done/Not yet	Done/Not yet	Not yet	Not yet	Not yet
Countermeasures features/Remarks	Reinforcement to buildings varies to each company Stand-by Generator furnished	60% of lessees completed reinforcement to new flooding design criteria			
• Physical Distribution Facilities	Done inside, but not yet outside	Done but a few	Not yet	Not yet	Not yet
Countermeasures features/Remarks	Reinforcing buildings and equipment foundations done generally, but no plan for outside				
• Others, if any					
2) Infrastructures					
• Road	Not yet	Done	Not yet	Not yet	Not yet
Countermeasures features/Remarks	CMS Plan of bypass to the access roads to sea and air ports underway, but no implementation schedule foreseen				
• Railway	N/A	N/A	N/A	N/A	N/A
Countermeasures features/Remarks	No railway	Do. To left	Do. To left	Do. To left	Do. To left
• Port	Done	Done	Done	Done	Done
Countermeasures features/Remarks	50% of Muara Port Quay-walls reinforced to the new design criteria requirements				
• Airport	Budget for CMS being deliberated				
Countermeasures features/Remarks	Investigation works on-going				
3) Lifeline					
• Electric power	Done	Done	Done	Done	Done
Countermeasures features/Remarks	Transmission net line newly connected				
• Water-supply	Not yet				
Countermeasures features/Remarks	Water supply by well system being discussed				
• Sewage	Not yet				
Countermeasures features/Remarks	No provision of public sewage system to IPK				
• Solid waste	Not yet				
Countermeasures features/Remarks	New dumping area sought				

• Telecommunication	Not yet				
Countermeasures features/Remarks	Base station increasing plan being raised				
Vulnerability Assessment Results against Natural Disasters					
• Private sector facilities	Medium, Dispersing by companies				
• Infrastructures	30% to NDR requirements				
• Lifeline	20% to NDR requirements				
Total Vulnerability/ CMS Achievement	30% CMS Achievement				

(2) Cambodia

Table 13.4.7 Industrial Park in Cambodia: Features and vulnerability Assessment against Natural Disasters **(Only for Example Purpose)**

Industrial Park Name	Phnom Penh SEZ	Manhattan SEZ	Sihanoukville SEZ 1	Neang Kok Koh Kong SEZ	Muara SEZ
Features					
• Place	National Road No. 4, Khan Dangkor, Phnom Penh	Bavet Commune, Chantrea District, Svay Rieng Province	Stung Hav District, Sihanoukville City	Neang Kok Village, Pakkhlong Commune,Mundul Seyma Destrict, Koh Kong Province	
• Operation Commencement Date					
• Nos of Operating Enterprises					
• Total IPK Annual Turn-over (Mill.US$)					
• Remarks					
Vulnerability Assessment for Each Industrial Park (IPK)					
Industrial Park Name:	Phnom Penh SEZ	Manhattan SEZ	Sihanoukville SEZ 1	Neang Kok Koh Kong SEZ	Muara SEZ
Natural Disaster Risk(NDR)					
• Flooding	Low	Low	Low	Low	Low
• Seismic intensity/ Tsunami	Low	Low	Low	Low	Low
• Volcano	Low	Low	Low	Low	Low
• Cyclone, Meteorological Disaster, Landslide	Medium	Medium	Medium	Medium	Medium
Brief Descriptions on Counter-measures (CMS) for NDR					
1) Private sector facilities					
• Land, In-park Roads	Done	Done	Not yet	Not yet	Not yet
Countermeasures features/Remarks	Boundary dyke and Drainage Well water supply system under planning	Soil improvement			
• Plant facilities	Done/Not yet	Done/Not yet	Not yet	Not yet	Not yet
Countermeasures features/Remarks	Reinforcement to buildings varies to each company Stand-by Generator furnished	60% of lessees completed reinforcement to new flooding design criteria			
• Physical Distribution Facilities	Done inside, but not yet outside	Done but a few	Not yet	Not yet	Not yet

Countermeasures features/Remarks	Reinforcing buildings and equipment foundations done generally, but no plan for outside				
• Others, if any					
2) Infrastructures					
• Road	Not yet	Done	Not yet	Not yet	Not yet
Countermeasures features/Remarks	CMS Plan of bypass to the access roads to sea and air ports underway, but no implementation schedule foreseen				
• Railway					
Countermeasures features/Remarks	Container transportation plan under consideration	Do. To left	Do. To left	Do. To left	Do. To left
• Port	Done	Done	Done	Done	Done
Countermeasures features/Remarks	50% of Sihanoukville Port Quay-walls reinforced to the new design criteria requirements				
• Airport	Budget for CMS being deliberated				
Countermeasures features/Remarks	Investigation works on-going				
3) Lifeline					
• Electric power	Done	Done	Done	Done	Done
Countermeasures features/Remarks	Transmission net line newly connected				
• Water-supply	Not yet				
Countermeasures features/Remarks	Water supply by well system will be employed				
• Sewage	Not yet				
Countermeasures features/Remarks	No provision of public sewage system to IP				
• Solid waste	Not yet				
Countermeasures features/Remarks	New dumping area sought				
• Telecommunication	Not yet				
Countermeasures features/Remarks	Base station increasing plan being raised				
Vulnerability Assessment Results against Natural Disasters					
• Private sector facilities	Medium, Dispersing by companies				
• Infrastructures	30% to NDR requirements				
• Lifeline	20% to NDR requirements				
Total Vulnerability/ CMs Achievement	30% CMS Achievement				

(3) Indonesia

Table 13.4.8 Industrial Park in Indonesia: Features and vulnerability Assessment against Natural Disasters (**Only for Example Purpose)**

Industrial Park Name	Karawang International Industrial City (KIIC)				
Features					
• Place	Karawang				
• Operation Commencement Date					
• Nos of Operating					

Enterprises					
• Total IPK Annual Turn-over (Mill.US$)					
• Remarks					
Vulnerability Assessment for Each Industrial Park (IPK)					
Industrial Park Name:	Karawang International Industrial City (KIIC)				
Natural Disaster Risk(NDR)					
■ Flooding	Low				
■ Seismic intensity/ Tsunami	Low				
■ Volcano	Low				
■ Cyclone, Meteorological Disaster, Landslide	Medium				
Brief Descriptions on Counter-measures (CMS) for NDR					
1) Private sector facilities					
■ Land, In-park Roads	Done				
Countermeasures features/Remarks	Boundary dyke and Drainage Soil improvement				
■ Plant facilities	Done/Not yet	Done/Not yet	Not yet	Not yet	Not yet
Countermeasures features/Remarks	Reinforcement to buildings varies to each lessee company Stand-by Generator furnished				
■ Physical Distribution Facilities	Done inside, but not yet outside				
Countermeasures features/Remarks	Reinforcing buildings and equipment foundations done generally, but no plan for outside				
■ Others, if any					
2) Infrastructures					
■ Road	Not yet				
Countermeasures features/Remarks	CMS Plan of bypass to the access roads to sea and air ports underway, but no implementation schedule foreseen				
■ Railway	Not available				
Countermeasures features/Remarks	No railway				
■ Port	Done				
Countermeasures features/Remarks	50% of Tanjung Priok Port Quay-walls reinforced to the new design criteria requirements				
■ Airport	Budget for CMS being deliberated				
Countermeasures features/Remarks	Investigation works on-going				
3) Lifeline					
■ Electric power	Done	Done	Done	Done	Done
Countermeasures features/Remarks	Transmission net line newly connected				
■ Water-supply	Not yet				
Countermeasures features/Remarks	Water supply by well system will be employed				
■ Sewage	Not yet				
Countermeasures features/Remarks	No provision of public sewage system to IP				

■ Solid waste	Not yet				
Countermeasures features/Remarks	New dumping area sought				
■ Telecommunication	Not yet				
Countermeasures features/Remarks	Base station increasing plan being raised				
Vulnerability Assessment Results against Natural Disasters					
■ Private sector facilities	Medium, Dispersing by companies				
■ Infrastructures	30% to NDR requirements				
■ Lifeline	20% to NDR requirements				
Total Vulnerability/ CMS Achievement	30% CMS Achievement				

(4) Lao PDR

Table 13.4.9 Industrial Park in Lao PDR: Features and vulnerability Assessment against Natural Disasters **(Only for Example Purpose)**

Industrial Park Name	Savan-Seno	PSEZ(Phoukhyo Specific Economic Zone)	VITA Park		
Features					
• Place	Phetsalad Road, Khanthabouli District, Savannakhet Province				
• Operation Commencement Date					
• Nos of Operating Enterprises					
• Total IPK Annual Turn-over (Mill.US$)					
• Remarks					
Vulnerability Assessment for Each Industrial Park (IPK)					
Industrial Park Name:	Savan-Seno	PSEZ(Phoukhyo Specific Economic Zone)	VITA Park		
Natural Disaster Risk(NDR)					
■ Flooding	Low				
■ Seismic intensity/ Tsunami	Low				
■ Volcano	Low				
■ Cyclone, Meteorological Disaster, Landslide	Medium				
Brief Descriptions on Counter-measures (CMS) for NDR					
1) Private sector facilities					
■ Land, In-park Roads	Done				
Countermeasures features/Remarks	Boundary dyke and Drainage Soil improvement				
■ Plant facilities	Done/Not yet	Done/Not yet	Not yet	Not yet	Not yet
Countermeasures features/Remarks	Reinforcement to buildings varies to each lessee company Stand-by Generator furnished				
■ Physical Distribution Facilities	Done inside, but not yet outside				
Countermeasures features/Remarks	Reinforcing buildings and equipment foundations done				

	generally, but no plan for outside				
■ Others, if any					
2) Infrastructures					
■ Road	Not yet				
Countermeasures features/Remarks	CMS Plan of bypass to the access roads to sea and air ports underway, but no implementation schedule foreseen				
■ Railway	Not available				
Countermeasures features/Remarks	No railway				
■ Port	Done				
Countermeasures features/Remarks	50% of Tanjung Priok Port Quay-walls reinforced to the new design criteria requirements				
■ Airport	Budget for CMS being deliberated				
Countermeasures features/Remarks	Investigation works on-going				
3) Lifeline					
■ Electric power	Done	Done	Done	Done	Done
Countermeasures features/Remarks	Transmission net line newly connected				
■ Water-supply	Not yet				
Countermeasures features/Remarks	Water supply by well system will be employed				
■ Sewage	Not yet				
Countermeasures features/Remarks	No provision of public sewage system to IP				
■ Solid waste	Not yet				
Countermeasures features/Remarks	New dumping area sought				
■ Telecommunication	Not yet				
Countermeasures features/Remarks	Base station increasing plan being raised				
Vulnerability Assessment Results against Natural Disasters					
■ Private sector facilities	Medium, Dispersing by companies				
■ Infrastructures	30% to NDR requirements				
■ Lifeline	20% to NDR requirements				
Total Vulnerability/ CMS Achievement	30% CMS Achievement				

(5) Malaysia

Table 13.4.10 Industrial Park in Malaysia: Features and vulnerability Assessment against Natural Disasters **(Only for Example Purpose)**

Industrial Park Name	Shah Alam Section 15, 15, 21, 22, 23	Hicom Industrial Valley, Shah Alam	Prai Industrial Park		
Features					
• Place	Shah Alam 40200	Shah Alam	13600 Prai, Penang		
• Operation Commencement Date					
• Nos of Operating Enterprises					
• Total IPK Annual Turn-over (Mill.US$)					

• Remarks					
Vulnerability Assessment for Each Industrial Park (IPK)					
Industrial Park Name:	Shah Alam Section 15, 15, 21, 22, 23	Hicom Industrial Valley, Shah Alam	Prai Industrial Park		
Natural Disaster Risk(NDR)					
■ Flooding	Low				
■ Seismic intensity/ Tsunami	Low				
■ Volcano	Low				
■ Cyclone, Meteorological Disaster, Landslide	Medium				
Brief Descriptions on Counter-measures (CMS) for NDR					
1) Private sector facilities					
■ Land, In-park Roads	Done				
Countermeasures features/Remarks	Boundary dyke and Drainage Soil improvement				
■ Plant facilities	Done/Not yet	Done/Not yet	Not yet	Not yet	Not yet
Countermeasures features/Remarks	Reinforcement to buildings varies to each lessee company Stand-by Generator furnished				
■ Physical Distribution Facilities	Done inside, but not yet outside				
Countermeasures features/Remarks	Reinforcing buildings and equipment foundations done generally, but no plan for outside				
■ Others, if any					
2) Infrastructures					
■ Road	Not yet				
Countermeasures features/Remarks	CMS Plan of bypass to the access roads to sea and air ports underway, but no implementation schedule foreseen				
■ Railway	Not available				
Countermeasures features/Remarks	No railway				
■ Port	Done				
Countermeasures features/Remarks	50% of Tanjung Priok Port Quay-walls reinforced to the new design criteria requirements				
■ Airport	Budget for CMS being deliberated				
Countermeasures features/Remarks	Investigation works on-going				
3) Lifeline					
■ Electric power	Done	Done	Done	Done	Done
Countermeasures features/Remarks	Transmission net line newly connected				
■ Water-supply	Not yet				
Countermeasures features/Remarks	Water supply by well system will be employed				
■ Sewage	Not yet				
Countermeasures features/Remarks	No provision of public sewage system to IP				
■ Solid waste	Not yet				
Countermeasures	New dumping area sought				

features/Remarks					
■ Telecommunication	Not yet				
Countermeasures features/Remarks	Base station increasing plan being raised				
Vulnerability Assessment Results against Natural Disasters					
■ Private sector facilities	Medium, Dispersing by companies				
■ Infrastructures	30% to NDR requirements				
■ Lifeline	20% to NDR requirements				
Total Vulnerability/ CMS Achievement	30% CMS Achievement				

(6) Myanmar

Table 13.4.11 Industrial Park in Myanmar: Features and vulnerability Assessment against Natural Disasters **(Only for Example Purpose)**

Industrial Park Name					
Features					
• Place					
• Operation Commencement Date					
• Nos of Operating Enterprises					
• Total IPK Annual Turn-over (Mill.US$)					
• Remarks					
Vulnerability Assessment for Each Industrial Park (IPK)					
Industrial Park Name:					
Natural Disaster Risk(NDR)					
■ Flooding	Low				
■ Seismic intensity/ Tsunami	Low				
■ Volcano	Low				
■ Cyclone, Meteorological Disaster, Landslide	Medium				
Brief Descriptions on Counter-measures (CMS) for NDR					
1) Private sector facilities					
■ Land, In-park Roads	Done				
Countermeasures features/Remarks	Boundary dyke and Drainage Soil improvement				
■ Plant facilities	Done/Not yet	Done/Not yet	Not yet	Not yet	Not yet
Countermeasures features/Remarks	Reinforcement to buildings varies to each lessee company Stand-by Generator furnished				
■ Physical Distribution Facilities	Done inside, but not yet outside				
Countermeasures features/Remarks	Reinforcing buildings and equipment foundations done generally, but no plan for outside				
■ Others, if any					
2) Infrastructures					
■ Road	Not yet				
Countermeasures features/Remarks	CMS Plan of bypass to the access roads to sea and air ports underway, but no implementation				

	schedule foreseen				
■ Railway	Not available				
Countermeasures features/Remarks	No railway				
■ Port	Done				
Countermeasures features/Remarks	50% of Tanjung Priok Port Quay-walls reinforced to the new design criteria requirements				
■ Airport	Budget for CMS being deliberated				
Countermeasures features/Remarks	Investigation works on-going				
3) Lifeline					
■ Electric power	Done	Done	Done	Done	Done
Countermeasures features/Remarks	Transmission net line newly connected				
■ Water-supply	Not yet				
Countermeasures features/Remarks	Water supply by well system will be employed				
■ Sewage	Not yet				
Countermeasures features/Remarks	No provision of public sewage system to IP				
■ Solid waste	Not yet				
Countermeasures features/Remarks	New dumping area sought				
■ Telecommunication	Not yet				
Countermeasures features/Remarks	Base station increasing plan being raised				
Vulnerability Assessment Results against Natural Disasters					
■ Private sector facilities	Medium, Dispersing by companies				
■ Infrastructures	30% to NDR requirements				
■ Lifeline	20% to NDR requirements				
Total Vulnerability/ CMS Achievement	30% CMS Achievement				

(7) Philippines

Table 13.4.12 Industrial Park in Philippines: Features and vulnerability Assessment against Natural Disasters **(Only for Example Purpose)**

Industrial Park Name	Cavite Economic Zone	Laguna Technopark	Mactan Export Processing Zone		
Features					
• Place	Cavite				
• Operation Commencement Date					
• Nos of Operating Enterprises					
• Total IPK Annual Turn-over (Mill.US$)					
• Remarks					
Vulnerability Assessment for Each Industrial Park (IPK)					
Industrial Park Name:	Cavite Economic Zone	Laguna Technopark	Mactan Export Processing Zone		
Natural Disaster Risk(NDR)					
■ Flooding	Low				
■ Seismic intensity/ Tsunami	Low				

■ Volcano	Low				
■ Cyclone, Meteorological Disaster, Landslide	Medium				
Brief Descriptions on Counter-measures (CMS) for NDR					
1) Private sector facilities					
■ Land, In-park Roads	Done				
Countermeasures features/Remarks	Boundary dyke and Drainage Soil improvement				
■ Plant facilities	Done/Not yet	Done/Not yet	Not yet	Not yet	Not yet
Countermeasures features/Remarks	Reinforcement to buildings varies to each lessee company Stand-by Generator furnished				
■ Physical Distribution Facilities	Done inside, but not yet outside				
Countermeasures features/Remarks	Reinforcing buildings and equipment foundations done generally, but no plan for outside				
■ Others, if any					
2) Infrastructures					
■ Road	Not yet				
Countermeasures features/Remarks	CMS Plan of bypass to the access roads to sea and air ports underway, but no implementation schedule foreseen				
■ Railway	Not available				
Countermeasures features/Remarks	No railway				
■ Port	Done				
Countermeasures features/Remarks	50% of Tanjung Priok Port Quay-walls reinforced to the new design criteria requirements				
■ Airport	Budget for CMS being deliberated				
Countermeasures features/Remarks	Investigation works on-going				
3) Lifeline					
■ Electric power	Done	Done	Done	Done	Done
Countermeasures features/Remarks	Transmission net line newly connected				
■ Water-supply	Not yet				
Countermeasures features/Remarks	Water supply by well system will be employed				
■ Sewage	Not yet				
Countermeasures features/Remarks	No provision of public sewage system to IP				
■ Solid waste	Not yet				
Countermeasures features/Remarks	New dumping area sought				
■ Telecommunication	Not yet				
Countermeasures features/Remarks	Base station increasing plan being raised				
Vulnerability Assessment Results against Natural Disasters					
■ Private sector facilities	Medium, Dispersing by companies				
■ Infrastructures	30% to NDR				

	requirements				
■ Lifeline	20% to NDR requirements				
Total Vulnerability/ CMS Achievement	30% CMS Achievement				

(8) Singapore

Table 13.4.13 Industrial Park in Singapore: Features and vulnerability Assessment against Natural Disasters **(Only for Example Purpose)**

Industrial Park Name	Jurong Industrial Estate				
Features					
• Place	Jurong Town				
• Operation Commencement Date					
• Nos of Operating Enterprises					
• Total IPK Annual Turn-over (Mill.US$)					
• Remarks					
Vulnerability Assessment for Each Industrial Park (IPK)					
Industrial Park Name:					
Natural Disaster Risk(NDR)					
■ Flooding	Low				
■ Seismic intensity/ Tsunami	Low				
■ Volcano	Low				
■ Cyclone, Meteorological Disaster, Landslide	Medium				
Brief Descriptions on Counter-measures (CMS) for NDR					
1) Private sector facilities					
■ Land, In-park Roads	Done				
Countermeasures features/Remarks	Boundary dyke and Drainage Soil improvement				
■ Plant facilities	Done/Not yet	Done/Not yet	Not yet	Not yet	Not yet
Countermeasures features/Remarks	Reinforcement to buildings varies to each lessee company Stand-by Generator furnished				
■ Physical Distribution Facilities	Done inside, but not yet outside				
Countermeasures features/Remarks	Reinforcing buildings and equipment foundations done generally, but no plan for outside				
■ Others, if any					
2) Infrastructures					
■ Road	Not yet				
Countermeasures features/Remarks	CMS Plan of bypass to the access roads to sea and air ports underway, but no implementation schedule foreseen				
■ Railway	Not available				
Countermeasures features/Remarks	No railway				
■ Port	Done				
Countermeasures features/Remarks	50% of Tanjung Priok Port Quay-walls reinforced to the new design criteria requirements				

■ Airport	Budget for CMS being deliberated				
Countermeasures features/Remarks	Investigation works on-going				
3) Lifeline					
■ Electric power	Done	Done	Done	Done	Done
Countermeasures features/Remarks	Transmission net line newly connected				
■ Water-supply	Not yet				
Countermeasures features/Remarks	Water supply by well system will be employed				
■ Sewage	Not yet				
Countermeasures features/Remarks	No provision of public sewage system to IP				
■ Solid waste	Not yet				
Countermeasures features/Remarks	New dumping area sought				
■ Telecommunication	Not yet				
Countermeasures features/Remarks	Base station increasing plan being raised				
Vulnerability Assessment Results against Natural Disasters					
■ Private sector facilities	Medium, Dispersing by companies				
■ Infrastructures	30% to NDR requirements				
■ Lifeline	20% to NDR requirements				
Total Vulnerability/ CMS Achievement	30% CMS Achievement				

(9) Thailand

Table 13.4.14 Industrial Park in Thailand: Features and vulnerability Assessment against Natural Disasters **(Only for Example Purpose)**

Industrial Park Name	Bang Poo Industrial Estate	Rojana Industrial Park	Amata Nakorn Industrial Estate	Eastern Seaboard Industrial Estate(Rayong)	
Features					
• Place	Samut Prakan	1 Moo 5, Rojana Road (Highway No. 309), Tambol Kanharm, Amphur U-Thai, Ayutthaya 13210.	Chon Buri	Pluak Daeng District, Rayong Province	
• Operation Commencement Date					
• Nos of Operating Enterprises					
• Total IPK Annual Turn-over (Mill.US$)					
• Remarks					
Vulnerability Assessment for Each Industrial Park (IPK)					
Industrial Park Name:	Bang Poo Industrial Estate	Rojana Industrial Park	Amata Nakorn Industrial Estate	Eastern Seaboard Industrial Estate(Rayong)	
Natural Disaster Risk(NDR)					
■ Flooding	Low				
■ Seismic intensity/ Tsunami	Low				
■ Volcano	Low				
■ Cyclone, Meteorological Disaster, Landslide	Medium				
Brief Descriptions on Counter-measures (CMS) for NDR					

1) Private sector facilities					
■ Land, In-park Roads	Done				
Countermeasures features/Remarks	Boundary dyke and Drainage Soil improvement				
■ Plant facilities	Done/Not yet	Done/Not yet	Not yet	Not yet	Not yet
Countermeasures features/Remarks	Reinforcement to buildings varies to each lessee company Stand-by Generator furnished				
■ Physical Distribution Facilities	Done inside, but not yet outside				
Countermeasures features/Remarks	Reinforcing buildings and equipment foundations done generally, but no plan for outside				
■ Others, if any					
2) Infrastructures					
■ Road	Not yet				
Countermeasures features/Remarks	CMS Plan of bypass to the access roads to sea and air ports underway, but no implementation schedule foreseen				
■ Railway	Not available				
Countermeasures features/Remarks	No railway				
■ Port	Done				
Countermeasures features/Remarks	50% of Tanjung Priok Port Quay-walls reinforced to the new design criteria requirements				
■ Airport	Budget for CMS being deliberated				
Countermeasures features/Remarks	Investigation works on-going				
3) Lifeline					
■ Electric power	Done	Done	Done	Done	Done
Countermeasures features/Remarks	Transmission net line newly connected				
■ Water-supply	Not yet				
Countermeasures features/Remarks	Water supply by well system will be employed				
■ Sewage	Not yet				
Countermeasures features/Remarks	No provision of public sewage system to IP				
■ Solid waste	Not yet				
Countermeasures features/Remarks	New dumping area sought				
■ Telecommunication	Not yet				
Countermeasures features/Remarks	Base station increasing plan being raised				
Vulnerability Assessment Results against Natural Disasters					
■ Private sector facilities	Medium, Dispersing by companies				
■ Infrastructures	30% to NDR requirements				
■ Lifeline	20% to NDR requirements				
Total Vulnerability/ CMS Achievement	30% CMS Achievement				

(10) Vietnam

Table 13.4.15 Industrial Park in Vietnam: Features and vulnerability Assessment against Natural Disasters **(Only for Example Purpose)**

Industrial Park Name	Thang Long IP	Tan Thuan EPZ	Nomura-Haip hong Industrial Park		
Features					
• Place	Dong Anh District, Ha Noi	Tan Thuan EPZ, Tan Thuan Dong Ward, District.7, Ho Chi Minh City	An Duong District, Hai Phong City		
• Operation Commencement Date					
• Nos of Operating Enterprises					
• Total IPK Annual Turn-over (Mill.US$)					
• Remarks					
Vulnerability Assessment for Each Industrial Park (IPK)					
Industrial Park Name:	Thang Long IP	Tan Thuan EPZ	Nomura-Haip hong Industrial Park		
Natural Disaster Risk(NDR)					
■ Flooding	Low				
■ Seismic intensity/ Tsunami	Low				
■ Volcano	Low				
■ Cyclone, Meteorological Disaster, Landslide	Medium				
Brief Descriptions on Counter-measures (CMS) for NDR					
1) Private sector facilities					
■ Land, In-park Roads	Done				
Countermeasures features/Remarks	Boundary dyke and Drainage Soil improvement				
■ Plant facilities	Done/Not yet	Done/Not yet	Not yet	Not yet	Not yet
Countermeasures features/Remarks	Reinforcement to buildings varies to each lessee company Stand-by Generator furnished				
■ Physical Distribution Facilities	Done inside, but not yet outside				
Countermeasures features/Remarks	Reinforcing buildings and equipment foundations done generally, but no plan for outside				
■ Others, if any					
2) Infrastructures					
■ Road	Not yet				
Countermeasures features/Remarks	CMS Plan of bypass to the access roads to sea and air ports underway, but no implementation schedule foreseen				
■ Railway	Not available				
Countermeasures features/Remarks	No railway				
■ Port	Done				
Countermeasures features/Remarks	50% of Tanjung Priok Port Quay-walls reinforced to the				

	new design criteria requirements				
■ Airport	Budget for CMS being deliberated				
Countermeasures features/Remarks	Investigation works on-going				
3) Lifeline					
■ Electric power	Done	Done	Done	Done	Done
Countermeasures features/Remarks	Transmission net line newly connected				
■ Water-supply	Not yet				
Countermeasures features/Remarks	Water supply by well system will be employed				
■ Sewage	Not yet				
Countermeasures features/Remarks	No provision of public sewage system to IP				
■ Solid waste	Not yet				
Countermeasures features/Remarks	New dumping area sought				
■ Telecommunication	Not yet				
Countermeasures features/Remarks	Base station increasing plan being raised				
Vulnerability Assessment Results against Natural Disasters					
■ Private sector facilities	Medium, Dispersing by companies				
■ Infrastructures	30% to NDR requirements				
■ Lifeline	20% to NDR requirements				
Total Vulnerability/ CMS Achievement	30% CMS Achievement				

13.5 Subject and Opinion

This section will be provided in "Report 2".

CHAPTER 14 INFORMATION AND DATA TO BE COLLECTED AND/OR CONFIRMED IN THE NEXT STUDY TRIPS

By reviewing the collected data and information presented in Study Report 1, additional data and information required are identified for 10 ASEAN Member States (for study of Component 1) and for 3 pilot countries (for study of Component 2), namely Indonesia, the Philippines and Vietnam. Identified data and information to be collected in next study trips are summarized in Figure 14.1.

Figure 14.1 Data and Information to be Collected in Next Study Trips

Chapter		Summary	Required Data and Information	
			10 ASEAN Member States (Component 1)	3 Pilot Countries (Component 2)
2	Industrial Agglomerated Areas	Basic information on industrial estates can be obtained from open sources.	Basic information on industrial estates shall be collected from the existing documents. Most of the countries in the ASEAN Region have just started efforts for developing BCP. To develop a strategy for promoting BCP and Area BCP, hearing of current approach for BCP and requests for Area BCP from national government agencies, investment promotion organization, business groups, companies and others is required.	Survey of details of pilot industrial agglomerated areas (information relating to companies and industrial estates) is required.
3	Social and Economic Infrastructure	Basic information on major distribution infrastructure can be obtained from open sources. Information on lifeline is difficult to identify from open sources, as they are normally developed locally for cities and districts.	Additional information and data shall be collected from the existing documents	Survey of details of distribution infrastructure, lifeline and facilities of disaster risk reduction in the pilot industrial agglomerated areas and their surroundings is required.
4	Legislative Systems	Open sources summarize manly national laws and regulations, plans. Description of BCP/BCM cannot be identified in those documents easily from open source information.	Even guidelines for BCP have been prepared in limited way in most of the ASEAN Member States. To develop and promote Area BCP. Hearing of current approach for BCP and requests for Area BCP is required, including description of BCP in the law and regulations, and how they are implemented in practice.	Information on regulation, disaster management plan and system of local governments, and contingency plan, manual and others of companies is required.
5	Existing Investigation and Studies	There are many individual studies and researches of hazard, risk and vulnerability assessment	Additional information and data shall be collected from the existing documents	Investigate research institute and universities availability of existing hazard and risk assessments covering the pilot

		with a variety of methodologies. Systematic and united approach is required.		industrial agglomerated area, available methodologies for the assessment, and national and/or institutional plans for promoting hazard and risk assessment.
6	Economy and Trade	Statistical data on economy, industry and trade can be obtained from open sources.	Existing sources shall be used to collect information required for analyzing economic and trade relationships of a particular industry within and outside of the ASEAN Region.	Collect information required for analyzing economic and trade relationships of a major industry of the industrial agglomerated area or the industrial estate.
7	Lessons Learned from Catastrophic Natural Disasters	Information on impacts on supply chain and economy by catastrophic natural disasters can be obtained from existing information.	Additional information and data shall be collected from the existing documents.	Investigate responses and/or measures taken for natural disasters of small to medium size occurred near the industrial agglomerated area.
8	Description of Natural Hazards	Description of natural hazard by existing document is rather broad	Additional information and data shall be collected from the existing documents.	Collect information hazard and risk of the country and the region including the industrial agglomerated area from research institutes and universities.
9	Records of Natural Hazards	Use internationally recognized databases to evaluate ASEAN Member States at the same level.	Additional information and data shall be collected from the existing databases.	Collect data and information required for hazard and risk assessment of the industrial agglomerated area and it's surrounding from research institutes and universities.
10	Measures Taken for Natural Disaster Risk Reduction	Measures introduced by open sources are mainly those implemented by national government.	Additional information and data shall be collected from the existing documents.	Investigate measures taken by related organizations around the industrial agglomerated area and their capacity.
13	Distribution Network	Statistical data on economy, industry and trade can be obtained from open sources.	Additional information and data shall be collected from the existing documents.	Investigate responses and/or measures taken for natural disasters of small to medium size occurred near the industrial agglomerated area.