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Economic Damage from Natural Hazards and Local Disaster Management Plans in Japan and Thailand

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Abstract: Japan and Thailand are geographically similar in that both countries have a vast coastline and a population that is concentrated in urban areas. Natural hazards such as earthquakes, tsunamis, typhoons, floods, and landslides bring about a considerable amount of damage every year. To counter these natural hazards, both countries have developed disaster management laws at the national, provincial, and prefectural levels. Establishing and executing local disaster management plans is particularly important as the initial response to a disaster is first performed at the local level. In this study, we have focused on the local disaster management plans in Thailand and examined the state of the development of the plans, which are essential during a post-disaster period. We also found that in Japan there was a defined tangible system of cooperation with the private sector based on the unique characteristics of each local government.

Keywords: Disaster management plan and law, economic damage, private sector, DRR, Chon Buri Province, disaster risk reduction

JEL Classification: A10; A11; F00; F68

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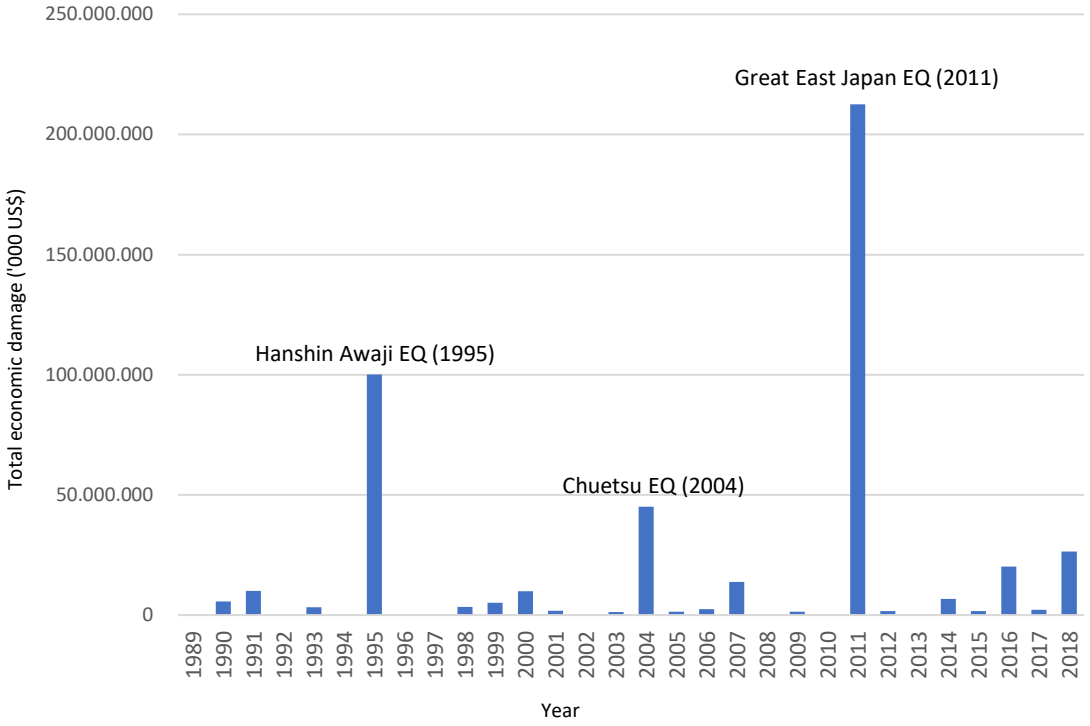
1. Background and Purpose

In recent years, natural hazards have occurred frequently in Japan and, more broadly, the Asian region. In fact, disaster statistics show that Asia accounts for around 62% of the total number of people killed by natural disasters over the past quarter century. Due to the nature of its geographical environment, Japan faces the danger of various natural hazards such as earthquakes, floods, tsunamis, and volcanoes. However, looking at the Asian region, large-scale natural hazards occur frequently in Association of Southeast Asian Nations (ASEAN) countries where the economies are growing rapidly. Natural hazards that occur in Asia, where many areas are still vulnerable to them, take away many lives and cause damage to infrastructure such as roads, railways, and telecommunication systems. This infrastructural damage causes problems such as a delay in distribution processes, which in turn amplifies the damage to the economy.

Figure 1 shows that in Japan, Hyogo Prefecture suffered a total of ¥9.6 trillion in damage to its buildings and utilities as a result of the Great Hanshin–Awaji earthquake that occurred in 1995. The Cabinet Office has also estimated that the Tohoku earthquake of 2011, which affected several local governments in Japan, caused approximately ¥16.9 trillion in economic damage. Japan's real gross domestic product (GDP) in recent years is currently the third largest in the world at under US$5 trillion; thus, the economic damage caused by natural hazards will inevitably increase. However, according to the data for 2016, the real GDP of the ASEAN countries is equivalent to half of Japan’s at about US$2.6 trillion, while the real GDP growth rate is around 5%. As mentioned above, the damage caused by natural hazards will increase in the Asian region due to the problems that exist in the earthquake resistibility and durability as well as the resilience of the infrastructure like buildings and roads.

Figure 1: Economic Damage from Hazards in Japan (1989–2018)



EQ = earthquake.
Source: EM-DAT: The Emergency Events Database - Université catholique de Louvain (UCL) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium.

Japan and the ASEAN countries establish disaster management legislation according to their past experiences.

In Japan, the Disaster Countermeasures Basic Act was enacted in 1961 and covered basic matters such as the establishment of disaster management laws, disaster prevention, emergency response measures during disasters, and financial measures. This act has undergone revisions as required according to the circumstances of the time. Subsequently, the Basic Disaster Management Plan, which holds the highest level of authority in the field of disaster prevention, was enacted in 1963. The plan includes more concrete measures against disasters as well as arrangements for cooperating alongside government organisations. At the prefectural level, local disaster management plans have been developed for each local government according to their unique situation. Similarly, these plans are also amended as necessary while considering the current circumstances.

Disaster management organisations in ASEAN countries, on the other hand, are now developing national disaster prevention and mitigation plans and local disaster management plans that correspond to Japan's Basic Disaster Management Plan. For

instance, in 2007, the Disaster Prevention and Mitigation Act 2007 was established on a national level in Thailand, where natural hazards such as floods bring damage to the country every year. However, only a limited amount of research and reports have been made about the development of local disaster management plans for each province. Having a proper understanding of the situation surrounding local disaster management plans is essential as the initial response to natural hazards is highly prioritised at the provincial or prefectural level.

Thus, the aim of this study is to investigate the situation surrounding the development of Thailand's local disaster management plans at the provincial level, and to examine these plan alongside Japan's local disaster management plans. Furthermore, cooperation with the private sector is essential in emergency response and in the recovery and restoration work done during a disaster, so it is also necessary to confirm whether cooperation with the private sector is included in Thailand's local disaster management plans and disaster management activities. We also conducted an interview with the local disaster management agency in Chon Buri Province, where many Japanese companies have expanded their businesses and where tourism is promoted in the city of Pattaya (Table 1). From this, we gained an understanding about the situation surrounding the development of the local disaster management plan and about how people were cooperating with the private sector.

Table 1: Number of Japanese Companies in Thailand (2017)

		Number of Japanese Companies	%
1	Bangkok Province	2840	52.2
2	Chon Buri Province	639	11.7
3	Samut Prakan Province	581	10.7
4	Pathum Thani Province	293	5.4
5	Ayutthaya Province	261	4.8
6	Rayong Province	251	4.6
7	Chachoengsao Province	126	2.3
8	Plan Chin Buri Province	66	1.2
9	Samut Sakhon Province	58	1.1
10	Nonthaburi Province	44	0.8
Total		5159	94.8

Source: JETRO Report (2017).

2. Comparison of Natural Hazards in ASEAN Countries

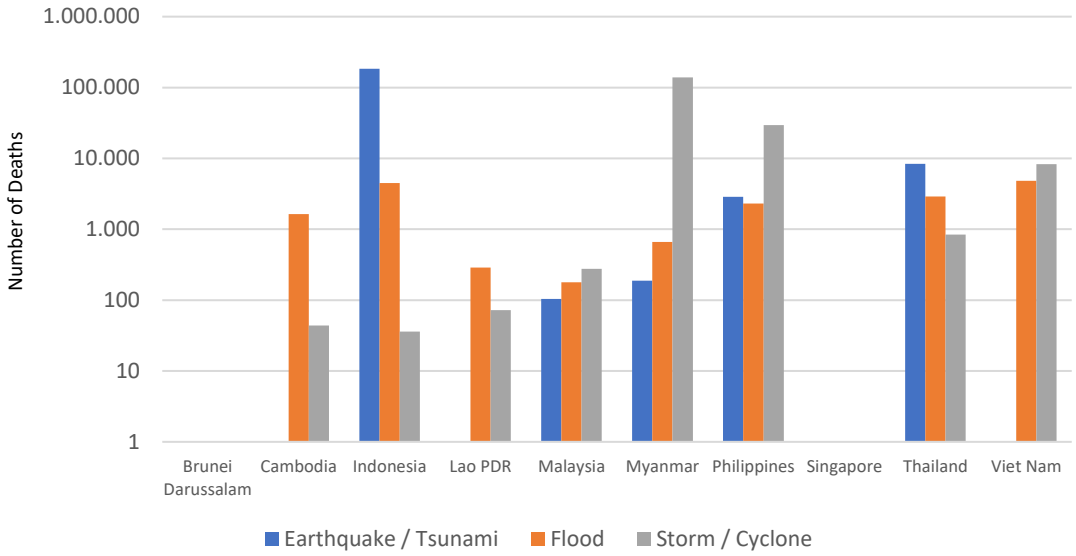
Large-scale natural hazards occur frequently every year in the ASEAN countries. Figure 2 shows the number of casualties that were caused by major disasters in each country between 1989 and 2018. These data are from EM-DAT, the database of the Centre for Research on the Epidemiology of Disasters.

In this database, there are no reports of damage caused by disasters in Brunei Darussalam and Singapore. This is believed to be attributable to the fact that first and foremost, both countries are not at risk of earthquakes due to being geographically located away from the boundaries of the tectonic plates. Additionally, it is presumed that floods, which cause an extensive amount of damage, do not have much of an impact on Brunei Darussalam and Singapore due to the small land area of both countries. Next, it was found that small-scale earthquakes occur regularly in Cambodia, the Lao People's Democratic Republic, and Viet Nam. However, there were very few reports about significant damage caused by earthquakes in these countries. Despite this, typhoons, storms, and the damage caused by floods associated with these natural hazards have been frequently reported. In particular, Cyclone Nargis, which occurred in Myanmar in April 2008, caused a considerable amount of damage to the country, and reportedly left over 130,000 people dead or missing.

In the case of Indonesia, the earthquake that occurred in offshore Sumatra in December 2004 became one of the largest scale disasters in history. This earthquake caused a great amount of damage mainly in the city of Banda Aceh, which is located in northern Sumatra. An earthquake also occurred in Padang in 2009. Other than that, the country is also at risk of various disasters such as the volcanic eruptions of Mt Sinabung and Mt Merapi, as well as the damage caused by winds and floods throughout the country. Similarly, the Philippines is a country where disasters occur frequently. It is also located in the middle of the path of typhoons, which often occur during the rainy season. In recent years, the Philippines has been affected by extensive damage caused by winds and floods such as that of Typhoon Yolanda, which occurred in November 2013. Like Indonesia, the Philippines also has many volcanoes and therefore suffers from volcanic mudflows that are triggered by the heavy rain caused by typhoons.

Lastly, Thailand, which is the subject of this research, has the same risk of being affected by earthquakes, tsunamis, winds, and floods as the other ASEAN countries. In particular, Thailand has experienced large-scale disasters such as the 2004 earthquake that occurred in offshore Sumatra, in which Phuket was at the centre of the damage caused, as well as the floods that occurred in Bangkok in 2010.

Figure 2: Casualties by Hazard in ASEAN Countries (1989–2018)



Source: EM-DAT: The Emergency Events Database - Université catholique de Louvain (UCL) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium.

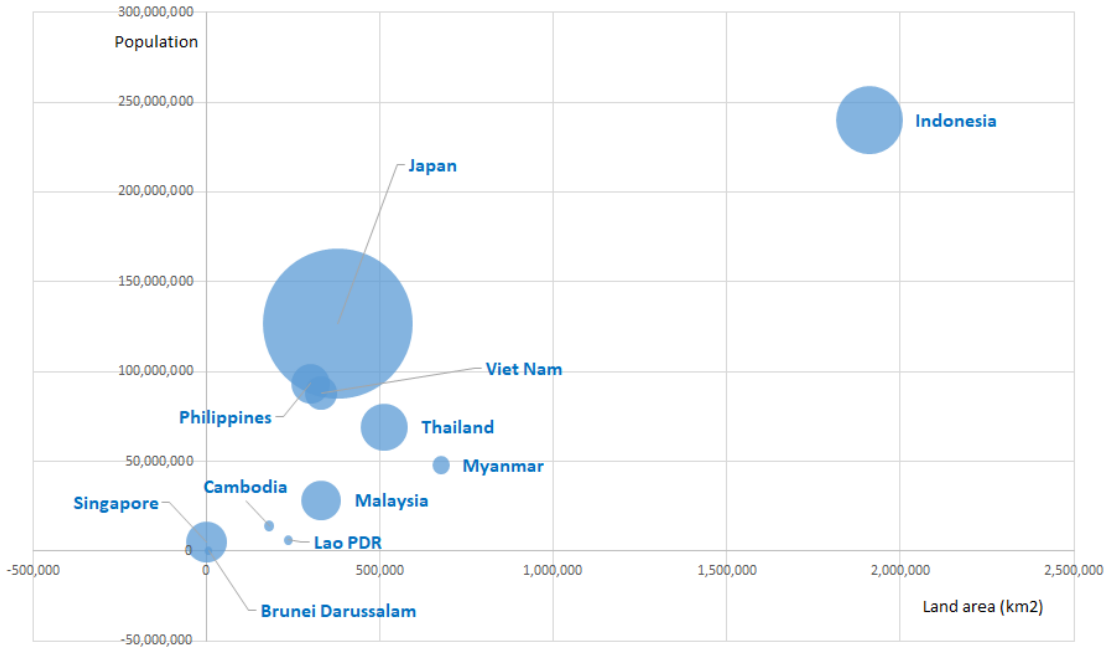
Figure 3 is a graph in which the horizontal axis represents the land area and the vertical axis represents the population in 2010. The nominal GDP of each ASEAN country in 2018 is also plotted on this graph. The GDP size is schematically indicated by the size of the circle. The data for Japan has also been included so that comparisons can be made with each of the ASEAN countries.

Indonesia, which is located at the top right of the figure, has a land area of more than 1.9 million square kilometres, which is the largest amongst the ASEAN countries. It also has a population of around 240 million, making it the ASEAN country with the largest population. Contrarily, Brunei and Singapore are small countries when compared to other ASEAN countries: both having small land areas, Brunei has a population of about 400,000 and Singapore has a population of about 5 million. Malaysia, the Philippines, Viet Nam, and Thailand share a similar land area and GDP. Figure 2 shows that the trends

in the natural hazards occurring in these countries are also similar.

The environmental characteristics of Thailand resemble that of Japan, as the country has a population of about 70 million and a land area of about 510,000 square kilometres. Thailand is also at risk of many natural hazards such as floods, earthquakes, and tsunamis. From these similarities in the geographic environment and trends in the occurrence of natural hazards, it is evident that the purpose of this study – to examine the local disaster management plans in both countries – is very relevant.

Figure 3: Comparison of the Vulnerability of the Economy and the Population with GDP in ASEAN Countries and Japan (2018)



ASEAN = Association of Southeast Asian Nations, GDP = gross domestic product.
Source: EM-DAT: The Emergency Events Database - Université catholique de Louvain (UCL) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium.

Table 2 presents data on the economic damage caused by natural hazards in each ASEAN country over the past 30 years in intervals of 10 years.

In the period from 1989 to 1998, the economic damage due to natural disasters sustained by Indonesia was the most prominent, followed by the Philippines, Thailand, and Viet Nam. In Indonesia, the large-scale earthquake and tsunami that occurred on the island of Flores in December 1992 along with other frequent floods are thought to have had a major impact on the economic damage sustained by the country. It is also believed

that the large-scale earthquake that occurred in July 1990 on the island of Luzon in the Philippines had a large impact on the economic damage suffered by the country.

Similarly, in the period from 1999 to 2008, the economic damage sustained by Indonesia was the most prominent, followed by that of Myanmar and Viet Nam. The aforementioned earthquake that occurred in offshore Sumatra in December 2004, and caused extensive damage to various countries in Southeast Asia, had the largest impact on the economic damage incurred by Indonesia. As for Myanmar, Cyclone Nargis, which struck the country in April 2008, is considered to have greatly affected the economic damage sustained by the country.

In the period from 2009 to 2018, the economic damage suffered by Thailand, the target country of this study, was the most severe, followed by the Philippines, Viet Nam, and Indonesia. The damage caused by the floods that occurred in the capital of Bangkok in 2010 is considered to be the cause of substantial economic damage sustained by Thailand.

Thus, it is evident that whilst natural hazards occur frequently in the ASEAN countries, the damage caused by natural hazards will continue to grow every year due to the fact that the economies of the ASEAN countries are growing rapidly, as well as the fact that there are still many areas that are vulnerable to the aforementioned disasters.

Table 2: Economic Damage from Hazards

	1989–1998			1999–2008			2009–2018		
	Total Deaths	Affected	Total Damage ('000 US$)	Total Deaths	Affected	Total Damage ('000 US$)	Total Deaths	Affected	Total Damage ('000 US$)
Japan	6,118	1,052,962	122,823,300	828	1,658,647	81,355,000	21,766	2,938,614	277,557,800
Brunei Darussalam	0	0	2,000	0	0	0	0	0	0
Cambodia	690	7,229,000	251,510	462	8,856,614	214,600	533	6,454,181	1,093,000
Indonesia	5,477	7,105,146	10,590,193	177,364	8,796,072	10,197,937	9,394	7,047,912	10,822,280
Lao PDR	96	2,840,862	328,779	23	1,277,190	1,000	242	1,993,403	456,050
Malaysia	444	42,494	355,000	206	451,407	1,501,000	75	2,610,039	418,002
Myanmar	164	599,094	144,955	138,848	2,801,236	4,500,688	805	3,626,065	199,070
Philippines	14,390	37,259,832	3,375,412	8,446	38,012,638	1,328,205	14,916	107,626,466	19,484,610
Singapore	0	0	0	0	0	0	0	0	0
Thailand	1,302	15,970,840	3,250,221	9,385	34,305,577	2,114,880	1,534	48,398,892	46,055,161
Viet Nam	7,938	16,481,794	2,340,845	3,871	24,379,549	4,299,505	1,672	20,738,685	15,188,224
TOTAL	30,501	87,529,062	20,638,915	338,605	118,880,283	24,157,815	29,171	198,495,643	93,716,397

Source: EM-DAT: The Emergency Events Database - Université catholique de Louvain (UCL) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium.

3. Trends in Natural Hazards in Thailand

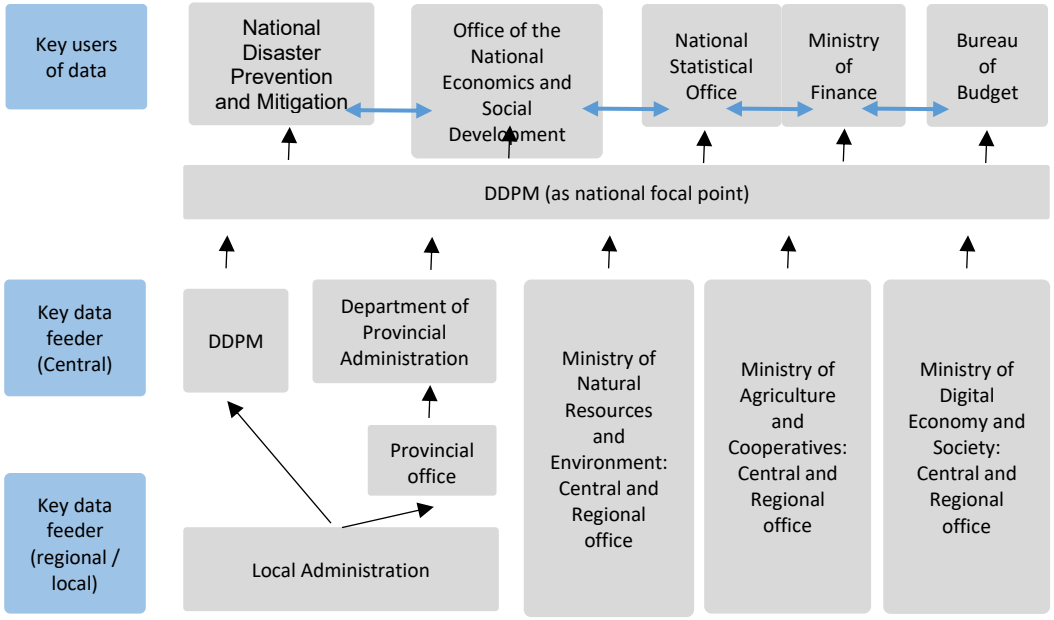
The topography in Thailand naturally divides natural hazards into four regions that is consistent with the country's administration. The northern area of the country is filled with hills, mountains, and jungles, which experience floods, landslides, and wildfire; active faults also make the northern area prone to the largest number of earthquakes. A large flat area together with the Chao Phraya River in the country's central region nourishes agricultural areas, but has put millions of people's lives at risk as a result of floods that have naturally occurred since long past. The expansion of settlements and the impact of climate change seems to have increased the danger of the flooding season in the country, as can be seen in incidents such as the 2011 flood that affected at least 65 provinces with economic damage amounting to more than B23 billion (US$0.7 billion), and leaving 13 million people affected (World Bank, 2012). Conversely, even though it is less affected by flooding than the central region, the northeast region of Thailand suffers from extreme drought that damages large rice cultivation areas, which are the key to national food security. Surrounded by sea, the southern region is often affected by monsoons that cause floods, landslides, and storms.

Thailand is known to be highly exposed and vulnerable to natural hazards caused by hydro-meteorological disasters, with floods, storms, landslides, and drought being the other major disasters by disaster type. However, earthquake (including tsunami) disasters have the highest death rate, which is nearly 30% higher (on average) than all other disaster types.

In Thailand, the process of natural hazard data collection consists of collecting data from four key ministries: (i) the Ministry of Interior (Department of Disaster Prevention and Mitigation), (ii) the Ministry of Agriculture and Cooperatives (Royal Irrigation Department), (iii) the Ministry of Natural Resources and Environment (Royal Forest Department, Pollution Control Department, Department of Mineral Resources, Department of Water Resources), and (iv) the Ministry of Digital Economy and Society (Methodological Department of Thailand, National Statistics Office). In addition to these key ministries, local authorities are designated by the central government to carry out primary data collection, such as socio-ecological data, local hazard data, and

demographical data. However, the Department of Disaster Prevention and Mitigation (DDPM), as the national focal point of Thailand's disaster risk management system, will henceforth analyse and support key decision-making agencies, such as: (i) the National Disaster Prevention and Mitigation Committee, (ii) the Ministry of Interior, (iii) the Office of National Economics and Social Development Council, (iv) the National Statistic Office, (v) the Ministry of Finance, and (vi) the Bureau of the Budget. The key data collection process for natural hazards in Thailand is shown in Figure 4.

Figure 4: The Key Data Collection Process for Natural Hazards in Thailand



DPPM = Department of Disaster Prevention and Mitigation.
Source: Department of Disaster Prevention and Mitigation (2018).

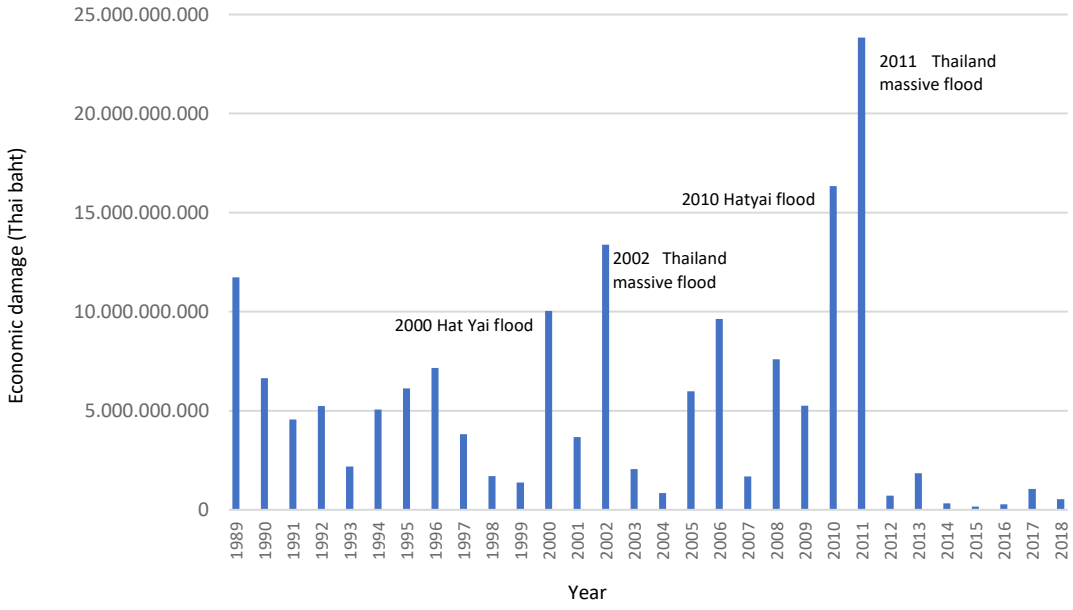
3.1. Overview of Natural Disasters in Thailand

Since the beginning of the 21st century, Thailand has been ravaged by its share of natural disasters that have killed and injured countless thousands and damaged multibillion-baht worth of property and infrastructure (DDPM, 2016). Almost no provinces have been spared the enormous human and economic toll from floods, droughts, tropical storms, tsunamis, wildfires, landslides, and earthquakes. However, many such disasters are at least partly caused by humans and could be minimised if authorities did more to tackle corruption, ineffective planning, mismanagement, negligence, and political wrangling in the realm of public works.

3.1.1 Floods

Floods are some of the most regularly occurring natural hazards in Thailand – they happen nearly every year between October and March. Flood risk can be found mostly in the central region, some southern parts of the northern region, and some parts of the eastern region of the country. Moreover, the average year cycles between floods and droughts. The National Disaster Relief Centre has indicated that flood disasters in Thailand between 1989 to 2018 have caused more than B160.8 billion (US$5.1 billion) in damage to the nationwide economy – the massive floods in 2011 generated economic damage of more than B23 billion (US$0.7 billion) alone (DDPM, 2019). The economic damage caused by floods in Thailand from 1989 to 2018 is shown in Figure 5.

Figure 5: Economic Damage Caused by Floods in Thailand (1989–2018)



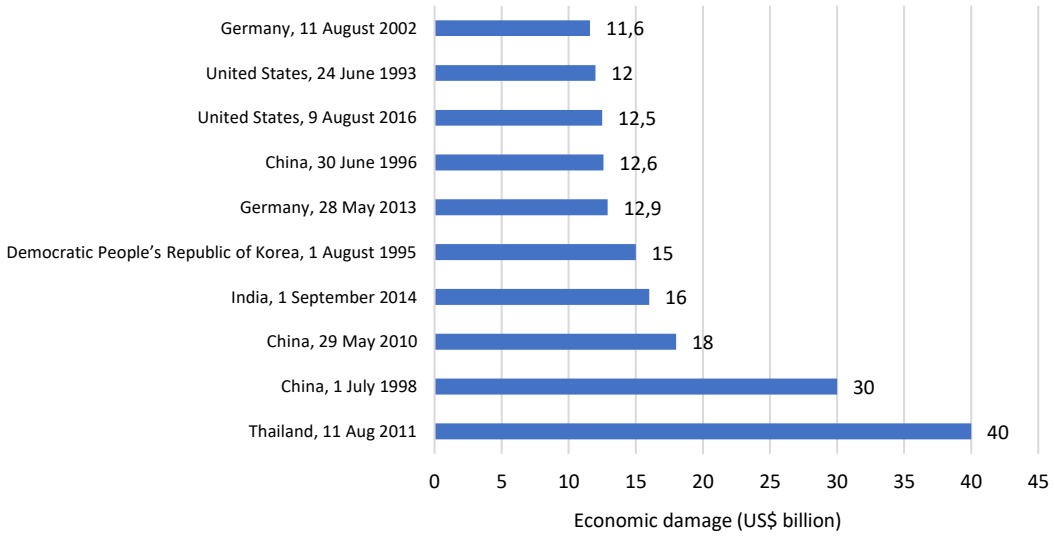
Source: Department of Disaster Prevention and Mitigation (2019).

Thailand incurs nearly B5.5 billion (US$200 million) in economic damage from floods every year (on average), despite the overall impact having decreased, whilst impacts on each event still increased. Data from the DDPM indicate that flooding in Thailand may be slowly decreasing; however, if the economic damage is considered, it might be found that each flood disaster is likely to generate higher economic losses. We may infer that the frequency of the disaster and its respective damage is inversely

proportional, so the decreasing frequency of floods does not mean that economic losses will also be reduced accordingly.

However, these economic damage assessments from the DDPM are only preliminary assessments. They may be underestimations: the real damage may be more than ten times as high as that estimated by the Bank of Thailand and leading research institutes in the country suggest that flood disasters such as the large-scale floods in 2011 announced by the Bank of Thailand would incur at least US$20 billion to US$40 billion in economic damage (Figure 6). Flooding in Thailand might no longer be a local economy-based problem because Thailand is a manufacturing base for Japanese and United States carmakers and global technology companies (Chongvilaivan, 2012). Seven industrial estates in Ayutthaya, Nonthaburi, and Pathum Thani provinces bordering Bangkok have been affected, causing billions of dollars of damage, disrupting international industrial supply chains. Although unlikely to cause a global economic slowdown, events here have disrupted industries in the global supply chain, in which Thailand plays a significant role.

Figure 6: Comparison of the 2011 Thai Floods to Floods in other Countries



Source: Bank of Thailand (2011).

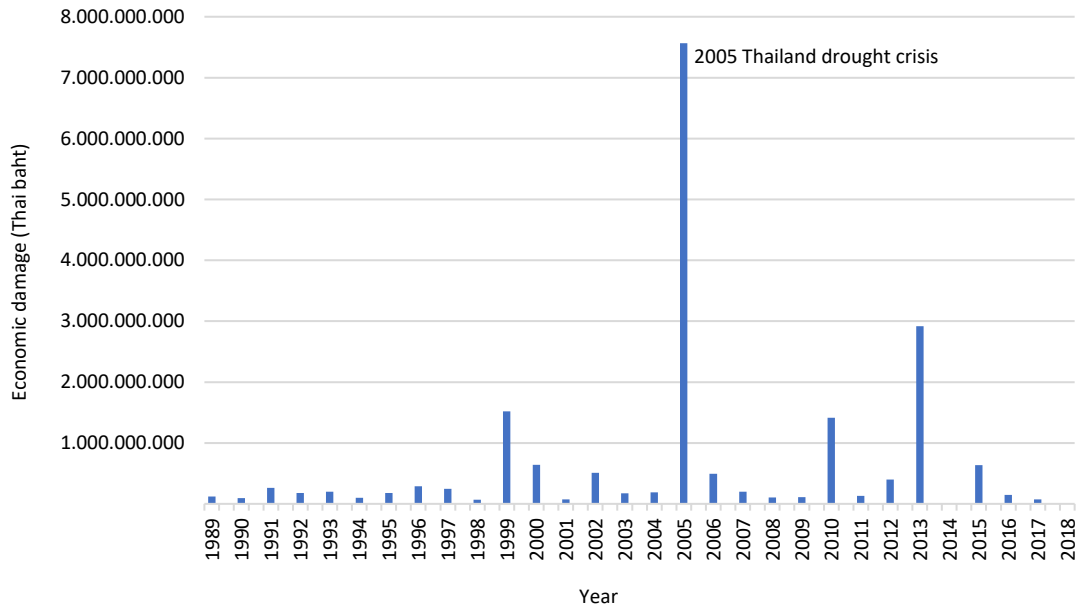
Furthermore, whilst Thailand has not experienced any large floods since 2011, it has been noted that cities across the country, including Bangkok, have experienced urban flash flooding. This is often caused by sudden rainstorms, resulting in heavy traffic and

disruptions in transportation throughout the city. Although not yet identified as a disaster, flash flooding and its effects continue to intensify, and may soon cause a disruption to the urban economy.

3.1.2 Drought

In the past 40 years, Thailand has experienced droughts and floods on a basis of around every 2 to 3 years (Jariya, 2013) with one agricultural region considered the most highly affected area. In particular, rice, corn, and other economic crops often suffer enormous economic losses, which directly affects the agricultural sector located primarily in the northeast region almost every year. In 2005, 11 million people in 71 provinces were affected by water shortages. In 2008, the population suffered once again from severe drought, with over 10 million people in the rural agricultural region being affected. The economic damage caused by droughts in Thailand between 1989 and 2017 is shown in Figure 7.

Figure 7: Economic Damage Caused by Droughts in Thailand (1989–2017)



Source: Department of Disaster Prevention and Mitigation (2019).

The primary impact of droughts that occur almost every year is the damage made to rice and sugarcane. This damage may cause economic losses of approximately B15,300

million (US$490 million) or 0.1% of GDP; this is, however, an initial assessment, and when combining it with the damage incurred to other agricultural plants, may result in a higher estimate of economic losses.

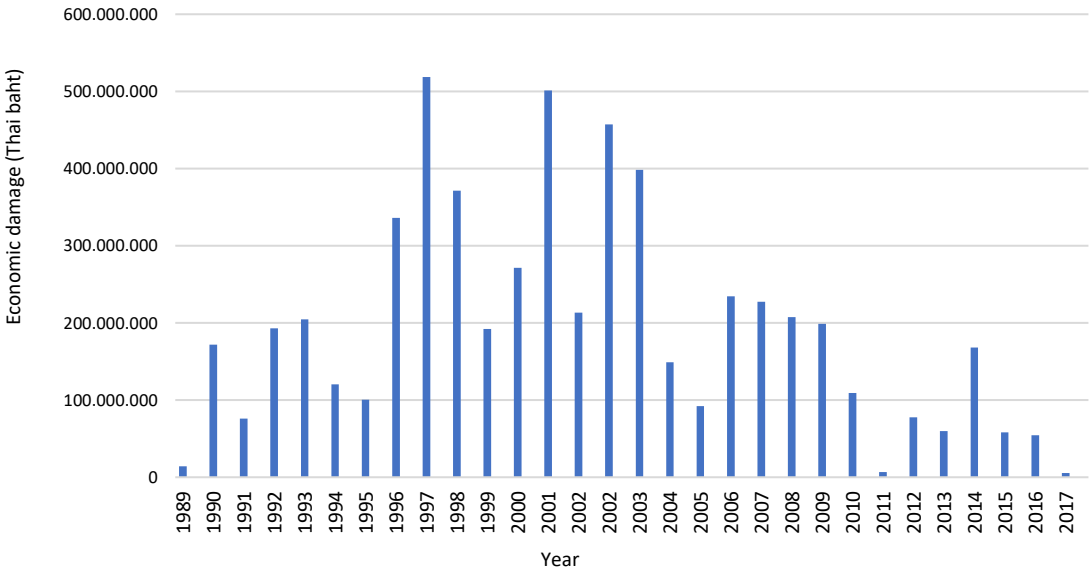
The National Disaster Relief Center has indicated that drought events in Thailand between 1989–2017 have caused more than B19.1 billion (US$0.6 billion) of damage to the nationwide economy, and economic damage as a result of drought amounts to nearly B0.6 billion (US$20 million) every year (on average), whilst the tendency of effects from drought remain relatively stable. In addition, the volatility of certain disasters, especially drought and floods, has a related effect on the income security of local farmers. Moreover, results from the Bank of Thailand study clearly indicate that drought is a key factor in the increase of debt for local farmers (BOT, 2018).

3.1.3 Storms

Based on weather data from the Methodological Department of Thailand and the Department of Disaster Prevention and Mitigation, on average three tropical cyclones and thousands of windstorms occur annually between October to April, which also cause floods and landslides nationwide.

The National Disaster Relief Centre has indicated that storm events in Thailand between 1989 and 2018 caused more than B5.78 billion (US$0.18 billion) (DDPM, 2019) of damage to the nationwide economy. Thailand incurs nearly B0.2 billion ($US6 million) of economic damage from storms every year (on average), whilst they continue to be highly volatile due to the effects of climate change. The economic damage caused by storms in Thailand between 1989 and 2018 is shown in Figure 8.

Figure 8: Economic Damage Caused by Storms in Thailand (1989–2017)



Source: Department of Disaster Prevention and Mitigation (2019).

3.1.4 Wildfires

Wildfires in Thailand occur annually during the December to May period, with the most critical period between January and March. Fires, mostly classified as surface fires, primarily take place in mixed deciduous forests, dry dipterocarp forests, and forest plantations, and to some extent in dry evergreen forests, hilly evergreen forests, or on occasion in certain tropical rain forest areas. In certain extremely dry areas, double burning during a single season is not uncommon. These surface fires consume surface litter, other loose debris on the forest floor, and small vegetation (National Park, Wildlife and Plant Conservation Department, 2018).

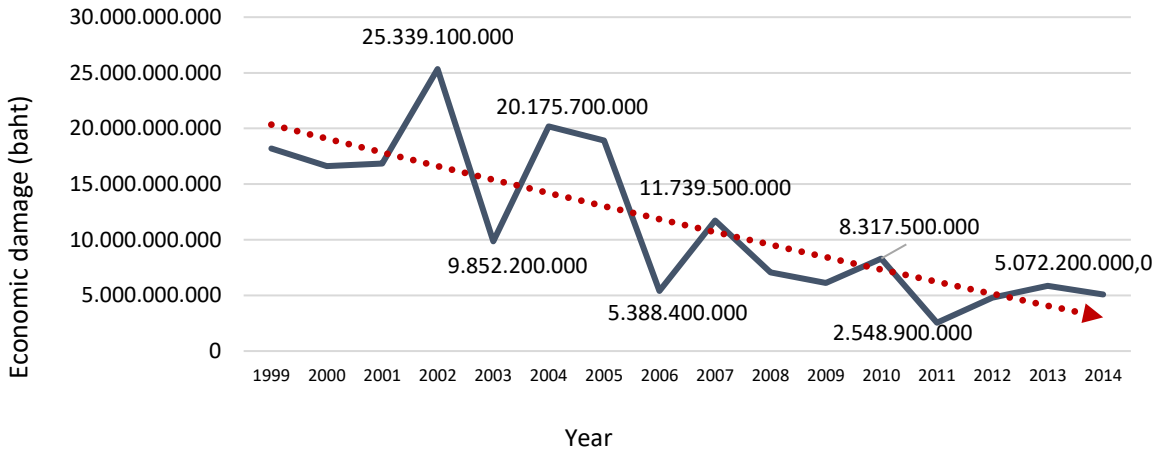
The Royal Forest Department of Thailand has indicated that forest fire events in Thailand between 1999 and 2014 caused more than B182.8 billion (US$5.8 billion) of damage to the nationwide economy. Thailand incurs nearly B11.4 billion (US$363 million) of economic damage from wildfires every year (on average) (National Park, Wildlife and Plant Conservation Department, 2018). However, trends in the amounts of damage have decreased significantly.

Whilst the northern region of Thailand has the highest number of wildfires, the cause of these wildfires is still the source of confusion, as a result of the complicated

identification of sources and strong political involvement from local agricultural interest groups and local influential groups (Moran, 2019). The wildfire and haze pollution situation in the northern region of the country contributed to the government's move to establish the first regional wildfire and haze action plan for collaboration in integrating and mobilising resources from all sectors, including the private sector.

However, in the southern region of Thailand, there is also a risk of some areas being affected by transboundary haze pollution caused by wildfires.

Figure 9: Economic Damage Caused by Wildfires in Thailand (1999–2014)



Source: National Park, Wildlife and Plant Conservation Department (2018).

3.1.5 Earthquakes and Tsunamis

Although Thailand has fewer earthquakes and tsunamis than countries such as Indonesia, the Philippines, and Myanmar (Thai Meteorological Department, 2019), in the northern and western regions of the country there are active faults with critical infrastructure, such as large dams, located in these areas. Based on recorded data, Thailand has only had five large earthquakes in the past, but these earthquakes have incurred the greatest damage to life in comparison with other natural disasters in the country.

Thailand was one of the countries that was heavily affected by the 2004 Indian Ocean earthquake and tsunami. The economic impact the tsunami caused was considerable, although not as great as in poorer countries such as Indonesia or Sri Lanka (Strand and Masek, 2008). Thailand has a liberalised, flexible, and robust economy, which has shown

powers of rapid recuperation after previous setbacks. The sectors most badly damaged were tourism and fishing – the beach resorts along the Andaman Sea coast were extensively damaged. Many Thai-owned hotels and other small businesses were ruined, and the Thai government provided large amounts of capital to enable the recovery of the private sector (Nidhiprabha, 2007).

3.1.6 Summary of Natural Hazards in Thailand

In conclusion, floods can be considered as a major natural hazard that have caused a considerable amount of economic damage to the country for decades. As such, the Thai government has committed to solving serious flood problems by making a multi-billion-dollar investment into infrastructure to prevent flooding in large economic and community-based areas such as the Chao Phraya basin, the northeast region, and Bangkok (National Water Resources, 2019). The impact of drought is also considerably more severe in terms of the affected population nationwide (16.5%), especially in Bangkok and the eastern provinces. Only five large earthquakes occurred between 1989 and 2018 – including the 2004 tsunami – but they were so devastating that they accounted for 29.8% (8,847 casualties) of the total disaster-related mortalities in Thailand, in comparison with floods (13%), a percentage that includes the casualties caused by the 2004 Indian Ocean tsunami, a disaster that was responsible for over half of all deaths in the country. Although the overall frequency of natural hazards seems to be decreasing in terms of statistics, the fluctuation in occurrence will likely increase significantly due to climate change, which in turn will incur further domestic economic damage.

4. Disaster Management Laws and/or Plans in Japan and Thailand

4.1. Japan

Japan's disaster management system covers all stages of disaster prevention, advance preparation, emergency response, as well as recovery and restoration. The system has defined roles and responsibilities for the federal and local governments, and requires the cooperation of the relevant affiliate organisations of both the public and private sector. In preparation for other potential large-scale disasters to come following the Great East

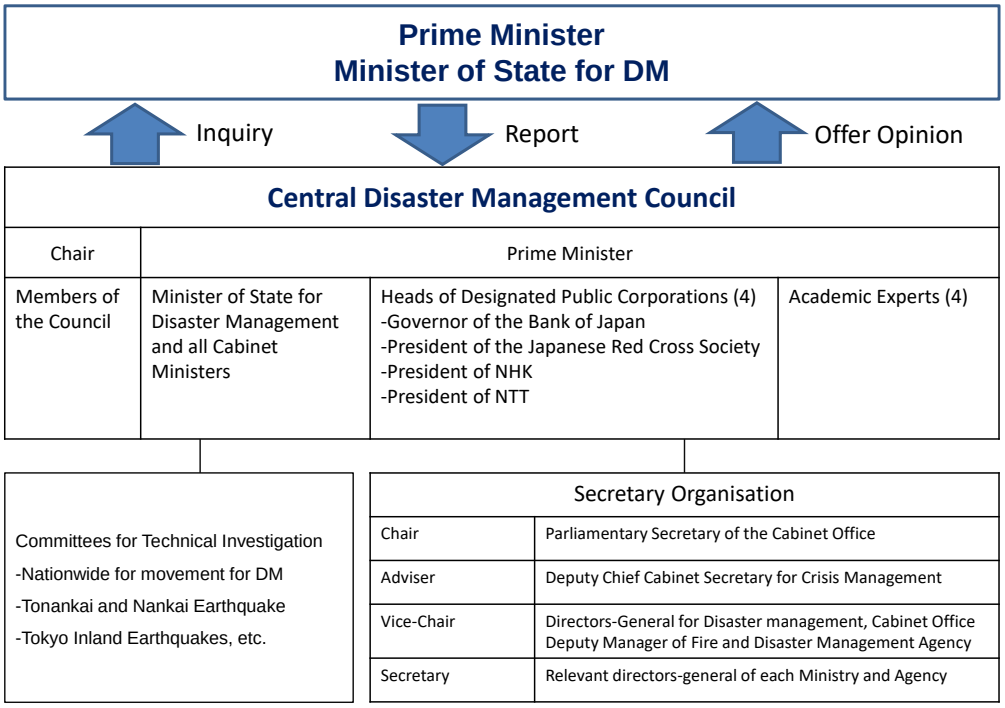
Japan Earthquake, the Disaster Management Laws will be examined, new lessons will be learned from this disaster, and aspects that need reviewing will be suggested. Historically, Japan was hit by many typhoons and earthquakes in the 1940s and 1950s. In particular, Typhoon Vera, which struck Japan in 1959, caused a significant amount of damage and led to the passing of the Disaster Countermeasures Basic Act in 1961. The act established the following points:

(i) The Central Disaster Management Council will develop the general policy for disaster management and serve as the national coordinating body. The chairperson of this council is the Prime Minister and the members of the council consist of public institutions such as ministries, Nippon Hoso Kyokai, the Bank of Japan, and the Japanese Red Cross Society, as well as representative academic experts (Figure 10).

(ii) The act defines the roles and responsibilities of the national and local governments, community organisations, and citizens with respect to managing disasters at the national, prefectural, and municipal levels. The act also requires the national and local governments to develop basic disaster management plans. In addition, all ministries and public institutions are required to create disaster management laws in their respective fields.

(iii) The Cabinet must submit an annual report to the Diet that explains the situation concerning disaster management efforts as well as the budget for disaster management projects. In the Diet, a Special Committee on Disasters has been established in both the House of Representatives and the House of Councillors, so that the government's disaster management measures can be monitored on a regular basis.

Figure 10: Structure of the Central Disaster Management Council, Japan



DM = disaster management.

Source: Cabinet Office, Government of Japan.

The Central Disaster Management Council serves the following role. The Cabinet Office is also the secretariat of this council. With the assistance of the Cabinet Office personnel, the Minister of State for Disaster Management has the authority to supervise the formulation and general coordination of basic policies concerning disaster management and measures against large-scale disasters. The Minister of State for Disaster Management is also responsible for gathering information and other emergency response activities.

(i) Developing, implementing, and regulating the Basic Disaster Management Plan

(ii) Developing, implementing, and regulating an emergency response plan

(iii) Forwarding opinions about matters that are important for disaster management to the Prime Minister or the Minister of State for Disaster Management

(iv) Deliberating over important matters concerning disaster management by consulting the Prime Minister or the Minister of State for Disaster Management

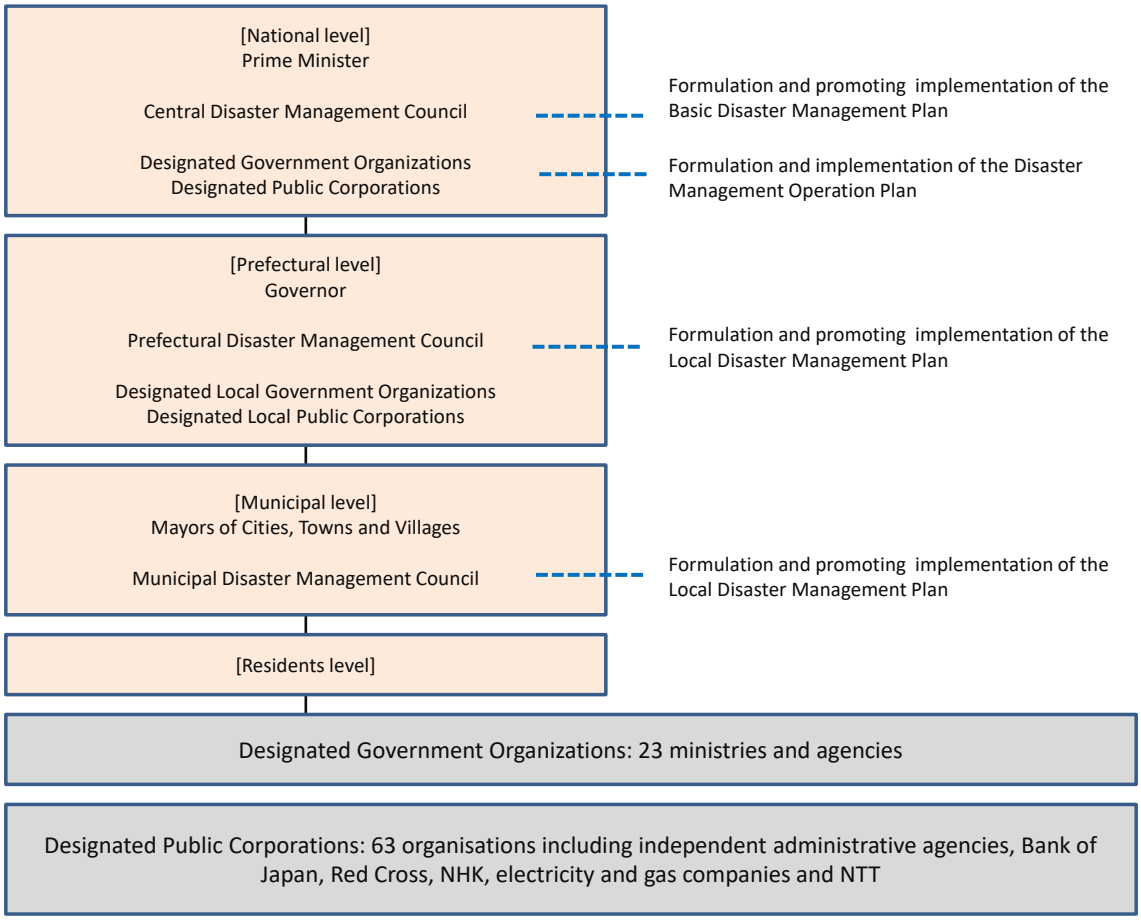
The Basic Disaster Management Plan, created by the Central Disaster Management Council in accordance with the Disaster Countermeasures Basic Act, clarifies the responsibilities of the government, public institutions, and local governments that are responsible for implementing measures for managing disasters. The plan includes a series of disaster control measures such as prevention, advance preparation, emergency response, as well as recovery and restoration. Designated local government organisations and designated public institutions will create their own disaster management plans based on the Basic Disaster Management Plan. When a disaster strikes, municipalities play a central role in managing the disaster. However, if a municipality is unable to fulfil most of its main responsibilities due to the extensive and immense damage caused by the disaster, the prefecture will issue the evacuation orders and instructions in its place. The local disaster management plans include the following:

(i) The roles assigned to designated public institutions such as government organisations, public welfare, public service entities, the Red Cross, and public institutions

(ii) Developing a plan to establish new disaster prevention facilities and improve pre-existing ones; research investigations; education, training and other disaster prevention measures; gather and share information; disaster forecasting and issuing warnings; evacuations; firefighting; flood control; rescue and relief activities; and sanitation, as well as other emergency measures and recovery activities for disasters

(iii) Developing a plan for the maintenance, stockpiling, supplying, distribution, transportation, and communication work involved in handling labour, facilities, equipment, supplies, and funds

Figure 11: Outline of the Disaster Management System in Japan



Source: Cabinet Office, Government of Japan.

The local disaster management plans are reviewed as necessary according to what has been learned from disasters that have occurred, as well as the revisions made to the Basic Disaster Management Plan, which is a high-tier plan amidst the Disaster Management Laws. After the Tohoku earthquake, which inflicted catastrophic damage to mainly of the coastal areas of the Tohoku region, the local governments that were affected began strengthening their disaster management systems. For instance, Iwate Prefecture made a proposal to revise the Disaster Management Laws based on their experience of the Tohoku earthquake. The aim of this revision was to strengthen the measures against disasters for the largest-scale earthquakes and tsunamis that may occur in the future.

The local disaster management plans developed by each local government are adjusted for all types of disasters according to factors such as the geographical location, topographical conditions, and experiences from past disasters. As an example, Japan

experiences frequent earthquakes and tsunamis due to being situated above the boundaries of four tectonic plates; as such, 45 local governments out of 47 prefectures have established either an earthquake edition or tsunami edition of their own local disaster management plan. Additionally, more than 30 municipalities have local disaster management plans for floods, typhoons, and landslides. Although not a natural hazard, an increasing number of local governments have also been developing local disaster management plans that contain measures against nuclear disasters in the wake of the Tohoku earthquake. These plans that focus on measures against nuclear disasters often contain explanations about the expectations of protective measures, information sharing, establishing evacuation systems, and decontamination activities.

Consequently, although there are local governments that make local disaster management plans that cover each type of disaster according to their unique circumstances, local governments that do not handle every disaster may assign general disaster measures for each disaster type.

The local disaster management plans are often divided into the prevention stage, the emergency management stage, and the restoration and recovery stage. For example, the chapter on prevention may include the method of setting up a disaster response headquarters and implementing disaster drills; the chapter about the emergency management stage may include information about gathering staff members and collecting information about disasters; and the chapter about the restoration and recovery stage may contain information about restoring public facilities, setting up temporary housing, and developing recovery plans. In addition, local governments have been promoting establish a standard operation procedure that is more specific to emergency situations.

During the prevention, emergency, and restoration and recovery stages, cooperating with the private sector is essential when implementing activities in accordance with the local disaster management plan. Therefore, a specific response policy is included in each chapter. For example, Miyagi Prefecture's local disaster management plan mentions the importance of cooperating with the private sector entities that deal with utilities such as the water supply, gas, electricity, and telecommunication systems. The plan also states the names of specific companies within the prefecture. In Shizuoka Prefecture, which is mountainous in the north and faces the Pacific Ocean in the south, the local disaster management plan clearly states that, based on its geographical features, there is a need to

cooperate with railway companies, shipping companies, and fishing vessels within the prefecture for the purpose of facilitating quick transportation and evacuation activities during emergency situations. It also contains information about the use of private land where departures and arrivals take place at times when helicopters are used. In Kochi Prefecture, where there are concerns about the damage brought about by the Nankai megathrust earthquakes, a department known as the Lifeline Coordination Centre has been established within the disaster response headquarters, and measures have been taken to facilitate prompt cooperation during emergency situations.

Thus, each local government develops local disaster management plans that cover each type of disaster according to the unique characteristics of each area. These plans also mention the need to cooperate with the private sector within the area. In terms of the budget, each local government is also raising disaster control funds to be able to manage finances smoothly during a disaster. The responsibility over these funds is stated clearly in Article 101 of the aforementioned Disaster Countermeasures Basic Act.

Table 3: Basic Structure of the Local Disaster Management Plan

Time	Content
Prevention	・Set up an organisation ・Establish a wide-area disaster control system ・Establish and operate disaster control offices ・Establish a system for medical care, transport, supplies, etc. ・Build and renovate disaster control facilities ・Conduct disaster control research, education, and drills
Emergency Management	・Establish an organisation ・Mobilise ・Collect and transmit disaster-related information ・Evacuation, rescue, supply provision, health & sanitation, waste disposal, etc. ・Secure lifelines
Restoration	・Restoration of public facilities, etc. ・Support for rebuilding and restoring homes ・Support with life rebuilding
Recovery	・Set up a recovery division ・Establish a recovery plan

Source: Hyogo Prefectural Government.

4.2. Thailand

The Disaster Management System in Thailand, which is based on the Disaster Prevention and Mitigation Act 2007 (DPM Act 2007), came into force on 6 November

2007 and implemented Thailand's national disaster management plans. All disaster management activities are directed and controlled by commanders and/or directors at three different levels: national, provincial, and local. As per the DPM Act 2007, the National Disaster Prevention and Mitigation Committee (NDPMC) acts as a policymaker, chaired by the Prime Minister (or a designated Deputy Prime Minister), while the Director General of the Department of Disaster Prevention and Mitigation (DDPM) acts as the Secretary.

The NDPMC consists of 34 members and various subcommittees. The Minister of Interior is the National Incident Commander during large-scale disasters (level 3), and the Prime Minister (or Deputy Prime Minister as assigned by the Prime Minister) takes on this role during a catastrophic disaster (level 4), as shown in Table 4.

Table 4: Disaster Management Levels in Thailand

Level	Disaster Scale	Key Incident Commander
1	Small	Local administration or district chief officers
2	Medium	Provincial Governor or Governor of Bangkok
3	Large	Minister of Interior
4	Catastrophic	Prime Minister/Deputy Prime Minister

Source: Department of Disaster Prevention and Mitigation (2015).

4.2.1 Institutions Involved in Disaster Management

The central state agency responsible for performing disaster risk management tasks for the country is the Department of Disaster Prevention and Mitigation (DDPM). The DDPM was created in 2002 as an agency under the Ministry of Interior with the responsibility of overseeing the administration of disaster management tasks in Thailand. The national disaster management system is made up of multiple agencies and committees that carry out disaster preparedness and response activities.

Policymaking can be separated into three different levels: (i) national level (chaired by the Prime Minister of Thailand or a designated deputy minister); (ii) provincial level (chaired by the provincial governor); and (iii) the Bangkok Metropolitan Administration (chaired by the Bangkok governor). Moreover, each policymaking level also includes the following committees: the National Disaster Prevention and Mitigation Committee (NDPMC), the Provincial Disaster Prevention and Mitigation Committee, and the Bangkok Metropolitan Administration Committee.

According to the National Disaster Prevention and Mitigation Act 2007, disasters can be classified into three key categories: (i) natural hazards and disasters caused by humans, (ii) disasters caused by war, and (iii) disasters caused by terrorism and sabotage.

4.2.2 Legal Framework and Policies on Disaster Management

Authorities at the national and provincial levels are enforced and encouraged to develop their own action plans as well as budget for plan implementation and exercises. According to the Sustainable Development Goals Sendai Framework for DRR 2015–2030, the Paris Agreement, and the ASEAN Agreement on Disaster Management and Emergency Response, all line ministries and relevant agencies from national to local levels are implementing their disaster risk management plans in compliance with the national DRM plan 2015 and various global frameworks.

Moreover, in Thailand multiple agencies function within and have responsibilities regarding disaster risk management. The Department of Disaster Prevention and Mitigation (DDPM), the National Safety Council of Thailand, and the National Disaster Warning Centre have specific and individual plans for disaster and emergency management. Each of the individual plans is a collective part of the national plan; the main disaster plans and acts in Thailand include the following: (i) the Disaster Prevention and Mitigation Act 2007, (ii) the National Disaster Prevention and Mitigation Plan 2010–2014, and (iii) the National Disaster Risk Management Plan 2015.

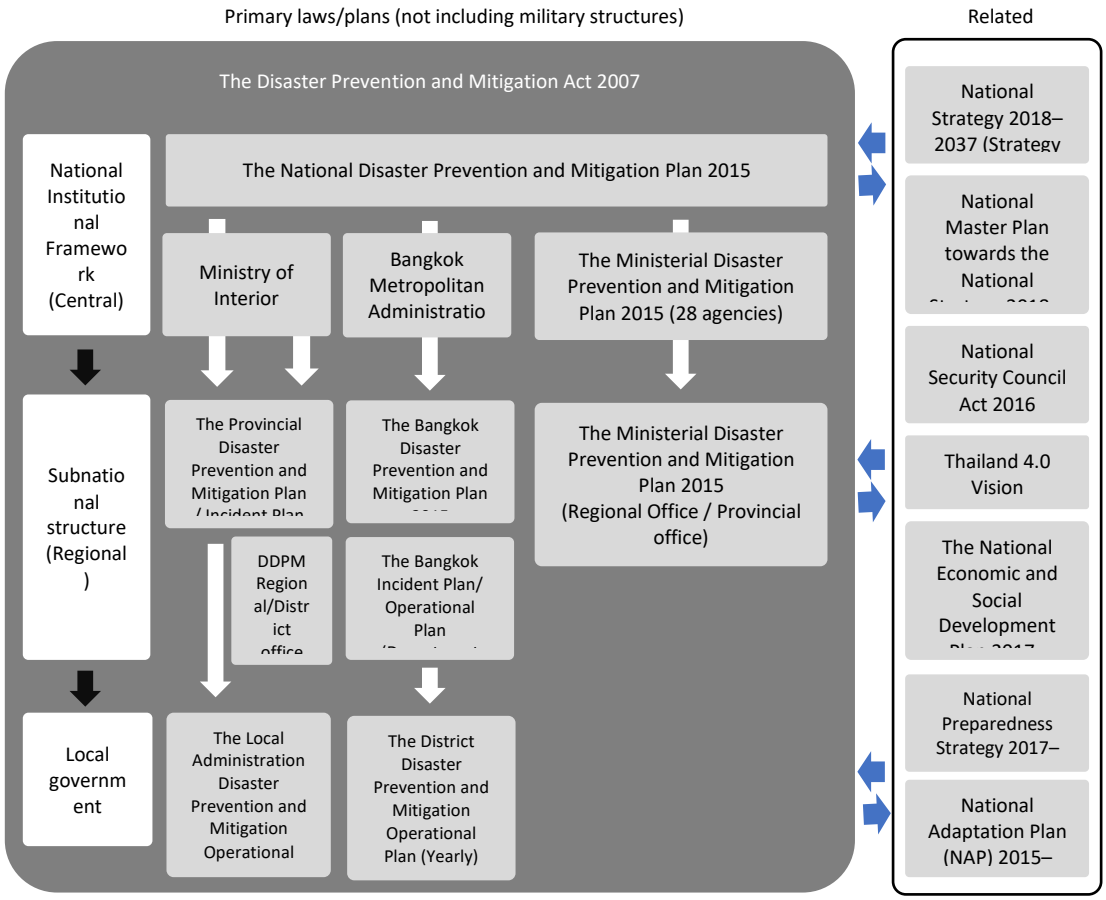
The Disaster Prevention and Mitigation Plan 2015 was approved by the Cabinet on 31 March 2015. All appropriate agencies are expected to utilise the plan as a nationwide procedure of operations to collectively implement disaster risk management activities in an integrated and systematic manner, all in the same direction. It functions as the primary national disaster management plan, and focuses on reducing disaster risks as well as loss of life and property. The plan provides structure for the operations and preparedness processes across all agencies, for all phases of the disaster management cycle. Guidelines are given for pre-, during, and post-disaster management activities for government and nongovernmental agencies.

The plan also addresses municipalities and provinces as having fundamental roles in disaster risk management throughout Thailand. According to the Disaster Prevention and Mitigation Act 2007, all local administrations are required to develop their own

operational plan that is consistent with the national plan by covering local risks and necessary information, including the situation and conditions of any local hazards, standard of operation, resource allocation process, communication, and budget and donations. However, local administrations can also develop hazard-specific plans for local risks, such as floods, drought, fires, transport disruptions, dangerous goods, dangerous substances, and so on. The local administration can freely adjust details within local plans, but they have the same structure as the national plan.

The National Disaster Prevention and Mitigation Plan and the National Disaster Prevention and Mitigation Act 2007 were key mechanisms of Thailand's disaster management, but there were other national plans and policies that were created after them that addressed other matters, such as: (i) the Thailand National Strategy 2018–2037 Strategy 5 Green for Growth, (ii) the National Master Plan for National Strategy 2018–2037, (iii) the National Security Council Act 2016, (iv) Thailand 4.0 Vision, (v) the National Economic and Social Development Plan 2017–2021, (vi) National Preparedness Strategy 2017–2021, and (vii) the National Adaptation Plan (NAP) 2015–2050. These national plans and policies are all related to disaster management as per the Disaster Prevention and Mitigation Plan 2015, and thus seamlessly correspond to other national plans. An overview of Thailand's disaster laws and plans is shown in Figure 1

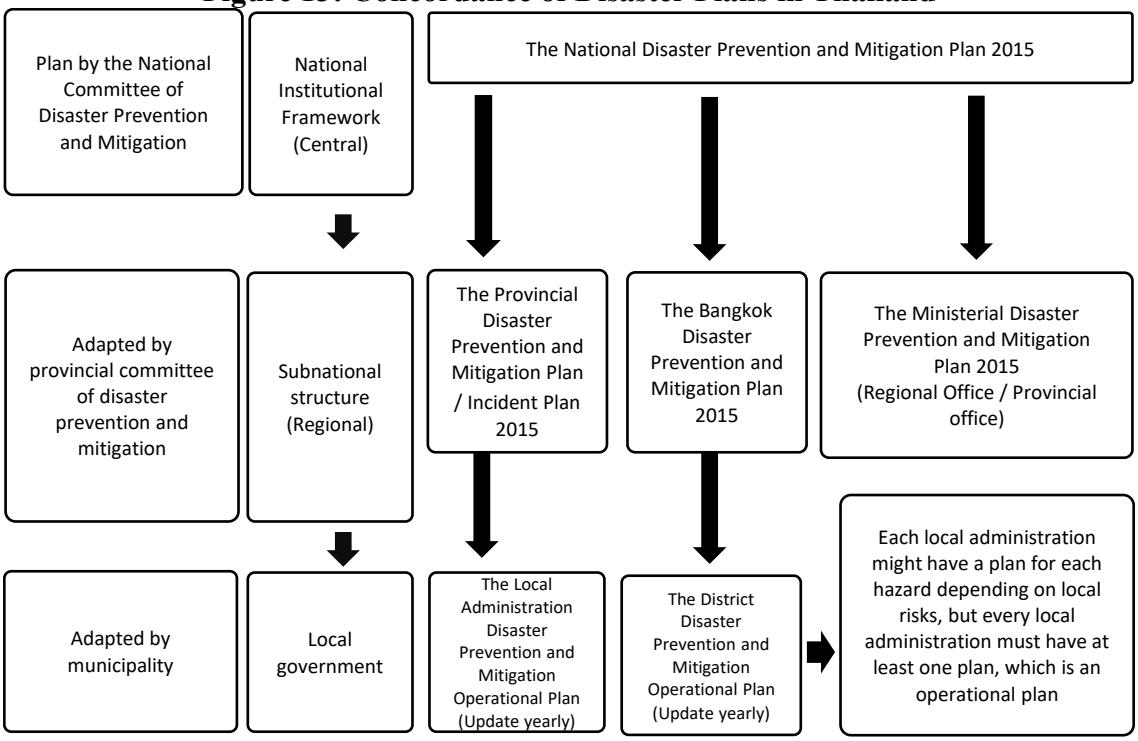
Figure 12: Overview of Thailand's Disaster Laws and Plans



DDPM = Department of Disaster Prevention and Mitigation.
Source: Department of Disaster Prevention and Mitigation (2018).

National disaster laws and plans in Thailand are disaster risk management system laws that cover the full spectrum of disaster risk management – disaster risk reduction, prevention, preparedness, early warning, mitigation, emergency management and/or response, and early recovery. The Disaster Prevention and Mitigation Act 2007 has served as the principal legal mechanism for disaster risk management practices in Thailand, coupled with an application of other disaster risk management-related laws, regulations, notifications, and directives.

Figure 13: Concordance of Disaster Plans in Thailand



Source: Department of Disaster Prevention and Mitigation (2018).

4.2.3 Legal Framework of Disasters and Policies on Private Sector Collaboration

Collaboration with the private sector in Thailand's disaster management plan was briefly identified as being necessary to support operations across all levels and promote private partnerships for the development of efficient and effective disaster management systems, as stipulated under the provisions of Articles 6 and 7 of the Disaster Prevention and Mitigation Act 2007. However, government agencies have written key roles and collaborated with the private sector on disaster management though various laws and plans, such as:

The National Disaster Prevention and Mitigation Plan 2015 underwent a participatory planning process, wherein related public, private, and civic sectors were engaged. Moreover, the National Disaster Prevention and Mitigation Committee, which is a key mechanism for national disaster risk management, has identified their roles as that of ensuring the effectiveness of public and private cooperation and coordination in disaster risk management. The committee has been tasked with formulating national disaster management policies and integrating public–private partnerships in terms of private sector support in disaster response operations and investments for the

development of efficient and effective disaster management systems, as stipulated under the provisions of Articles 6 and 7 of the Disaster Prevention and Mitigation Act 2007. Concurrently, the Disaster Management Centre at each level is in charge of identifying and putting in place the guidelines and procedures for government agencies, units, and private sector organisations to follow in responding to emergency situations, as well as in developing emergency evacuation plans and conducting evacuation drills.

The Public Private Partnership (PPP) Strategic Plan 2017–2021 creates clarification for both the private and public sector regarding subsectors that require private sector investment, and subsectors in which the government encourages participation and investment from the private sector during the period of the plan. Some top-priority PPP development target projects may relate to disaster risk reductions, such as: (i) public health infrastructure; (ii) science, technology, and innovation infrastructure; (iii) shelter for low- to middle-income earners, the elderly, the handicapped, and the underprivileged; and (iv) water supply and irrigation system.

The Provincial Disaster Prevention and Mitigation Plan/Incident Plan 2015. In Thailand, not all provinces have clearly identified the role of the private sector in disaster management. However, the dominant role of the private sector in disaster management often appears in provinces with a huge economic or industrial area, such as Bangkok, Rayong, Chon Buri, Samut Prakarn, and Samut Song Karm, where the private sector often becomes part of the board for a local disaster management mechanism or as an executive advisor. In addition, in economic and industrial areas, the collaboration between the private sector and the public sector is often much higher than in other areas. Relationships are often in the form of dependency on each other – for example, government agencies do not have the ability to handle large disasters such as chemical and hazardous substance-related incidents; therefore, many local administrators often make a memorandum of agreement with the private sector to let them provide some technical support when necessary, such as in complex situations that required professional protocol and emergency professionals that locals might not be capable of managing. Moreover, some local agencies also let the private sector provide public services related to disaster management – for example, the Emergency Incident Command Centre, which provides hazard surveillance and coordination with government agencies and the local private sector, was established in the Map Ta Phut Municipality (Rayong).

5. Case Study in Chon Buri Province

PPPs have been a popular approach in Thailand for several years, and aim for not only a boost in domestic investment but also a reduction in disaster risk though investments, by engaging the private sector in the delivery of government infrastructure and services with the aim of increasing quality and providing better value for money (PwC, 2018). This study will explore whether PPP can be used as a strategic approach to overcome, or at least to minimise, the negative impacts of disasters in developing countries.

In Chon Buri, the PPP approach has also been implemented in order to solve complex governance issues related with Disaster Risk Management involvement of the private sector in government programs provides added value and can reduce government financial restrictions on delivering better services to the community. Even Chon Buri Province is not located in an area prone to natural hazards, unlike many other parts of Thailand such as the Chao Phraya basin area and the northeast region that experiences disasters such as floods, drought, storms, and earthquakes, but hazards caused by humans such as chemical or transport accidents are a key concern for local authorities and the private sector in Chon Buri.

The PPP implementation in Chon Buri has not resulted in a multi-billion-dollar structural investment towards disaster risk reduction due to The Eastern Economic Corridor (EEC) project. The EEC project is the Thai government's flagship policy to accelerate infrastructure development and encourage local and foreign investments in the three eastern provinces of Thailand including Rayong, Chon Buri, and Chachoengsao. under the EEC act that providing Chon Buri's PPP investment in the future with directly effort by the EEC committee than local agencies alone. Moreover, the EEC projects can be broadly categorised into four core areas: (i) transport, (ii) industrial clusters and innovations hubs, (iii) tourism, and (i) new cities and communities (in the new cities and communities there would be opportunities for disaster risk reduction investments due to the development of public utilities, which are a key channel for the private sector to partner with public agencies). However, according to the Board of Investment of Thailand in 2018 the number of overall investments, national policies (eastern economic corridor

initiatives), and legal frameworks has increased (BOI, 2018), even though they might not directly address disaster-related investment.

In case of Chon Buri Province, there is a multi-stakeholder collaboration in disaster management and disaster risk reduction activities through the co-creation of activities between the local private sector and government agencies, such as:

(i) Disaster drills. Normally the DDPM cooperates with all sectors in conducting disaster drills annually, aimed at facilitating coordination between relevant agencies to save lives and protect property should such a disaster strike. Similarly, Chon Buri Province also conducts multi-hazard drills in response to disasters covering floods, fires, drought, and tsunamis. A highlight of the public–private collaboration involved in Chon Buri's disaster drills is the private sector playing a key role in some of the drills such as sharing the cost and the initiative involved in the activities, sharing professional techniques with local agencies, and holding disaster and emergency response workshops. In addition, the disaster drills in Chon Buri Province show advantages of strong collaboration between the public sector, private agencies, and locals in disaster-related activities that might not be seen in other provinces such as Songkha, Khone Kaen, and Bangkok (Thammasat University, 2019).

(ii) Public safety promotion. The local private sector of Chon Buri has often conducted public safety campaigns, with messages on transport accidents and chemical safety. For example, during local holidays such as the New Year festival and Songkran festival, road safety campaigns are conducted by local companies or jointly with local agencies.

(iii) Establishing a memorandum of understanding between local authorities and the private sector. Memorandums of understanding are often made with high-level local authorities such as Saensuk Municipality, Chonburi Town Municipality, Sriracha Municipality, and Laem Chabang City Municipality to ensure collaboration in local disaster management, including emergency response, resource allocation, and data and information exchange. In addition, a local authority would be allowed to reduce operational costs and cooperation obstacles, and increase resource efficiency. Collaboration with the private sector is also often in the form of association, such as with trade associations or industrial estates, rather than individual private companies.

(iv) Long-term approach to corporate social responsibility (CSR) activities. Many local private sector entities seem to adjust their CSR activities to be more sustainable in terms

of time, such as running multi-year campaigns, integrating with communities, and conducting co-creation activities with local government agencies such as the Toyota White Road Campaign (1988 to the present), the Continental Zero Accident Campaign (2011 to the present), and the Honda Thailand Foundation (2012 to the present).

(v) Donations for post-disaster support. Even Chon Buri Province does not have a specific local fund for disaster management, but there are temporary channels for fundraising from locals, which include donations from the private sector. For example, when a disaster strikes, the provincial office might create a temporary fund account as a public fundraising platform for the private sector and locals.

(vi) Provision of disaster mitigation activities by the private sector. Some local authorities with high financial stability such as Saensuk Municipality, Chonburi Town Municipality, Sriracha Municipality, and Laem Chabang City Municipality in Chon Buri Province use the private sector to provide some disaster management services, such as the monitoring and surveillance of hazards, emergency responses (search and rescue), and data management for local decision-support systems. These collaborative models are a practical example that show that local authorities and the private sector can join in operating a public service together.

(vii) Engage with volunteers, nongovernmental organisations, and local partners as part of a friendship network for local disaster management. Friendship networks play a key role in Chon Buri Province for encouraging organisations to be involved in disaster preparedness networks. It is the collaboration that occurs during disaster preparedness that influences the participation during a disaster response. The structural attributes of emergency management systems have an impact on the development of multiplex relationships amongst organisations within various networks. Moreover, a local friendship network is an informal facility that contributes towards the collaboration between local authorities and the private sector through activities such as business lunches, site visits, the appointment of consultants, and becoming part of the King of Thailand’s volunteer network.

6. Key Challenges of Effective Disaster Risk Management through Public–private Partnerships and Local Disaster Mechanisms in Thailand

When a disaster strikes – which includes not only natural hazards, but also disasters caused by humans – the local economy's resilience depends on the private sector's ability to recover. Likewise, local resilience to disasters involves assuring that the economic situation and life in the area is protected, enduring only minimal impact and endeavouring to return to normal as soon as possible. The situation in Chon Buri Province can be considered as an effective method of public–private collaboration in disaster management, in light of the following points:

(i) Shared risk – local hazards are a shared risk for all, especially the private sector such as industrial estate groups and giant multinational companies that dominate the local economy. Local hazards drive the private sector to work more closely with government agencies though collaborative activities such as disaster drills and disaster risk-related campaigns. In Chon Buri Province the private sector plays a leading role in creating initiatives for disaster-risk related activities, providing financial support for the public agencies and non-public networks that work in risk-driven local activities such as the CSR Amata Nakorn group, the Green Network, and the CSR Place Club.

(ii) Multi-stakeholder collaboration and friendship networks. Friendship networks are typically informal and self-organised governance systems, which can include a variety of sectors from different organisational levels working together with a common purpose and a minimal amount of collaboration. Moreover, daily activities such as lunch talks, morning coffee sessions, or festival parties could be used as local multi-stakeholder collaboration platforms for enabling stakeholders to share ideas and work together in more efficient informal ways.

(iii) Integrating with the community. The interdependence and the scaling-up of public–private partnerships through community-based disaster risk management approaches are still needed in Thailand. These include engagement with the whole society on issues such as having women, children, the elderly, and the disabled being involved

in disaster risk reduction. In the case of Chon Buri Province, the integration of a partnership with the local community is critical to enabling effective public–private partnerships with local acceptance. Due to a strong local interest group and traditional community value, key actors in the community, such as community leaders or activists could be a gamechanger to the success of cooperation between communities and the private sector by reason of these groups have high influence and trust from the community in making decisions for the public benefits.

(iv) Long-term approach to CSR activities. In terms of the timeline for CSR activities, expanding the length of campaigns, as well as the frequency of the activities such as multi-year or annual activities would contribute to the increased efficiency of collaboration between government agencies, the private sector, and civil society.

(v) Co-creation activities and local-sharing knowledge platforms. The provision of a central platform for sharing knowledge between government agencies, the private sector, and civil society is an important factor. These are key spaces that encourage the cross-sectoral exchange of data, information, knowledge, and innovation with regards to disaster management. In addition, the platform must be open to various sectors playing leading roles that may depend on matters such as disaster drills conducted with the private sector as a host, the participation of the private sector and civil society in local disaster policy processes, or establishing a public platform for local disaster risk communication, which involves collaboration with local schools and research units.

However, Thailand is still faced with several key obstacles that can hinder the efficiency of disaster management; e.g.:

(i) bureaucratic fragmentation – economic damage data are collected separately by non-integrated agencies that have different tasks, which causes a lack of standardisation in economic damage data collection and the systematic collection of risk information;

(ii) underestimation of damage assessments – the results of government agency damage assessments may have significant discrepancies with the results of research by domestic research institutions and financial institutions; and

(iii) lack of multi-hazard economic damage data – assessments of the economic impact incurred from a hazard are often conducted in regard to only certain types of hazards.

Thus, assessments fail to cover all types of hazards in the country, and information related to economic damage may not be given priority by executives that use a decision-making support system.

7. Policy Recommendations for Effective Disaster Risk Management through Public–Private Partnerships and Local Disaster Mechanisms in Thailand

7.1. Clear and Consistent Policy in Public–Private Partnerships

The central government and local governments should have a clear and consistent policy in public–private partnerships that addresses disaster-risk management partnerships as a key strategy as well as a political commitment to facilitate the project or activity with an appropriate legal framework. Moreover, to clarify a consistent policy between the public and private sectors, public agencies at all levels such as the central government, regional agencies, and local authorities should have a needs assessment for disaster-risk related partnerships that might show gaps where the private sector can intervene in activities or projects as necessary.

7.2. Conduct a Comprehensive Social Impact Assessment

Conducting a comprehensive social impact assessment is needed for the private sector and for public agencies due to the enhancement of benefits for the local community and the broad society. In addition, this process could be a guide for action on sustainable development by focusing on long-term impacts such as programmes with multi-year campaigns.

The principles and practices of comprehensive social impact assessment could involve any affected communities and other stakeholders in the process along with the activities of partnership. Moreover, such a mechanism could be a fundamental process for locals to create agreements with indigenous communities before the start of development projects as in Chon Buri Province, which is a key area of the East Economic Corridor projects. A precautionary solution from a comprehensive social impact

assessment could be the avoidance of conflicts by foreseeing possible impacts and solutions.

7.3. Clarify the Role of all Stakeholders in Local Disaster Management Mechanisms

According to local disaster management mechanisms in Thailand, local authorities such as municipalities, should clearly identify and address the roles of public–private partnerships in disaster management mechanisms.

Clarifying the roles of all stakeholders in local disaster management mechanisms means more efficient disaster management and enhancement of opportunities for integration of cooperation. For instance, provide clear information to the private sector, establish formal platforms, and improve legal requirements to facilitate local public–private partnerships.

7.4. Building Better Partnerships by Providing a Collaborative Platform

The Chon Buri case has shown that informal relationships such as friendship networks in public agencies, the private sector, and with citizens, play a leading role in effective collaboration in public–private partnerships.

The establishment of a collaboration platform is needed to more successfully integrate all stakeholders. Collaborative platforms could be in various forms depending on the local culture, such as weekly meetings, social network groups, weekly city walks, video conferencing, and learning tools. These could be key to increasing the level of public–private partnerships at all levels. Collaborative platforms let public agencies, the private sector, and other potential stakeholders share information, and identify any gaps that might create opportunities for partnerships in the future. Moreover, collaborative platforms could empower and strengthen the working relationships in the networks.

7.5. Integration of Transparent and Accountable Communication in Local Disaster Management Mechanisms

Regarding the improvement of multi-stakeholder collaboration and integration with community challenges that could be minimised by providing information and clear communication with locals though various disaster management mechanisms for example an annual revision of the local disaster plan. Local authorities and the private sector

should have clear direction and plan to communicate public–private partnership activities or projects that the public could understand and alternative channels for local community that can participate in the activities or projects such as local disaster drills, safety campaigns, and public workshops.

8. Summary

Japan and Thailand share many similarities as well as the various natural hazards that occur frequently in both countries. The two countries also have disaster management laws at the national level, which were developed as a measure against natural hazards, as well as local disaster management plans at the provincial and prefectural levels. The local disaster management plans have been made to cover each type of disaster according to the unique situation of all regions in the two countries. However, it was found that unlike the Japanese plans, the National Disaster Prevention and Mitigation Plan and the Provincial Disaster Prevention and Mitigation Plan/Incident Plan established in Thailand do not adequately address the need to cooperate with the private sector. Nonetheless, the National Disaster Prevention and Mitigation Plan in Thailand is currently being revised for its 2020 edition, and the provincial-level Local Disaster Management Plan is also scheduled to be revised accordingly. As an example, Chon Buri Province, where many Japanese companies have expanded their businesses, is expected to be a key to the country's growth as it holds many of the industrial areas in Thailand and has an abundance of resources for tourism, such as the city of Pattaya. Furthermore, as an advanced example in the field of disaster management, it was also discovered that people were responding to emergencies alongside the private sector and performing evacuation drills in an active manner. Efforts are currently being made to spread the disaster management activities being carried out in Chon Buri Province to other areas of Thailand.

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