

Emergency Management in Taiwan: Learning from Past and Current Experiences

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Introduction

Located on the East side of Asia, Taiwan is an island with significant risks for natural disasters. In 2005, the World Bank report entitled “Natural Disaster Hot spots – A Global Risk Analysis” indicated “Taiwan might be the most vulnerable [country] to natural hazards on Earth, with 73% of land and population exposed to three or more hazards (Lin 2008). The five major natural hazards confronting Taiwan are: typhoons, earthquakes, landslides, floods, and debris flow (Lin 2008). Making matters worse, in October 2010, the population in Taiwan was estimated at 23,150,923 (ROCMOI 2010) and it is spread across a total land area of 35,980 km². This makes Taiwan one of the most densely populated countries in the world, with a rate of 643.4 people per km².

Taiwan is therefore vulnerable to many natural hazards that cause major economic losses. Such disasters arouse citizens’ concern, but also stimulate government officials to develop an improved emergency management system with the application of advanced hazard mitigation technologies to reduce the negative consequences of disasters (Chen, Wu, and Lai 2006).

With this brief introduction in mind, the following paper will provide contextual information about Taiwan. It will then discuss hazards, vulnerability and disasters in Taiwan along with a case study about the Naphtha Cracking Plant disaster. The paper concludes with an exploration into lessons other nations may glean from Taiwan.

Background

Taiwan is situated in East Asia in the Western Pacific Ocean and is located off the southeastern coast of mainland China. In 1684, the Qing Empire administrated Taiwan as

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a part of Fujian province. After the First Sino-Japanese War in 1895, Taiwan was ceded to the Japanese Empire. Fifty years later, Taiwan was freed from Japan as a result of World War II. Then, in 1949, the Republic of China (or ROC, which was created in 1912 as the successor of the Qing Empire that ruled China mainland) lost its control of mainland China to the Chinese Communist Party in the Chinese Civil War. The ROC resettled its government to Taiwan. Therefore, the term “Taiwan” is also a common name to refer to the Republic of China itself (Wikipedia 2011a).

Starting in 1949, Taiwan was under a single dominant party system. The ruling party or Kuomintang (KMT, the Chinese Nationalist Party lead by Chiang Kai-shek and his son, Chiang Ching-kuo), kept fighting with PRC government. However, from the late 1970s, Chiang Ching-kuo adopted political reforms that enhanced democratic development in Taiwan. He also started to decrease the tension between Taiwan and China. When the opposing party, the Democratic Progressive Party, won the presidential election in 2000, the one-party rule history ended and the two-party system was established.

In October 1949, the People Republic of China (PRC) was created by the Chinese Communist Party. Both ROC and PRC governments claimed that they were the only legitimate government of China. Hence, the relationship between these two rival governments (the so-called “cross-strait relations”) has become a critical and debated issue in world politics. From the 1980s onward, the ROC government began to talk with the PRC and created several mutual beneficial efforts such as allowing Taiwanese people visit China mainland for tourism and business. When Ma Ying-jeou was elected as the President of ROC in 2008, he started to enhance the cooperation with PRC. Thus, the tension between these rival governments has been reduced over time.

On the other hand, the United States government also plays an important role in the cross-strait relations. The United States is one of the main allies of Taiwan and, since the Taiwan Relations Act passed in 1979, the United States has sold arms and provided military training to the armed forces of the Republic of China. This situation continues to be a concern for the People's Republic of China, which considers US involvement disruptive to the stability of the region. In January 2010, the Obama administration announced it intended to sell \$6.4 Billion worth of military hardware to Taiwan. As a consequence, the PRC threatened the US with economic sanctions and warned that their cooperation on international and regional issues could suffer (Wikipedia 2011a).

In terms of political structure, the Taiwanese government is divided into five administrative branches (or Yuan):

- 1). the Control Yuan, borrowing ideas from the Ombudsmen agency in western countries, it monitor other branches of the government;
- 2). the Examination Yuan, deals with validating the qualification of civil servants in Taiwan, like the Office of Personnel Management of the United States of America;
- 3). the Executive Yuan, is the highest administration agency in Taiwanese government;
- 4). the Judicial Yuan, the highest judicial agency; and
- 5). the Legislative Yuan: the Congress.

Under this system, the President is elected by popular vote for a four-year term as the leader of ROC government. He also has a power to appoint members of the Executive Yuan without approval of the Legislative Yuan. The Prime Minister, who is the leader of the Executive Yuan, is the highest administrative official in Taiwanese government.

There are five levels of local government in Taiwan: the Provincial government,³ the Municipality City,⁴ the County and City, the Township, and the Village. Thus, there are three different types of “cities” in Taiwan and many people may confuse these distinctions.⁵ Whether the Village can be viewed below the local government is still in question. Though the leader of villages is held by the villagers, most of the power and resources come from the Township office, the administrative and governance power of the leader are restricted. Hence, the Township can be viewed as the lowest level of Taiwan local government.⁶

Hazards and Vulnerabilities Affecting Taiwan

Taiwan is vulnerable to many natural hazards. As mentioned earlier, typhoons, earthquakes, landslides, floods, and debris flow are the five main natural hazards

³ The Taiwan and Fujian Province government have symbolic roles with no political power.

⁴ There are five Municipality Cities: Taipei (the capital city in Taiwan), Kaohsiung, New Taipei, Taichung, and Tainan City. The latter three cities are created by urban consolidation in December, 2010. These cities' position is equal to Province, however, the power and resources of the Province has been weakened,. That is, the Municipality City is the highest level of Taiwan local government.

⁵ Other than the municipality and county level, there are some “cities” located in the township level. In other words, there are three levels of “city” in Taiwanese local government system.

⁶ See Local Government Act, website of Ministry of Justice:
<http://law.moj.gov.tw/Scripts/Query4B.asp?FullDoc=所有條文&Lcode=A0040003>

affecting Taiwan. Typhoons are among the most serious hazards that cause significant damages and economic losses. On average, Taiwan is hit by 3.6 typhoons a year and these result in US \$667 million in economic losses (NAPHM 2011).

Taiwan is one of the most earthquake-prone places in the world. The tectonic setting and dynamics of the Eurasian and Philippine Sea Plates are the major triggering mechanism of earthquakes in Taiwan. For instance, the Chi-Chi earthquake was a major event that occurred on September 21, 1999, and killed more than 2,400 people in the middle of the night. Although quakes occur often, most of them are not noticeable and cause minimal damage on the island. However, the frequency of severe earthquakes in East Asia and Pan-Pacific area seems to be increasing in recent years.

In addition, the consequences resulting from earthquakes (like tsunamis and infrastructure damage) also magnify the threats to human beings. For example, when the earthquake in Japan occurred in March 11, 2011, most life and property losses were caused by the tsunami. At the same time, the Taiwanese government received tsunami warnings both from both Japanese and U.S. officials. Although the tsunami caused by Japan earthquake did not cause damages in Taiwan, the high frequency of earthquakes in the region still threatens Taiwan.

After the earthquake in Japan, the risk from the Fukushima Daiichi nuclear plant threatened not only Japan but also all the neighboring countries like Korea, Russia and China. The release of radioactive materials into the air, water, and soil will have long term negative side effects on environment. The prior two experiences in Hiroshima and Nagasaki in World War II (the only two cities which experience a nuclear attack) had already shown the danger of nuclear hazards. The recent radiation release likewise aroused people's concern that the technology hazards come after natural disasters may cause more damage than the disasters. This is especially worrisome since there are three operating nuclear plants in Taiwan (two in north Taiwan and the other one in the south). A fourth plant is under construction and will be finished in one or two years. How to ensure nuclear crises such as what happened in Three Mile Island and Fukushima will be a critical issue for Taiwanese emergency management efforts.

In addition to hazards, the vulnerabilities in Taiwan are worth noting. As discussed previously, there are many geological factors that make Taiwan a disaster-prone area. However, some failures within public policy and government actions such as a lack of building codes or inappropriate design increase vulnerability in Taiwan. For instance, when the Chi-Chi earthquake attacked Taiwan in September, 1999, many public buildings (e.g., local government offices and fire department headquarters) collapsed due to insufficient anti-seismic construction. When these government buildings were destroyed,

disaster areas also lost communication abilities as a result. Thus, the flow of information was hindered and the central government could not obtain an understanding of what was happening in the disaster areas. The information transportation difficulties not only delayed governmental rescuing actions, but also broadened the scope of impact.

There are also other problems with development in disaster prone areas in Taiwan. Urban sprawl often leads to development in hazard zones (Sylves 2007), and this has also been a major cause of vulnerability in Taiwan. The lack of sufficient living space along with high population density has caused people to move to mountainous areas. Unfortunately, farming in mountainous regions has been testified as the main factor which causes landslide and debris flow. Because the development of agriculture in mountainous areas has not included appropriate soil and water conservation methods, more and more people are exposed to natural hazards. When typhoons increase the quantity of rainfall, landslides and floods threaten property and human life.

Zoning regulations and land-use policies have been implemented to limit development in these disaster-prone areas, but such laws not been well executed. Many people still live in such areas because they do not have financial ability to live in a safer place. From local government's view, it may also be hard to move people to a safer place because they cannot afford the cost of public housing communities. Although local government officials have legitimate power to force them move out, where to settle these dwellers has become a hot political issues in local land-use and zoning policy fields. Vulnerability is also related to construction practices and building codes. The Chi-chi earthquake in 1999 aroused concern about construction and building codes, and more strict regulations were adopted to enhance mitigation efforts. However, the process of implementation has been problematic and this has aggravated disasters.

Because the mission of PPA is to avoid corruption within government procurement works, the Public Procurement Act (PPA) set up strict rules for executing all the procurement works relating to public sectors in Taiwan. For this reason, the legal process of procurement takes time, thereby affecting efficiency and increasing the costs of mitigation and preparedness actions before disasters. Under this situation, government officials have to choose a service provider with the lowest cost. Private contractors also have to use any cost cutting measures in order to increase the possibility of winning the public construction contract. Thus, jerry-building has become a popular activity for such service providers, and the quality of public construction has declined.

For example, when Typhoon Nari hit Taiwan in September 1999, the swollen river stream flooded Taipei City and caused significant damage. The levees under construction could not contain the flooded river and were finally destroyed. Afterwards, Taipei City

Government officials were harshly criticized by the Control Yuan, the highest supervision agency in Taiwan, for their mismanagement in executing flood mitigation actions. How to eliminate these institutional problems resulting from PPA has become a major topic of discussion in Taiwan.⁷

Disasters in Taiwan

Due to Taiwan's distinguished geological characteristics (being located between two tectonic plates and in the crosshairs of tropical cyclones and typhoons in the Pacific Ocean), its citizens have suffered from earthquakes and typhoons for more than a century. These disasters also have profound influence upon Taiwanese people's perception of disasters, stimulating changes in existing emergency management institutions. In the following paragraphs, several massive natural disasters are summarized.

1. The 8/7 Flood

The 8/7 (August 7th) Flood in 1959 caused serious damage in 13 counties in central and southern Taiwan. More than one thousand people were killed and more than 45,000 buildings were destroyed due to the flood. The damage caused was up to 11% of the GDP (Gross Domestic Product) of Taiwan.

2. Typhoon Herb

Between July 31 and August 1, 1996, Typhoon Herb brought a maximum rainfall of 1,798 mm in Taiwan. This historically high rainfall caused flooding, debris flows, and landslides, which took 51 human lives and left 22 people missing. The total damage to property was more than NT\$ 5 billion. Thus, Typhoon Herb replaced Typhoon Thelma in 1977 as the most disruptive weather event on record in Taiwan (Wu and Kuo 1999).

3. 9/21 Chi-Chi Earthquake

For most Taiwanese people, September 21, 1999, symbolizes a deep sorrow. A strong earthquake measuring 7.6 on the Richter scale awakened all the people that live in Taiwan Island. Half of a village was lost by subsidence into the Ta-an River and landslides blocked the Ching-shui River, creating a large lake. Two other lakes were created by substantial ground deformation near the epicenter. As a result, at least 2,400

⁷ The Control Yuan is working on collecting data and public opinion as references to review the PPA. All opinions are welcomed by leaving messages or mailing to the Control Yuan via its website. See <http://building.cy.gov.tw/lp.asp?ctNode=1643&CtUnit=375&BaseDSD=7>.

people were killed, 8,700 were injured, 600,000 people were left homeless, and about 82,000 housing units were damaged by the earthquake and large aftershocks. Damage was estimated at 14 billion U.S. dollars.

Rescue groups from other countries joined local workers and the military in digging out survivors, clearing rubble, restoring essential services, and distributing food and other aid to the more than 100,000 people made homeless by this earthquake. The disaster, described as the “Quake of the Century” by local media, had a profound effect on the economy of Taiwan and the consciousness of the people.

Many government buildings in the disaster area collapsed and officials could not take actions immediately after the earthquake. The low effectiveness and efficiency during rescue actions resulted in public dissatisfaction with government’s performance. In fact, it is believed that this earthquake could be viewed as an important factor which caused the ruling party, Kuomintang, to fail in the 2000 presidential election.

After the shock, economic and environmental policies as well as the emergency management system were reviewed again. This earthquake contributed to the birth of the DPRA (the Disaster Prevention and Response or the fundamental law of Taiwanese emergency management institutions to be discussed later) and indicated a new era in Taiwanese emergency management.

4. Typhoon Nari

Four days after the September 11, 2001 attacks in the United States, Typhoon Nari caused significant wounds on Taiwanese people. Typhoon Nari brought torrential rainfall which caused numerous landslides and destroyed homes and buried people. In mountainous regions, more than 1,225 mm (48.2 in) of rain fell over a two-day span, leading to many rivers to overflow their banks. Some areas recorded a record-breaking 800 mm (31 in) during a single day, equivalent to four months of rain in Taiwan. At the height of the storm, an estimated 650,000 people were without power and 350,000 lost their water and telephone supply (Wikipedia 2011c). At least 94 people were killed and 10 others were listed as missing. Agricultural losses from Nari were estimated at NT\$ 2.9 billion (\$84 million USD).

Most of the fatalities took place around the city of Taipei and nearby counties. These areas were also affected in other ways. Stores and businesses around the Taipei Railroad Station and the central business district in Taipei City were shut down due to the loss of electricity for one week. Even the stock exchange market was closed for several days. The Taipei Metro (the mass rapid transportation system in Taipei) was severely damaged by floods and could not resume full operation for one month. In addition, two

lines (Banciao and Nankang) were shut down for six months. When Taipei City went back to work on September 19th, traffic ground to a halt. The city government introduced other measures in response to the MRT closure (e.g., additional busses), at least two months of traffic chaos annoyed citizens (Chang 2001).

The Taipei City Government was criticized for insufficient preparedness for the disaster. Under such political pressure, Mayor Ma Ying-jeou⁸ made a public apology and promised he would not allow such failure to occur again. The Taiwanese Government soon announced several projects to improve its crisis management capabilities, and quickly approved assistance payments and various tax relief measures (Chang 2001). The Control Yuan, the highest supervision agency in Taiwan, reprimanded Taipei City Government officials for not predicting the possible damage and thus taking necessary preparedness and rescue actions in after Typhoon Nari.

5. The 8/8 Flood (Typhoon Morakot)

When Typhoon Morakot hit Taiwan in August 2010, it reminded the Taiwanese of the bad memory of the 8/7 Flood about half a century ago. Like the 8/7 Flood, Typhoon Morakot brought similar catastrophic damage in central and southern Taiwan on August 8th, 2010. The storm produced copious amounts of rainfall, peaking at 2,777 mm (109.3 inches), and surpassed the previous record of 1,736 mm (68.35 inches) set by Typhoon Herb in 1996. The extreme amount of rain triggered enormous mudslides and severe flooding throughout southern Taiwan. One mudslide buried the entire Xiaolin Village and killed hundreds of people. 461 people passed away and 192 others are still listed as missing. Roughly NT\$110 billion (\$3.3 billion USD) in damages.

After the typhoon, Taiwan's president Ma Ying-jeou faced extreme criticism for the slow response to the disaster. He therefore increased the number of soldiers to 46,000 working in rescue and recovery actions. In spite of these additional efforts, the president publicly apologized a few days later for the government's slow response to the disaster.

On August 19th, the central government announced that it would start a NT\$100 billion (\$3 billion USD) reconstruction plan that would take place over a three year span in the devastated regions of southern Taiwan. The tragedy and huge amount of property lost in Xiaolin Village stimulated Taiwanese Government to think about ways to enhance the effectiveness and performance of the existing emergency management system. The Executive Yuan sent the first draft amendments of DPRA to the Legislative Yuan. After several months of discussions and debates, the final draft of amendments had been passed

⁸ After finishing his term as Taipei City Mayor from 1999 to 2006, Ma has been selected as the President of Republic of China in 2008.

thus the new era of Taiwanese emergency management history was also created.

History of Emergency Management in Taiwan

Because Taiwan was colonized by the Japanese Empire from 1895 to 1945, this chapter only reviews the history of Taiwanese emergency management system from 1945 to present. Chen, Wu, and Lai (2006) identify four periods in issuing the development history of Taiwanese emergency management system. An additional period can be added in order to reflect the latest activity in the country.

1. A period without Any Official Disaster Management Related Ordinance (1945-1965)

The Chinese Civil War after the end of World War II created a martial law era in Taiwan. During this era, military and police were the major responders to emergencies. Following the police system created by Japanese Colony Government, the police department combined the functions of both police and fire departments. Thus, emergency management function fell within the purview of the police department. It not only acted as the responders, but also undertook the responsibility to keep the society stable during hazards and disasters.

2. The Standard Procedure for Natural Disaster Assistance (SPNDA) Period (1965-1994)

The history of the development of Taiwanese emergency management system can also be traced to 1965. After suffering from the 1964 Paiho Earthquake which killed 106 persons and caused about 27,000 buildings to collapse or be damaged (Chen, Wu, and Lai 2006), the government was forced to create a more effective disaster response and recovery mechanism. Thus, the Standard Procedure for Natural Disaster Assistance (SPNDA) was created in 1965 by the Taiwan Provincial Government as the guideline of government actions before disasters. Besides the provincial government, two special municipalities, the Taipei and Kaoshiung City governments, also developed similar procedures in 1975 and 1981. Under SPNDA, a task force style Disaster Prevention and Response Council (DPRC) was established, and the police department in the Taiwan Provincial Government was the major organization to take this responsibility. During this period, the emergency management system focused on search and rescue, social assistance, and started to pay more attention to disaster preparedness. The military and police were still the major responders during emergencies (Chen, Wu, and Lai 2006).

3. The NHMP Period (1994-2000)

After the Northridge Earthquake in January and the China Airline Air crash in July 1994, the Executive Yuan, the highest executive agency in Taiwanese government, formulated the National Hazard Mitigation Program (NHMP) in August 1994. During the policy process, decision makers combined ideas and experience both from U.S. and Japanese emergency management systems. Learning from U.S. government's response to the Northridge Earthquake and Japan's coping with the China Airline Air Crash that occurred in Osaka, the NHMP required four levels task force style for DPRCs in normal conditions and Emergency Operation Centers (EOCs) in an emergency situation.

In this era, emergency management emphasized disaster response, early recovery and pre-disaster preparedness (Chen, Wu, and Lai 2006). The fire-fighting system became independent of the National Police Administration in March of 1995, at which time it was renamed as the National Fire Agency under the Ministry of the Interior (MOI). This new organization was to be responsible for fire prevention, disaster rescue and emergency medical service (Chen 1997). Since the fire department has been separated from the police, it has become the major responder to emergencies. Nonetheless, because the fire department may not have sufficient resources for large disasters, it is still required to cooperate with the police and military forces. Thus, the "Big Three League (i.e., fire, police and military agencies)" has been given much of the disaster responsibility.

4. The DPRA Period (2000-2010)

The 9/21 Chi-Chi earthquake occurred in 1999, and inflicted heavy losses in human life and major damages to property in Taiwan. 2,415 people were killed, 11,305 were injured, and US\$10 billion worth of damage was done. In light of these substantial impacts, public concerns about the needs for enhancing the existing emergency management system were voiced (Wikipedia 2011d). After the earthquake, the Disaster Prevention and Response Act (DPRA) was passed by Legislative Yuan and the congress of Taiwan. It was promulgated in 2000. The DPRA was the first disaster management related foundational law in Taiwan, which integrates the management mechanisms for natural and technological disasters and covers all four phases of the disaster management cycle: mitigation, preparedness, response and recovery (see figure 1). Both the SPNDA and NHMP were suspended after DPRA was promulgated (Chen, Wu, and Lai 2006).

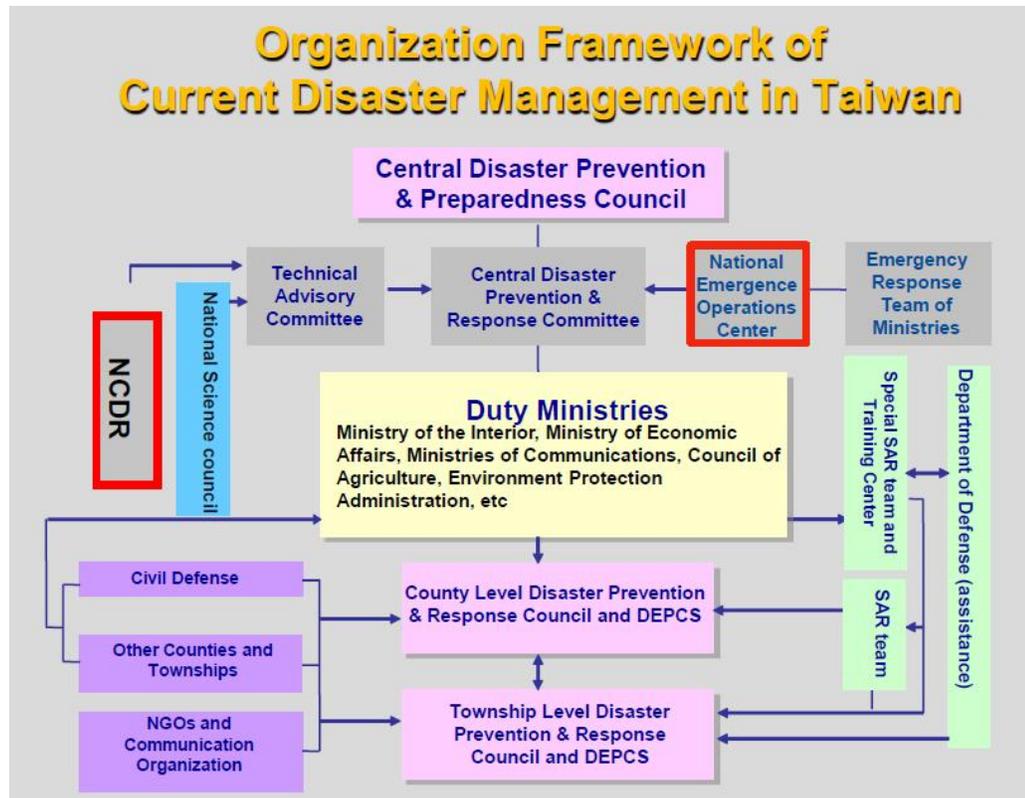


Figure 1. Taiwan Emergency Management System (Lin 2008)

According to the DPRA, the disaster management system consists of four governmental levels: the Central, Municipality, County, and Township.⁹ Every level of government is required to establish a Disaster Prevention and Response Council (DPRC). Each DPRC is responsible for making and implementing relevant disaster management policies and plans. Since the DPRC itself is a task force style organization, it doesn't take responsibility for policy implementation. The specific agency, Disaster Prevention and Response Communities (DPRCM) under the DPRC, takes charge of overseeing and implementing disaster related policies and plans. Under the DPRA, not only government officials but also armed force, military corps, non-governmental organizations (NGOs) and community organizations are included in the comprehensive emergency management network (Chen, Wu, and Lai 2006). The NGOs' role has become more and more important. Thus, we may view them as the fourth actors join in the former "Big Three" league.

⁹ The DPRA views the Township, not Village as the bottom level of local government to exercise emergency management policies. Because a Village may not have enough financial and human resources, it may need to be guided by Township and County governments.

In this framework, each level of government is required to make its own local disaster management plans. However, because of a lack of human and financial resources, many local governments could not create a comprehensive plan like those of the two biggest municipal governments (Taipei and Kaohsiung City) or the central government. When a huge disaster occurs, these local governments still have to rely on the support and resources from the central government. And, since Taiwan is a small island, even a local disaster becomes a mass media headline. This sometimes has forced the central government to take responsibility for local disasters (Chen, Wu, and Lai 2006).

Since the Taipei City Government has a well-designed emergency management framework and an abundance of resources, it often takes the responsibility of helping other local government in rescue and recovery actions. A regional cooperation action agreement has been signed by Taipei City and its two neighboring local area, Keelung City and Taipei County.¹⁰ Such a regional cooperation league helps to relieve the central government's burden and enhance the efficiency of rescue and recovery actions after a disaster.

When a disaster occurs, the local government would immediately open the EOC as the command center. As the front-line commander, the local government leader (township mayor, county commissioner, or city mayor) has to direct rescue actions, coordinate rescue forces from nearby cities counties, and work with the central government when it asks for help. Under this mechanism, the different roles and tasks of local leaders in dealing with disasters can be seen.

On the one hand, the local leaders such as county magistrate and city mayor are commanders over rescue and recovery actions so they have to communicate with other government agencies, NGOs, civic organizations or individuals. On the other hand, local leaders may organize local opinions to force the central government taking actions to response or to satisfy their demands. These local leaders could gain benefits and accumulate political capital at that time. But these leaders may be harmed at the same time if they perform poorly after disasters. For example, after the 911 tragedy in 2001, New York City Mayor Rudy Giuliani was highly praised for his directing. He won extensive support and named as Person of the Year for 2001 by Time magazine and was called "America's Mayor" by Oprah Winfrey and it soon became his global icon. In contrast, Taipei City Mayor Ma Yin-Jeou and other city government officials were highly criticized for the huge amount of property losses caused by Typhoon Nari in September 2001. Thus, the role of government leaders is critical in analyzing disasters and

¹⁰ It has been upheld to the special municipal level and changed its name as "New Taipei City" from December 25, 2010.

emergency management system in Taiwan.

5. The Amendment of DPRA Period (2010-present)

As mentioned earlier, Typhoon Morakot caused huge damage and property loss in central and southern Taiwan in August 2010. This disaster stirred the public to seek a high-performance and more professionalized emergency management system. In December, several amendments were made by the Legislative Yuan (the Taiwanese Congress). These amendments focus on rebuilding the organizational framework in central government level.

Borrowing ideas from other countries like Japan and the U.S., the Taiwanese emergency management system can be viewed as a mixture of different styles. For example, learning from Japan, the emergency management agencies such as DEPCs and DPRCs are composed of part-time officials. Local government leaders have to serve as part-time leaders of these agencies in their local areas. In recent years, the Taiwanese Central Government has also worked to create a central level “full-time” emergency management agency like FEMA in the U.S.¹¹

After the amendments of the DPRA had been passed by the Legislative Yuan in 2010, several changes have been made in the central level emergency management system. Firstly, the former central DPRC (see figure 1) has been replaced by central DPRCM. Under the central DPRCM, the Office of Disaster Management (ODM) has been created in the Executive Yuan to take charge of overseeing and implementing emergency management relating policies and actions. Secondly, the National Fire Agency will be reorganized as the National Disaster Prevention and Response Agency in 2011. All levels of local government also have to set up disaster prevention and response offices for dealing with related issues. Full-time employees are hired in ODM in order to enhance the professionalization and efficiency of policy implementation (ODM 2010). Finally, the Executive Yuan are required to make annually National Disaster Prevention and Response White Paper which will be reviewed by the Legislative Yuan.

Although several full-time officials have been hired, the members of the central DPRCM still come from the cabinet. In other words, all of the members are cabinet ministers. What is more, the Minister of Interior is designed as the chief executive officer of central DPRCM. We can see similar phenomenon in the local level. Most of the committee members and chief officers are designed to be local government leaders in a

¹¹ After huge damages caused by Typhoon Morakot in August, 2009, President Ma Yin-jeou announced the creation of full-time emergency management agencies in central and local government. See Apple Daily (2009).

part-time job. From this point, it seems that the new Taiwanese emergency management institution still maintains its part-time, non-routine role in the public policy area.

Case Study

The explosion and fire accident of the No. 6 Naphtha Cracking Project (Oil Refinery) in July, 2010 is a good example of the performance of Taiwanese emergency management system today. Through this case, Taiwan is able find out what should be enhanced in order to have a better performance and preparedness for the next disaster in the future.

On July 7, 2010, a huge fire resulted after an explosion in the No.6 Naphtha Cracking Plant Complex in Mailiao, Yunlin County. At first, local dwellers that lived near the plant complex were not surprised at this accident. After experiencing 11 fires and explosion accidents since 2009, these local neighbors seemed to have gotten used to such accidents and tend to view these as “normal.” However, when the fire and explosion came again on July 25, the huge fire in the night not only irradiated the sky but also aroused people’s fear and anger. Thus, the angry dwellers protested the plant on July 26, and they were led by local politicians who urged that the plant has to be shut down immediately.

On July 29, Yunling County Commissioner, Chih-Fen Su, led a protest in Taipei. Local dwellers, politicians, and Commissioner Su kneeled down in front of the Executive Yuan, the highest administrative agency in Taiwan, to protest central government’s industrial and environment protection policies. This action soon aroused a national wide concern and debate. The next day, after visiting the plant, the Prime Minister Den-Yih Wu announced that the exploded plant would shut down immediately and it would not reopen until passing the safety check by central government.¹²

In addition, on September 2nd, a compensation agreement was made. In the agreement, the Formosa Group agreed to offer free health examinations through Chang Gung Hospital, the largest medical cooperation in Taiwan branch of the Formosa Group. Furthermore, a 250 million NT\$ first-year compensation will be paid by Formosa Group. Also, all the residents live in Mailiao will receive 7,200 New Taiwan Dollars (NT\$) per person as annual compensation from the second year.

After the disaster, Yunlin County Government implemented several disaster mitigation and preparedness actions in order to eliminate the possibility similar

¹² On May 12, 2011, explosion and fire occurred again. The exploded plant has not returned to production till now.

experiences in the future. For example, Yunlin County Government held a comprehensive disaster rescue drill on November 19. Technological disasters such as the fire, explosion, and pollutions were the main targets of this drill. The county government incorporated the local fire, police department and armed forces to create a joint disaster management mechanism. However, due to its weak financial resources, the lack of sufficient facilities, and inadequate resources to prepare for disasters, the county government's performance in emergency management is still limited. Hence, when facing serious disasters like the accident occurred in July 2010, the county government still has to rely on the help from the central and nearby county governments.

Although Yunlin County has a SOP (Standard Operation Process) for dealing with serious traffic accidents like air crashes and shipwrecks, there is no current SOP which deals with technological disasters. Thus, Yunlin County Government should make more SOPs which can be used in different kinds of disasters.

The central government usually bears the responsibility in recovering actions after disasters. But, if the disaster is caused by human actions or errors, the central government will help the local officials to oversee and make sure that the responsible party has to pay for the recovery. In this case, two government bureaus were involved in this accident. The Environment Bureau is in charge of monitoring the environment condition around the plants and avoiding any kinds of pollutions result from the plant's operation. Offering a better environment for capitalists to increase their capital investments is a critical mission of Ministry of Economic (MOE). Although protecting the natural environment does not fall on the jurisdiction of MOE, it is still responsible for preventing industrial accidents or hazards.

After this accident, both of these bureaus not only oversaw the recovery actions from Formosa Group, but also helped Yunlin County to create monitoring mechanisms to assure the environment will not be harmed by the plant in the future. Hence, cooperation between the two central government bureaus and local government may have impacts upon the efficiency and performance of the recovery efforts. This arrangement may provide a good lesson for dealing similar events in the future.

This Naphtha Cracking Project case also teaches that the financial asymmetry among local governments is the main problem in Taiwanese emergency management system. Local governments, with weak resource bases such as Yunlin, tend to lack enough human power and equipment to deal with wide-range hazards. In most cases, local governments still rely on help from their neighboring jurisdictions or the central government. Thus, it is necessary to create a cooperation mechanism between local governments which offers mutual aid in dealing with such events. However, there are still

many local governments that have not created or joined such mutual aid relationships. Also, the lack of necessary equipment such as satellite phones hinders the information flow between hazard areas, local government, and the central bureau.

To sum up, the fire and explosion occurred in July, 2010, showed the difficulties Taiwanese local governments have in dealing with disasters. First, financial asymmetry and a lack efficiency and cooperation between local governments in implementing emergency management policies are the main factors which need to be enhanced in the future. Second, this accident also aroused public concern about technology hazards. Natural disasters have always been the main target in Taiwanese emergency management policy and research field. Such disasters indeed cause huge damage more frequently than human-made disasters like transportation accident or terrorist attacks. That is why government officials tend to pay more attention to response operations for natural disasters.¹³ However, in recent years, the Taiwanese government is beginning to pay more attention on human-made disasters such as toxic pollution, nuclear accidents, and transportation accidents. The explosion and fire in the No.6 Naphtha Cracking Project in 2010 again reminded Taiwanese people about the importance of preparing for human-made disasters. In the 2011 Disaster Prevention and Response Plan, several chapters include guidance for dealing with human-made disasters such as technology disasters and terrorist attacks. This could be viewed as an evidence to demonstrate how Taiwanese government officials learning from past experiences to enhance the existing emergency management system.

Lessons learned

Learning from the past could help emergency managers define the existing problems and know possible solutions. Reviewing the experience of emergency management in Taiwan, we find four problems need to be solved. There are also some notable successes in Taiwan that must be recognized.

Organizational arrangement can have a dramatic impact on the effectiveness on disaster institutions (McLukie 1970, McEntire 2007). Although several amendments were made to enhance the professionalization of the entire system, the current system still focuses on emergency preparedness and responses. According to Chen, Wu, and Lai

¹³ For instance, the “National Science and Technology Program for Hazards Mitigation” is a large scale research project executed by the Executive Yuan from 1997 as the most important scientific research project dealing with disaster mitigation efforts in Taiwan. Nonetheless, due to lacking a strong financial base, the scope of this project only falls on researches in typhoon and earthquake. See <http://naphm.ncdr.nat.gov.tw/>.

(2006), this is probably because DPRCM doesn't have enough full-time members. Moreover, lacking supporting ordinances and regulations developed by the duty administrations as well as the local government prevents the DPRA from reaching its goal.

From institutional view, vague segregations of duties between agencies result in chaos. The revised DPRA does not clarify duties and responsibilities among related agencies such as the central DPRCM, ODM, and the National Disaster Prevention and Response Agency. Furthermore, most of the positions in these agencies are part-time, not full-time, jobs. Because officials come from different bureaus, this increases agency leaders' difficulty of commanding. Besides, the problem of unity of command also exists between different duty ministries. For example, after a flood, the responsibility of dealing with flood falls on the Department of Economy. However, the Department of Transportation has to take the responsibility for transportation recovery. At the same time, the Department of Agriculture is required to take charge of recovering from landslides and mudslides. How to organize these duty ministries to operate effectively during recovery efforts is a hard, but critical task for the leaders of the emergency management system.

Financial asymmetry limits the efficiency of the emergency management system at the local level. Most of the local governments still need help from Taipei City and the central government. Due to a weak financial base, the lack of sufficient facilities and resources for disaster preparedness limits Taiwanese local government's performance in emergency management. When Typhoon Morakot hit southern Taiwan, the central government could not get enough information from disaster areas (e.g., Kaoshiung County). Even the county government did not know what happened in Xiaolin Village until survivors escaped from the disaster area. The low degree of information exchange and communication led to unnecessary time wasted and the disaster conditions worsened. Without money, a well-designed plan for preparedness will become a fancy document.

The lack of regional plans and cross-border cooperation mechanism may also cause inefficiency in responding disasters, especially when local governments cannot afford to deal with the damages that come with a huge disaster. Although several cooperative relationships have been established between several local governments (such as Taipei City, Keelung City and New Taipei City), most of local governments still lack such relationships now. Having an intergovernmental cooperation relationship would help to release the burden of the central government in supporting local emergency management system. Thus, local disaster resistance and resilience could be enhanced as well.

On the other hand, Taiwanese people's hard work has resulted in some successes as well. For example, using technology in mitigation works has helped to reduce the impact of disaster and save human life and properties. In order to enhance flood resistance, the Taiwanese government has invested a lot in flood control works such as building dams, levees, and floodwalls. Some local governments such as Taipei City are also implementing channelization as a way to strengthen its flood control ability. From 1998 to 2010, the prevalence ratio of public sewage system in Taipei City has increased from 41.6% to 100% (Taipei City Government 2010). The sewerage system not only enhances sanitation, but also facilitates flood discharges. After Typhoon Nari in 2001, Taipei City has rarely suffered from flooding.

It is worth noting that non-governmental forces have also played important roles in cooperating with government officials to relieve the burden on the public sector. Many scholars describe the contemporary era of urban politics as one characterized by governmental devolution (a process in which national and regional government functions are increasingly shifted to local government oversight) (Martin 2004). Private-sector and nonprofit organizations (NPOs) can therefore be utilized to repair or replace public infrastructure and to meet other disaster-related human needs, including emergency housing, employment counseling, and short-term health and family services (Sylves 2007).

In Taiwan, the role of public-private cooperation in responding disasters has become more important in the emergency management framework. Government officials rely on private or non-profit sector participation in offering goods and services that help facilitate disaster response and recovery activity. These non-governmental actors also offer their professional skills and resources that enhance disaster preparedness and mitigation efforts. For example, the International Headquarters of S.A.R. Taiwan (founded by scholars, volunteers and veterans in 1981) serves as a NPO which cooperates with government to rescue victims of natural disasters. It offers training programs for government officials, the military, and citizens. It also serves Taiwan during joint international operations (including rescue activities after a 7.0 earthquake struck Haiti on January 12, 2010).

Besides such private and non-profit organizations, religious organizations have become a distinguishing feature in Taiwanese disaster prevention and response framework. They are major service and resource providers in rescue and recovery actions in Taiwan's disasters. Among all of the religious organizations, the Buddhist Compassion Relief Tzu Chi Foundation (usually called as Tzu Chi), a well-known NPO in Taiwan, has joined in numerous local and international disaster rescuing and recovery

actions. After a powerful earthquake (Magnitude 7.0) struck Indonesia on September 2, 2009, Tzu Chi formed a team to evaluate the damage in the disaster areas. Then Indonesia branch coordinated a freight transportation to deliver living necessities like food, mineral water, blankets, medicine, raincoats and so on to disaster areas. Later, on January 22, 100 volunteers from Tzu Chi Australia branches carried out a large-scale distribution of medical goods and daily necessities to 282 people in Brisbane, Australia, which was hit by the worst flooding in the country in 50 years (Tzu Chi 2011). These cases illustrate how private, nonprofit and religious organizations in Taiwan enhance emergency management effectiveness.

Conclusion

Having some of the highest risks for natural hazards on Earth, Taiwanese people have suffered from disasters for a long time. However, many of the impacts of disasters do not result from the environment alone. They can instead be traced to failures evident within public policy and government activity. For instance, inappropriate building design, lack of construction codes, and low-effectiveness in implementing zoning policies still limit the performance of hazard mitigation and preparedness efforts in Taiwan.

However, past experiences also help Taiwanese people learn how to cope with such disasters and recognize the importance of having a well-designed emergency management system. The private sector and civil society have become powerful actors in the Taiwanese emergency management network nowadays. Government officials rely on private or non-profit sector participation in offering goods and services that help to facilitate disaster response and recovery works. The increasing public involvement in local disaster rescue and recovery actions gives us hope for a better future.

Taiwanese people and government officials are evidently more willing to focus more on emergency management today. Civil society may therefore act as a powerful partner as it cooperates with government officials in dealing with emergency management issues. Creating mutually beneficial networks between local governments and civil society appears to be a practical tool to lower costs and reduce the burdens that fall on government officials. Thus, the possibility of success in the Taiwanese emergency management system will be increased with efforts both from civil society and public sector.

References

Apple Daily (2009). "President Ma Apologizes" Apple Daily.

- http://tw.nextmedia.com/applenews/article/art_id/31873065/IssueID/20090819.
Buddhist Compassion Relief Tzu Chi Foundation (Tzu Chi) (2011).
<http://tw.tzuchi.org/en/>.
- Chang, Chin-Ju (2001). "Freak Typhoon Nari Ravages Taiwan-Taste of Things to Come?" *Taiwan Panorama*. October: 65-66.
- Chen, Liang-Chung, Jie-Ying Wu, and Mei-Ju Lai (2006). "The Evolution of the Natural Disaster Management System in Taiwan" *Journal of the Chinese Institute of Engineers*. 29(4): 633-638.
- Chen, Marlene (1997). "On the Edge of Disaster Taiwan's Disaster Relief Network" *Taiwan Panorama*. 11:112-121.
- FEMA (2006). Tuscaloosa County Emergency Management Cycle.
<http://www.tuscoema.org/cycle.html>.
- Hsiung, Kuang-Hwa, Samuel S. G Wu, and Chun-Hsing Yeh (2010). "Analysis of the development of Emergency Management System in Taiwan" Presented in The Sixth Cross-Strait Conference on Public Administration, August 19-20, 2010, I-Shou University, Kaohsiung, Taiwan.
- International Headquarters S.A.R. (2011) <http://www.rescue.org.tw/index.html>.
- Lin, Feng-Tyan (2008). "Disaster Management Information System in Taiwan" Presented in Pacific Neighborhood 2008 Annual Conference in Conjunction with ECAI and JVCC. Ta Quang Buu Library, Hanoi University of Technology. Ha Noi, Vietnam.
- Lindell, Michael K. et.al. (2007). Hazard Mitigation: Reducing Risk. *Introduction to Emergency Management*. Pp. 192-223. New Jersey: Wiley.
- Martin, Deborah G. (2004). "Reconstructing Urban Politics: Neighborhood Activism in Land-Use Change" *Urban Affairs Review*. 39(5): 589-612.
- McLukie, B.F. (1970). *The Study of Three Functional Responses to Stress in Three Cities*. Ph.D. dissertation. Ohio: Ohio University.
- McEntire, David A. (2007). Local Emergency Management Organizations. *Handbook of Disaster Research*. Edited by Harvidan Rodriguez, Enrico L. Quarantelli, and Russell R. Dynes. Pp. 168-182. New York: Springer.
- Ministry of Justice. *Local Government Act*.:
[http://law.moj.gov.tw/Scripts/Query4B.asp?FullIDoc=所有條文
&Lcode=A0040003](http://law.moj.gov.tw/Scripts/Query4B.asp?FullIDoc=所有條文&Lcode=A0040003).
- Multidisciplinary Center for Earthquake Engineering Research (MCEER) (2009). "Major Taiwanese Earthquakes of the 20th Century"
http://mceer.buffalo.edu/infoservice/reference_services/taiwan-major-earthquakes.asp

- National Science and Technology Program for Hazards Mitigation (NAPHM) website:
<http://naphm.ncdr.nat.gov.tw/>.
- O'Connor, Mark (2000). "Taiwan Earthquake" *Australian Journal of Emergency Management*. Spring: 31-34.
- Office of Disaster Management (ODM), Taiwan (2010). "The Adjustment of Disaster Prevention and Response Agencies" The Executive Yuan, Republic of China:
<http://www.ey.gov.tw/public/Attachment/1159594371.pdf>.
- ROCMOI (2010). Republic of China Ministry of the Interior Department of Statistics
<http://www.moi.gov.tw/stat/>.
- Sylves, Richard T. (2007). "Federal Emergency Management Comes of Age: 1979-2001"
Pp. 111-160 in Rubin, Claire B. (Ed.) *Emergency Management: The American Experience 1900-2005*. PERI: Fairfax, VA.
- The Control Yuan, Republic of China (2011). <http://building.cy.gov.tw/mp.asp?mp=1>.
- Taipei City Government (2010).
<http://www.taipei.gov.tw/ct.asp?xitem=1225768&CtNode=5158&mp=100001>.
- Wikipedia (2011a) "Republic of China" http://en.wikipedia.org/wiki/Republic_of_China
- Wikipedia (2011b) "Typhoon Morakot" http://en.wikipedia.org/wiki/Typhoon_Morakot.
- Wikipedia (2011c) "Typhoon Nari" http://en.wikipedia.org/wiki/Typhoon_Nari.
- Wikipedia (2011d) "921 earthquake" http://en.wikipedia.org/wiki/921_earthquake.
- Wu, Chun-Chieh and Ying-Hwa Kuo (1999). Typhoon Affecting Taiwan: Current Understanding and Future Challenges. *Bulletin of the American Meteorological Society*. 80(1): 67-80.