

**DISASTER MITIGATION: THE INTEGRATION OF INTER-
ORGANIZATIONAL ACCORDING TO PUBLIC DISASTER
PREVENTION AND MITIGATION STRATEGY PLAN
TO ENCOURAGE EARTHQUAKE READINESS
IN CHIANGRAI PROVINCE**

Sirinon Suwanmolee

**A Dissertation Submitted in Partial
Fulfillment of the Requirements for the Degree of
Doctor of Philosophy (Social Development Administration)
School of Social and Environmental Development
National Institute of Development Administration**

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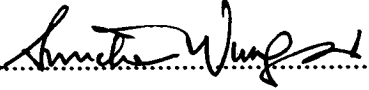
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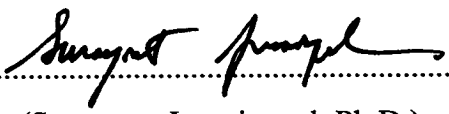
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ABSTRACT

Title of Dissertation Disaster Mitigation: The Integration of Inter-organizational
According to Public Disaster Prevention and Mitigation
Strategy Plan to Encourage Earthquake Readiness in Chiangrai
Province

Author Miss Sirinon Suwanmolee

Degree Doctor of Philosophy (Social Development Administration)

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The objectives of this dissertation were 1) To study the problem condition and obstacles in Chiangrai earthquakes mitigation according to disaster prevention and mitigation strategy plan. 2) To study the actors in local, provincial and national levels of policies network in Chiangrai earthquakes mitigation 3) To study the guideline to integrate coordination between organizations involved in the earthquakes mitigation in Chiangrai. Data collection started from qualitative research followed by quantitative research.

It was found that the problems and obstruction with the policy in the Chiangrai's preparation for earthquake according to the disaster prevention and mitigation strategy could be described in three dimensions, following the concept of complex adaptive system, which were the organization flexibility, the technical infrastructure, and the cultural openness.

1) The organization flexibility dimension. It was found that the power structure in managing the local administration and the district offices was inconsistent. Many organization's works were redundant. The provincial commanding center did not fully act as the mediator in resource raising and information sharing. The process adjustment according to the complaint feedback was slow. Each organization lack the adaptation and understanding in other organization's role in the shared mission during the crisis. The earthquake drills were mostly the practice of interior rescue, rather than the practice of commanding between organizations and the affected area.

2) The Technical Infrastructure dimension. It was found that the communities lack the skill and the experience in self-organization during the disaster. The local officers did not let the community to participate in the sub-district disaster management planning. Cross-duty resource raising or working in the place of each other were limited. The adjustment of risk management plan according to the professional engineering knowledge was limited. The amendment of the local regulations in building control was not found. And there was the obstruction in spending the budget to prepare for the disaster.

3) The Cultural Openness dimension. It was found that the provincial commanding unit perceived that the local administrative organizations and the communities as the weak and passive, rather than being able to self-organize. And the operation officers would only follow the orders. The plan adjustment and the operation in disaster prevention and mitigation in the local level and the provincial level was not continuous. There was also the government culture problems in which the officers in the system lack the conscience to connect with other organization. They would not emphasis the official operation adjustment according to the feedback from the unofficial actors, and would not accept the mission in temporary data management without the permanent structure in the district organization. There was also limited priority for the community and the local capabilities development.

The social network analysis demonstrated the relationship of the actors from the government sector, the people sector, and the civil society who were involved in disaster management, that the topology of the network was decentralize. Most relationship were connected to the Emergency Operations Center (EOC). As the Chiangrai province had the operation plan during the earthquake that designated the roles of each organization in the emergency phases and had performed the drill previously, the provincial operation was ready and united during the crisis. However, during the recovery phases, the centralized management became the limitation when the provincial unit lack the information system to connect the inter-organization database. The data exchange and resource sharing among the organization could not fully occurred. And the risk estimation for the disaster prevention plan as a whole was also limited.

The integrated coordination in disaster risk management should start by adjusting the disaster management power distribution in the provincial level. There should be the inter-organization coordination in the distribution type, which would allow the local administrative organization to flexibly communicate and exchange resources with other organization. There should be the utilization of information technology in data management, and the communication system, which would support the network to adapt its form flexibly. The vertical and centralized relationship should be replaced by the distribution structure, so that the local administrative organization could exchange resources or coordinate with other organizations after the situation unfolded. As for the community level, there should be the knowledge training for people, so that they know how to conduct during the earthquake, as well as the training of risk estimation and building renovation to withstand the seismic activity for the local builders and the community leaders, which would encourage the risk awareness during the preparation for disaster together with the recovery and the disaster risk control.

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You can find this dissertation in Thai version in goo.gl/VnGy7F

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CHAPTER 1

INTRODUCTION

1.1 Background and Significance of the Study

The world is facing more critical and more frequency of natural disaster in the past 10 years (A.D.2014-2014). The cause of this natural disaster are either variation of weather or natural geologic processes that caused natural disasters. According to World Bank, the worst natural disaster that cost economic damages is the earthquake, tsunami and nuclear disasters in Japan when the disasters happened in 2011. The damages were USD300 billion. And the 2nd is hurricane Katrina in the United States of America in 2005 cost USD7.3 billion. Meanwhile, severe flooding occurred in 2011 in Thailand was the 5th highest economic damages, and cost USD 4.57 billion. (Economist, 2011)

When we look back into 2011 Thailand floods. Although they had 3 months to prepare before the flood goes through northern of Thailand to downstream in central areas, the prevention and mitigation processes were not efficient enough. The inefficient caused by the lack of Standard Operating Procedure (SOP) between organizations that in charge of public disaster management. They don't have communication methods between organizations in command system during the incident. The commanders are confusing in their own roles. They are lack of knowledge and experiences in emergency phase management. These issues caused the conflicts between organizations. (Tavida Kamolvej, 2014). The result of mentioned issues is the duplication of job roles, lack of unity of disaster management and the decision making process is slow to make it hard for the population in affected areas and industrial sector to self-organize when the disaster hit their areas.

Earthquake magnitude 6.3 occurred in Chiangrai on May 5th, 2014 is the worst earthquake disaster recorded in 100 years. The seismic activity lasted for 30 seconds. However, the damages did not cost a lot as the epicenter is in agricultural areas. The hypocenter was not far from the surface of the ground, it caused rapid seismic. Medium

and small size buildings, schools, temples and hospitals are affected by the quake. It also damaged part of the road linked to bridges, 20,000 households affected by the disaster. (Panya Jarusiri, 2014)

Lesson learned to visualize 3 months after the disaster in self-organize of population and public disaster management organizations found that main issues of the affected areas are not changing 1) Chaos population and community leaders didn't know how to respond because they lack knowledge. They also don't have an emergency generator and communication devices for emergency phase. 2) Confusion in job roles of the commander's officers in SAO lack of experience and confidence in Incident Command System: ICS. Decision-making process is slow because they are waiting for the command from provincial level. 3) Duplicated job lack of database utilization between organizations in the recovery phase, organizations just focus on their own task and lack of inter-organization make staffs from different organizations ended up doing the same task. The provincial level hasn't prepared the master plan for recovery in disaster management along with preparedness plan. They are having a bottleneck in damages data collection which they have to send the data to the provincial level committee. However, the data have to be verified by sub-district office and district office before the data and requests will be sent to the provincial office.

The bottleneck of management structure also happened in severe flood disaster in 2010. Local public disaster management and provincial level connection is complicated is stall in damages data management and compensation process. District level have to gather the data and request resources from provincial level before they can allocate those resources to local level. Complicated decision-making processes caused delayed operation and it doesn't get along with the emergency needs at that point. (Sirirak Singhasem, 2011)

In other words, apart from the damages from direct seismic, the sensitivity from disaster management isn't different from the flood disaster in 2011. However, if we compare this disaster to the tsunami that happened 10 years ago Tawida Kamolvej (2014) see that Thailand has learned from tsunami disaster and improved disaster management system from non-adaptive to emergent-adaptive. Government sector has learned from their operations and improve policy to be more open for data exchange and inter-organizations in national-provincial-local systematically. This improvement

is the way to encourage the governmental system to adapt to emergency phase because the main issue of government system operation is 1) Standard operating procedures : SOPs) were designed for the stable and not require prompt actions situations. Their operation procedures are difficult to adapt to emergency phase. Their staffs get used to with routine tasks. 2) Section operation decentralization in the normal state helps sectors to work independently. However, this operation is difficult an emergency phase that requires inter-organizations operation. (Somporn Phuangchan, 1996)

The study on public disaster prevention and mitigation policy implementation, Kampanart Wongwatthanaphong (2013) used 10 criteria to evaluate the success of disaster management. Quarantelli (1997) He collected the data from 249 SAOs in the tsunami disaster risk areas. The similar study result on disaster management that doesn't conform to good disaster management principle is 1) Assemble staffs and resources without proper resources distribution plan 2) Assign or distribute tasks by sector with specific mission which stall in relation with other organizations and some of them might not willing be take charge of those specific missions 3) Give priority to coordination, government sectors focus on command and control rather than coordinate. 4) Corporate with new established groups or organization, government sectors tend to obstruct other organizations to have their leading role 5) Government sectors have an issue on proving communication system to share information with public 6) Emergency center is in charge of command and control the situation, they are not able to be center of the coordination.

The Flexible organization relation system and share lesson learned to respond complicated state with other organizations should be used in Public Disaster Prevention and Mitigation strategic plan B.E. 2555-2559 (A.D.2012-2016). Public disaster management for an earthquake in Chiangrai province is a case study of inter-organizations operation after the lesson learned from severe flood disaster in 2011. Research problems, structure, and the relation of disaster management network helps us to come up with the suggestion for in organizations to support public disaster management. Researcher review concept and methods to systemize data collection method which starts from.

Characteristics of Disaster: Earthquake is not yet possible to predict the occurrence, time or place. It is not a seasonal disaster. Not yet possible to prevent the

occurrence of the earthquake. Furthermore, the population is not acknowledged. Relevant organizations not yet prepare the specific plan and an alternate plan to response the disaster.

Disaster management methods: Mileti (1999) have given an expression on public disaster management in the United States of America, policy-making in disaster response must be changed from the linear trend. Linear Trend starts from research problem and solves the problem before start manages other problem to non-linear. Non-Linear method proactively looks into the other coming up problems and merge them into 3 phases of disaster management are preparedness phase, emergency phase, and recovery phase.

The Preparedness phase, in this phase we have to look into the character of the disaster. Disaster that “continually” caused or another type of disasters. The disaster might spread to a bigger areas or more intense. Management methods must be opposite to the first disaster. Hence, management conditions must be changed and caused “Chaos” and make the situation have more “Complexity”, Tavida Kamolvej (2011) For example, the earthquake occurred in the sea, the tsunami might be following the disaster. After the tsunami hit the area, disease outbreaks and chaos occur in the shelters are following the disaster. Inter-organization, complementing skills from different organizations and adapt their methods to situations are methods to understand Chaos and Complexity. Complex Adaptive Systems must be used to evaluate their capacity to response the situation and analyst loophole of the disaster management. Andrus (2005) Also, finding alternative to response uncertainty that might happen. (Roger, 2010)

Analyzing factors define the system is the way to understand complexity. The socio-technical the component under complex adaptive systems, Comfort (1995) is the tool to understand the complexity and consider the alternative of organizations to adapt for responding disaster. There are three dimensions as 1) Technical infrastructure which indicate the capacity of data exchange as well as operation and risk management 2) Organizational flexibility which indicates the capacity of emergency phase and complex situation respond as well as integrate the coordination between organizations 3) Cultural openness indicate value and open for the changes in organization, improve operation method and solve the conflicts which are adaptive way that leads to efficient operation in emergency phase. We cannot manage the whole circle of disaster by divide

the sectors or divide management phases. Kunz, Reiner and Gold (2013) systematize activities helps efficient management circle in emergency phase and recovery phase. They divided preparedness activities into 2 activities are;

Physical activities preparedness are 1) Prepare tools and equipment for resuscitation and rescue 2) Prepare disaster resistant buildings

Visionary activities preparedness are 1) Human resources trained staffs ready for working in disasters 2) Acknowledgement learn from experienced disasters, disaster warning, areas information, risk information as well as create model and tools for decision making 3) Management process organization structure for responding to disasters, legal provision, regulation as well as prepare transportation and support system 4) Prepare budget and gather resources beforehand 5) Community aware of risk in their own areas, cooperate, work with local government in disaster management plan, gather sensitive groups data and damages that might occur in the community as well as cooperate with organizations outside community, local government, military, media, NGO and business sector join in the network.

Adaptability organization culture in mitigation to prepare before the disaster occur rely on cooperation. Mileti (1999) suggested that sustainable disaster management contain 7 important operations are 1) Build capability and operated by local networks consensus 2) Government sector must have holistic government framework 3) Follow up disaster situation and evaluate the risk in their own areas 4) Connect database 5) Knowledge management and skills training 6) Operation assessment 7) Share experience and knowledge for improvement to outside.

Lesson learned of disaster management in foreign country, Button (2012) have opened disaster management failure in America. When hurricane Katrina hit the area in 2008 and Deepwater Horizon oil leak in 2010. The factor that caused continuity of disaster is social arrangement on disaster management culture and imbalance of power between organizations that have to work together. Button (2012) explained management failure rely on 3 mains institutions are 1) Media majority of the medias doesn't report the information on the cause of disaster, analysis and follow up the situation as well as doesn't show long-term effects of the disaster. Media only present "the middle" of disaster. Media are shallow about presented information, population ignore the disaster. In fact the disaster doesn't comes and goes. The effects are

continuity happening in long-term 2) Science and technology aren't utilize in controlling the occurrence before it became disaster. Science and technology usually used after the disaster to resolve the effects. Moreover, science and technology are twisted by relevant organization or influencers to choose the technology for management controlling. Meanwhile 3) Government Organizations included various organizations. However, their tasks are similar. The obstacle of operation is the intenseness of being investigate between organizations within the structure that control them. Hence, the problems are often being resolve after the disaster rather than preparedness. This problem lead to social disaster from management more than the effects from natural disaster itself.

In Thailand, policy and legal provision for preparedness and mitigation study, Tavida Kamolvej (2006) found that problem of management doesn't caused by lack of legal provision and knowledge, Lack of inter-organization and lack of preparedness culture is the problem. As we can see from National Public Disaster Prevention and Mitigation Act B.E. 2550 (A.D.2007) divided disaster management structure to 3 levels are National, Provincial and Local. The act decentralized power to Provincial and Local government in operation. They are able to establish public disaster prevention and mitigation volunteer team. Create disaster management plan by coordinate with relevant organizations. However, majority of local governments not yet create their own plan and they are still facing the obstacle of operation by divisions as well as lack of cooperation in mitigation. Although local government have fully right encouraged by law to work inter-organizations, they don't have the agreement before the occurrence of disaster beforehand as well as lack of experience in working inter-organizations. These problems make it impossible to unite and access risk data.

Policy implement this issue conform to the data analyzed by Department of Disaster Prevention and Mitigation (2011) on problems and conditions to operate in the operation between communities and between organizations.

Legal provision and policy the operation according to article 12 of National Public Disaster Prevention and Mitigation Act B.E. 2550 (A.D.2007), relevant organizations proceed continuity and systemically operation. This operation has not yet achieve their goal. As a result of management level and operation level lack of knowledge, understanding and cannot completely implement the policies. Most of these

staffs operate doing what they are used to and don't follow the instructions by law. Inter-organizations are not yet practice in reality.

The coordination among the communities, SAOs, Department of Disaster Prevention and Mitigation (DDPM) occurred loopholes in overall operation. Establish network associate and participation operation is still in policy level. Projects are fixed more than flexible and understanding of areas context.

Public Disaster management improvement method although Thais are reliable in helping each other in disaster, organizations lack of lesson learned visualizing for improvement, mitigation before the occurrence of disaster and preparedness. Therefore, the most important thing to encourage local and provincial organizations in risk areas to improve is preparedness plan. Improve relation structure between organizations to be able to coordinate and work together.

Policy implement method improvement analyze system structure, influences of communication, resources and behavior of operation level, Edwards, 1980. Consider the distance of policy window as Rutherford (1999) assured that the window of disaster management will be opened in recovery phase because it's the most critical problem.

Disaster research in Social Science aspect of this research conform to Methods of Disaster Researched, Killian (2002) expressed that the core of disaster research is to find out "The factors that caused chaos to social context" and "How individual and group of people respond to that chaos". Data collection process in the identity of disaster research that indicates territory of 2 types of data are 1) Function time phase this phase divided into preparedness, emergency, and recovery. The research not able to consider the effects of only one phase because disaster is the continuity occurrence. The study looks into data in each related phases and 2) Spatial zone, there is total zone and fringe zone that affected by the disaster.

For research methods, Killian (2002) suggested that we cannot control sampling in the affected areas. Data collection should be exploratory research. Qualitative research is done to understand areas context and methodology design by issues and variable. After that design selections of operation plans, analysis and summary in order of timeline from sources.

The Policy network analysis both formal and informal relation from stakeholders. This method helps us find out form of policy implement, Rhodes (2006).

Meanwhile, Social network analysis helps us find natural setting which is holism of management in the area. Organizations are actors in emergency phase till recovery phase. By finding out about the structure of relationships between organizations to support disaster management helps us find the way to improve inter-organizations. This analysis conform to Brenda (2002), simplifying complexity shows alternatives to improve relation which helps the overall operation.

Tavida Kamolvej (2006) using complex adaptive system and social network analysis to study relation of the organizations in the emergency phase of public disaster mitigation and information management in tsunami disaster in Thailand. This study found that enough information helps operation level to have an alternative in responding to disaster better. The communication system that open for stakeholders to be able to communicate and exchange information inter-organizations helps them to automatically make the decisions at the scenes and coordinate in response the disaster.

This research study the problem of DDPM's strategic plan in inter-organizations as well as find the methods in improving relation structure to support earthquake preparedness according to public disaster prevention and mitigation policy. This research use policy network analysis to analyze the relation of stakeholders relevant to disaster management policy. Also use social network analysis in other aspect of relation between government, population and civil society that happened during the operation. Researcher uses socio-technical component under complex adaptive systems to design alternative to improve inter-organizations in the future.

1.2 Research Problem

Main Problem

What is the appropriate of the relationships among organizations that encourage preparedness phase?

Secondary Problem

What is the policy and structure in mitigation operation in Chiangrai province according to public disaster prevention and mitigation strategic plan supposed to be?

1.3 Objective of the Study

1.3.1 To study problem and obstacle in earthquake mitigation policy according to public disaster prevention and mitigation strategic plan in Chiangrai province.

1.3.2 To study actors in network policy in local, provincial and national levels on earthquake preparedness in Chiangrai province.

1.3.3 To study the guideline to integrated the inter-organizations on earthquake mitigation in Chiangrai province.

1.4 Scope and Methodology

1.4.1 Scope of area

Chiangrai Province, earthquake disaster on 5 May 2014

1.4.2 Scope of study

- The Implementation, problem and obstacle in public disaster prevention and mitigation policy implement in local level and provincial level.

- Analyze policy network and social network in 3 levels are

- 1) Local level : Local administration organization, sub-district and district level.

- 2) Provincial level :Government organization, civil society and academic.

- Study integration of inter-organization methods in disaster mitigation with the complex adaptive system by considering socio-technical elements in 3 aspects are

- 1) Organization Flexibility 2) Technical Infrastructure and 3) Cultural Openness.

1.4.3 Study Period

2 years after the earthquake occurrence (5 May 2014 - 5 May 2016)

1.5 Benefit of the Study

- Methods to improve structure and relation between supporting sectors in Earthquake preparedness for risk areas in Chiangrai Province.

- Methods to implement public disaster prevention and mitigation strategic plan in inter-organizations to prepare for the earthquake in Chiangrai Province.

CHAPTER 2

LITERATURE REVIEW

Relevant concepts, theories and literatures review as a guideline for influence factor in disaster preparedness, researcher have divided issues to study herein;

2.1 Definition and Principle of disaster management

2.2 Complex Adaptive System

2.3 Policy Implementation

2.4 Policy network concept

2.5 Social Network Analysis

2.6 Conceptual Framework

2.1 Definition and Principle of disaster management

2.1.1 Definition of Disaster

Thailand has various organizations work on disaster management. Definition of “Disaster” according to these organizations are;

Disaster (Ministry of Finance order B.E.2540 (A.D.1997)) mean Public Disasters are Fire Hazard, Hurricane, Drought, Rain Shortage, Strike of Lightning, Hailstorm, Wildfire, and Disease outbreak or pest, winter deaths, War perils and terrorism and etc.

Public Disaster Prevention and Mitigation Act B.E. 2550 (A.D. 2007), the definition of disaster are unexpected danger or crisis. The potential loss of life or damaged assets.

Civil Defense (Secretariat of Civil Defense B.E. 2541 (A.D.1998),: 4-5) mean a serious disruption, occurring over a relatively short time, of the functioning of a community or a society involving widespread human, material, economic or environmental loss and impacts, which exceeds the ability of the affected community or society to cope using its own resources.

Civil defense means the effort to protect the citizens of a state (generally non-combatants) from military attacks and natural disasters. It uses the principles of emergency operations: prevention, mitigation, preparation, response, or emergency evacuation and recovery. (Secretariat of Civil Defense B.E. (A.D.1998) : 4-5)

United Nations International Strategy for Disaster Reduction: UNISDR, 2009 defined disaster mean a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.

Considering the definition of Disaster, it is a serious disruption of the widespread human which exceeds the ability of the community to cope using its own resources. And disruption of the functioning of a community.

2.1.2 Characteristics of Disaster

Disaster preparedness should base on an understanding of disaster. We should learn disaster characteristics. This condition makes organizations not able to manage it under their normal conditions.

1) Disaster trigger other disasters

Earthquake can trigger other natural disasters. The followed disaster sometimes larger than the earthquake or some of them need the opposite management methods. For example, beneath the shallow waters offshore, an enormous earthquake unleashed, sending a tsunami ashore. The procedure is is to evacuate population to high areas away from the shore. After the tsunami, there might be the disease outbreak. Understanding this chain reaction helps to control expanded disaster and other disaster followed.

2) Disaster can develop to be more severe

If the community has high level of vulnerability, the local government must understand its physical and social aspects. The preparedness has to include technical infrastructure-social such as culture, Muslim women in South Asia are not able to leave the house without a permission from the family leader or different populations face different levels of risk and vulnerability.

3) Disaster able to expand its damages widely

Disaster able to expand the affected areas cross-jurisdiction. Hence, local government especially District Administration should coordinate with nearby areas to prepare for disaster. Request human resources to support in the affected areas and preparedness in case of the disaster expand its damages in nearby areas.

4) Disaster is unpredictable

Disasters have uncertainty type and form. They might be larger and more frequency and occur under different conditions. For example, some areas got hit by the storm when it doesn't supposed to happen or earthquake occur at night as well as the severe tsunami in the areas where it never happened before. These characteristics make local government have to be cautious and improve their preparedness measures.

5) Disaster causes chaos

Under usual situation such as disaster, there are various group or type of injured or damages. If there are numerous of offers or help, the operation will be more complex. Transportation might as well being difficult because of landslides, flood or the road are disconnected. People who have the intension to help or allocate donations also can cause chaos in the areas.

This situation makes disaster management unit should see that coordinating with local units is important. They should have a process to coordinate for disaster preparedness in every step. Utilize potential, skills and follow up the situation help risk reduction and mitigation. Mileti (1999) believe that the problem of disaster management caused by "People believe that technology can control nature and keep them safe". They invest in technology rather than see the overall system and people who are involved in operation as well as relation between humans and natural environment also overlapping in 3 aspects are;

- **Physical of environment** Global system have chain reaction to the ecosystem.
- **Society and population** for example experiences of community, habitation, population dispersal, equality and economic. These issues influence vulnerability.
- **Manmade buildings** such as buildings, road, and bridges are the manmade environment that needed tools. Disaster mitigation by implement land use measure, warning, building code, insurance, and information technology and data management. These are technical infrastructure for mitigation.

2.1.3 Principle of Disaster Management

Nilubon Supanich (2006) stated that Thailand is currently implement the new concept of disaster management, which is mixed between vertical and horizontal system, together with the active disaster management that involve complete prevention and risk reduction cycle. The department of disaster prevention and mitigation had changed from passive role such as the management during emergency, rescue, and relief after disaster, towards the more active role in prevention and risk reduction during the preparation period before the disaster. The community itself plays an important part in risk analysis, evaluation, and planning. The disaster management strategy as displayed in the following figure 2.1.

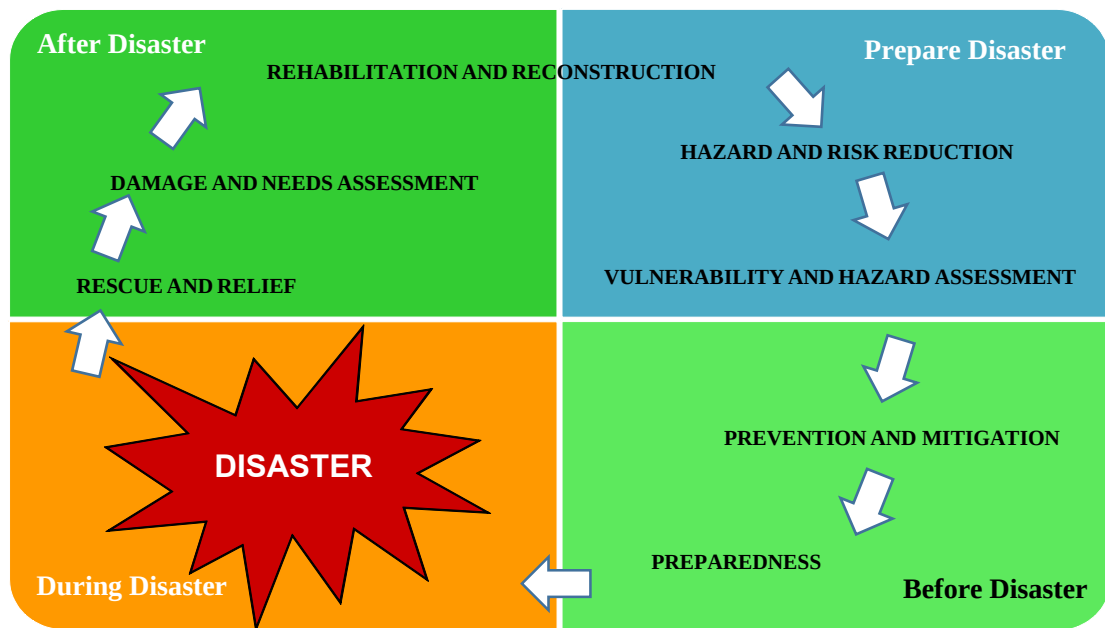


Figure 2.1 Proactive Disaster Management Cycle

Source: Department of Disaster Prevention and Mitigation, 2010.

The current direction of disaster management thus involve the strategy to enhance the resourcing capability by the community participation in every process, from planning to the implementation in each level together. The community became the center that responsible partially for disaster risk management. (Department of Disaster Prevention and Mitigation, 2006). As the natural disasters varied throughout

the country, the disaster risk would then differ according to each area. The community knowledge utilization and the coordination between communities organizations would led to the suitable measure in disaster and the local's vulnerability management, which would enable the community to better cope with the disaster. The adjustment from the existing vertical structure which the government is the commander towards the contemporary disaster risk management concept enable the officers to realize the importance and necessity of the community participation. This led to the application of active strategy focusing on the prevention and risk reduction that could better protect the community itself. Therefore, the disaster management is the duty of everyone. Tavida Kamolvej (2011) proposed that the community and the local organization should prioritize the following activities, which involve three phases of work according to figure 2.2.

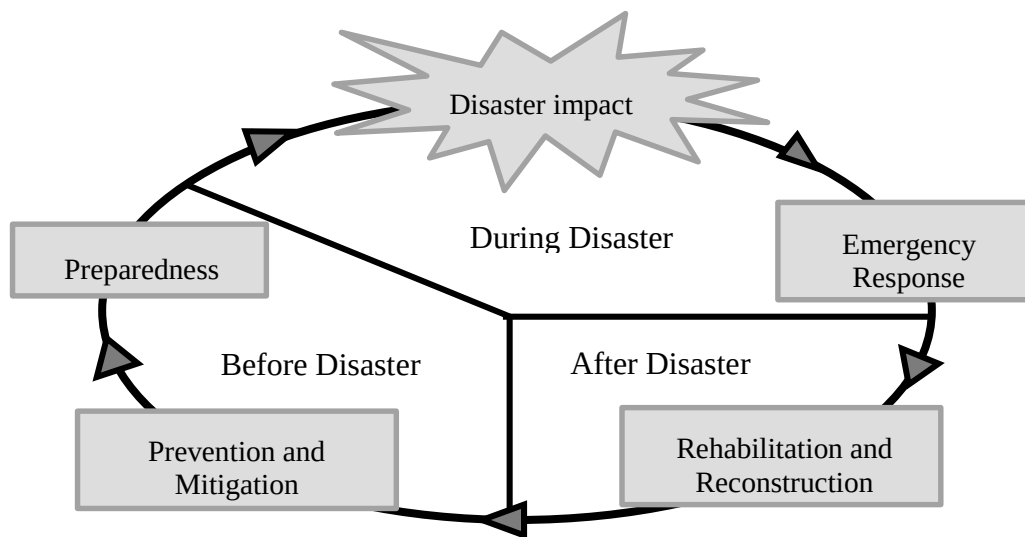


Figure 2.2 Disaster Management Cycle

Source: Department of Disaster Prevention and Mitigation, 2010.

1) Mitigation and Preparedness before the disaster occur in the area, population should be educated on disaster and safety procedures by training and communicate. Risk analysis of disasters and in each area, create simulation and evacuate trail, identify safety zone and create take refuge plan, drills, alarm and evacuate before the disaster occur.

2) Disaster and emergency response is operation in emergency phase, mobilize resources to rescue disaster victims. Indicate main organization and coordinate organization, command system must be used in the emergency phase, evacuate, communication channels, resources moving, traffic management, set up rescue team and provide the shelters.

3) Recovery and rehabilitation recover community functioning as well as government to back to normal phase by physically and mentally recover, follow up damages assessment, donations management, create recovery plan and risk assessment as well as support community to recover themselves.

2.1.4 Evolution of Public Disaster Management

2.1.4.1 Periods of disaster prevention and mitigation in the world

The researcher reviewed the trends in disaster risk management through the periods of disaster management evolution in the United States from FEMA (2005) and the United Nations from UNISDR (2007), in which Thailand had adapted into its model of disaster management. We should first understand that crisis, which happen during the disaster, is the condition which disrupts the usual actions. Therefore, the perception of the actor's factors in coping with crisis would varied in different periods and affected the forms of disaster management. (Boin, McConnell and 't Hart, 2008) Disaster management could then be divided into three periods as followings.

1) Disaster management in the period of Hero and Individual Prior to the 20th century (before 1901), disaster management resembles the confrontation between the hero and the villain. It was believed that disaster management is the individual's burden, therefore the situation should be mitigated by a savior. Likewise, the laurel would then belongs to someone.

2) Disaster management in the modern period.

As the matter of fact, the mitigation is possible through the collaboration of many sub-units in the society. Disaster management after mid-twentieth century (during the WWII) thus evolved into the Modern Emergency Management, which designated the cycle of disaster management into four phases including the preparation, the mitigation, the recovery, and the emergency. This paradigm was accepted and

spread to the whole world due to the swiftness in coping crisis through the suitable commanding structure and the inter-organization coordination. (FEMA, 2005)

During the 1940's (WWII), the government was the key actor in the prevention and coping with emergency. There were the specific laws to prevent the aerial dangers and deal with the nuclear bomb. The organizations for the civil defense were also founded, in order to create the system of risk evaluation, danger alert, shelter founding, search-and-rescue team preparation, and the local disaster management center as well as the national ones.

Later in the 1960's, disaster management in the United States became more active. The concept of disaster management was understood as the way to minimize the property damage prior to the disaster. The flood insurance law became the new standard of property owner's policy, instead of the existing law which cover the recovery funds only.

During the 1970's, there was an important structural change in the organizations involving in the civil defense. In 1979, after the Three Mile Island Nuclear Power Plant disaster, the President of the United States founded Federal Emergency Management Agency (FEMA), under his direct supervision (FEMA, 2005). This structural change included many organizations under the FEMA's umbrella, such as the National Fire Prevention Control Administration (Department of Commerce), Federal Insurance Administration (HUD), Federal Broadcast System (Executive Office of the President), Defense Civil Preparedness Agency (DOD), Federal Disaster Assistance Administration (HUD), and the Federal Preparedness Agency (GSA). This new structure enable the disaster management organization to cope better with the serious and complex disaster. FEMA would be responsible to any emergency when the governor declare the state of emergency and notify the President of the US, requesting for help.

During the 1970s the US also developed the system of founding temporary organization in order to dynamically respond to the crisis and control it before it get worse, by balancing between the ability to control and the flexibility of the shared organizations. They would switch from the usual role to operate under the new top-down structure designated during the crisis, or under the Incident Command System (ICS).

The first organization which responded to the crisis with the ICS was the Wild Fire Control Department of California. ICS was applied from the military's Hierarchical Command and Control Structure, when it is mandatory for many units to coordinate in a mission and thus required flexibility and standard protocol, in order to adapt swiftly to the dynamic situation. The first person on scene would act as the commander until replaced by the designated person. The organization structure during the state of emergency could be expanded or compacted as suitable to the situation. But there would always be the commander responsible in the area until the commanding power would be transferred to the suitable person. (Boersma, Comfort, Groenendaal, Wolbers, 2014)

During the 1980s, there was an increasing anxiety of the nuclear in the cold war, while the FEMA was in the period of starting. General Louis O. Guiffrida, who was experienced in dealing with the state-level terrorism became the Director of FEMA by the order of the President. The FEMA's major mission then focused on the preparation for the nuclear attack, as the principle commanding organization in contact with the civilian whenever there would be any nuclear attack. During this period, the FEMA was encountered by many morale conflicts, inter-organization conflicts, and the different leader's vision. The officers' slow decision-making led to the late response in the crisis during the Hurricane Hugo in 1989, and greatly reduced the organization's credibility. It became worse during the event of Hurricane Nikii in Hawaii, when there was none of the preparation by the FEMA.

It could be implied that the origin of the ICS was the result of the paradigm which prioritize the inter-organization coordination. As the people, policies, and the institutions are all the important factors in coping with the crisis under the political system. Therefore, the disaster management in this period focused on the shared responsibility between the organizations and the shared lessons in coping with the complex situation. (Boin, McConnell and 't Hart, 2008) If the government organization who was the major actor did not learn to adjust its policies and structure according to the situation, the decreased credibility and trust from people would affect the management in the next phase.

3) Period of the national coordination in disaster mitigation. During the 1990's, the paradigm in disaster risk reduction focused on the people and the private sectors, who were able to self-manage and become the important actor in disaster risk management in the long term. As the communication technology advancement allowed them to decide more, and the social media is faster, the people can quickly criticize and expect the government's responsibility in controlling situation. Decentralizing the power to approve policy and sharing responsibility to people became the important factors of management, together with the more intensive international coordination among the government. During this period, there was the important development as followings.

The United Nations had declared the 1990's as the International Decade for Natural disaster Reduction (IDNDR), when all countries were requested to reduce the disaster risk together. The operation during 1990 – 1999 focused on the mitigation capacity building in the developing country through the international coordination, science knowledge development, supporting the local management structure, installing the alert system, and international knowledge sharing.

Until the year 2000, the United Nations had finally found the United Nations International Strategy for Disaster Reduction (UNISDR), with the continuous goal in the sustainable reduction of disaster risk in the international level. It would define the problem, the gap in disaster management, raise awareness, prioritize the policy risk reduction, increase the credibility, and publish the useful information for disaster management to the international organizations (UNISDR, 2007). And in 2004, it aimed at the concept of Appropriate Governance as the protocol in the institution and legal development which would led to the risk management coordination prior to the disaster. In 2007, it aimed at the Good governance which attempted to bring the civil society and the private sectors, who were the good governance actor, in the disaster risk management according to the Hyogo Framework for Action (HFA), in order to reduce the disaster risk. (UNDP, 2015)

The concept of Disaster risk Governance then originated as the risk management protocol among the inter-organization involving the government officers, the private sectors, the civil society, and the mass media in the local, regional, and international level, especially the risk from disaster involving the weather condition.

The protocol would enable the society to decide together and enhance the understanding, agreement, and the shared operation as well as unite the differences. The people could express their concerns and exercise their legal rights involving the disaster risk. (UNDP, 2014)

While the FEMA changed its organization management in the 1990s, and prioritize the partnership building, it also shifted the focus from disaster management during the emergency phase towards the preparation phase. As a result, the evacuation during the event of the Midwest flood in 1993 could be done promptly. There were also the resourcing sharing and the volunteering, which brought back the FEMA's credibility

However, the question of who should be responsible for the disaster management in the case of terrorism was raised again in the event of Oklahoma City's bombing in 1995. The plan to cope with the event together among the inter-organization and the risk evaluation were then developed into the community-based concept in disaster prevention. This concept look at the community as the root of crisis management, on how to reduce its own risk.

Prior to the year 2000, FEMA realized that the technological danger also posed another international threats. There was the concern of Y2K bug during that time, which was predicted to generate chaos in the financial and banking system.

During the 2000's, the World Trade Center Sabotage in September 11th, 2001 brought the major change in the United States' emergency coping structure. The FEMA was restructured under the Department of Homeland Security, which was founded in 2002 in order to be responsible for the protection of the United States from terrorism, man-made disaster, and all natural disaster. This is equivalent to the Ministry of Defense in Thailand. Although the Department of Homeland Security could not authorize any military action, the ministry of defense would allow FEMA to exercise partial military power in the relief mission during the event of natural disaster.

2.1.4.2 Period of the disaster prevention and mitigation in Thailand

Sirirak Singhasem (2015) thought that Thailand public disaster management was influenced by the two waves of the government reformation. The first reformation occurred during the period of King Rama V, when the government was reformed into the modern state in order to confront the colonial trend. As a result, there

was the first fire brigade organization designated by the firefighting act authorized on January 25th, 1898. Firefighting became the duty of the patrol unit, army officer unit, and the marine unit. The patrol unit was responsible to the initial firefighting as soon as the fire broke out. Afterwards, the King authorized the separation of the fire brigade from the military sector, and changed the name of the patrol unit into the metropolitan police unit, which was fully responsible to the firefighting (Fire Brigade Division, 2009). During this period, the government would centralize all the power, resource, and the mechanic in controlling the people in the society. For example, the flood management was treated as the internal security problem by the Department of Provincial Administration. (The Civilian Defense Act 1989 The second wave was the government system reformation in 2002, according to the concept of the new public management, which resulted in the founding of Department of Disaster Prevention and Mitigation. In other words, Thailand Disaster Management seems to adjust according to the international trends.

However, in classifying the disaster management development in each period according to the response and participation of the actors, the researcher propose that it might be better to consider Pongsathorn Sirisakorn (2015), which defined four periods of disaster management in Thailand as followings.

1) Period of passive disaster management during the wartime. This was the period influenced by the western's civilian protection model

In 1934, there was the improvement of the protection from aerial danger, by transferring the duty from the military sector to the civilian sector. The protection from aerial danger was transferred from the Ministry of Defense to the Ministry of Interior, and change the name into “Department of Aerial Danger Protection”

In 1944, there was the amendment of the Kingdom Defense Rule act, 1934, by founding the Department of Air Defense under the Ministry of Interior. This department was responsible for the active aerial defense only.

In 1946, during the WWII, there were many adjustment of the aerial defense activities, until it was later reformed as previously mentioned.

2) Period of passive disaster management and organization reform during the normal situation. This period focused on the passive disaster response operation, by coordination under the Secretariat of the Civil Defense. During this time, there was also organization reformation as followings.

In 1946, there was the Royal Decree which founded the Division of Prevention and Mitigation under the Interior Department, Ministry of Interior.

In 1952, the division was raised into the department, and the name was changed into the Department of Disaster Prevention, Ministry of Interior

In 1958, the Department of Disaster Prevention was dissolved, and the Division of Civil Defense was founded under the Office of the Permanent Secretary, Ministry of Interior.

In 1962, there was the adjustment of government division. The Division of Civil Defense under the Ministry of Interior was transferred under the Department of Local Administration. Moreover, Thailand participated in the General Assembly meeting of the International Civil Defense Organization (ICDO) in Geneva, and became the regular member of the ICDO executive congress. The officers from the Department of Disaster Prevention were also sent to participate in the trainings provided by the ICDO.

In 1979, there was the enactment of the Civil Defense Act in the government gazette, no.96, section 39, dated March 22nd, 1979, which designated the committee of the National Civil Defense from the representatives of each ministry, bureau, and department involved. The officers responsible for the civil defense in each level, from the national level, provincial level, to the district level, were also designated. And the Department of Local Administration would act as the Secretariat of Civil Defense who responsible for the operation as designated by law.

3) Period of active disaster management. This was the time when each ministry, bureau, and department were designated to response to the disaster management together. The Department of Disaster Prevention and Mitigation under the Ministry of Interior would be directly responsible for the disaster management, and served as the coordination hub between the government organization, private sectors, and the civic society in the mission of self-organization to cope with the disaster risks. During this periods, there were the reformation occurred as mentioned below.

In 2002, the Department of Disaster Prevention and Mitigation was founded by compiling the Civil Defense Division under the Department of Local Administration, National Safety Council, The Prime Minister's Office, Division of Disaster Victim Assistance, Department of Public Welfare, Center of Community Development Academic Assistant Center district 1-9, Community Development Department, and Department of Rural Development

In 2004, after the Tsunami disaster in the six provinces along the Andaman coast, there was the major change in the disaster management policy of Thailand, starting from the civil defense plan in 2005, which focused on the capacity building in management. There were more active goals in preparation and reducing vulnerability by both the structured method and non-structured method. There were also the participation by the civic society, the private sectors, and the non-profit organization.

In 2007, the lesson learnt from coping with the Tsunami disaster led to the amendment of the Disaster Prevention and Mitigation Act, 2007. (Which the researcher will describe in detail in the next topic). This Act supports the active public disaster management with the participation of the local community. There was the reformation in the commanding level to suit the Ministry of Interior's structure and allowed the civic society, as well as the public charity organizations and the individuals, to take part in the disaster management. The director from the local level could also set up the local volunteers to support the disaster prevention and mitigation.

In 2011, during the flood disaster, it was found that the social media became more influential. It was crucial to develop the information system in order to link and operate more efficiently. The private sectors, the state enterprises, the civic society, and the communities were more aware of the public disaster from the policy level towards the operation level.

4) Period of Resilience. The National Disaster Prevention and Mitigation plan, 2015, was an important policy in the attempt to develop the operation in responding to the situation, with the mission to enhance the standard in the international disaster management coordination, the integration of the operation and the other plans. It also aimed to support the capacity building, the renovation to the safer and better condition, raise the standard of the risk evaluation system, development of

the risk reduction by prevention and mitigation, development of the need evaluation after the disaster, using the preparation concept based on the community disaster management, support the adjustment of disaster coping plans in all sectors and all levels, approval and resourcing the budget in disaster prevention and mitigation, and designation of the mechanism in evaluation and learning lessons from the previous disaster management.

2.2 Complex Adaptive System

As previously mentioned in the definition of Disaster management, it seems that during the period of technological, economical, and social advancement when the population is much denser than during the past, it is crucial to incorporate the interdisciplinary knowledge in the management of complex situation which could affect many dimensions. The concept of complex adaptive system, which is the imitation of the biological system in the living organism, could be suitable in explaining how to cope with the complex situation during the disaster. This section aim to understand the concepts as followings.

2.2.1 System Theory

“Disaster” the incident of interaction of confusion and systematic under open system, the change of dynamic system according to the change of environment and subsystem stop when the event stop.

System theory of Bertalanffy (1968) utilizes as an origin of complex adaptive systems concept to explain disaster preparedness methods because System means the existent of united elements. Understand nature of disaster with system theory helps us understand nature of courses of the disaster. “Disaster” has the system of the incident. The system of incident aggregate from the whole system formed up by sub-systems that approach in various ways.

Kauffman (1993), the Complex system is a system composed of many components which may interact with each other under its basic rule. The system has not yet self-organized in the beginning, subsystem components have their own behavior. However, emergence makes components change their behavior in chain

effects under the condition of situation. The higher complex, emergence more difficult to predict.

Hence, divide the components to analyze, loss the characteristic of the system. We have to look at the system as a whole and analyze each component to understand the system correctly. The main characteristic of the system is.

- **Components in system dynamics** objects in the world either natural or manmade have their own properties and abilities.

- **Component movement interact each other** gathered components interacted other components and situations.

- **The system formed up** by the subsystem is where work is processed on the system. A subsystem is a single, predefined operating environment through which the system coordinates the workflow and resource use. The system can contain several subsystems, all operating independently of each other.

- **Chain of effects** the change of any part of the system, the system has to adjust or change other parts of the system to balance the situations. The confirmation of system situation different from components or follow the incident.

Simplifying complexity needs to gather behavior data of subsystem, find out basic properties of subsystem and analyses interaction of system. This study for system management. Hence, we can reduce complex system if we understand more about factors of the system. To access structure under complexity are 1) System boundary 2) Interaction 3) New factor to change to change system complex to stability.

2.2.2 Origin of System Theory in Complex Adaptive System

Complex adaptive system is the concept started in 1980 in Mexico. However, it grew and utilize in America and Europe. This concept modifies political science and natural science, compare the structure of ecosystem and creatures and related system of human society which facing complexity. They found that natural system manages themselves in emergency response with communication, coordination and subsystem adaption. Adopting condition from basic in life to social-economic, politics, computer system and disaster response help us complex situation response as the way nature does.

In The United States of America, this concept crossed to politics school from Biology and Physics science. This concept was utilized in government organization

management paradigm after 9/11 in 2001. This concept was utilized in public policy in terrorism threat assessment to prepare their citizen, recovery, resources mobilization and reduce uncertainty effect operation by draft the worst case scenario and calculate the degree of uncertainty. The result is degree effect to control the population and predict the course of the collapse of civilization according to states' structure and life style condition.

2.2.3 Definition of Complex Adaptive System

The Complex adaptive systems (CAS) is the concept from observation found that system as a whole consist of subsystems. These subsystems adapt their format to the change of environment to survive in the bigger structure. Natural systems are brain system, immune system and society as well as man-made systems such as computer system and artificial neural system. These systems are non-linear and complex behavior in interaction with the environment as a whole or system as well as coordination in game theory.

Definition of “system” in this concept is whenever two or more creatures collaborate to achieve common objectives, the system happened. And when subsystems combine together, systemic structure happened such as an immune system which is a network of cells, tissues, and organs that work together to defend the body against attacks by foreign invaders. There is 3 principle in stimulation are 1) Antigens are targeted by antibodies. Each antibody (immune response) is specifically produced by the immune system to match an antigen after cells in the immune system come into contact with it; 2) Self-antigens any molecule or chemical group of an organism which acts as an antigen in inducing antibody formation in another organism but to which the healthy immune system of the parent organism is tolerant. 3) Body system has to memorize those foreign invaders to prevent from getting an attack in the future.

Communication, coordination, assessment, temporary cooperation and repetition in adaptation to survive as well as mentioned immune system above. This is the concept founder of CAS found that it's a process that happens similar to creatures in almost all level from cells, ecology, and evolution of creatures. This is an unavoidable condition in the system, systems tie together closely and the change of subsystem, subsystems closely tie-in. The change of several subsystems gather together

and evolve relation and adapt themselves to the environment. Emile Durkheim 1858-1917, we can predict the behavior of society member from overall image of their society. However, we cannot predict overall image of the society from members of society. To understand behavior or subsystem, we have to understand overview of the system first.

2.2.4 Characteristic of Complexity

Gap between science and decision making in disaster management is utilized theories or evidence data alone cannot actually help in making a decision. As mentioned in the introduction that disaster is a non-linear condition. Situation assessment cannot rely on data in one dimension. The problem is scientists always suggest the best solution as outreach. However, in economic-politics have to suggest the solution as in reach to the affected population in issues both pancreatic and insular.

Roger (2010), responsible organizations have to use inreach and outreach dimension both from theories and practices to reduce decision making the gap. Policy making is both ways process which is learning while practicing. As well as improve practicing process to theoretical sciences. We can see that complexity have 5 significant characteristics are.

- 1) **System and subsystem** interact in the system.
- 2) **Behavior doesn't respond to the sub system** but response to whole impact.
- 3) **Non-linear action** non liner occurrences.
- 4) **Feedback from** memorizing, record, evaluate and learn from occurrences
- 5) **Adapt to equilibrium** from the action

2.2.5 Complex Adaptive System Component

Andrus (2005) utilize factors from complexity theory to develop the operation for intelligence officer in Central Intelligence Agency: CIA of intelligence community. (The United States Intelligence Community: IC is a federation of 16 separate United States government agencies that work separately and together to conduct intelligence activities to support the foreign relations and national security of the United States.) Their main mission is protect public interest and national security. Hence, they need integration of specialist and interdisciplinary knowledge. Learning process and adapt

to dynamic system was utilized with complex adaptive system which contain 6 elements are;

1) Self-organization

The Self-organization is the process by which system components and agents mutually adjust their behaviors in ways needed to cope with changing internal and external environmental demands. Coordinate action in one direction to achieve objectives. Per and Kan (1991) found that self-organization action in a crisis and maintain the condition “Sand pile model” on which on which new sand grains were being slowly sprinkled one after another until it reaches crisis condition, sand self-organize themselves to maintain the shape. In fact an inert individual grain of sand free from the pile. They react to the environment by change their behavior to respond critical state If a sand pile is formed on a horizontal circular base with any arbitrary initial distribution of sand grains, a sand pile of fixed conical shape (steady state) is formed by slowly adding sand grains one after another (external drive). In the steady state, the surface of the sand pile makes on average a constant angle with the horizontal plane, known as the angle of repose. The addition of each sand grain results in some activity on the surface of the pile. An avalanche of sand mass follows, which propagates on the surface of the sand pile. This is the first factor in complexity response. An important factor of communication in crisis and the normal state is aware of their own roles to strategic plan and operation which direct or indirect interaction. Knowledge and understanding in the system especially behavior of (self-organization) to conform dynamic change.

2) Emergence

Self-organized system would led to the accidental and unpredictable structure, new behavior, or new process within the system, from the action of each sub-unit which could result in the differences in the larger system. (Zimmerman, 2010) The Scientist explains this behavior by experiment on variant the row of 12 Canadian geese. When the geese started to fly, they will variant the row in “V” shape automatically against the wind. The form of row shows “group behavior” for “individual behavior” to remain at its post by looking at other members, calculate the distance, position, and speed to maintain the condition of the group same as a human social system. We look at other members and copy them, however, we look around that assess what we want is

considerable public interest not just copy other members. Create collaboration frameworks in a complex system, position interacts between individuals and naturally aware of their own duties to consider public interest of the group. As same as soldiers deployment without having to be told what to do. They can automatically put themselves in the row structure. Which is the basic thinking process programmed in the soldiers to put themselves in the position in the tactics real-time.

3) Relationships

Social scientist, Comfort (1995), we need to reduce the complexity of the system by system structure analysis, actor and system boundary for complexity response. Identify objectives and create strategies to manage the system. For complexity response, we need to reduce the complexity by analyses 1) System structure 2) Actors and 3) System boundary to create strategies for system management.

Data exchange communication like the swarm of ants, soldier ants communicate on the threat to networks, plants communicate with hormones to weather in an ecosystem as well as soldiers and intelligence communities in America use as collaborate principle in the IC areas. This is the way to make self-organization of the organizations more efficient. Because an increase of data sharing and receiving drive new alternatives for operation. Data sharing among operation members, strategic acknowledgement and realize about other members' duties.

Factors in self-organize need enough information to build up energy and understanding. Create paradigm that big enough to drive sub-systems in the groups, improvement of subsystems in each period of them is the indicator of system changes. Interact points between groups indicate an increase of data exchange which possible to design intersect structure conform to the dynamic system.

Hence, coordination in network formation is the answer of the system. Characteristic of the system should be mixed which is heterogeneous organizations. Diversity should be blended, differences of skills and abilities fulfill the networks. Tie relational both horizontal organizations and vertical organizations helps resonance in complexity.

4) Feedback

Apart from data sharing, information circulates also influence behavior such as ants established the path, ants communicate with each other using pheromones.

Previous members will leave pheromone on the trails they found an obstacle to tell following members that “Do not walk in this path” this is important from experience of members give feedback to the system.

System thinking is the way to manage complex the complex. The discipline that concerns an understanding of a system by examining the linkages and interactions between the components that comprise the entirety of that defined system which creates Feedback Loops send data back to the beginning. Then utilize that data for operation in the next step. There are 2 types of feedback are;

- **Reinforcing Feedback Loop** is one in which an action produces a result which influences more of the same action thus resulting in growth or decline

- **Balancing Feedback Loop** circles of cause and effect that counter a change with a push in the opposite direction. The harder the push, the system feedback.

Ditto and Pecora (1993), the physicists were feedback the dynamic movement of the complex system. The internal process of self-organization has layer of interaction. Data can send feedback to stop or to support. Especially our system is like creature, free will decision of individuals have feedback. Hence, the behavior of the social system is non-linear. The more elements, more complex that social system. Learning and feedback every time the mission is finish as well as accept the mistake and put lesson learned to decision making process is the way to improve operation for members of subsystems.

5) Adaptability

System that opens for data to flow in and out, the behavior of units in the system have to adapt. For example, the kids are playing upstairs and leave toys everywhere as usual. Dad walked in and say to the kids to put the toys away and will be awarded ice-cream. The kids put the toys away and get the award as promised. This example is metaphor shows the old behavior of the kids before receiving new information about the award in exchange. In other words, old behavior keeps repeating until new information or order be informed to reach the changing point and the new condition is the flow of new information make the system respond immediately.

Unit and individual communicate and feedback make them know that what's suitable and realize of their own duty. The individual in the system able to adapt and change themselves to be a fit element in the system that changes in short-term and long-

term. Adapting as an element of nature instead of change nature. Society needs to learn to live with natural disasters, control the opportunity of damages and adaptive capacity in responding uncertainty in the future.

6) nonlinear

Nonlinear is the behavior that is unpredictably related to input. Small changes in variables can have small impacts at some times, and large impacts under other condition. Mention uncertainty in the future, non-linearity is always in the disaster condition. Small changes can cause tremendous change in the whole system. Complex system response has to accept uncertainty and open for an opportunity in crisis. Start from accepting that cannot forecast degree of certainty in that condition as system happens in non-linear, random selection is possible and irreversibility. The new behavior is in happening in the change. Interaction study needs to study the continuity of subsystems act until evolving according to dynamics by using lesson learned and interpreted experiences.

Furthermore, cannot attach to theories used in the linear condition. In fact, chaos in the complex system has its pattern. Kauffman (1993), the biologist mentioned survival dimension in the chaos that the systems we are living in have deterministic continue to stochasticity. In fact, under stochasticity have Edge of Chaos. In other words, the system has the condition of inventing to origin evolve of new organization formation among the chaos. If the organizations have enough of data exchange, flexibility to adapt to the condition of change. Natural selection of evolution makes organizations or units survive. Hence, organizations need data exchange system tie to selection process of the system.

Meanwhile, Luhmann (1989) utilize this concept with Darwin's evolution theory "Those individuals with heritable traits better suited to the environment will survive". Hence, although motivation and creativity are important factors to survive, the factor drive social organization is data exchange. Create new information and experiment to adapt to the condition of the new environment. The organization is an alive organization able to evolve adaption to interact condition under more complexity.

2.2.6 Disaster Management in Complex Adaptive System

Series of concepts in disaster management improvement have to revolutionize policy process and Science information, Kaspersen (2010) suggested that combining these 2 concepts to create the frame in finding the convergence of coordination practical. In social aspect, decision-making focus on the role of people involved in the process analysis is local organizations, government sector, business sector, the private sector, and NGO. These actors can be reducing risks or creating risks. Meanwhile, specialists in science both science and political science such as barrister, government officer, and policy analysis work together in data exchange under the same boundary to find neutral solutions for every sector as well as create the opportunity for solution innovation. Hence, decision making in normal condition command and control have to change to adaptive management to manage complexity in disaster, identify the type of relationships, network extensive and increase nodes of the subsystem. This method creates density of networks and reduces vulnerability of networks. Relationship creation and network analysis indicate change of network, as well as show strength or vulnerability of networks, see figure 2.3

This system needless command and control management, need trust, respect in their own power and teach to create Self-organize and make members strong, data exchange are a positive reinforcement the team respect and the trust. They are ready for the lesson learned visualization, adapt and improve the plan. Apart from the policy-making need to be changed, members in crisis state also need to have invention also. Kauffman (1993) mentioned that among edge of chaos. Data exchange is a factor of an invention from individuals as well as strengthen the system.

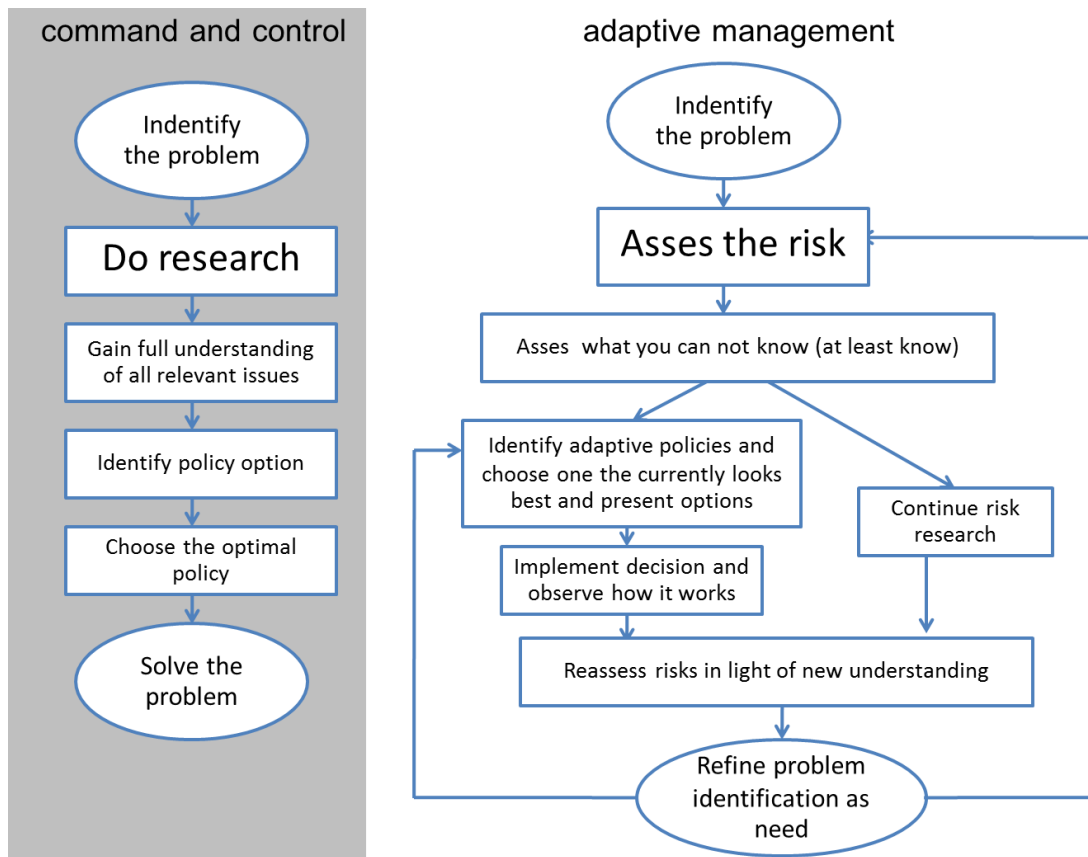


Figure 2.3 Decision Making Process in Normal Condition and New System in Disaster Condition

Source: Kasperson, 2010.

Evaluation of factors involved in chaos incident to find response method to reduce severe risk reduction. This process has to start from not attach to theories used in normal condition and utilize theories for chaos. Kauffman (1993) mentioned complex system has its pattern. There are deterministic continue to stochasticity. In fact, under stochasticity have Edge of Chaos.

As a result of an interaction of sub-system is emergence which approach of systems is different due to subsystem elements. We have to understand that input of the system and output are not rational as we thought. Hence, we cannot predict the result efficiently. As the incident is non-linear, there are the random selection, irreversibility. New behavior always change and distribute of subsystem measurement in the period of

time indicate data exchange level, the number of the node between groups indicate the possibility of data exchange dynamic.

2.2.7 Sociotechnical Systems Theory

2.2.7.1 Socio-Technical for Organization Management

Socio-technical Systems Theory was invented in 1960 by using science principle and rational to create the theory of organization management in the modern era to answer the previous question on organization management theories in the past, “human” does not have the role in organization management. The research team of The Tavistock Institute of Human Relations (TIHR) in London, UK suggested that organization is the social system, social is a creature, behavior of human and technology have relations, change in technology impact social relation, attitude and feeling on jobs. Hence, the conformation of human and job make efficient coordination operation. (Anurak Watthanathawornwong, 2009)

Appelbaum (1997) mentioned sociotechnical theory in organization management that those research designed for industrial countries in Europe especially in Scandinavia in designing work and employees. Then Canada and America receive this theory in designing operation for automotive companies are Cincinnati Milacron, Amoco, USAA, Stanley Works, General Electric and Caterpillar which organization operation need to conform to change of situation, vision and operation have to be adapt continuity. The Society based on the hypothesis that management unit or operation is constituted of technical and social which open to an environment as technical and social have to work together to accomplish the missions. Operation system produces both physical result and social result. Adapt to equilibrium by itself which is absolutely a different theory from the classic method which design technical element and then adapt people to the technic. While this management method, operation design to suit objective of management by using participation process which supports organization members to participate in operation process design. Hence, members able to control technical change to be able to utilize faster and able to access resources more. One of the factors for the success of the organization is shared values of organization members or organizational culture.

Eason (2008) mentioned that technology utilizes in organization management the most is information technology. Communication occurs by information technology utilization, the flow of information in the organization. This process caused social network in organization system which self-organization occurred automatically. As well as resources move and exchange between organization more. The sociotechnical system is the integration between technical system and social system, the technical system identifies form of social system. In the complex incident, if members of organizations able to utilize tools and technology to achieve the shared goal.

2.2.7.2 Sociotechnical Elements in Disaster Management

In the disaster, not only physical equipment such as road, electricity, and communication system was destroyed, society, organizations, and economics all damaged. The factor caused failure operation in social network start from electric cut and communication system cut off as well as the transportation system and public utilize also cut off. Operations cannot be the same. The failure occurred in chain effect which is a tremendous danger for the population.

Comfort, Ko, and Zagorecki (2004) found that “socio-technical system” is not strong system because systems rely on each other vulnerable. When part of the system effects, the whole system easily black out. Hence, if the connection between technical aspect and social aspect are solved, the finding are;

1) In practical, disaster occur and spread by geological not govern the territory. Although they connect by areas, both matters don't have to conform.

2) Interaction and communication pattern change according to emergency phase both inside the organization and between organizations depend on the severity of disaster in the beginning. For example, if the flood starts little by little from the start in the landslide, no case of death or damage in agricultural product, the relevant organization will have communication and interaction on one level. However, if there's case of death on the first day of the flood disaster, relevant will increase level of communication and interaction with more various organizations.

3) Communication is the factor in coordination between operators **elevator** disaster might cause sociotechnical system cut off. Hence, system recovery need reconnect activities in each sector.

4) Type and quality of emergency management the indicator of dynamic and emergency phase management is the initial ability of disaster management staffs, resources mobilization, tiredness of disaster management staffs or the ratio of volunteers. In principle, an order of unit that should reach the affected area first is rescued units such as firefighters followed by rescue unit such as an emergency medical unit to rescue people in time limit then followed by police and recovery units such as vocational recovery-residence-sanitation to proceed long-term recovery before start recovery and preparedness phases.

This concept was adapted to disaster management. There is various operation in management system are government sector, business sector, and NGOs. These sectors need to change the routine task to adaptive both promptitude and adaptive in response uncertainty and coordination with organizations in affected areas. Data is a broker for collective decision making in the occurrences, 2 systems tie in this process are 1) Information network which is the technical computer system and 2) Cognition system in society need decision making as well as acceptance between organizations. These systems connected by the communication system in computer network linkage which is connected technology and human in the situation need to make collective decision to respond to situations. These systems also fulfill each other in their of technology support complex management through the collection, storage, and finding. While human have cognition ability to assess the situation by utilize collected data and make the decision.

To understand deterministic, Axelrod and Cohen (1999) modified Sociotechnical Systems Theory to Complex adaptive systems. These theories are tools to solve the complexity and consider options for organizations to adapt to preparedness under different conditions.

Jessica and Jeffrey (1997 quoted in Mileti 1999) found that cultural openness is a factor influence disaster management for 90%, the rest is technical infrastructure and organization flexibility are accurate data and enough for human resources and resources assessment for incident response, have necessary tools for incident response and enough skilled staffs conform the size of affected areas and government sector have to prepare reserve systems in communication, transportation, and shelter to build reliability and strength for community.

Control small incident not to spread to the big incident can be done by responsible organizations receive an emergency call or ask for help, access to affected areas and stop the incident in time. Complex adaptive system occur if responsible organizations have cultural openness trait, able to adapt management method under the change of situations, willing to exchange information with organizations from other sectors in any way possible.

Hence, disaster management improvement has to start from systemize necessity data such as population data, geographic and govern territory data, disaster management tools and equipment list, as well as associated network for resources, support or data exchange. Comfort (1999) suggested that sectors reduce human error by shared risk and make population have shared values that community and organization have to self-organize as well as improve technology in disaster management. While government sector have to change management method from command and control to adaptive management. And learn condition of management to understand complex that increase all the time.

Comfort (1999) designed indicator for disaster management potential analysis by utilizing Socio-technical Component to create a measurement for the complex adaptive system in 3 aspects are 1) Technical Infrastructure 2) Organizational Flexibility and 3) Cultural Openness as Tavidia Kamolvej (2006) utilize emergency management crisis in Tsunami disaster in Thailand. Researcher utilizes those factors modified Complex adaptive system elements of Andrus (2005) to classify problem found in operation for disaster response level consideration.

2.2.8 Case study of Sociotechnical System element in disaster management

Socio-Technical system theory in disaster management analysis of this research based on disaster coping is complexity, involved organizations need data exchange and connect operation, to manage various organization in open system situation and uncertainty need to manage subsystem to be able to adapt their directions to achieve the shared goal at all time.

To link understanding between theory concept and spatial study, researcher chose to show case study also utilize sociotechnical concept in earthquake disaster analysis in Thailand and earthquake disaster in a country with similar context herein;

- **Self-organization in the Great Hanshin Earthquake: Southern Part of Hyōgo Prefecture, Japan. Self-organization in Disaster Response: The Great Hanshin Japan Earthquake of January 17, 1995** by Comfort (1995). Disaster is continuity. One incident can trigger following disasters. Suspension to prevent chaos in Kobe where the high density of population, needed self-organization and quick communication inter-organization to control effected areas in time.

- **Inter-organizations Coordination for Emergency Response: Nantou, Taiwan.** Response Operations Following the Chi-Chi (Taiwan) Earthquake: Mobilizing a Rapidly Evolving, Inter-organizational System by Comfort (2000) is the sample shows that although Taiwan has experienced rescue team, have the national plan as well as laws in disaster response inter-organization, the most effective response is self-organization of population.

- **Lesson learned in disaster management in Thailand, Tsunami 2004.** The Integration of Intergovernmental Coordination and Information Management in Response to Immediate Crises: Thailand Emergency Management by Tavidia Kamolvej (2006) utilize sociotechnical theory to analyses roles of organizations in Tsunami management in 2004. From emergency phase to recovery phase.

2.2.8.1 Self-organization in The Great Hanshin Earthquake: Southern part of Hyōgo Prefecture, Japan

January 17 at 20:46:53 UTC in the southern part of Hanshin Prefecture, Japan, known as Hanshin. It measured 7.3 on the JMA Shindo intensity scale. The tremors lasted for approximately 20 seconds. Up to 6,434 people lost their lives about 4,600 of them were from Kobe which is a big city and industrial city located nearest to the focus of the earthquake. 200,000 households were damages and total damages cost 10 million Japanese YEN.

Comfort (1996) studies self-organization in this disaster and reveal an important behavior of disaster found that “The great failure occur in chain effects of small disaster that grow the severity in order” start from seismic of the earthquake destroy buildings, houses, bridges and other infrastructure as well as electricity plant, water, and gas supply system.

In this incident, the gas pipe was damaged for 4,500 Km. (In Japan, gas pipe installation from private companies straight to households). When the gas pipe

leak, 109 places was on fire and water supply also destroyed, Hence, they couldn't stop the fire without water. The worst case was firefighters couldn't access the scenes as the buildings collapse and blocked the road. They couldn't stop gas leak situation for another 6 hours as Osaka Gas Company couldn't communicate with municipal staffs.

Meanwhile, landline system also collapses from the earthquake. Officers took only 24 hours to repair the system. Most areas able to use the telephone and affected population call for help average 100 calls per hour which is 1.7 calls per minute. Kobe is city community with the high density of population. The main communication system, telephone stopped working again, firefighters had to use radio system for communication. However, the radio system doesn't work with organizations that don't have this system. Emergency response was slower than it supposed to be. Even though Kobe has 11 firefighter units, 176 sets of tools and 305 staffs. They install CCTV to monitor fire incident in the communities later on.

Kobe municipal improve emergency phase management inter-organization by regulated new management condition call first on the scene to stop small incident to spread in wider areas and more severe. Start with an emergency call 199, call center pass the data to firefighter unit, rescue team includes skilled staffs in rescue and primary nursing care arrive at the scene as well as manage the traffic and followed by an emergency medical team to move the injured to local hospital.

Considering sociotechnical system found that Japan have strength in coordination and self-organization by communities. Population volunteer to help by nature. Private organizations is an important sector invest in earthquake mitigation process because majority of population see the importance of lives and coordination in the households. However, considering inter-organizations, researcher found that there is limitation in efficiency of resources mobilization and operation on time. Disaster cause the failure of subsystem and losing equilibrium in the system. Coordination structure design need to give importance to "Groups".

2.2.8.2 Inter-organization coordination in emergency response: Chichi earthquake in Nantou, Taiwan.

Tuesday, 21 September 1999 at 01:47:12.6 TST (Monday, 20 September 1999 at 17:47:12.6 UTC 7.6–7.7 Mw earthquake which occurred in Chichi, Nantou County, Taiwan. The tremors lasted for approximately 40 seconds. Affected areas in

27 cities in 5 counties. The earthquake effect communication system, electricity, water supply as well as transportation system, the landslide blocked the road, damaged bridges, and railways. Louise K. Comfort (2000) compared disaster management in Chichi to Kobe, Japan. Chichi which is research area, has 88,000 population, the disaster killed 198 and 149 injured and small injured 2,958. 4,442 buildings were damaged.

Government has gathered disaster situation in the first hours of the incident. Although Taiwan has national plan and laws in disaster response cross govern territory in national, county, city and community. There are rescue foundation and volunteer in every city. However, the limitation on operation plan in local level for the big disaster. Not every city able to set emergency operation center right away. The problem found in Taiwan similar to Kobe, not enough rescue officer in the communities. Operation in wide affected areas is limited. For the community, the first unit arrived at the scene to help was neighbors and family members that help people trapped under the collapsed buildings. Meanwhile, the incident in huge structure buildings, there are not enough tools and experienced staffs for this tasks.

These 2 disasters, the similarity is communication system cut off, affected areas wide and need help as much as any other areas at same time. Special tools and skilled staffs are not enough. The government couldn't respond the situation fast enough. Diversity organizations in the areas, affected community never experienced the situation and unfortunate that they Chichi didn't have fire like Kobe.

Affected areas in Taiwan wider than Kobe in term of an area. Meanwhile, the affected areas in Kobe were the high density of population areas, the affected area in Taiwan was remote areas. Transportation and resources mobilization were more challenge.

Japan and Taiwan have self-organization in the community with similar characteristics are most of the survivors received help from the local community more than foreign rescue team. As a result of political limitation at that period of time, it was the delay in sending help from international organizations. Self-organization with equipment that not skilled rescue units. Both brought their experience in organization level to reflect their lesson to work with enough as well as skilled staffs happened before

international help with advanced tools and government level on what kind of innovation and protocol need in that emergency situation.

Disaster management evaluation in Taiwan they had data system management, research and innovation prepared for disaster response, they set up integration data system and risk management process beforehand. Government sector also quick to connect the data, knowledge, information technology and advance technology to monitor the incident and assess affected areas. They also had news media on websites and data system connect knowledge in each field needed for management. Louise K. Comfort evaluate disaster management by using sociotechnical element in 4 levels to evaluate operative adaptive system are table 2.1.

Table 2.1 Disaster Adaptability Evaluation

<i>Disaster response level</i>	<i>Organization flexibility</i>	<i>Technical Infrastructure</i>	<i>Cultural Openness</i>
Non-adaptive System	Low	low	low
Emergent adaptive system	Medium	Low	Low-medium
Operative adaptive system	Medium	Medium	Medium
Auto-adaptive system	High	High	High

Source: Comfort, 1999.

Technical Infrastructure Taiwan implemented building code since 1996. The damages depended on the success of implementation of each city. They have fire fighter unit in the city level but small communities have small units in the community. However, under the emergency without communication system, they switched to the radio system for communication. While, communities tried to self-organize as much as they could.

Organization flexibility not every city able to set up emergency management team right away. Under the situation need resources allocation and decision making, Taiwan has limitation in politics.

Cultural Openness this is open for new information, idea and norm for operation, related organization in rescued learn about the structure and building affected by earthquake. And learn how to utilize lesson learned in the incident in the future. Government sector also learn inter-organization.

2.2.8.3 Tsunami management in Thailand 2004

Tavida Kamolvej (2006) utilize Socio-Technical component analyses lesson learned in disaster management in Tsunami Disaster in Thailand 2004 from the emergency - recovery phase to study the disaster management factors are table 2.2.

This study show ability in disaster management in Thailand in each aspect shows Cultural openness in Thailand has strength in volunteering and public mind. However, there are several weaknesses are 1) Thais never thought of this tremendous disaster is possible 2) Fault alarm make those warning become unconvincing. And Thais will be started to stop believing in warning and disaster alarm 3) Local organization non-systematic operation 4) National and local politicians tend to use welfare method rather than strengthen communities. 5) Community wait for help from outsiders instead of self-organize. Organizational Flexibility main problems for management in Thailand are 1) We have laws and regulations in disaster management command system but lack of implementation in the disaster 2) Laws should indicate authorization of local organizations in integration and decision making 3) Laws improvement in budgeting for preparedness phase, current law only allows budget for emergency phase 4) Government organizations, as well as other sectors, should be formal and informal coordinate operation and 5) Establish single command unit overlap existing structure in both normal state and emergency.

Technical Infrastructure main problems of management in this aspect is lack of modification in reducing vulnerability from disaster in risk reduction are 1) Thailand lack of implementation and inspection of building safety 2) We are lack risk assessment by areas in vulnerability to disaster aspect and damages aspect to arrange risk and urgency in each different areas 3) We lack system, data, database, social data and tools for decision-making process as well as End-to-End warning system 4) We

lack risk area evacuation center format 5) We lack system and logistics management bath main system and reserve system 6) We lack of communication channels and professional information selection, the increase of technology in data exchange and acknowledge risk group conform to vulnerability reduction.

Table 2.2 Socio-Technical Component

Organizational Flexibility	Technical Infrastructure	Cultural Openness
National emergency laws	Risk assessment	Shared value of humanitarian
Special emergency regulations	Building codes	Commitment to goal of protecting life
Emergency integrated response plans	Structural inspection	Willingness to share information needed
Emergency commands and coordination	Alternative communication	Acceptance of new information
Communities Emergency inter-organization	Alternative electrical facilities	Openness to new methods
Emergency inter-organization for agencies	Special emergency operation and equipment	Willingness to review actions taken
Multi-ways of info exchange between agencies	Identification of major facilities	Willingness to correct mistakes
Multi-ways of info exchange across sectors	Alternative rescue or emergency response	Willing to responsibility, solve conflicts
Trained professional managers on duty	Self-technical manual procedure	Willingness to service public
Trained reserved personnel on recall	Other technical support	Continual search for relevant, accurate info

Source: Tavida Kamolvej, 2006.

From these case studies, the researcher found that sociotechnical elements, Tavid Kamolvej (2006) is the best way to study interactions of organizations in disaster management in Thailand. This concept prioritize operational factors in 3 aspects are 1) Technical Infrastructure indicate efficiency of data exchange as well as operation and risk management 2) Organization Flexibility indicate ability in emergency response and complex which need integration between organizations 3) Cultural Openness indicate values and change acceptance, operation adaptive and conflict management are adaptive operations for efficiency in emergency phase.

These case study using sociotechnical elements shows Socio-technical Component study should be done by classify factors in each sector first, then indicate characteristics of subsystem by disassemble elements of incident from subsystem and assemble them back with data collection by ordinal data, present qualitative data and descriptive statistic as the observing phenomenon is dynamic, linear equation to predict the occurrence is impossible.

2.2.8.5 Data Management in Crisis Management

As mentioned in case studies, Comfort (1995) found that the first problem organizations come across in disaster is lack of data. In disaster dynamic occurrence, organizations found themselves lack of data or how change has affected an area. The problem on lack of enough data to assess the situation as well as alternative traffic management after the bridge collapse or landslide that block the road. They also found that they need to collaborate with organizations from other sectors are government sector, private business sector, NGO or charity to control the chaos.

Comfort (2007) show case study in Hurricane Katrina incident, actual occurrence have dynamic change. However, disaster response plan and hierarchy command system. Operation level have reorganized emergency function with communication and coordination instead of hierarchy command system as this way have weaknesses are;

1) Inequality management and divide operation there are several operation groups in this method. Data flow process is inequality, work cross responsibilities and information allocation between groups is impossible. Integration operation is impossible. Although the government has divide responsibility by job description and level of government are sub-district, district, and province, those units

not able to manage tremendous disaster by themselves. The solution for this problem is set up the common operating picture which is a common goal for operation between organizations in disaster occurrence.

2) Single data processing if the common operating picture isn't utilized in operation, hierarchy command system is still there. Single data processing and ignore feedback from operation level cause unnecessary mistakes. As the operation in the areas not able to share their vision and fault solution happens.

3) The gap of necessity information when those two problems happened, necessity data for coordinating groups cannot flow in the system, Operation process start without coordinating between groups.

Government organizations coordinate crisis management have to adapt operation framework to complexity. Environment, society and engineering technique. Sociotechnical concept indicates these operations come from an infrastructure of data support recognition, communication, coordination and control in organizations collaboration as well as human resources efficiency skills in learning, utilize technology in disaster monitoring to improve operation process and solve the mistakes as well as improve alternative solutions. In other words, coordination between organizations needs role of leaders in each level have to be able to coordinate with local leaders and organizations in the affected area in preparedness, recovery and emergency phases. Comfort and Resodihardjo (2013) suggested that efficient occurrence management is a result of leaders who understand operational levels to response the disaster in the same direction. Good leaders able to negotiate and exchange resources with other sectors, communication skills, open to new information and willing to solve the mistakes as well as prioritize organization flexibility for mission adaptive. They also need to be able to reconciliation and lead the coordination of their personnel to work with other organizations in different levels. Roles of coordinators in each level are micro level is organizations to organizations meso level is regional organizations and macro level is international organizations, regional organizations and local organizations are

Micro level emergency medical unit is in charge of taking the injured outside of affected areas as well as screening and evaluating risk with safety inspector such as civil engineers, rescue units who need to evacuate the injured out of risk areas

Meso level leader has to utilize their communication skills to keep the common interest of coordination, need the flexibility to adapt operational process such as conflagration cases, firefighters can be volunteers from organizations. Good leaders should be able to connect volunteer network to be able to work together in the pressure situation.

Macro level tremendous disaster crisis management, international and national organizations or national organizations and local organizations need coordination. Leaders need to considerate coordination with knowledge common in searching information and data exchange processes. Those data need to be on time, accurate, coordinate and have management process that supports these purposes to drive collaboration with using knowledge or common data between organizations. Leaders at the macro level have to have efficient situation management by coordinate with local and community levels in data report, data update and data exchange. They also need to create an adaptive operational framework in efficient resources usage to society as a whole. As well as strengthen self-organization for continuity recovery process.

2.3 Policy Implementation

According to the complexity of disaster and the evolving concept in disaster management in each periods, Thailand had amended its regulation in the disaster management continuously and resulted in the policies and strategies which influenced this research as followings.

2.3.1 Policy and Strategy related Public Disaster Management

2.3.1.1 Public Disaster Prevention and Mitigation Act B.E. 2550 (A.D.2007)

From 1) Civil Defense Act, B.E. 2522 (A.D. 1979) and 2) Fire Defense Act, B.E. 2542 (A.D. 1999). This act was implemented and set disaster management structure. Main point of this Act are;

- **In case of severe public disaster** Prime minister or Deputy Prime minister assign commander or director general of local administrative office. Any resistance or ignore the assignment, will be Penalties for Violations of State Ethics.

Structure and relation between management and related organizations according to ministerial order (Department of Disaster Prevention and Mitigation, 2010). 3 levels mentioned above see figure 2.4

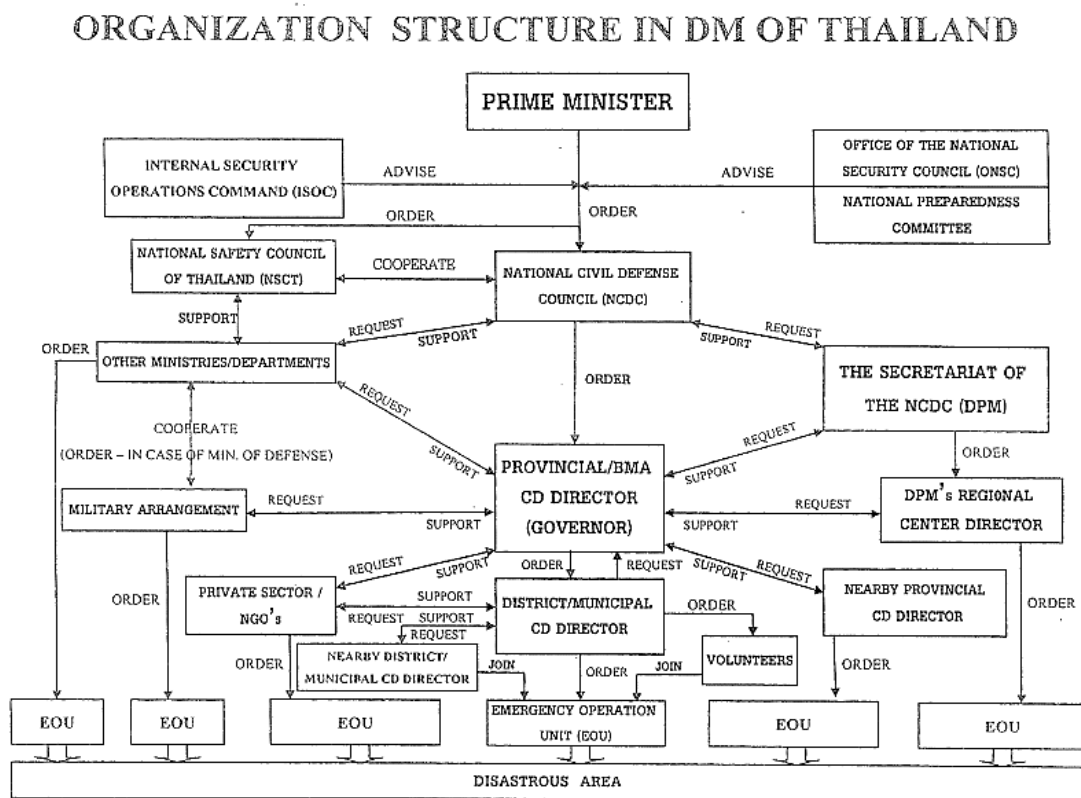


Figure 2.4 Public Disaster Management Structure of Thailand

Source: Department of Disaster Prevention and Mitigation, 2010.

- **Department of Disaster Prevention and Mitigation** is the mediator from central government who is working with related government department and the representative from Local Administrative Organizations. The private sector also open

to participate in giving information or suggestion for creating the plan. Disaster management according to ACT was set in 3 levels are;

1) National Level command center of this level is Ministry of the Interior. The commander is Ministry lawfully authorized to control, regulate and command all levels in the country. Director General of Department of Disaster Prevention and Mitigation is the central director also lawfully authorized to control and command the operation at all level in the country.

2) Provincial and Bangkok Level is the main unit in mitigation and recovery in their own areas. Provincial governor is in charge of provincial director and Provincial Administration Organization mayor is deputy director.

3) Local Level is the support unit for provincial level and responding unit in the area, District chief (As well as assistant district officer) are district directors. Their responsibilities and operation in public disaster prevention and mitigation in district area. Local mayor (SAO Chief, Municipal Chief, Pattaya Chief and Chief of Local Administration Organization) are local directors. Their responsibilities are disaster prevention and mitigation in their areas as well as assist provincial director and district director.

This ACT focus on strengthening management policy under good governance, encourage population and network to participate in public disaster prevention and mitigation. The Main point of encouraging civil society to be a part of disaster management is Open for civil society to participate in disaster management. Local director set up volunteer in the areas to support public disaster prevention and mitigation and assist the director as assigned as well as specify in ministerial rules, authorized office have lawful authority to assign the missions or provide the areas for charity groups or donators or personals assigned to help during public disaster occurrence. In this circumstances they came up with Proactive disaster management by the community and local organization Project. This project's mission is to improve community network, volunteer and population to provide them for disaster presentation and mitigation which they focus on prevention more than preparedness and focus on improving population and society. Improve disaster knowledge skill. In 2008, article 41 to encourage all sectors to participate and strengthen the operation to reduce the loss from the disaster. DDPM operating the project for population to participate are;

1) One Tambon one search and rescue team: OTOS, goal of this project is to have 7,255 searches and rescue team all over the country

2) Community based disaster risk management: CBDRM, an objective of this project is 400 communities a year.

3) Volunteer network project “Mr. Warning”, an objective of this project is 2 volunteers from communities in landslide risk areas 2008.

4) Civil Defense Volunteer Program, the goal of this project is trained volunteers for 2% of population or over 1 million volunteers all over the country.

Furthermore, there is capability improvement for communities according to community based disaster risk management: CBDRM for sustainable disaster preparedness, **Capacity building for disaster preparedness project**. The improvement of disaster management capability by using existing resources and human resources in the community. This training also relates to Local administration organization in preparedness. Also, community able to self-organize in disaster occurrence.

2.3.1.2 Disaster Management Strategic National Action Plan B.E.2555-2559 (A.D. 2012-2016).

Lesson learned visualization from the disasters reveal weak point that needs to be improved. DDPM (2011) analyzed problems and conditions in operation of the plan between communities and between organizations found that.

Laws and Policies the operation under **Public Disaster Prevention and Mitigation Act B.E. 2550 (A.D. 2007)** not yet achieve objectives. In other words, law implement with the organizations involve article 12, organizations have to take responsibilities for continuity and systemically operation. However, staffs in management level and operation level still lack knowledge and understanding. Hence, they are not able to completely implement. Most of the staffs still operating in the way they are used to and ignore the process according to the laws. Inter-organization operation does not practice in reality.

Coordinate with local and community, DDPM able to access and coordinate with some of local and communities. There are loopholes in overall operation. Establish network associate and participation operation is still in policy level. Projects are fixed more than flexible and understanding of areas context.

This strategy set up framework of direction in coordination between networks in public disaster management in local level coordinate with organizations to improve the capability of network in local level in strategic 3 by;

- **Build a mechanism to make all sectors see the importance** and realize that it's the duty of network organizations in public disaster prevention and mitigation.

- **Encourage network organization in local level to integrate their resources** in disaster management.

- **Build knowledge** for network organizations in local level in public disaster prevention and mitigation.

- **Encourage network organizations to realize** about public disaster prevention and mitigation plan/project for integration of budget.

- **Build operation improvement methods** under “encourage and coordination in a network on public disaster management capability improvement in local level” strategic. Below are procedures for the improvement.

- **Set measure of public disaster management** for public disaster prevention and mitigation network assessment. The content should cover prevention and mitigation.

- **The result of public disaster management assessment by province.** The assessment shows accomplishment of strategic indicator.

- **Provide capability improvement course for the network** to increase the standard of prevention and mitigation with integration system from all sectors.

As we can see that government sector also try to build the mechanism to strengthen preparedness for community and local. The last question is how to coordinate between the government sector and population to make it practical?

2.3.1.3 National Strategy Public Disaster Risk Reduction B.E.2553-2562 (A.D. 2010-2019)

Laws and Policies on disaster management mentioned above shows disaster management direction is prevention and preparedness phase. Consider **National strategy public disaster risk reduction B.E.2553-2562** (Department of Disaster Prevention and Mitigation, 2010) found the conformity strategic plan are

Strategic 1 Prevention and Mitigation included both building and non-building rule such as database management system, risk assessment system and risk areas map. The master plan and operation improvement and community-based disaster risk management (CBDRM), raise awareness and disaster education.

Strategic 2 Preparedness included alarm and broadcast system improvement, create the plan and plan drills, preparedness training, emergency kit preparation and prepare equipment, tools, and budget as well as prepare publicity and infrastructures.

Strategic 3 Emergency phase management included follow up and monitor situations, command system, planning, communication system improvement, evacuate plan, basic nursing aid, responding procedure and rescue procedures as well as emergency operation, etc.

Strategic 4 Recovery included damages assessment, help and relief procedures, sanitary and environment procedures, financial aid as well as disaster relief goods, recover basic facilities, initial damages assessment, stress relief procedures, follow up and initial assessment and create the recovery plan.

2.3.2 Problem and Obstacle of Disaster Management

Although we have policies improvement to connect system between organizations to conform variable disaster situation in Thailand, problems that analyses in 2004 are still there in the emergency phase, Wattakan Lapsan (2014). Strength, weakness, threat, and opportunity for operation improvement in table 2.3

As the problems and obstacle reflection from SWOT analysis, the majority of the inter-organization problem caused by policy implementation. Involved organizations have to continuity and systematically operate according to article 12 of Public Disaster Prevention and Mitigation Act B.E. 2550 (A.D. 2007), encourage coordination between networks in public disaster management potential improvement in local level to coordinate with organizations in Strategic 3 of Department of Disaster Management Strategic National Action Plan 2012-2016 as well as prevention and mitigation in strategic 1 of Strategic National Action Plan (SNAP) on Disaster Risk Reduction B.E.2553-2562 (A.D. 2010-2019). It's important to support operation level in policy implementation,

they should be able to operate according to plan and policies which were set as the master plan of implementation by organizations instead of ministerial plan.

Table 2.3 SWOT Analysis of the DDPM Operation

Strength	Weakness
Broad authority and function of the organization enough to achieve the vision in framework of Public disaster prevention and mitigation act 2007.	- Uncleared role, ignored by operation level. - Centralized management authority - Lack of knowledge and skill support to Local administration organization personnel. - Lack of participation and neglected public issue communication causes conflicts. - Uncleared proactive prevention and ignore necessity that need to be done beforehand.
Threat	Opportunity
- Thai society don't have awareness culture. Which caused flexibility to respond the sign of changed situations. - Thai society lack of the alternative innovation. - Thai society don't understand democracy, lack of openness and respect others. Also lack of agreement of commitment.	- All sectors are policy, private sector, state enterprise, civil society and local operation level interested in public disaster. And try to improve their operation to be more flexible for disasters. - Social media have more role in severe flood in 2011. Improve Information technology to connect and more efficient for operation is important.

Source: Wattakan Lapsan, 2014.

2.3.3 Definition of Policy Implementation

Definition of Policy Implementation in consideration in this research are;

Piyanus Ngenklay referred policy implementation process by Eugene Bardach. Policy implementation means interaction process, strategic in the process to accomplish goals of stakeholders which might consist or in consist of policy objectives. Tawan Woratepputthipong (1996) referred policy implementation study according to Kerr's concept, organizations' ability to utilize management resources for policy achievement study. Ability and readiness of organizations are budget, staffs or materials.

Voradech chantrasorn (1996) explicated that policy implementation is to study whether organizations in charge will be able to bring and stimulate management resources as well as the significant mechanism to achieve policy objectives. Policy implementation is to find process and method to improve policies, plans and projects by focusing on abilities of organizations to push the policy accomplishment.

A more specific definition is provided by Van Meter and Van Horn (1975) found that policy implementation encompasses those actions by public or private sectors that are directed at the achievement of objectives set forth in prior policy making. Organizations effort to change incorporeal policy to reality operation. Organizations have to understand the policy and allocation of resources. As well as continuity operation to achieve the policy objective.

Therefore, consider the definition of policy implementation and policy classification at the same time to analyze the type of disaster management policy found that policy implementation is to seek for the mechanism to policy execution by coordination of organizations and policy implementers. Seeking for mechanism or implementer should prioritize consequential damages that might affect community and decision making shouldn't be complicated.

2.3.4 Actors in Policy Implementation

Policy implementation is the process of changing policy to operation. This process starts with making the policy, methods, planning, project and activity. Chamnan Khamchoo (2012) found that actors in this process are;

1) Government Sector these are governmental organizations who are important resources in policy implementation. In term of governmental network link

policy implementation in the whole system as well as skills and knowledge in government system for the efficient policy implementation process.

2) Government Personnel they are the basis of policy implementation as they are implementers. Policy implantation as policy enforcement, mediator to push operation process and bring the policy to stakeholders.

3) Stakeholders, there might be advantage or disadvantage that caused by policy implementation to the population. They are the direct factor of policy implementation result.

Consider **Actors in Policy Implementation** found that government system and officers are **formal actors in policy**. They are actors in ruling and policy enforcement. Meanwhile, stakeholders are both **formal and in formal actors**. They are of interest groups and civil society groups. They are the actors who don't have legal power. However, they are indirect influencers in policy. These informal actors have more influence in the policy-making process more than in the past. Consider Territory of actors consideration has to cover stakeholders more.

Consider current interest groups in pluralism found that groups have their own sources of power although the degree of influence of groups is different. These sources of power are financial, information or skills. Groups utilize these sources of power to compromise interest between each other. Dahl (1961 referred by Somporn Phuangchan, 1996). Definition of interest group is a collection of individuals aim to influence government for their benefits. This group doesn't include the political party.

Dye (1981 quoted in Somporn Phuangchan, 1996) mentioned about conflict management of interest groups, an important duty of political system is managing conflicts between groups by regulating usurpation or compromise as well as balance power of groups. Those compromise results come out in public policies and policy implementation in the next step. Benefit system in the society still exist because of the balance of 3 powers are 1) Majority group or potentiality to encourage resistant if there an effort to ruin this balance condition. 2) Individuals who are the member of more than 2 interest groups, these people stop the conflicts not to move to one way or another too far. 3) Validate condition and balance between groups.

2.3.5 Influence Factors in Policy Implementation

As mentioned management level should have policy implementation strategic to make policy implementation process achieve plan and project objectives. These strategic should be set before elucidate responsible parties or operation level. They also should provide advice or improvement in every phase of operation. Researcher found that disaster management organizations should prepare for changes at all time. Influence factors in effective policy implementation. Mountjoy and O'Toole (1979 quoted in Sombat Thamrongthanyawong, 2003) study found that;

- Organizations with custom changes, specific operation and require resources in their operations. Those organizations should be given enough resources.
- Organizations must be given specific and clear methods. Otherwise, policy implementation easily fails. Hence, main principle to prevent problems and obstacles are;
 - Having new resources but vague operation methods. Explanation of policy must be clarified and policy explanation management outlook must be conformed to the policymaker.
 - Having enough resources and clear operation method. Members of organizations adjust their routines tasks to special tasks. Operation methods conform achievement of policy objectives.
 - In case of resources shortage and unclear operation method, activities to encourage operation level to will to operate those tasks is needed. They should be encouraged to make an effort to achieve the objective.

2.3.6 Comparison of Propositions in Policy Implementation

Consider policy implementation and policy implementation research in Thailand, most of them utilize top-down theories in their studies if central organizations able to regulate policy direction. As well as system theories considered policy is the direct influence for the result. Policy assessment according to policy considers following of indicators. In other words, if the result is the letter of indicators mean the operation is accomplished. By using these theories, operation level is controlled by top position. In fact, they cannot control anything.

Bottom-up theories prioritize the result over policy directions. This theory emphasizes policy research must not separate policy-making process from policy implementation. In practical, policymakers not able to state policy objectives and everything are full of interest. Study operation level adjustment that caused by an interaction of actors in the area is important for the success of policy analysis. Because interest groups who influence decision making are many. Ruangvit Ketsuwan (2008) classified 4 interest groups are;

1) Economic motivated group this group is the most influence because they are directly affected by policy making.

2) Vocational group this group is 2nd influence because they are effected from service members.

3) Government organization group are government organizations, government officers, staffs who are involved in defending public interest as well as data and information collection.

4) Ideology group is Non-Government Organizations (NGOs), foundations and voluntary groups claimed that they represent the public interest. Their operation comes from ideal to manage issues which are small system inside the big system.

Nakamura, R. T. and Smallwood, F., (1980) summarized the overall of policy implementation that original management and decision making in policy implementation are 1) Actors who receive and select policies from policy makers 2) Actors communicate related parties than 3) Actors in the structure implement the policies. Finish point and goal are output achievement of policy see in figure 2.5

Classic methodological approach usually is done by non-structure data collection, document assessment, participant observation and data analysis as well as select influence factors, this method conforms target group, the success of policy implementation and conforms to policy objectives. Output and impact influence feedback in policy improvement.

Current methodological approach, Ruangvit Ketsuwan (2008) explained that there are 3 different theories explain policy implementation are;

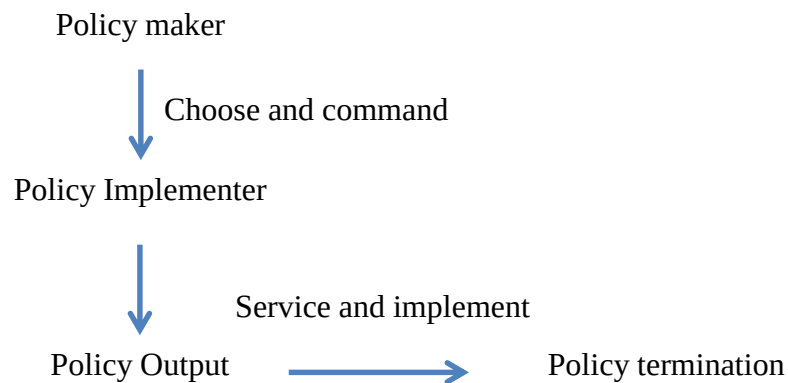


Figure 2.5 Stimulation Model of Policy Implementation

Source: Nakamura and Smallwood, 1980.

1) Top-down theories come from stage model and rational system model. Top-down theories started from the assumption that policy implementation starts with a decision made by central government. These theories set policy as an input and implementation is an output. These theories used in quantitative research.

2) Bottom-up theories different from Top-down theories as this theories assumed that local implementers are closer to the issues. Theorists suggested studying what was actually happening at the recipient level and analyzing the real causes that influence action on the ground. The outcomes did not always sufficiently relate to original policy objectives according to this theories. Rational relation between central and local are not necessary.

Methodology in this theories always start from the type of policy such as allocation of resources or distribution of resources policy and utilize policy network study, classify stakeholders and policy network type such as data network or operation network. Explain relation of actors in problem solving in each group, 1) How independent from each other 2) How the collection of groups 3) Roles 4) How do they decentralize power in the group, as well as study outside factors, are social condition and economic influence policy implementation. Interpretive of actors or interest groups behavior and show strength and weakness as well as support the decisions.

3) Mixed theories this method gathered main points of both above theories.

As the matter of fact in research, the direction is going to abolish top-down and bottom-up theories. Because of top-down theories based on deductive approach and bottom-up theories based on an inductive approach which is opposite. In other words, the first theories try to predict the direction in policy implementation and the 2nd try to explain policy implementation behavior. Mixed theories interested in improving the study of democracy and participation

2.3.7 Disaster Management Policies Implementation Study

Quarantelli (1997) quoted in Kampanat Wongwatthanapong (2013) with 40 years experiences in Sociology study in disaster management. He developed 10 criteria for evaluating success of disaster management are;

Criteria 1 Correctly recognizing differences between response and agent-generated demands.

Criteria 2 Adequately carrying out generic functions.

Criteria 3 Effectively mobilizing personnel and resources.

Criteria 4 Generating an appropriate delegation of tasks and division of labor.

Criteria 5 Adequately processing information.

Criteria 6 Properly exercising decision-making

Criteria 7 Developing overall coordination

Criteria 8 Blending emergent and established organizational behaviors

Criteria 9 Providing appropriate reports for the news media

Criteria 10 Having a well-functioning emergency operations center.

Kampanat Wongwatthanapong, 2013 applied these criteria to collect the data for quantitative research on the success of public disaster policy implementation in 249 Local administration organization of tsunami risk areas. The study found total success rate is high. Meanwhile, the qualitative research found that some of the evaluation criteria do not conform to good disaster management are 1) Effectively mobilizing personnel and resources government sector have not planned for resources utilization 2) Generating an appropriate delegation of tasks and division of labor government organizations were divided by sector. sectors have their own specific tasks and not open for assignment in special situations 3) Developing overall coordination government

organizations focus on commanding and controlling more rather than coordinating
 4) Blending emergent and established organizational behaviors government organization block other organizations in leading roles 5) Adequately processing information government organizations lack communication and broadcast systems 6) Having a well-functioning emergency operations center emergency operations center only in charge of command and control the situations not coordination center.

Thanawat Pangjai (2015) studied Public disaster management influence factors of DDPM to analyze the facts as well as problems and obstacle in operation to suggest improvement methods. Independent variables influence management are human resources, budget, tools, equipment and management structure. Dependent Variable is success of public disaster management of DDPM in provincial according to National Public Disaster Prevention and Mitigation Act B.E. 2550 (A.D.2007).

The study found an appropriate structure for disaster management is extending the office of disaster management in district areas by setting up the office and authorized according to ministerial regulations and related acts in order to convenient and efficient management. While budget in the management of provincial office should be allocated by the size of the areas, population, and responsibility. Most samplings agreed with this suggestion as Disaster Prevention and Mitigation (DPM) provincial office is in charge of many districts, some areas are far and difficult to travel to as well as operation in emergency phase if the disaster occurs in the areas. The material, equipment, machines, and vehicles are not enough for the disaster in wide areas, the rescue in affected areas is not efficient enough. Allocation of these resources should be enough for district level. For human resources, DPM provincial office allowed 5-7 staffs in provincial offices. However, there are vacancy positions and new staffs lack of understanding in policy and related laws as well as discretion in rescue population in the affected areas.

Thawach Sareethas (2000) studied Operation according to policies and flood prevention and countermeasure in Bangkok: Lad Prao area. Study result are 1) policies and flood prevention and countermeasure in Bangkok is clear and cover all problems in Bangkok area. Implementers able to achieve objective more than district plan which lack of policy framework. 2) Operation according to policies and flood prevention and countermeasure in Bangkok: Lad prao area is appropriate and satisfy population in the

area in medium level 3) Evaluation of operation according to policies and flood prevention and countermeasure in Bangkok: Lad prao area implementation found that the differences of community make different result of effectiveness in 5 criteria are 1) Build and maintain drainage system 2) Waterway maintenance 3) Pumps installation for flood prevention and countermeasure 4) Services in affected areas 5) the differences of community make different result of effectiveness not different in 4 criteria are 1) General issues 2) Flood levee installation 3) Communication process 4) Recovery process.

Apichart Chatasinha (2010) studied Factors influence success human resources improvement policy implementation: Firefighters in fire brigade 1, Bangkok Office DDPM. Independent variations are Policy standard and objectives, organizations structure, communication, staffs attitude, training, resources and economic society and politics situations. Dependent variations is skill improvement in operation for achievement of policy implantation. The study found that basic public disaster prevention and mitigation course doesn't cover understanding of command system. Organization structure is unclear make it difficult for operation. Organization should reduce operation process, communication equipment are old, lack of technology utilization, Staffs have skill but should separate training courses for commanders and operation level and staffs should understand organization structure. The organization has an issue with purchasing and equipment maintenance. The factor in economic society and politics situations found that organization lack of coordination from the private sector because it didn't mention in the laws. Meanwhile, there is no coordination with the political leader.

Viroj Semrum (2011) studied Emergency medication service policy implementation. To study the effectiveness of policy implementation and find an appropriate method to increase the success of achievement in the areas. The study found that influence factors of policy implantation are 1) Attitude of operation level able to explain the change of satisfaction score in emergency operation unit which service in maximum 10 minutes 2) Support networks in the coordination of group or organizations for data exchange and support each other both through center or leader and indigent. However, they directly communicate between groups which members are independent and the coordination process is informal and mostly happen in emergency situations

3) News media need mechanism of instruction and operation process from higher officers. The process has to me in the same direction of standard and policy objectives
 4) 2 types of communication are communicate in the organizations and outside organization. There is no problem in communication inside the organization. However, the problem in communication outside the organization is the communication system for far locations and 5) Standard and objectives of policy, there is no problem with the budget. However, the most important resource for success of policy implementation is support from government organizations.

2.3.8 Decentralization model of Disaster Management Policy

Implementation in District Level

According to Public Disaster Prevention and Mitigation strategic plan B.E. 2555-2559 (A.D. 2012-2016), Public Disaster Prevention and Mitigation Act B.E. 2550 (A.D. 2007) that focus on decentralizing and encourage local government to be able to self-organize in preparedness. Study model of policy implementation is a model of Decentralization Program Implementation Process, Cheema, G. S and Dennis A. R (1983) developed for the impact of development evaluation which decentralized power to local organizations to have the self-organize ability. Under the consumption the operation in local level influenced by 4 variations see in figure 2.6 are;

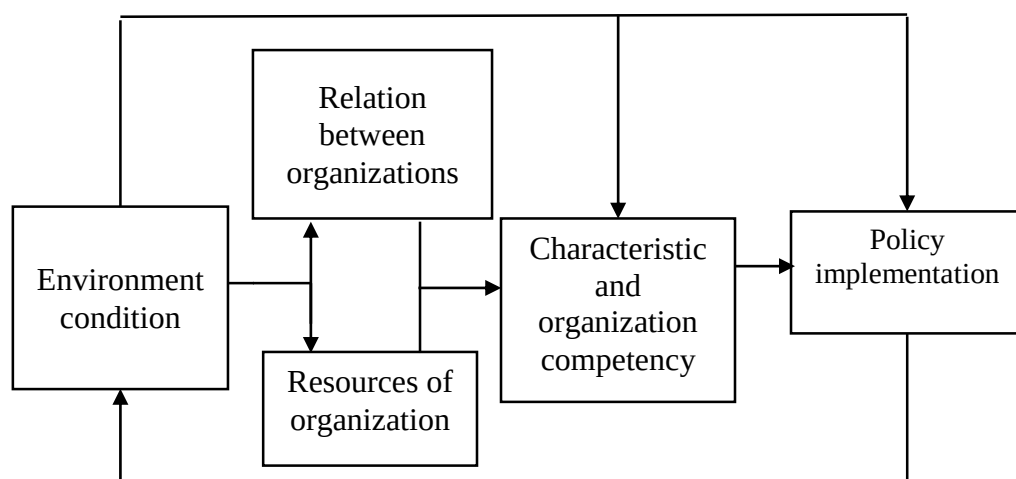


Figure 2.6 Decentralization Model

Source: Cheema and Dennis, 1983.

1) Environment condition which outside factor is the relation of organizations and inside factor is resources that directly influence characteristic and the ability of operation unit. And the impact is operation result and affection of operation plan.

2) Relation between organizations relation between resources of organization for plan implantation and characteristic and ability of operation unit.

3) Resources of organization for plan implementation are skilled management and operation levels which related to environmental condition and relation between organizations in resources exchange.

4) Characteristic and competency of the operation unit which indicates which indicate whether human resource, material, budget, and management structure are enough. Which effected by the relation between organization and resources which directly affect operation result.

This research study policy implementation in district level which decentralized power from central government by using decentralization model to study policy implementation in integration coordination between organizations according to public disaster prevention and mitigation strategic plan. Independent variables of initial factor in coordination between organizations in inter-organizations according to Comfort (1999) and dependent variable from Public Disaster Prevention and Mitigation strategic plan B.E. 2555-2559 (A.D. 2012-2016) assessment.

2.3.8.1 Independent variables

1) Relation between organizations are

Initial factor in coordination inter-organizations

- Connect articulation of commonly in earthquake disaster preparedness.
- Trust in leaders, organizations and population in disaster management.
- Sufficient resonance between Local administration organization and community in disaster management.

Information exchange

- Diversity of organizations in information exchange process necessary for preparedness.

- Information exchange for disaster preparedness between community, Local administration organization and provincial organizations.
- Information exchange between organizations and community in disaster warning.
- Command and coordinate between organizations and community in disaster preparedness.

Acquisition in organizations and between organizations

- Acquisition in organization in earthquake disaster preparedness.
- Feedback loop in emergency phase response.
- Feedback loop in mitigation by revise local code of law.

2) Knowledge and resources for policy implement

Knowledge and ability enough for collaboration.

- Staffs have enough experiences in earthquake disaster preparedness.
- Staffs have enough ability for collaboration.
- Trained leaders or management staffs in earthquake disaster preparedness.
- Number of staffs are enough for earthquake response.

Resources for collaboration

- Enough budget for earthquake mitigation.
- Enough tools and equipment for earthquake mitigation.
- Enough knowledge and technology for earthquake mitigation.

3) Characteristics and ability of operation unit

- Organization structure in Local level is flexible and not too complicated.
- Organization structure in provincial level is flexible and not too complicated.

4) Environment condition

Sociological environment conditions are;

- Open for participation in formal policy-making process.

- Open for participation in informal policy-making process.
- Political culture gives importance to stakeholders' opinion.
- Political culture gives importance to direction in self-organize of stakeholders.
- Vision of leaders give importance to disaster preparedness improvement.
- Utilize media influence to expand knowledge in disaster.
- Population is disaster preparedness vigilant.
- Public utilities are improved in the area.

Economic environment factors are;

- Economic development in the community.
- Natural resources and environment richness enough for substance.

Geological and historical environment factor are;

- Historical records on disasters occurrence.
- Local customs support coordination in disaster preparedness.

2.3.8.2 Dependent variables

Researcher has designed evaluation for policy implementation in disaster mitigation by integration of coordination between organizations according to Public Disaster Prevention and Mitigation strategic plan B.E. 2555-2559 (A.D. 2012-2016). This strategic plan has stated direction framework for network coordination in public disaster management potential improvement in local level or coordinate with specialists, private organizations and civil sector. Local networks potential improvement and disaster prevention and mitigation plan in Chiangrai A.D. 2015 have stated strategy to urge all sectors and levels to create methods for disaster mitigation are;

1) Principle of national policy methods are

- Mitigation principle is economic, social and environment policy are stated public disaster mitigation in Nation economic and society development plan, encourage private sectors to participate in planning and budget allocation process.
- Support and allocate budget for public disaster mitigation.

- Learn and gather regulations, rules and orders in public disaster mitigation for improvement plans such as building code and impact on environment evaluation.

- Strengthen coordination between organizations and cooperation between government, civil society and private sectors in all levels.

- Support disaster management project are threat management process as well as potential improvement to respond and protect stakeholders.

- Encourage government organizations to continuity create population services plan when in disaster occurrence.

- Encourage and support coordination between government and private sectors projects. Private sector participation in public utilities building and improving under risk framework.

2) Disaster risk reduction methods are

- Revise and improve policies, laws and organizations in disaster risk management.

- Improve and encourage all sectors in plans, projects and activities operation in disaster risk reduction such as risks ranking, participation and budget plan.

- Support budget for policy implementation.

- Arrange agreements between civil societies in public disaster risk reduction plan implementation.

- Improve regulation in law enforcement development plan.

- Improve and encourage cognition to authorized persons and political sector in risk management.

- Appoint coordinator of related Minister in risk reduction.

- Establish public disaster management fund and a special fund for public disaster risk management, fund management and Committee of Ways and Means as well as issues of materials.

- Establish disaster management assembly in national public stage open for participation of all sectors to discuss, knowledge and experiences. This stage objective is to find the solution for common issues, suggestions and public policy in risk management improvement. The meeting should be held at least once a year or depends on situations.

Hence, success of policy implementation evolution in district level operated by Local administration organization according to 9 important methods are;

1) Encourage population to be vigilant and recognize risks from earthquake disaster lesson learned visualization, improve and encourage authorized persons and political in risk management.

2) Strengthen community for earthquake preparedness improve and encourage a community to operate public disaster risk reduction plans, projects and activities such as risks ranking for management methods.

3) Connect information and data between local and regional organizations strengthen coordination process between organizations, provide communication channels between organizations, resources for affected areas by identify main organizations and coordination organizations in commanding system.

4) Communication between local and community for disaster preparedness and mitigation strengthen coordination process between organizations and provide communication channels between organizations.

5) Coordination between local and regional organizations encourage coordination, participation and budget plan.

6) Coordination between communities for disaster preparedness and mitigation encourage coordination, participation and budget plan.

7) Earthquake mitigation methods learn, review and revise related policy in public disaster risk reduction for development process such as building code and impact on environment evaluation.

8) Earthquake mitigation operation in local level establish public disaster management fund and special fund for public disaster risk management and improve potential of organizations for responding and protecting stakeholders.

9) Earthquake mitigation operation in community level improve potential of organizations for responding and protecting stakeholders

2.3.9 The Framework of Intergovernmental Crisis on Policy Implementation in Community Level

According to article 12 of Public Disaster Prevention and Mitigation Act B.E. 2550 (A.D. 2007), involved organizations must continuity and systems operate and

Public Disaster Prevention and Mitigation strategic plan B.E. 2555-2559 (A.D. 2012-2016), focus on potential improvement for networks. Researcher chose the concept of intergovernmental crisis management Comfort (2007) to study policy implementation at the community level.

As a community is an actor impacted decentralization from Local administration organization as well as encounter the disaster first and environment operation is open, they have to be open for an operator in the system to take part of decision-making process and respond condition of the variation of a situation to adjust and balance in the emergency phase. Inter-organization. in crisis response in variation environment to flexible system need 4 factors are

1) Cognition is risk monitoring and realizes how to response abnormal situation such as duct into the safe place in earthquake occurrence, damages assessment, and cognition what is the following situation. Adjust from static management to flexible and learn to utilize innovation as well as adjust to disaster condition in each phase.

2) Communication leads to inter-organization operation as communication create share meaning in finding solutions between groups. Clear communication in operation adjustment and respect each other.

3) Coordination is an action actors and organization practice to achieve common objectives. Efficient coordination comes from good communication.

4) Control is the ability to keep the action to achieve common objectives to protect lives, property, and recovery. Control in this definition is knowledge, abilities and help to share in saving situation and control affected area. Organizations operate in their own ways to achieve common interests.

Policy implantation study in community level which decentralized by Local administration organization, Researcher use independent variables in initial factor of inter-organizations for disaster management and independent variations from Public Disaster Prevention and Mitigation strategic plan B.E. 2555-2559 (A.D. 2012-2016) are;

2.3.9.1 Independent variables

1) Cognition

- Aware of the damage caused by an earthquake.
- Aware of risk and safety in earthquake occurrence.
- Views on risk from earthquake.

2) Communication

- Gather necessary information for risk management in community
- Gather necessary information for vulnerability group management in the community
- Provide communication channels in emergency phase.

3) Coordination

- Community based disaster risk management: CBDRM,
- Recovery as well as create preparedness network.

2.3.9.2 Dependent variables

Policy implementation evaluation for disaster mitigation in community level with the integration of coordination between organizations according to **Public Disaster Prevention and Mitigation strategic plan B.E. 2555-2559 (A.D. 2012-2016)** conform to operation in district level mentioned in 2.4.6. We must consider operation methods to support public disaster risk reduction at community level are

1) Provide necessary tools-equipment for earthquake occurrence

- Vehicles
- Reserve communication equipment
- Disaster warning equipment
- Households provide an emergency kit in case of evacuation.

2) Improve ability for community members

- Ability to respond earthquake disaster in emergency phase improvement.
- Ability to respond earthquake disaster in recovery and preparedness phase.

3) Mitigation operation

- Hold the meetings to program the practice of the villagers.
- Establish disaster management fund.
- Earthquake drills.

4) Building improvement

- Improve earthquake resistant houses.
- Improve earthquake resistant temples.
- Improve earthquake resistant school buildings.

2.4 Policy network concept

As mentioned that policy network study is important for policy implementation study. Study disaster management strategic condition with top-down theories raise to networks coordination which is a selected method for this research. Because we faced problems about ranking and positioning relation of an organization in practice.

Integration of coordination for complexity response should start from study policy network to consider the relation of policy actors in each level. These actors direct and indirect influence disaster management. Since disaster management network is complex, dynamic and variously relate and overlap, actors have various degree of relations. Inter-organizations in policy making and politic analysis helps us see influence and relation of networks between institutions that caused interaction analysis, understanding and improvement suggestions.

2.4.1 Definition of Policy Network

Policy networks are sets of formal institutional and informal linkages between governmental and other actors structured around shared if endlessly negotiated beliefs and interests in public policy making and implementation. (Rhodes, 2006)

Policy networks study give importance to responsibilities, importance, and form of interaction between actors with interest between each other. The behavior of actors study is the way to find solutions and improvement. (March and Olsen, 2006)

Behavior and interaction of policy network study are important for disaster management as relations structure between actors in policy process study helps us see an empirical picture of conditions in management level in the government system. Openness raises to trust and communication to reduce uncertainty. And manage the changes which policymaking is needed. This decision based on the coordination of common interest according to Rational Choice Theory. (Montpetit, 2002).

Policy networks are institutional setting on an interaction between formal and informant government and private organizations under laws and regulations of government organizations in policy implementation lead to benefit exchange.

2.4.2 Study Method and Related Theory of Policy Network

Policy networks study tends to utilize **Anthropological methodology** and Political Science. Because political methodology alone is not enough for follow up and interpreted the changes of policy and result of a policy.

Apart from anthropological methodology to study relations between sub-groups, inter-organizational relations based on **power dependency theory** to consider hierarchy in relations of resources dependent and games theory to study negotiation in resources exchange. Networks behavior dependent on resources, information, laws in the achievement of policy objectives. (Rhodes, 2006) Coordination of government organization is centralized and critical top-down relation between social groups and public organizations raised to efficient coordination, trust in individuals is horizontal relation able to rise to informal relations help smoothen coordination process. However, horizontal relations make it difficult to coordinate with the government sector, Chisholm (1989).

Public policy making explanation by utilizing group theory suggested to win over the power and benefit of between interest groups. Sombat thamrongthanyawong, (2001) explained this concept that the balance between groups consider public policy is the result of balance of fight between groups, these balances caused by influence between interest groups agreed and compromise on changes. Policy change direction to the more influenced group and weaker groups loss their benefit in this process. Bargaining and compromising caused by making an effort to gather the majority.

Policy implementation in system theory explained reactions of actors relate to environments as a political system is similar to organism system. Easton (1953) modified in explanation that politics exist as political life, the relation between political system and political environment is an input. These inputs are demand, requirement, and support of population and society. Political system liken to black box is structure group and relate to political and management activities. Meanwhile, the power of management is in the conversion process. When input comes to black box process, the result is output and this output impacts political environment in the form of feedback to respond requirement of society and support of the population. This reaction raised to the dynamic system by adjusting to create a balanced system.

Political institution structure, organize institution and institution processes in institutional theory relate to policy-making and policy implementation, James E. Anderson (1994) suggested that political institutions are a part of system theory because political activities centralized in political institutions in general. Policy will not be public policy until those policies were consented and implemented by government organizations. Government institutions is legitimacy agency of policy as those policies will be committed by population, (Dye, 1984). Sub government are individuals who relate to politicians, parliament system in public solution specialist, government operation system and scholars implement the policy. 3 connections are government officers and related organizations influence public policy implementation.

Dye (1978) Understanding rational decision making is a model emphasize value of public policy. Rational-choice theory uses in economics analysis based on the idea there are no policy cost more than interest value. The differences of archived value and loss value must be positive. The change in policy or policy implementation according to infinite changes of environment condition.

2.4.3 Classification of Network Level and Characteristics

Rhodes (2006) who created the main concept of policy networks study the classified relation between organizations in 3 levels are.

1) Macro level overall of the relation between central organizations and actors who implement the policy study.

2) Meso level relation between government organizations in regional level such as district organization, provincial organization and local organization in resources exchange, allocation of resources and power dependent study.

3) Micro level relation between organizations and individuals or sub-organizations to consider sub-system behavior study.

3 levels of policy networks consideration found that relation in meso level link to micro level by depending on government, macro level networks specify overall of power. Policy community is the destination of all relations which classified by participation condition are;

1) policy/territorial community which is closed system, specify territory of relation and top-down relation.

2) Professional network is closed system as well. The leader is the main influencer. Top-down relation.

3) Inter-government network central government and local government are the center of relation. Most of them are the horizontal relation.

4) Producer network business group is the main influencer. Number of member change according to change of interest group. Most of them are the horizontal relation.

5) Issue network which is an open system. Alter after level of issues. Most of them are the horizontal relation.

Movement of policy community in Thailand, Prapart Pintobtang (2005) found that Issue network such as agriculture, environment, and alternative medicine play a role in the link the relation cross border, the coordinate network is the mechanism of strategic connection of civil society in the area. Hence, it became policy networks to create public policy together. Public policy networks. Public policy networks able to have many functions in policy making, policy follow up, identify issue and policy improvement. The most important lesson depends on public policy operation process should support policy networks, groups able to participate in suggestion, offer and negotiate. Hence, discussion and consult policy analysis which focus on social sector creates room for sectors to participate.

Conform Coleman and Perl (1999) suggested that subsystem of policy network need mediator between policy communities and perform as policy interpreter between 2 policy communities with different paradigms to concert policy making. For example, create policy in banking and agriculture, this process need mediator to interpret and connect paradigms of both sectors, consulting process lead to policy making need mediator to balance both communities' requirements.

2.4.4 Policy Network related to Disaster Management Study

To understand policy networks in disaster management coordination, Mohammad and Kwanju (2013) studied policy network of disaster management in Japan and America. Classified actors and level of networks to see the relation of participants which is components in policy process according to Table 2.4, participants both individual and organization have the common interest in policy achievement.

Consider the number of participants and characteristic found that we can classified participants in 3 sub-components are 1) Actor 2) Attitude 3) Motivation. Size of participants in the network is a component in network unit analysis. Relation, interaction, and type of relation need to be studied as well. Interaction is “core” of process raised to resources exchange. Interaction component, the frequency of interaction and relation direction will be explained subcomponent of policy networks. And relation shows the network structure influence policy result. In other words, interdependence shows coordination or conflict in the network. Exclusion is the degree of openness for the new member to join or withdraw from a network. Network component analysis needs to consider basic components are relation and type of participants which is an influent factor in the change of network structure.

Table 2.4 Component and Variables in Disaster Management.

Component		Variables	Detail
Participant		Actor	Government and private sectors
		Attitude	Proactive or defensive behavior
		Motivation	Motivation
Relation	Interaction	Frequency	Relation and interaction of actors
		Direction	Single direction communication or data exchange
	Network	Interdependence	Coordinate or uncoordinated
	structure	Exclusion	Open or close for new participants

Source: Mohammad and Kwanju, 2013.

Dynamic of policy network, Mohammad and Kwanju (2013) study interaction all component in disaster management to see the type of network and how to encounter disaster management from the policy network component are participants, interaction, and structure. How do they respond to disaster management in figure 2.7.

Study result found that disaster management coordination failure caused by 4 main problems are 1) **Lack of coordination** 2) **Lack of communication** 3) Lack of

leadership and 4) **Lack of help from an outsider**. These problems can be improved by hierarchical connection as well as community based open system connection.

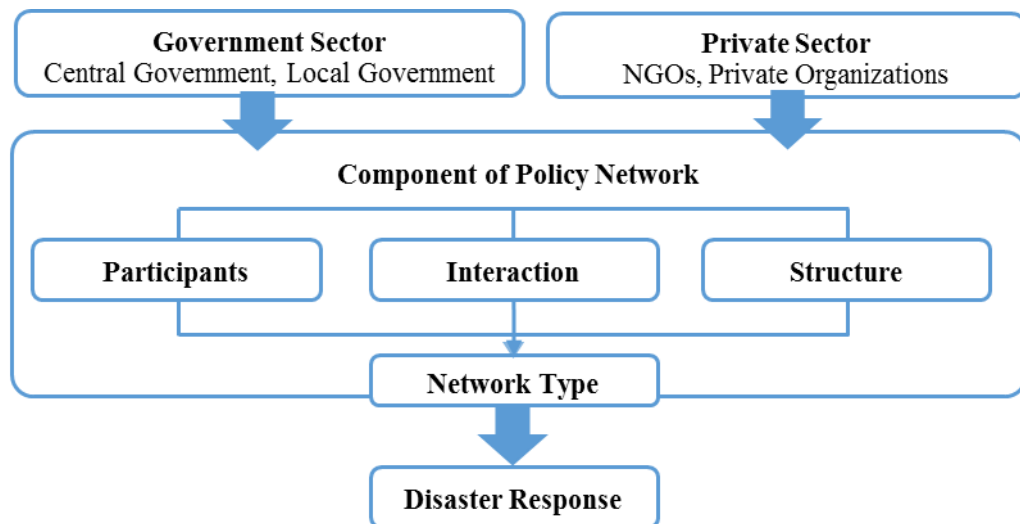


Figure 2.7 Policy Network in Disaster Management

Source: Mohammad and Kwanju, 2013.

Policy network in disaster management in Thailand, Sirirak Singhasem (2011) compared **Flood management in Nakhon Ratchasima and Chiyapoom in 2010** found that policy implementation in local level is in line with public disaster management structure stated in hierarchy and allocation of resources. In fact, an informal relationship between organizations own resources and local organizations is the indicator of negotiation and coordination. To conform duties appear to be conflicts caused by confusion in job roles. Disunited integration in goal and operation process caused wasting of resources and ineffective in policy due to duplicated work in disaster management. Failed result of policy appears in delayed resources support from provincial organizations. Disaster management lack flexibility because of centralized management structure paralyze local organizations power in management and possession of resources. Researcher have assessed problems and suggestion in each aspect are;

Resources aspect, Nakhon Ratchasima is the center of public disaster mitigation, they are highly prepared in resources and coordination from organizations.

Meanwhile, Chiyapoom is a small province and distinctive. Management readiness mainly comes from coordination of government organizations. Which is lacking participation of stakeholders. Researcher suggested that local organization should increase their potential in resources management, encourage negotiation in resources exchange methods and flexibility in cross jurisdiction such as lending equipment cross SAOs. As well as cross-functional such as military change their missions to helping affected area in an evacuation. Function has to improve in uncertain situation accordingly.

Management structure aspect Public Disaster Prevention and Mitigation Act B.E. 2550 (A.D. 2007) assigned local organizations such as municipals and SAOs authorized in decision making and resources to manage disaster in their own areas. Operation at local level highly flexible. In case of excessive crisis and local organizations not able to manage, coordinate with district organizations. District organizations are mediator function as coordinator from the provincial organizations who are holding resources. District represent the provincial unit. The problem in this aspect is district authorized in coordination. However, they are not authorized in top-down decision making. Hence, they do not own resources for public disaster management. Operation at the district level is slow as they are lacking resources and decision-making authorization.

In case of Pak Thong Chai district, they didn't have district chief, they didn't have a coordinator to coordinate with provincial organizations. Hence, top-down management in the area completely stopped. The researcher suggested that district level should have public disaster prevention and mitigation office for resources supply and short-term operation while waiting for provincial level.

Nakhon Ratchasima municipal and Muang Chiyapoom municipal are local actors who have high resources and authorization in decision making. They chose to coordinate with "military" as they have resources for disaster management, real authorization not in hierarchy system. This informal relation means local have enough resources and power above provincial organizations. Provincial authorization over local organizations is decreased as they are resources independent. Actors seek participation with organizations that they have resources dependent.

Communication aspect, communication in Chiyapoom different from Nakhon Ratchasima's in crisis. In term of communication between commander and operation in Chiyapoom is two-way communication between the provincial governor and governmental actors participate in the operation. Their information management is flexible. Meanwhile in Nakhon Ratchasima, provincial governor focus on united command communication. Centralized management structure according to the code of laws. Coordination of participants in bottom level is impossible. Furthermore, they have actors who are not under the command of provincial governors such as rescue unit and private sectors. Centralized management cannot control these actors.

Coordination aspect, apart from lack of skill problem in disaster management at the local, both provinces came across organization cultural diversity. Actors lack of trust in management and resources possession potential. Local organizations chose to coordinate for resource exchange with other organizations directly rather than coordinate with provincial organizations. The study suggested that motivate actors to have cultural openness for learning between actors and change organizational culture to confirm the operations to achieve coordination and learning exchange. These suggestion support organizations to achieve resources exchange. Budget factor is an important condition for the possession of the provincial unit. This process should be opened for the local unit to acknowledge and participate in making the decision on resources management direction. Budget condition improvement and bottleneck process caused by lack of interaction solution, should be participated by related actors to utilize resources in authorization and interaction between actors.

Policy improvement and policy implementation, there is a question of improvement. 10 years ago from Tsunami disaster to Flood, Have Thailand improve disaster management at all? Tavida Kamolvej (2014) summarizes an important answer on this improvement, Tsunami disaster has made Thailand started to pay attention to preparedness. Warning system in the coastal area where damaged by Tsunami was prioritized by the government sector. However, local authority lack experiences and network cooperation. These conditions make it difficult for recovery and emergency phase response in practical.

In contradiction, disaster management cycle was difficult to operate in the severe flood in 2011. Because flooded area expands in wide areas and various stage of

disaster in different areas (While the affected areas in the north started recovery phase, the central area started emergency phase as flood water just reached the affected areas). The government faced the problems of management decision making when flood water reaches Bangkok area. The government had to manage all 3 phases of disaster are preparedness phase, emergency phase, and recovery phase. Although organizations are experienced in flood response and flood disaster occurred little by little, Inefficient and ineffective management still happened. Organizations integration is in policy and operation plan. However, integration of coordination isn't organization culture as well as lack of Standard Operating Procedure: SOP for collaboration in Incident Command System: ICS. Indistinct network management in the direction and lack of operation detail for communication between organizations.

Coordination in those conditions is difficult and confusing. Especially, flood management of Bangkok which lacks trust in the inefficient decision making of Flood Relief Operation Center established by the government. This condition caused communication failure and conflict with Bangkok Metropolitan Administration City Hall (Bangkok) in disaster management coordination. While news media report on situations differently. Disaster management theories call "Disaster is a diplomatic policy". The government underrated influence of media in causing the conflict, the indistinctly communicate to risk areas, flood area, and resistant areas turn into the double standard that caused political conflict between Flood Relief Operation Center and Bangkok.

Disaster management in Thailand from Tsunami disaster study to utilize lesson learned in the severe flood in 2011. Tavidia Kamolvej (2014) suggested that consider socio-technical element in the complex adaptive system, disaster management in Thailand have improved from non-adaptive to emergent-adaptive. As a result of Laws, disaster management policy, plan, flexible collaboration and authority systematically positioning connect from national level-provincial-district-local. Although there is the condition in coordination, the conflict between organizations as well as commanders lack knowledge and experience in the emergency phase, sectors have to share the lesson learned and experience between the organizations that comes from the flexibility of organizations.

Important issues should be improved for disaster management efficiency in Thailand are 1) Political sector shouldn't interfere public disaster management. 2) Accurate the information technology and data system improvement. 3) Incident command system (ICS) improvement and standard operating procedures (SOP) as a mechanism for local organizations. 4) Improve regulation and disaster management plan indicate that disaster management staffs have to pay attention to disaster management more than politics. 5) Strengthen efficiency of disaster risk reduction for staffs and community in all levels to understand coordination networks and build up preparedness culture.

2.5 Social Network Analysis

Social networks analysis is a useful tool for studying various relations in the networks and organizations in unstable condition. Analysis result makes us understand that flexibility help organizations in efficient plan and operation. Lesson learned about relationship management and network extension conform to disaster period of time. This lesson increase opportunity in the encounter with disaster in each phase.

Social networks analysis is a tool accepted in general for studying social support network, communication and preparedness improvement methods. Magsino and National Research Council (U.S.) (2009) found empower all members of the community to be collective in preparedness, emergency response, and recovery phases. This statement comes from social networks analyses in disaster management and brings in suggestions on roles improvement, network structure, interaction and communication role as well as get rid of the condition and create opportunity in preparedness of the community.

Researcher believe that disaster response methods in Chiangrai province study must analyze social networks from interaction in 3 levels are 1) Collaboration organizations in the network continue their operation by having common achievement relation 2) Coordinate organizations operate by having common achievement and operation plan relation 3) Collective organizations define achievement, operation process, and consistent operation and those plans will be considered along with policy network analysis in disaster mitigation and create suggestions in integration

coordination between organizations according to public disaster prevention and mitigation strategic plan conform to natural setting of affected areas.

2.5.1 Definition of Social Network

Network means the group of individuals or organizations willing to communicate or coordinate operational activities. Those individuals or organization must not give up their free will. (Seree Pongpit, 2005)

Social Network means series of the relation between individual, groups or organizations for resources exchange. Resources are data, information, service, and suggestions. (Kasem Nakhonkhet, 2011)

Social network analysis is the method to identify actor or organization have a relationship with other actors or organizations. Inside of the network at the period of time, type of network structure appearance depends on the interaction between networks members caused several of structure. (Sarit Tiya Wongsuwan, 2012) And Satian Jirarangsiman (2007) classified type of network are;

1) Area network which means individuals and groups form the network in residential areas or collective activities such as community networks, district network, provincial network, watershed network and international network.

2) Issue network which means network formed by problem issues or activity issues. This type of network disregards area dimension but concentrate on activities in those issues to create coordination with other sectors such as environment network, human right network and consumer protection network.

3) Functional network which means network formed up by mission or benefit allocation. These group of the network can be government sector, population sector, business sector or civil society sector. Operate under the common concept, achievement or structure of groups.

Social networks analysis currently utilize is modified Technique in 3 divisions of sociology are Social Psychology, Anthropology, and Social sciences. Social Psychology usually used in cognition process and social relation analysis. Anthropology utilizes in the natural setting of target group study. Social sciences utilize in role-position under hierarchy or social system influence conflict or benefits

management study framework. Hence technical terms borrowed from this concept as much as modified science.

2.5.2 Social Network Methodology

Most of research in social science don't need to strictly follow a methodology. Most of the process is qualitative research which flexible for data collection. Conceptual idea, in theory, to design network structure before data collection and design improvement along the way make it easier for research. Social networks study in general included 9 steps are

Step 1 Literature Review

Review similar research papers help create the questions and clearly design network analysis. Prell (2011) suggested that should give importance to reading literatures in social networks and modify them to the contents we are interested in. And design methodology according to the research. And try to pose a question in the research we are working on in the meantime and collect the data. During data collection, we are able to improve data collection methods and analysis.

Step 2 Conceptual theory improvement

Design empirical model in the method utilized by anthropologists and social scientists since 1950. This step makes us see conceptual concept improvement in network data collection start from the introduction of direct observation not theory. But blend the theory with collected data. However, there is various type of networks, latter study usually utilize deduction methods. Proceed the data which was noticed according to the conceptual theory first and examine concept from collected data is another method to find the answer of the network. Clyde (1969) quoted in Prell (2011) using induction to study network formation concept to model first and collect the data to assure that observation followed in the theory.

Hence, knowing that studying network should have why type of network helps data collection designation and examination process will be easier. We should consider the network we are interested in similar to concept or theory such as social capital, social exchange, biased net Theory, social influence and social selection.

Step 3 Improve research questions or hypothesis of the research

After induction of concept or theory for data collection, research questions and hypothesis of the phenomenon to be studied is the following step. Research question helps us see variables or variables series. For example

- How do actors influence by the network in resources access?
- How do actors social support from the network?
- How do network structure impact news media?

Following are samples of questions to find variables in the network. These variables are dynamic, improvement and maintenance of network structure.

- How do social relationships between individuals impact the organizations?
- How physical geological influence news media?
- Does similar characteristics of actors cause the similar type of relation?

Sample of questions helps find network analysis methods. Researcher has to guess the conditions occur in the networks and identify question in influence variables to relation and network structure. Hence, consider the role of social networks relate to variables helps us see the formation of relation structure in the networks we are studying.

Step 4 Identify population group, samplings, and network boulder

Network boundary is necessary knowledge apart from structure and type of network. Network information such as centrality and density are the output of analysis depends on population and samplings. There are 3 options for network boundary

Option 1 actual approach (or necessity) boundary is actors are actual actors in the phenomenon, associate or organizations. Researcher search for related actors by collection accurate data from network members to create network boundary. Research must be sure that the interviewees completely understand the question.

Option 2 the nominalist approach select trustworthy nominees according to the conceptual theory such as focusing on individuals who coordinate with organizations or social situations in that period of time to study relation and influence to situation in that period of time. However, researcher able to specify main point to

observe influencers. And have to assure that network image under this boundary is theatrical accurate.

Option 3 snowball, select the samplings this method is sampling collection start from interview initial groups who represent the networks on who are the key persons in the situations. Researcher follows those next key persons to collect the data and repeat this process until we reach saturation point (both resources and researcher). The problem with this method is snowball samples are subject to numerous biases. The term "snowball sampling" reflects an analogy to a snowball increasing in size as it rolls downhill. In other words, time spending in collect the data rather than find network boundary. Researchers should specify “Zone” series of data shows sub-network from samplings at the same time. Zoning also helps us consider research questions and understand the main point for data collection in the zones.

Step 5 Data Collection after identified research questions and network boundary, data collection in interested variables. There are 4 methodology options for creating image of data collection process are;

Option 1: Questionnaire and/or structural interview

For close questions in quantitative data collection, Researcher usually uses Likert scale questionnaires in data collection. In fact, the questions can be both closed end and open end questions. However, most of the researchers use the quantitative method and open end questions interview actors in the networks to pull out memories of sources and recruit future subjects from among the networks.

Free and fixed recall free recall requires participants to output as many items from the study list as possible in any order. The researchers start from ego network expand to outside of the boundary. Meanwhile, researcher questions them in relation to network recalled by actors.

Crafting your question there is no answer to how many questions to be able to collect enough information for Network relation characteristics. However, one question can't be enough. A method widely utilize is crafting your question such as;

- 1) Who gave you advice?
- 2) Who gave you advice in difficult situations?
- 3) Who gave you advice in difficult situations that need technology utilization such as the computer?

- 4) Who gave you advice when you are facing difficulty from your commander?

As we can see that the first question might be of no use for analysis. However, it's the question that leads to the real answer to the following questions. Majority of the following questions are deeper and reveal more information in relation.

Option 2 Observation

From the first option in data collection, both interview and questionnaires can an error from "Question" method. Meanwhile in "Observation" method, the researcher not able to trust in recall memories only. The observation on the interaction between actors needs to be studied. Data collection in observation method has to start from clearly define the definition by coding relations of actors. Because participation observation in the situations every time is impossible. Hence, trustworthy data collection is difficult as well.

Option 3 Study from documentation and records

Data collection from the document such as journals, newspapers, records, articles and historical data is also social networks analysis method. Record various types of network relations data by using code such as 1) Relatives 2) Partnership 3) Employment 4) Relation in real estate 5) Position appointment and 6) Friendship. These relations information can utilize in economic decision making and dynamic in decision making the evaluation.

Option 4 Internet Resources

Facebook, Twitter, E-mail and online Medias have records of useful resources such as Wikipedia which is an intellectual community. Actors volunteer to create information as well as improve the information in this online encyclopedia. Information technology growth especially online media create enormous data exchange channels. Hence, data collection from internet resources can't be ignored.

Step 6 Consider collected data

After data collection process, the researcher has to consider the data in these main points.

Reliability and Accuracy generally reliability of collected data mean repeat experiment and repeat data collection, data cannot be changed. However, relations in social networks tend to change all the time. For example, the ratio of gender

in the groups or economic-social classes. Hence, social networks analysis have to take reliability in a different way into consideration. First of all reciprocal choice consideration which is 2 actors have relations in the same way such as if we ask a kid about who is his/her best friend and we ask that friend if the first kid is his/her best friend, if the kids give the same answer, this relation is reliable.

Validity of data for social network analysis, we look into response answer point, if samplings response the correct answer as expected by the network. For example, “Who will you talking to?” If this is the question of network analysis, that’s mean the interviewer’s intention is to indicate that who is nominated in data exchange in the network. If the interviewee response in the term of objective, data is validated.

Missing data by using questionnaire, interview and free and fixed recall, there are chances of missing data. Those missing data might cause by forgotten or error data input as the perception of people are different. Furthermore, those data might be noisy data as a result of an error in network boundary or fixed data collection design. Hence, consider data correction or error structure.

Ethical concern in social network analysis starts from data collection. In other words, roster design for actors’ assessment. Sometimes informants get confused to see that some actors are not their network members. Solution is let the informants see only data related to their networks. And utilize snowball data collection for cumulative data collection. If the informants refuse to participate, the researcher has to leave out that information also.

Although these relation approaches were coded, the researcher has to respect informant decisions. Also facebook and social media, these media have privacy setting. Researcher has to consider informant’s privacy setting in the disclosure of information. Analysis suggestions also need to consider the impact of the consequence of informants in term of economic benefits, trading, employment status and social action that might be changed after disclosure of information. Solution for this issue is defining code instead of real names.

Step 7 Data management and structure layout, arrange the roster.

After data collection process, the researcher has to arrange data in the table in an appropriate manner. Data arrangement for missing data verification and make it easy for data management on the computer.

Step 8 Network visualization by using computer program

There are several programs for network analysis and visualization of graph shows relations of actors and Topographical type of network extension or fall off the network point.

Step 9 Analysis and study result interpretation

Final data is statistic descriptive such as density, centrality, variable distance range, S.D. for Social Science research. These statistic data included qualitative data and visualization of the graph in various type of relations.

2.5.3 Explanation of Social Network by using Graph Theory

Before the understanding of social networks analysis, we should understand technical terms in social network analysis. Since social network analysis method is the concept utilizes import theories from several sciences are Balance theory from psychology, Social exchange theory from Social Science and Graph theory from mathematics.

First theory is Graph theory which utilizes mathematic theory to study social networks. We see several basic technical terms mentioned in the study, show the result of actors' formation. Individual actor will be presented by point, node and line represent the actors and ties in social network analysis see in figure 2.8

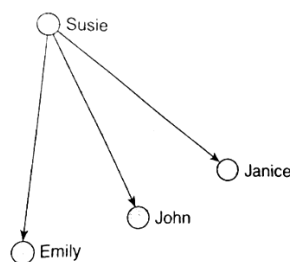


Figure 2.8 Sample of Digraph

Graph with arrowhead shows degree of interaction between node and vertices. “Lines” show relations usually these lines have edge or arcs show the direction of relation in term of giver and receiver, who benefit and who loss, nominate and nominee.

2.5.3.1 Technical Term used in Social Networks Description

For network description in term of Social Science, executors are “Actor”. However, in term of graph actors are node and vertices are;

Actor, vertices and nodes = are points in term of graph represent social entities interact with organizations in the network.

Tie = is connection (Relation tie) A relate to B.

Relation = relation between actors such as friends, family, and interests.

Ego network = social network included focal actor, ego, ego’s alter and the relation between main actors and tie or between vertices and vertices.

Social network = series of the relation of social entities. Characteristics of actors and relations.

2.5.3.2 Analysis

After data collection process, put those data in program and create the graph (Network visualization). Researcher has to process graph perusal by using conceptual theory specified in the beginning to describe phenomenon and relation appeared according to research question and hypothesis. Result analysis in general or graph perusal and come up with “result” in the topographic network along with statistic descriptive data. In this article present only graph format in initial level are;

Centrality measures centrality of actor indicates a position of those actors in the network. Individual who have relationships with more people will be selected to be a leader and centrality of society. Centrality visualization shows in star graph see figure 2.9. Actor A is a node with the degree of centrality (vertices) the most. Actor A has least distance range (between) others, closet to other actors.

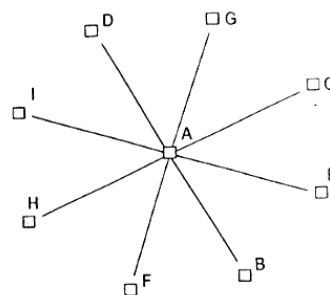


Figure 2.9 Sample of Star Graph

Degree centrality the indicator of centrality count number of altering which directly interact with the ego in the middle of the graph. We don't look into the direction of relation. Have more alter means degree centrality is high. Applications include identifying the most influential person(s) in a social network. For example, friendship graph sees figure 2.10. Actor A is the higher centrality as the have node (actor actors are E, D, C, B) connect in 4 directions, node A is focal actor.

While node F is the actor who has least node as F only have 1 node (Actor E). Node A has most connection which means A is Ego. If there is no E, actor F will not be in the group.

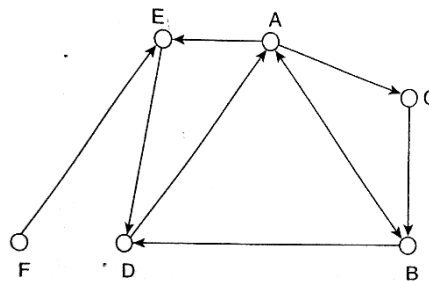


Figure 2.10 Sample of Friendship Graph.

Betweenness centrality is a measure of centrality in a graph based on shortest paths. Which mean who is the most efficient in connection controlling see picture 9, node C is between actor for O and C groups. If we remove C, Relation between O and C group will fall apart. Node E is betweenness actor with F. Hence, in communication network betweenness centrality shows data forwarding from source to destination.

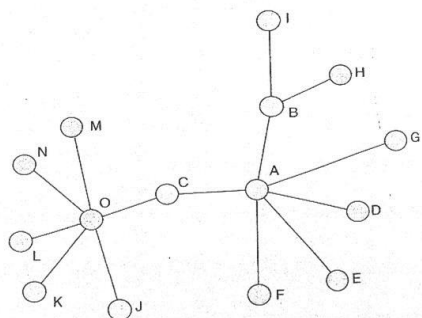


Figure 2.11 Sample of Betweenness Graph.

Closeness centrality mentioned above can be easily explain that degree centrality focus on focus on activities and betweenness centrality focus of system controlling or flow of data. Closeness centrality focus on actors' dependency.

Closeness calculated as the sum of the length of the other actors (number of lines to centrality) see figure 2.11. Actor F is farther from other to in the network. In other words, A have 1 length to other actors but F have 2 or 3 length to other actors. F is closeness in the network.

2.5.4 Phenomenon Explanation on Social Network Analysis

2.5.4.1 Positive and Negative relations in social network analysis

In fact centrality calculation have to consider positive and negative relation in the network as theories and phenomenon have to explain in both side are;

Negative relations in case of data exchange and trade bargaining, we found that “centrality” impact in negative relations when zero-sum basis. Actor with less power and lower status in the network will be disadvantaged. This type of graph is hub or star will be benefit in the relation. While vertices will be disadvantaged.

Positive regulation found in the situation that no zero-sum exchange. Actors in the network have opposite power. None of the vertices being disadvantages such as communication network or influence network. This relation found the case of centrality tie with actors with higher influence.

2.5.4.2 Status and Role analysis

As the present perusal of graphs above, Network structure interpretation by reflect status and role is also an import part of social network analysis. Generally status analysis before role analysis. Status of the actor, in this case, is groups or block of the actor in the network. Role is the relation in the block.

2.5.4.3 Theories Explain the Phenomenon

Theories explain relations between individuals or organizations such as heterophilly theory explained that formal network groups in the organizations tend to divide in groups. However, informal group formation creates reliability in data exchange. Meanwhile, groups of individual in homophilly will make ones have close relationship will cause an individual to have both close and not close with members of

the new group if those individuals still have close relation with the group he/she left. These individuals can be broker to tie relation between two societies. New information and resources will flow through the strangers of society or organizations. **Strength of weak ties** is the bridge interweave these subgroup in the organizations.

2.5.4.4 Network Practical for Disaster Management

Baran (1964), general 3 patterns of the network in urban management are Centralize make actors in the system send information to central government and the only authorized organization to send the information back to destination is central government, Distribute let node directly tie actors in the system. This system shorten communication path, Decentralize is the mix of distribute and centralize which actors still depend on central government.

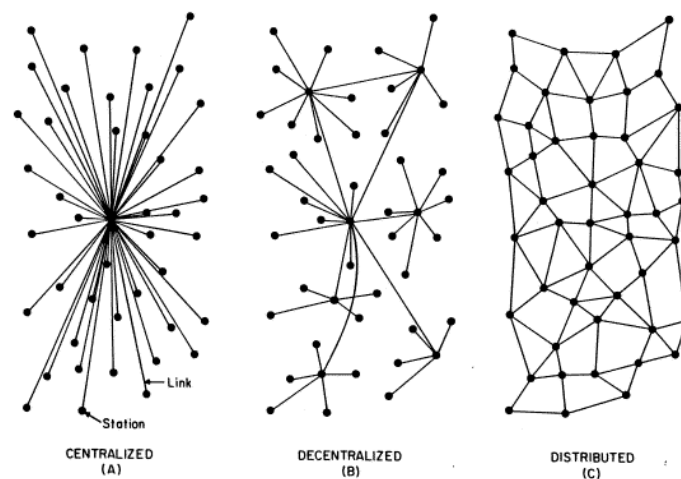


Figure 2.12 Town Administration Networks

Source: Baran, 1964.

Suitable system for unite disaster command is decentralize. In case of system failure, reserve command center, and subsystems still work. This system is good for disaster management in the emergency phase. However, the most conform system for disaster management is the flexible system. This system that adjusts from decentralizing in emergency phase to distribute to tie organizations in all level and sector for the recovery phase.

2.5.5 Social Network Studies related to Disasters Management

Shineha and Tanaka (2013) study gap of information in the earthquake, tsunami, and nuclear accident in Japan on 11 March 2011. They then looked at the information flow in mass and social media. Then draw on quantitative analysis, which includes a frequency analysis and a network analysis focusing on the co-occurrence of keywords (co-word), as well as a content analysis and the network structure. They found that during the first week of the disaster, there was a tremendous confusion of topics and agendas such as the case of missing, death, medical situation, help and transportation recovery. After that communication agenda getting clearer. Mass media started to use the same keywords and agendas on electricity and accident. The research summarized the study and found that we can see networks work collaboration in each phase of disaster management. Network analysis make us see the gap of structure, resources and public interest to evaluate damages and social condition caused the damages.

Huggins (2007) utilize social network analysis in earthquake disaster recovery and mitigation by comprehensive disaster management in hurricane preparedness in developing Caribbean countries, policy study, decision-making process and lesson learned to visualize. He believes that the mitigation will be better is utilize information technology and policy decision making improvement. Improve mitigation process during recovery by government sector and the relation between actors in recovery process are affected population, builders, designers, recovery units and disaster management organizations to study how do they support disaster preparedness process. There are 3 levels of study are 1) micro level, planning in households, 2) meso level, national planning and 3) macro level, regional planning. Objective of this study is to survey recovery plan and mitigation plan according to government plan and utilize geo-informatics of disaster organizations in the emergency phase. He found that factors support coordination in regional level for hurricane disaster preparedness are updated GIS information, connected information in regional level and joint command center.

2.6 Conceptual Framework

The above literature review enabled the researcher to create the conceptual framework, that in order to understand the complexity of the Chiangrai Earthquake disaster management, it is crucial to arrange the qualitative data of the actual operation into the timeline which represents the order that each actor was involved in responding to the situation during each period. Afterwards, the quantitative data from studying the result of policy implementation could be used to explain the output of the local level and the community level operation, on how the policy and strategy concerning the disaster management in the Chiang Rai Earthquake event had impact the inter-organization coordination. Then, the complex adaptive system would be used to explain the problems found, on what are the problems and obstacles in the policy of Chiangrai earthquake preparation, according to the strategic plan in disaster prevention and mitigation.

Finally, the social network analysis and the policy network analysis would represent the interaction within the system, on how each actor within the local policy network, provincial policy network, and national policy network would manage the earthquake event according to the strategic plan in disaster prevention and mitigation.

Therefore, this research utilize the mix methodology which evaluate the operation result according to the management structure, on how each action would led to the interaction of the actors within the system, in order to find the further suggestion to integrate the inter-organization coordination that support the Chiangrai earthquake mitigation.

CHAPTER 3

RESEARCH METHODOLOGY

Disaster Mitigation: The Integration of Inter-organizational According to Public Disaster Prevention and Mitigation Strategy Plan to Encourage Earthquake Readiness in Chiangrai Province. This study is a Survey Research by using mix method. Started from qualitative research by followed quantitative research. The researcher studied relation between organizations that work together in each phase of disaster are;

Emergency phase to recovery phase (May 2014 – July 2015). The researcher has participated in this stage for 3 months after the earthquake as a volunteer and participation observation during the operation. 1 year after the earthquake, the researcher has attended public stage in lesson learnt discussion on Public disaster management system improvement in provincial level, document compilation, interview person in charge regards operation process, making the decision on missions, issues and obstacle in resources distribution that happened later on as well as analyze policy network and social network. To see an overview of inter-organizations at the provincial level in emergency phase and recovery phase which took 1 year after the earthquake.

Preparedness phase (July 2015 – July 2016) this period is after DDPM implemented National Public Disaster Prevention and Mitigation Plan 2015. Office of Public Disaster Prevention and Mitigation Chiangrai ordered municipals and SAOs to revise district operational plan and this revise must be done by 31 July 2015.

The researcher marked this period as preparedness phase. Start from July 2015 and operation continue for another 1 year. Hence, quantitative research to study preparedness operation started in July 2016. This study focuses on the operation of SAOs which is the destination of disaster management power according to Public Disaster Prevention and Mitigation Act 2007. Using distribution of power model to study policy implementation in on the local. Community level will be the first unit who face the disaster. The missions related to local. The researcher uses the concept of intergovernmental crisis management. (Comfort, 2007)

Study policy implementation to see their capacity in handling crisis in the community. Concept and study method/ Conceptual Framework and Methodology of this research can be explained in 2 sections are Qualitative research and Quantitative research herein;

3.1 Research Methodology in Community Level

3.1.1 Qualitative Data Collection in Community Level

The researcher chose to collect qualitative data by in-depth interview and participant observation by attending workshop fix-build the houses after the earthquake with civil society disaster management Chiangrai network in June 2014 in 5 communities are;

- Baan Dong Lan community moo 17 Sai Khao sub-district, Pan District.
- Tung Fa Pa community moo 7 Mae Prik sub-district, Mae Sruay District.
- Huay San Plub Pla moo 6 Pong Prae sub-district, Mae Lao District.
- Pa Au community moo 1 Pa dad, Mae Sruay District.
- Huay San Pattana moo 6 Wiang Sruay sub-district, Mae Sruay District.

The researcher collects quantitative data by purposive sampling to in-depth interviewed with Village leader of Baan Dong Lan community about emergency response, recovery and preparedness in July 2015 (1 year after the earthquake). After rechecked by sources, the data will be used for questionnaire creation for quantitative data collection.

3.1.2 Quantitative Data Collection in Community Level

The researcher use qualitative data was compiled from above. The finding show the risk perception of the people are influence the risk control. Thus the quantitative framework are;

3.1.2.1 Quantitative Research Framework in Community Level

The researcher chooses a model of policy implementation study as the concept of intergovernmental crisis management in community level. The independent variable is the cognition, the communication, the coordination. The dependent variable

is the control which is the operation for reducing the earthquake mitigation by integrating inter-organizations according to DDPM's strategic plan in figure 3.1.

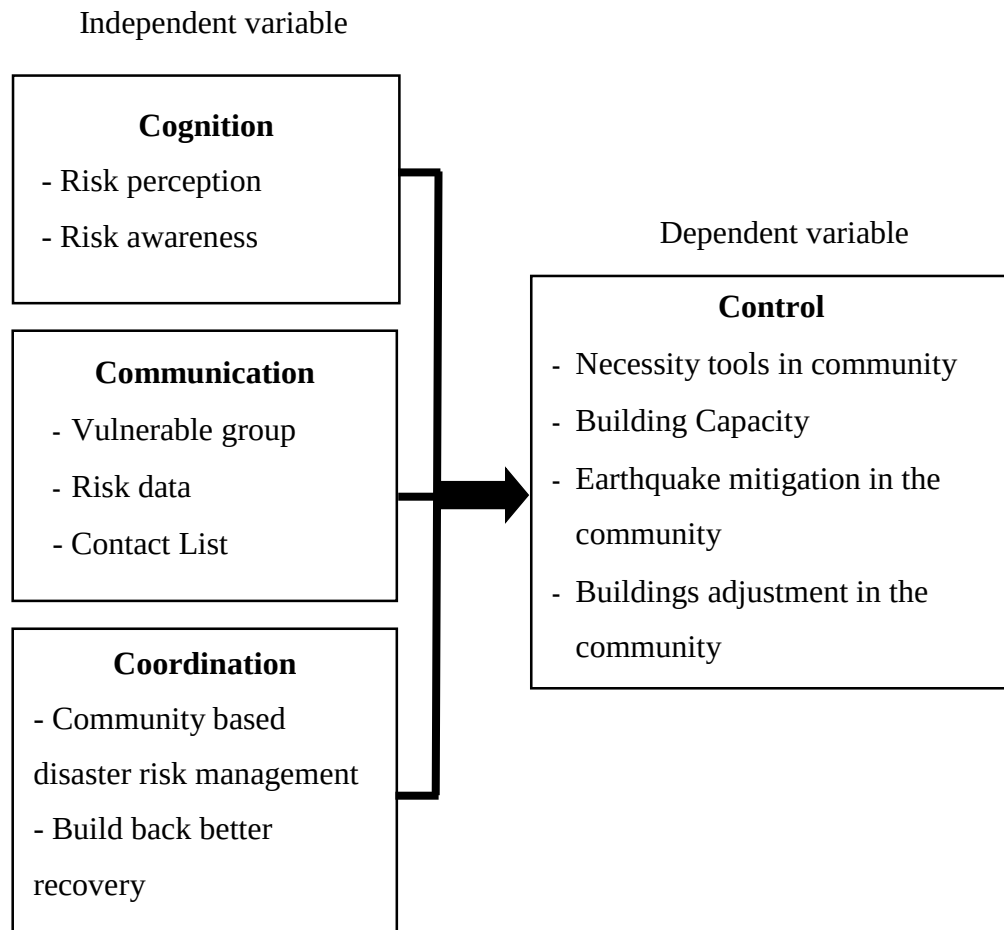


Figure 3.1 The Conceptual Framework of Quantitative Research in Community Level

3.1.2.2 Research Tool Assessment in Community Level

This questionnaire was verified the effectiveness by 3 specialists are;

- Dr.Surangrat Jamnienpon researcher at the social research institute, Chulalongkorn University, Specialist in Civil society and Social movement.
- Dr.Man Purothakanon Secretariat of Thai Water Partnership. Disaster management inspector, Office 1, Thai Health Promotion Fund.
- Pradit Jiarakunprasert Lecturer at Faculty of engineer, Technology Rajamonkol Lanna University. Specialist in building inspector.

They started with Content Validity verification, Language and the researcher have revised the questionnaire as suggested. Test the revised questionnaire with 30 people in the area but not the sampling to analyze the reliability by using Cronbach method to find alpha coefficient and the result is the reliability of the questionnaire. The completed questionnaire is ready to collect the data from samplings.

After revising all item past compatible which all item are over 0.60 Reliability of Alpha Coefficient of questionnaire = 0.906 Questions on awareness have reliability equal 0.907, Questions on communication have reliability = 0.904, Questions on coordination have reliability = 0.904 and questions on controlling have reliability = 0.904.

3.1.2.3 Measurement of Research Tool in Community Level

The researcher determined the measurement as suggested by the specialists. The measurement of the questionnaire according to Table 3.1

Table 3.1 Measurement of Research Tool at Community level

Latent Variable	Observation Variable	Item of question	Score	Measure
Cognition	- Risk perception	11-14	0= Wrong	>80 = High
			1= Correct	79-50 = medium
				<49 = Low
	- Earthquake risk awareness	15-17	1=very low	1.00-2.50 = low
			2=low	2.51-3.50 = medium
			3=not sure	3.51-5.00 = high
			4=high	
			5=very high	
Commu- nication	- Vulnerable group	18-22	0=No	0-0.33 = low
	- Risk data	23-27	1=Yes	0.34-0.66 = medium
	- Contact List	28-37		0.67-1.00 = high

Table 3.1 (continue)

Latent Variable	Observation Variable	Item of question	Score	Measure
Coordination	- Community based disaster risk management	38-45	0=No 1=Yes	0-0.33 = low 0.34-0.66 = medium 0.67-1.00 = high
	- Build back better recovery	46-55		
	- necessity tools in community	56-60	0=No 1=Yes	0-0.33 = low 0.34-0.66 = medium 0.67-1.00 = high
Control	- Building Capacity	61-62 63-69		
	- Earthquake mitigation in the community			
	- Buildings adjustment in the community	70-72	1=Low 2=More than half 3=All	1.00-1.66 = low 1.67-2.33 = medium 2.34-3.00 = high

3.1.2.4 Sampling and Quantitative Data Collecting in Community level

Sampling group are the village leader in Pan, Mae Lao and Mae Sruay District. These areas are located on the fault lines and there occur the aftershock. Sampling group are operation level. The researcher gave questionnaires to the village leader in the meeting of district chiefs and village leader during May-July 2015.

However, the respond rate was only 30%. The researcher sent out verified questionnaires as well as requested letter to them again by mail. Hence, the responder rate both in district level and community level is 60%. The questionnaire were incomplete and they are not usable 10%. Hence, the usable data from District level is 41 sets of the questionnaire from 65 Sub-district Administration Organization (SAO).

And the usable data from community level is 255 respondents of the questionnaire from 425 communities.

3.1.2.5 Quantitative Data Analysis in Community Level

The researcher put coding in the questionnaires and revised missing data by putting replacement of missing data, this analysis done by SPSS. Add average before taking the data to descriptive statistics test. Analyst basic statistics are the average number of general information of the respondents, this number will be scored and calculate into percentage (%) Average ($\bar{x}$) and (S.D). This analysis was done by SPSS version 20.

3.2 Research Methodology in Sub-district Level

3.2.1 Qualitative Data Collection in Sub-district Level

The researcher chose to collect qualitative data by in-depth interview and participation observation by attending workshop fix-build the houses after the earthquake with civil society disaster management Chiangrai network and interviewed Vice District Chief Officer from Sub-district Admiration Office Pong Prae, Mae Lao District, Vice District Chief Officer in social security from Mae Lao district and Office of Public Disaster Prevention and Mitigation Chiangrai, Wiang Pa Pao who supports unit in disaster management in Mae Lao District. To study a form of the coordination and problem in disaster management at a local level in 14 May – 27 July 2014 (First 3 months after the earthquake). The researcher focus on recovery phase after the earthquake as well as preparedness phase data collection 1 year after the disaster in July 2016 On the other hand.

- **Emergency phase** how do organizations operate, communicate, data exchange and inter-organizations.

- **Recovery phase** how do organizations operate, communicate and utilize data and inter-organizations in recovery affected areas.

- **Preparedness phase** how do organizations exchange data inter-organizations to create preparedness policy, new plans and policies as well as how it improves inter-organizations operation?

In the interview representative from organizations, the researcher focus on finding the relation between organizations, problem-obstacle in inter-organizations. The suggestion in managing for improve inter-organization between both government to government and government to other sectors. Then combine the result-social network analysis. And reflect study result to data givers in each level. To reflect the problem of a data connection from social network analysis, resources can recheck if the data is accurate and use those data to create a questionnaire to study the success of public disaster prevention and mitigation policy implementation.

3.2.2 Quantitative Data Collection in Sub-district Level

The researcher uses qualitative data that was compiled by social network analysis and policy network. The finding show decentralization structure influences the policy implementation. Thus the quantitative framework are;

3.2.2.1 Quantitative Research Framework in Sub-district Level

The policy implementation model must be decentralization model. The Independent variable are the relationship among organizations, natural resources and condition of the organizations. The dependent variable is operation for the earthquake mitigation by inter-organizations according to DDPM's strategic plan. Below figure 3.2

The researcher have created the questionnaire according to this concept for data collection from Sub-district Administration Organization (SAO). To study the success of policy implementation in the affected areas in Chiangrai are Mae Lao district, Pan district, Mae Sruay district, Phaya Mengrai district, Viengchai district, Muang Chiangrai, Pa Dad district. Total affected areas in Chiangrai are 65 areas. Office of Public Disaster Prevention and Mitigation Chiangrai ordered municipals and SAOs to revise district operational plan 2015 in 2 years after the disaster.

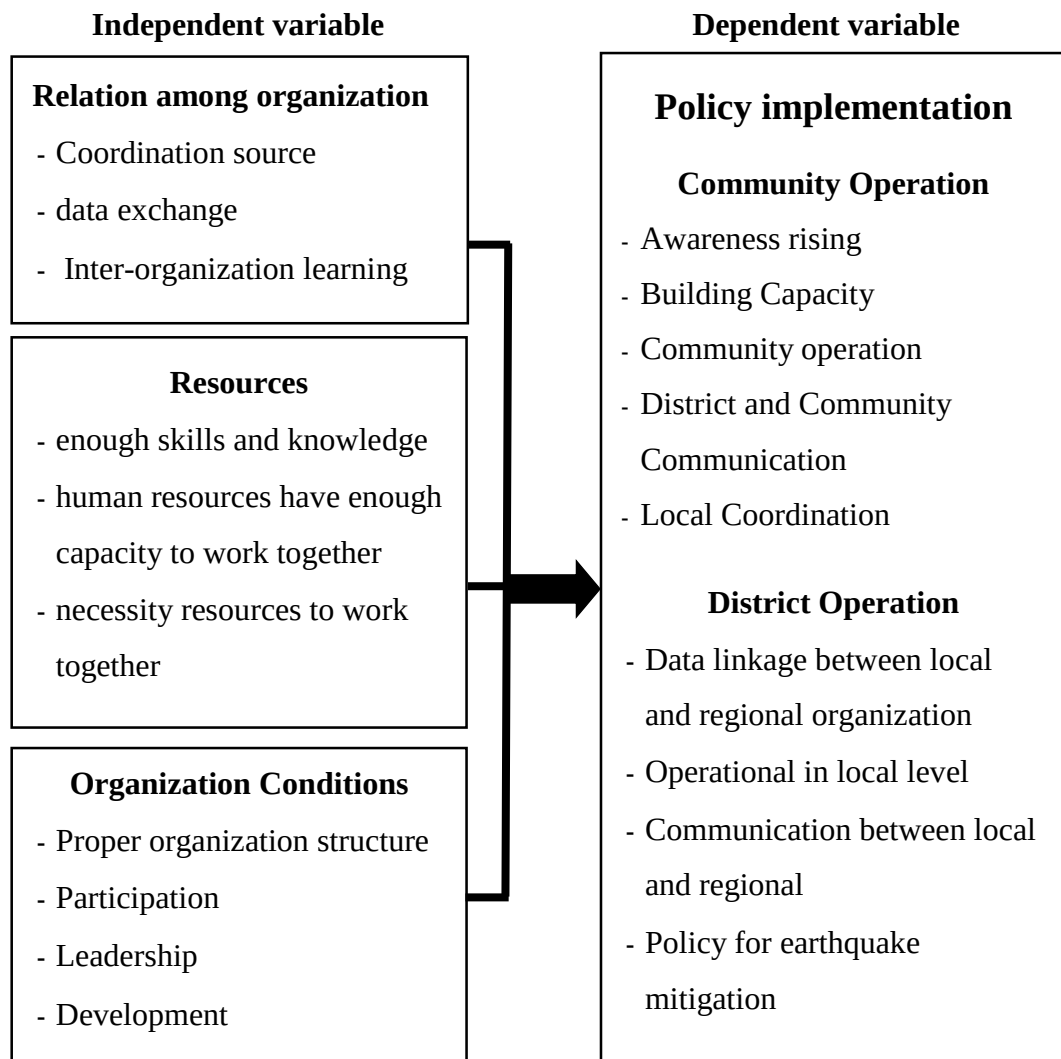


Figure 3.2 The Conceptual Framework of Quantitative Research in Sub-district Level

3.2.2.2 Research Tool Assessment at Sub-district Level

After the specialist are consider the content validity verification, Language and the researcher have revised the questionnaire as suggested. Test the revised questionnaire with 30 people in the area but not the sampling to analyze the reliability by using Cronbach method to find alpha coefficient and the result is reliability of the questionnaire. The completed questionnaire is ready to collect the data from samplings.

Questionnaire in district-level is verified the reliability by specialists index of consistency (IOC). After revising all item past compatible (over 0.60)

Reliability of Alpha Coefficient of questionnaire equal 0.958. Technical infrastructure aspect questions have 0.959 reliability, Cultural acceptance aspect 0.959 and Flexibility in the organization aspect 0.959.

The study on policy implementation, questions on the relationships among organizations have reliability equal 0.959, Resources for operation question group got 0.959, surrounding condition have 0.958 reliability and the questions on the success of policy implementation got 0.958 reliability.

3.2.2.3 Measurement of Research tool in in Sub-district level

The researcher have revises the measurement as suggested by the specialists then determine measurement the questionnaire according to Table 3.2 and 3.3

Table 3.2 Measure of the Condition in Socio-Technical Dimension

Latent Variable	Observation Variable	Item of question	Score	Measure
Technical infrastructure	- Management skills	1,2,4,5,6 11,14,15,16	1=none 2=low	1-2 =low 2.01-3 =medium
	- Building inspection	26,27,28,29	3=medium 4=high	3.01-4 =high
	- Data management			
Cultural Openness	- Conflicts caused by donations	3	1=none 2=low	1-2 =low 2.01-3= medium
	- Limitation of coordination in recovery phase	17	3=medium 4=high	3.01-4 = high
	- Understanding on roles and responsibility	18		

Table 3.2 (continue)

Latent Variable	Observation Variable	Item of question	Score	Measure
Organization Flexibility	- Relation	7,8,9	1=none	1-2 =low
	- Coordination	10,12,13	2=low	2.01-3 =medium
	- Command	19,20,21,22	3=medium	3.01-4 =high
	- Control	23,24,25	4=high	
	- Control by using laws and acts such as building code of SAO.	30,31	1= Very low 2= Low 3= no change 4= High 5= Very high	1-2.44 =low 2.34-3.66 = medium 3.67-5.00 =high

Table 3.3 Measurement of Research Tool in Sub-district Policy Implementation

Latent Variable	Observation Variable	Item of question	Score	Measure
Relation among organizations	- Coordination source	32-34	1= none	1-2 = low
	- data exchange		2=low	2.01-3 = medium
	- Inter-organization learning	35-38	3=medium 4=high	3.01-4 = high
		39-41		
Resources	- enough skills and knowledge	42	1=none 2=low	1.00-2.00 = low 2.01-3.00 =
	- human resources have enough capacity to work together	43-44	3=medium 4=high	medium 3.01-4.00 = high
	- necessity resources to work together	45-47		

Table 3.3 (continue)

Latent Variable	Observation Variable	Item of question	Score	Measure
Organization conditions	- Proper organization structure	48-49	1=none	1.00-2.00 = low
			2=low	2.01-3.00 =
		50-52	3=medium	medium
	- Participation	53-56	4=high	3.01-4.00 = high
	- Leadership	57-61		
	- Development			
Policy implementation	- awareness rising	62-65	0=none	0-0.33 = low
	- Building Capacity	66-70	1=Yes	0.34-0.66 =
	- Community operation	86-91		medium
				0.67-1.00= high
	- communication between district and community	93-100	0=N/A	0.00-0.99 = N/A
			1=Non	1.00-2.00 = Low
			2=Low	2.01-3.00 = Medium
	- Local Coordination	106-110	3=Medium	3.01-4.00 = High
			4=High	
Policy implementation	Sub-district operational (1)		0=none	0-0.33 = Low
			1=Yes	0.34-0.66 = Medium
	- Data linkage between local and regional organization	71-76		0.67-1.00 = High
	Operational in local level	77-85		

Table 3.3 (continue)

Latent Variable	Observation Variable	Item of question	Score	Measure
Policy implementation	Sub-district	101-105	0=N/A	0-0.99 =N/A
	operational (2)		1=Non	1.00-2.00=Low
	- communication		2=Low	2.01-3.00=Medium
	between local and regional	111-113	3=Medium	3.01-4.00=High
	- Policy for earthquake mitigation		4=High	

3.2.2.4 Sampling and Quantitative Data Collecting in Sub-district Level

The researcher gave questionnaires to the personnel in District Governmental Office supervisors meeting as well as Pan, Mae Lao and Mae Sruay Community Chiefs and Village Headmen meeting during May-July 2015. However, the responder rate was only 30%. The researcher sent out verified questionnaires as well as requested letter to District Administration Staffs and Village headman offices by mail. Hence, the responder rate both in district level and community level is 60%. 10% of the questionnaire was incomplete and they are not usable. Hence, usable data from district level is 41 sets of the questionnaire from 65 SAOs.

3.2.2.5 Quantitative Data Analysis in Sub-district Level

The researcher put coding in the questionnaires and revised missing data by putting replacement of missing data, this analysis done by SPSS. Add average before taking the data to descriptive statistics test. Analyst basic statistics are the average number of general information of the respondents, this number will be scored and calculate into percentage (%) Average ($\bar{x}$) and (S.D). This analysis was done by SPSS version 20.

3.3 Research Methodology in Province and District Level

Since researcher has defined “Data” is the factor that is in the middle of decision making and inter-organization, the question focuses on data exchange and communication in interaction between actors in public disaster management by using sociotechnical components to study the issues found in operation during the recovery phase and reduce the earthquake mitigation.

Compiling data on the relation of actors will be analyzed by social network analysis to show the structure and linkage of communication for data and resources exchange in management. After that, we analyze policy network analysis to explain that what type of network does that interaction creates and components of network are participants, interaction and how the structure of those policy networks compatible with public disaster prevention and mitigation strategy plan in integration between organizations.

3.3.1 Qualitative Data Collection in Province and District Level

- **Documents** study from relevant records, reports, plans and law, analyze policy network and social network in emergency phase to preparedness phase management.

- **Participation observation** from recovery phase to preparedness phase as;

1) Participate as a volunteer during the first 3 months after the earthquake by attended civil society network for disaster management of Chiangrai during May-July 2014

2) Attended academic seminar 3 months after the earthquake to discuss on government and civil society lesson learned on 27 July 2014 at Chiangrai city hall.

3) Attended Public forum 1 year after the earthquake to discuss on inter-organization in recovery phase 5 May 2015 at Chiangrai city hall.

- **In-depth interview** the researcher collects quantitative data specifically by interviewed government organizations, civil society network, and academic sector in Chiangrai who was appointed to be committee who play an important role in Emergency Operations center according to public disaster prevention and mitigation plan, Chiangrai 2015 are;

Prevention and Operation unit

- Office of public disaster prevention and mitigation, Chiangrai
- Office of public health, Chiangrai

Operation Center

- Department of public works and town planning, Chiangrai
- Metrological Office, Chiangrai

Public Relation

- Office of public relation, Chiangrai

Academic

- Technology Rajamonkhol Lanna University, Chiangrai and Chaingmai

Civil society network in Chiangrai

- Civil society network for disaster management of Chiangrai

The researcher was interviewed the key informant by focus on relationship among the organization, the problem and suggestion to develop the inter-government and civil society coordination on recovery and preparedness operation in July 2015 (1 year after the earthquake) as follow;

- **Emergency phase** how do organizations operate, communicate, data exchange and inter-organizations.
- **Recovery phase** how do organizations operate, communicate and utilize data and inter-organizations in recovery affected areas.
- **Preparedness phase** how do organizations exchange data inter-organizations to create preparedness policy, new plans and policies as well as how it improves inter-organizations operation?

The qualitative data was analyzed by social network analysis follow topic 3.3.2 to show the data exchange. Then the key informant was approved and correct the data. This process was completed in August 2015. The data were used for questionnaire creation for quantitative data collection as policy implementation in community level and sub-district level.

3.3.2 Qualitative Data Evaluation

The operational condition, problems, and suggestions the researcher categorized data from interviewed relevant parties by Timeline. This shows operational

condition and used Socio-technique component under complex adaptive systems, Tavida Kamolvej (2006). Moreover, the operational problems and disaster management data from emergency phase, recovery phase and preparedness phase according to Complex Adaptive System and the result of policy implementation in inter-organizations. And show the relation of actors in emergency phase to recovery phase in each sector by using social network analysis graph. The researcher used NodeXL Excel Template 2014 version 1.0.1.340 and the result of this analysis are descriptive statistics are density, centrality, betweenness describe the interaction of the network. And the graph can describe the relation of policy network analysis according to DDPM's strategic plan in integrations between organizations.

CHAPTER 4

THE OPERATION AND PROBLEM

The researcher arranges the qualitative data of the Chiangrai earthquake response under socio-technical component by using Complex Adaptive System. The researcher has put the operational timeline in order from the exchange of information and communication between sectors in 1 year after disaster strike. Classified qualitative data in 2 parts are;

4.1 The Implementation of Disaster Management Cycle

4.2 The Problem on Chiangrai's Earthquake Response

4.1 The Implementation on Disaster Management Cycle

Since “Information” is core element that related sectors need for decision making and coordinating between organizations. The researcher put the timeline in order. Showing the information used for making decision and command. As well as the information, that helps with coordination between organizations in the early state of the incident. The geological information was used from mainshock to aftershock. In other words.

On Monday 5th May 2014 at 6.08 pm, the 6.3-magnitude quake struck at latitude 19.68N longitude 99.69E in Ban Nai Khao, Pan District, Chiangrai area at 7 Km. depth. Caused by sub-fault line in “Phayao fault group” which distributed in Mae Sruay, Mae Lao and Pan district areas located on 2 parts of fault line are;

- **Upper Sub-fault line**, which lies along Northeast-Southwest on the left side of the area.
 - **Lower Sub-fault line**, which lies along north-east on the right side of the area.
- Passakorn Pananon (2015) Lecturer, Department of Earth science, Faculty of Science, Kasetsart University found that there is evidence of earthquakes on every fault lines that happened 1,000-2,000 years ago. Considering the number

of quakes which higher than 2 magnitude around 100-200 quakes, from statistics collected by Thai Meteorological Department (TMD). Then the number decrease. Which aftershock from 6.0 magnitude quakes for 500 days.

Hence, the quakes within 1 year of study are normal incidences. Currently the quakes usually a 2-3 Magnitude. 5-4 Magnitude quakes can be found in the early stage only. However, we cannot say that there will not be 5-4-Magnitude quakes ever. We can only predict the probability.

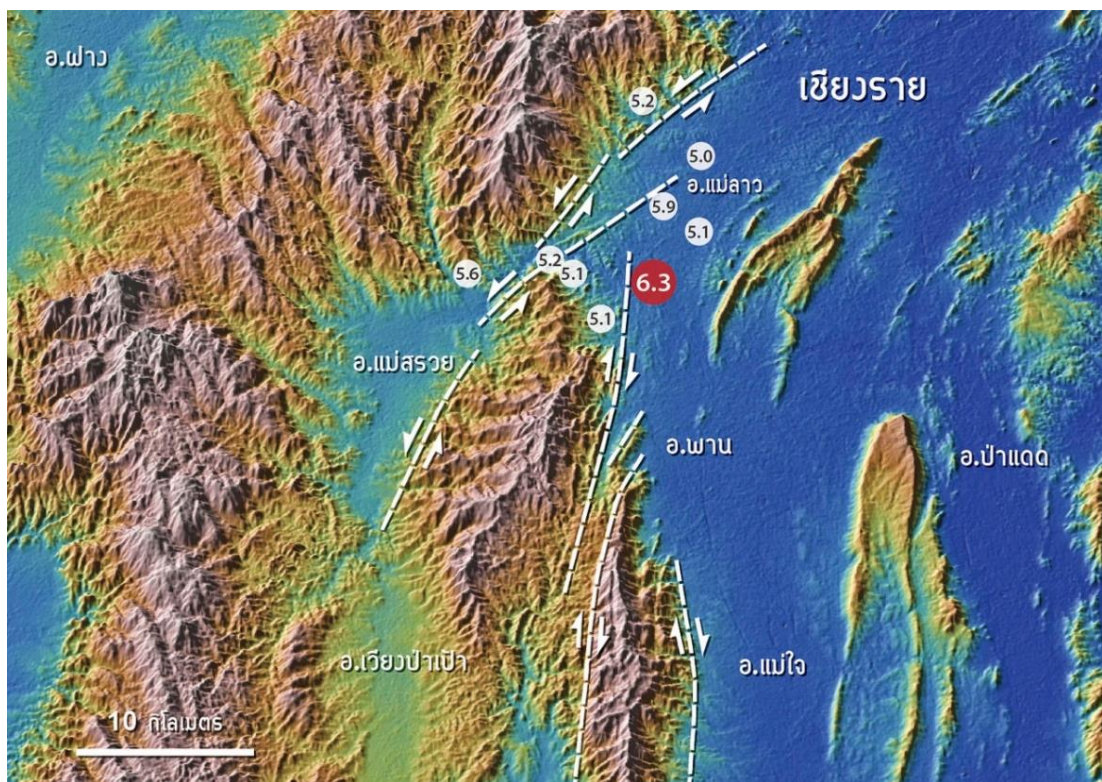


Figure 4.1 Map Showing Seismic Epicenter and Phayao Fault Line Group.

Source: Sukonmet Jitmahantakul, 2014.

The collection of data from the document, report and individual interview in charge, found that the response to disasters according to formal structure and informal start from the emergency phase in Topic 4.1.1-4.1.5, the recovery phase in topic 4.1.6-4.1.8 and Preventive phase in topic 4.1.9 as follow;

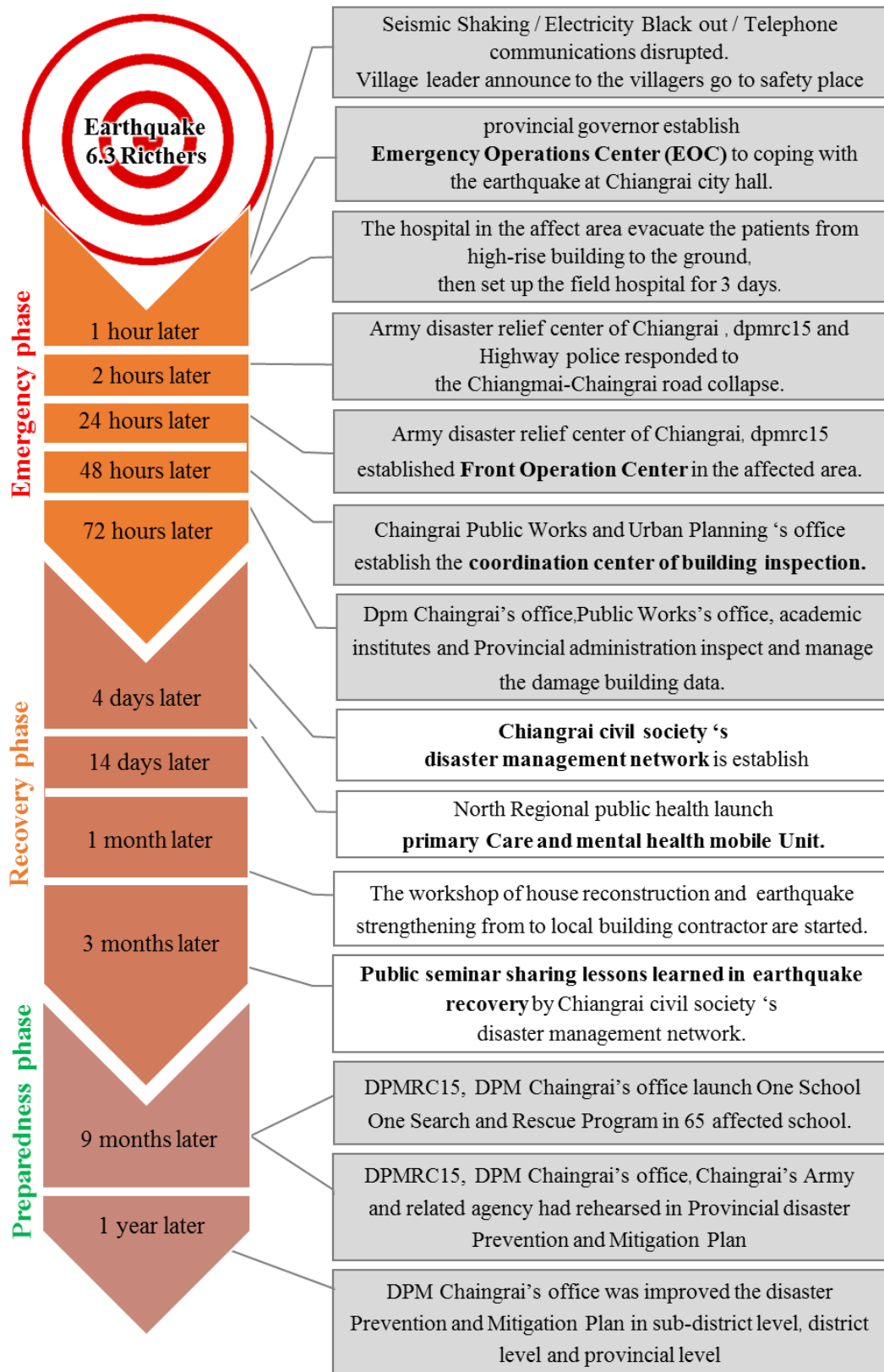


Figure 4.2 The Earthquakes Response by Sectors in One Year Later.

4.1.1 The Response in Emergency Phase

In the Chiangrai Earthquake event, the self-organized community would start by an announcement for the villagers to evacuate to the safe area and stay together to set up temporary shelter before the external help arrive, much in the same way with the set-up of field hospital by the hospital within the disaster area which had to evacuate their patients down from the buildings after the earthquake, in order to reduce the panic and prevent the chaos. Afterwards, the major search and rescue teams from the 15th District Center of Disaster Prevention and Mitigation, which received the information about the heavily damaged area, would arrive to control the situation and organize the front operation center. While the commanding center such as the Coordination Center of Building Evaluation after the Chiangrai Earthquake, the Disaster Mitigation Center of the Chiangrai Army would be responsible for the information receiving and evaluation of the damages within the area, in order to decide to send the support team according to the level of each unit and the operation plan. The important actors who responded, could be explained as followings.

4.1.1.1 Community Response to Emergency Phase

Dong Lan community Moo 17 Sai Khao Sub-district, Pan District, Chiangrai consist of 90 households. This community located nearest to the earthquake epicenter. The seismic started when they prepared for the annual religious ceremony.

Sombat Sriaun, Dong Lan community leader mentioned, In 15-30 minutes after the mainshock, he announced the villager keep themselves safe by doing step by step follows as, 1) turn off the main electricity of the house 2) turn off water supply 3) move to open area. However, the announcement system failed in 20-30 minutes. Because the electricity was black out. While, he has to walk in the door to door to talk to people to evacuate to the safety zones. During that time, he was using the application such as LINE Group on a mobile phone to receive the information from district chief command. His main response in the first hour was evacuation the panicky people to Ban Rong tarn school's football field and set up the emergency response kitchen by food material of religious ceremony. (personal communication, June 6, 2014)

In the first hour of the incidence, the community formed an informal group led by the community leader and set up a shelter in Ban Rong Tarn school area.

The villagers from Dong Lan, Rong Tarn Nua and Rong Tarn glang communities were living together in this shelter. As well as victim's observation and run first aids before sending them to the hospital. Some people have small injuries such as open wounds from fallen bricks. They set up informal shelter by setting up tents in the school's football field. When the electric system comes back on, they put up the televisions to follow up the incidence.

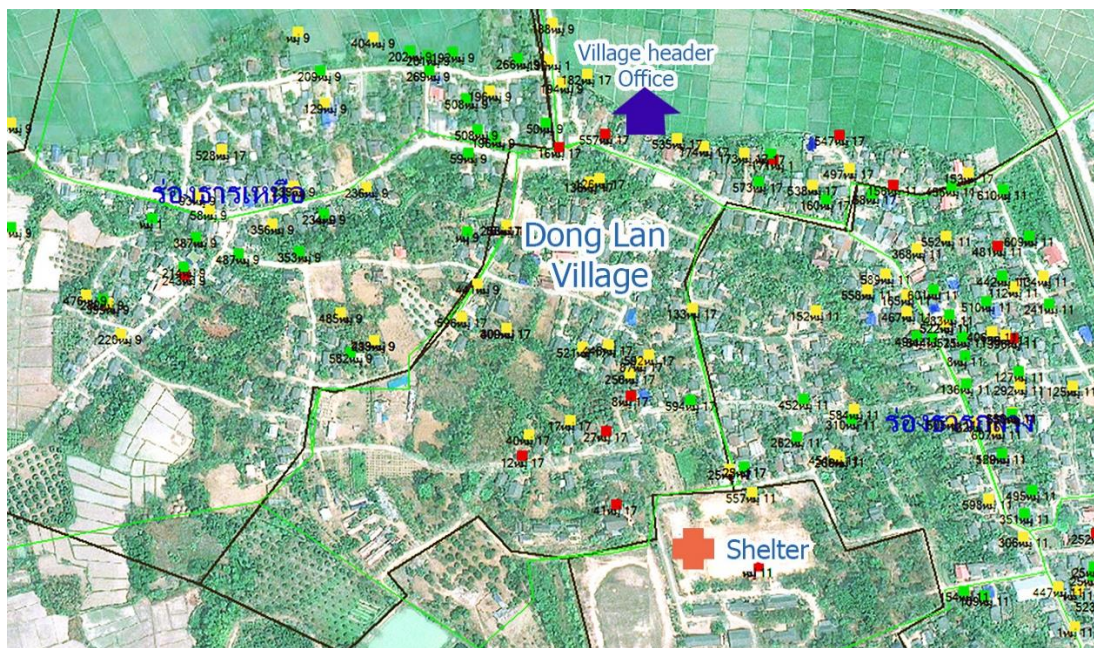


Figure 4.3 Map of Dong Lan Community, Saikhao Sub-district, Pan District, Chiangrai.

4.1.1.2 Ministry of Interior's Agency Response in Emergency Phase

Since the first hour of the incidence, the provincial government as director of Chiangrai's prevention and mitigation center had in charge as Emergency Operation Center (EOC). Yossakorn Suksaart (DPM Chiangrai personnel mentioned, Disaster prevention and mitigation Chiangrai office at 3rd floor in City Hall was started to monitor the situation and control the operation in the name of Building Inspection and Earthquake Relief Emergency Operation Center of Chiangrai Province. (personal communication, June 16, 2015) The structure of EOC as follows in figure 4.4.

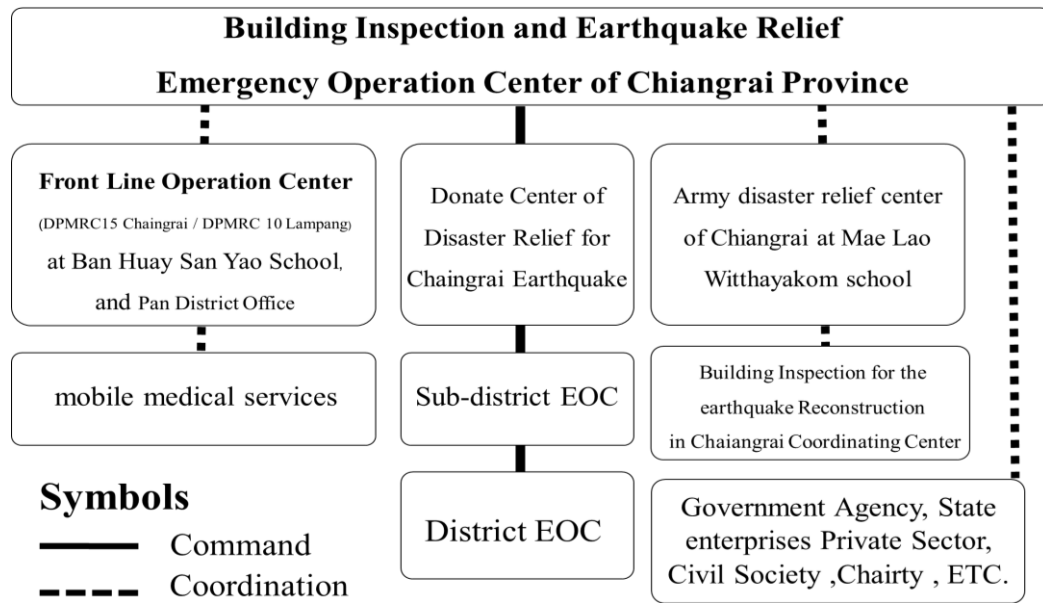


Figure 4.4 Organization Structure in Earthquake Disaster Diagram

Source: Chiangrai Disaster Prevention and Mitigation Office, 2014.

The researcher arranged the timeline of the event from the damage situation report and the rescue of the victims from the Chiangrai Earthquake was found; (Chiangrai Office of Disaster Prevention and Mitigation, 2014)

This Emergency Operations center was set up to be the center of command, control and coordinate among related organizations in need. Which disaster prevention and mitigation office Chiangrai was provincial level operation. The provincial level directly a commander of district level. And the local level is under district level as well as help themselves. This disaster management is operated by formal organizations under Ministry of interior according to disaster prevention and mitigation act, 2007 is set up EOC. According to Emergency operation from earthquake and collapse building in Chiangrai plan, 2014. This operational structure shows in list of figure 4.5 and 4.6. The procedure start from announce level of disaster, the provincial governor announced level 2nd from 4 of disaster for this earthquake. (Department of Disaster Prevention and Mitigation, 2008) Which mean this is medium scale disaster, district and sub-district administrative organizations not able to control the situations all by themselves.

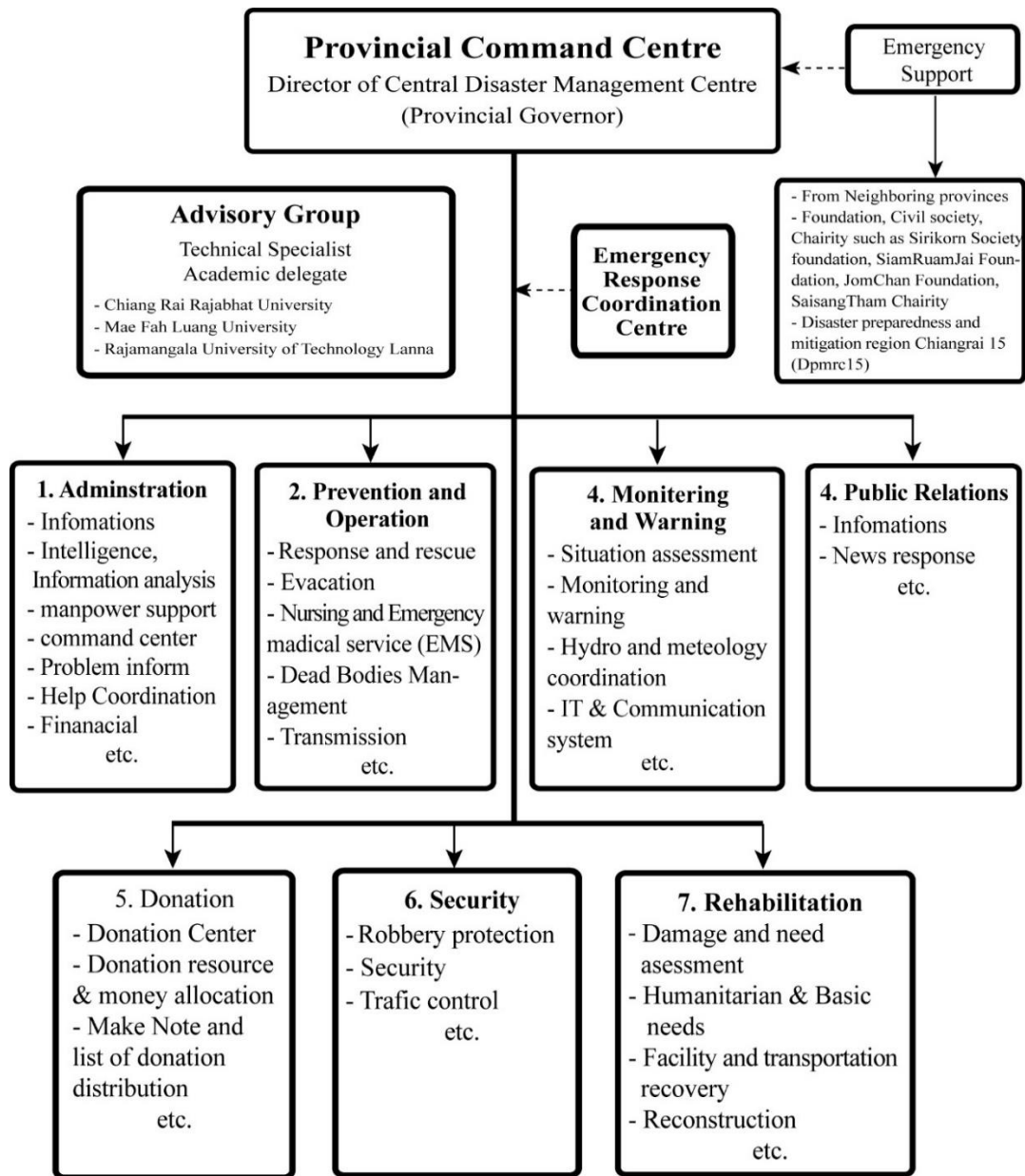


Figure 4.5 Chiangrai Emergency Operation Center Diagram

Source: Chiangrai Disaster Prevention and Mitigation Office, 2014.

In Case of Public Hazard severity are medium scale (level 2)

medium scale (level 2) : Public hazard are over capacity of Sub-district Administration Office (SAO) , SAO Chief, District office, District Chief to coping with disaster by themselves. The Provincial Centre is required to make recommendations to the Provincial Incident Commander in the context of setting up the Provincial Emergency Operations Centre to undertake emergency response interventions.

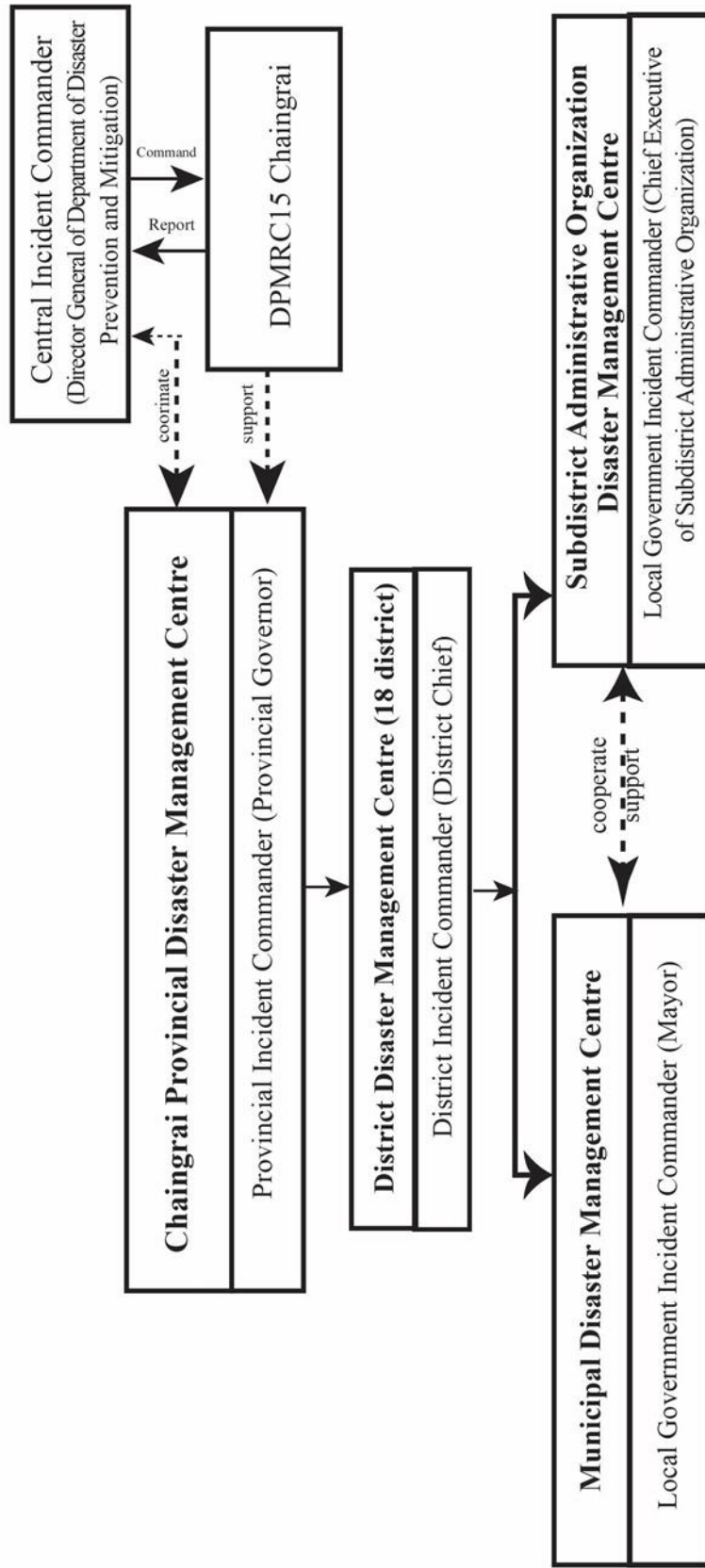


Figure 4.6 Disaster Response and Single command Diagram
Source: Chiangrai Disaster Prevention and Mitigation Office, 2014.

The damage alleviation in the first hour handled by Chiangrai Disaster Prevention and Mitigation Regional Center 15 (DPMRC 15). They had set up mobile emergency light on the road between Chiangrai - Chiang Mai in Huay San Yao Community, Dong ma da, Mae Lao. The road in this area had collapsed from the quake for 500 meters. Both offices in charge and police have put their forces to control the traffic in risk areas.

During the first couple of hours of the attack, there are cooperated force of provincial office and Military district of Chiangrai assigned to survey the damage of the road and Ban Pong Pu Fueng community area along Lao river that damaged for 200 meters.

The next day, May 6th, 2014. Mr.Jarupong Ruangsuwan, Minister of Internal Affair office have visited the area along with provincial office staffs. Main propose of this visiting is to check the engineering structure condition of Mae Sruay dam to make sure that there will not me more damage after the quake.

Meanwhile, disaster prevention and mitigation center, district 15 Chiangrai and district 10 Lampang. As well as disaster prevention and mitigation office staffs in Wiang pa pao and Chiang Khong have set up **Front Line Operation Center** at Ban Huay San Yao School, Dong ma da, Mae Lao and Pan District Office. They have provided light rails, drinking water tank, necessity machines, vehicles and shelters' tools. Furthermore, they have contacted mobile TOT Satellite for mobile network service. As well as coordinate with resources such as manpower and machines from related organizations. The detail will be explained in the next topic.

3 days after the quake, May 7th, 2014. Public works and town planning of Chiangrai office have set up **Building Inspection after the earthquake in Chiangrai Coordinating Center** at their office in Rob Wiang district area. Which resources supported by The Engineering Institute of Thailand, Northern Branch, Faculty of Engineer, Chiang Mai University Alumni, Engineering team from Technology Ratchamongkol Lanna University, Civil Works Technician and Engineer from disaster prevention and mitigation office. Inspection district areas are Mae Lao, Pan, Mae Sruay, Mueang Chiangrai, Pa Dad, Phaya Mengrai and Wiangchai.

4.1.1.3 Ministry of Public Health Agency Response in Emergency Phase

According to Emergency Act in Earthquake disaster of Chiangrai province Year 2014. The protocols are the medical personnel in the area have to take charge of control division. In this of the minor earthquake which classified as the 1st level from 4 cases, this control center under the ministry of public health able to handle the situation without asking for help from outside areas. According to public health protocol under emergencies are 1) Provincial level 2) Provincial group by zone by paring up 8 nearby provinces are Lanna 1 zone included Chiang Mai-Lamphun, Lanna 2 included Lampang, Phrae, Nan and Lanna 3 included Chiangrai, Phayao. This zoning categorized by geographic and population 3) District level, which is the biggest protocol as all 8 provinces have to get involved and 4) The National level which minister of public health and or prime minister has to take charge by themselves.

In the first hour after the attack, The most critical situation Chiangrai 's public health has faced was Hospitals in Pan, Mae Lao and Chiangrai Prachanukroh districts were damaged by the earthquake. Hospital staffs had to move the patients to open door area in panic. Medical Doctor, Professional Level from Pan Hospital and its staffs had decided to set up field hospital outside hospital building for safety reason and operate as normal. However, Mae Lao Hospital had sent 17 patients to Chiangrai Prachanukroh Hospital, as it was safe to use their building. (Doctor Kriangsak Pintatham, personal communication, June 27, 2015)

Chiangrai Prachanukroh Hospital was not affected by the quake that much as it located far from the earthquake epicenter. However, they are uncertain about how bad aftershock will be, they had to temporarily stop treating outpatients. They waited for the inspections of the buildings by the civil engineer for safety reason. After the situation in their hospital has settled, they sent paramedic team to Huay San Yao community shelter and Rong Tarn community afterward.

4.1.1.4 Ministry of Defense's Agency Response in Emergency Phase

The researcher arranged the timeline according to the operation report by the Office of Disaster Prevention and Mitigation in Mae Lao District and Pan District of Chiangrai and found that (Chiangrai Military district, 2014). Within the first couple of hours after the attack, Military district of Chiangrai have been working with disaster prevention and mitigation unit 15, Police force and paramedic team to survey the

damages. The report of Chiangrai Military district (2014) recorded the disaster relief operation were started by;

On May 6th, 2014. Commander in Chief has ordered the company and mobile medical unit to survey the damages, assist the victims and other organizations in Pan and Mae Lao district areas. Military district of Chiangrai has set up a Mitigation center at Mae Lao Wittayakom School. Figure 4.7 shows organization flow chart. This mitigation center is a part of integration between organizations to decrease the effects of the disaster in the area.

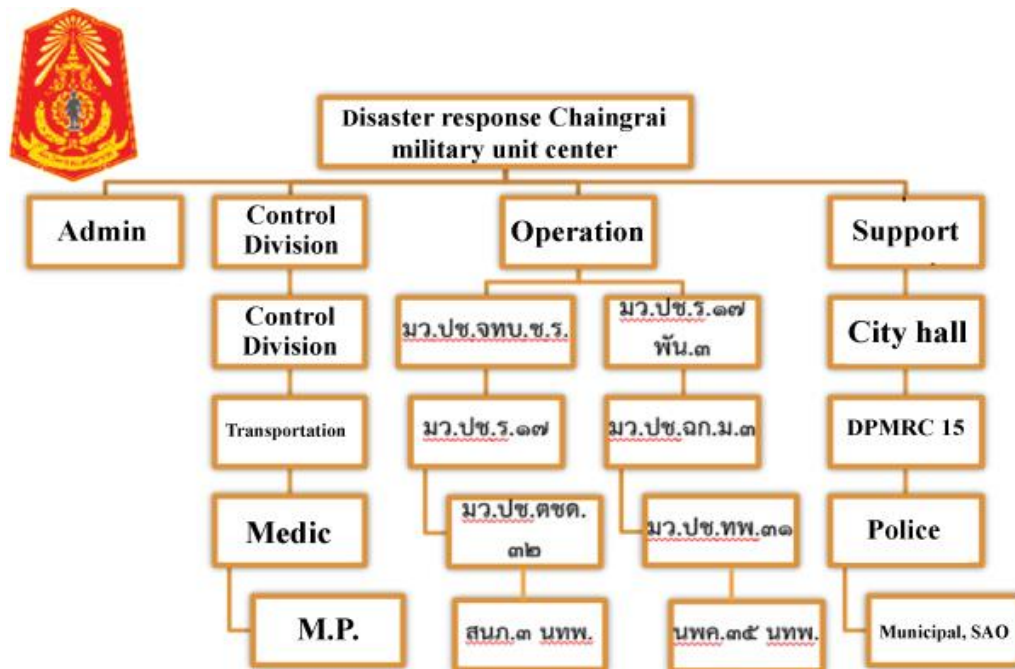


Figure 4.7 Chiangrai Military Disaster Relief Center Diagram

Source: Chiangrai Military District, 2014.

On May 9th, 2014, Thai air force unit 41 have opened Wing 41 Disaster Relief Center Operations at 416 station, Mueang Chiangrai . Main missions are damaged area survey and renovation.

This mission has last for 10 days (6-15 May 2014), Missions in emergency phase (first 3 days) are provided water supplies, mobile medical services and hand out aid packages. Missions in recovery phase are helped as labors for moving

and demolishing damaged buildings for schools, hospitals, government offices and reconstruct buildings. As well as psychology remedial and entertain people who effected by the disaster.

This mission has ended on May 15th, 2014 when the situation ease up in the areas. Then the mission passed on to Emergency Operations center.

4.1.2 The Response in Recovery Phase

After the commanding center and the coordination centers were set up during the emergency phase, the inter-organization coordination started to link their information in order to assist the damage area. The actors within the main structures in this phase were the Chiangrai Office of Disaster Prevention and Mitigation and the Chiangrai Office of Public Works and Urban Planning, who were responsible for the damage evaluation and the earthquake victim's compensation according to the province's operation plan. Meanwhile, the mass media and the civic society were also another group of actors who filled the gap by assisting the community with the information and knowledge in recovering the community, and let the community decide for itself. Thus, the responses by each actor during the recovery phase were as follow;

4.1.2.1 Mass Media's Agency Response in Recovery Phase

TV stations, local media, and digital TV are interested to report the situations. However, most of them only report the damages more than educate the audiences on the phenomenon or facilitate the supports from outsiders. Only ThaiPBS helped facilitate and coordinate with the community since the first day till recovery phase.

On May 9th, 2014. Public policy editor set up a meeting with Chiangrai civil society disaster management network on how to coordinate in community level to rehabilitate the situation.

On May 12th, 2014. Sathaneeprachachon (people Staion) program filmed at Ban Tha Ma O and discussed on community rehabilitation. And outsider started making donations.

On May 13th, 2014. Citizen media and scholars joined by local community started to observe the joints on the ground and cracks on Mae Sruay Dam.

On May 14th, 2014. ThaiPBS filmed WeTeeSatarana (Public Forum) Program about the safety of Mae Sruay Dam. And reported on the database system in Ban Dong Lan. Donation money, hand out aid packages. And started to report about buildings collapse and all the damages.

On May 15th, 2014. ThaiPBS have held a war room in Bangkok to discuss on the supports in every way included scholars, information, and donators from private sectors and fund raising

ThaiPBS is a key civil society based mechanism in rehabilitating stage. Nattaya Wawweerakupt who was the Public Policy News Editor of ThaiPBS TV station mentioned, the civil society networks, resources, and agenda setting and create public space to discuss it. As well as support matching in all aspects. And related parties learn from how to handle the disaster in the future. They as well coordinate with construction budget and created Ban Dong Lan model which is a show case of the construction know-how in the risk area. (personal communication, August 25, 2014)

4.1.2.2 Civil Society Response in Recovery Phase

Even if the civic society might not be able to help in the community during the emergency phase, for they were also the disaster victims, but when the situation unfolded, each organization would understand that they must re-emerge as a united group. On May 8th, 2014. (3 days after the attack) civil society organization lead by mirror foundation, Highland people education and development foundation, Mae Sruay district community council, elders group, Sang Fun Wan Mai group and ThaiPBS. These groups set up a meeting on recovery phase in the name of “**Chiangrai civil society disaster management network**” Weerapong Kangwannawakul, the network coordinator said, This is the informal network that operated by voluntary. The main mission to manage the disaster database. This network work with building inspection follows the disaster unit operated by public works office. On the 5th day of working with ThaiPBS, they have created a website “ThaiQuake” which based on ThaiFlood model. This website gathered information from related organization and link with its own network to coordinate the supports, rehabilitate, prevention and solution for people in the area. (personal communication, July 8, 2014)

On 9-21 May 2014. The network has gathered the damages in other aspects of from the communities that overlooked by the government sectors. Such as

mental damages, buildings, residence area. Agricultural tools. They coordinated with community leaders and have rehabilitated activities such as earthquake resistant reconstruction workshop, construction tools and material donation.

On May 30th, 2014. ThaiPBS have public forum at Dong lan community. The result of this discussion is to prioritize building renovation in the area. Attendances are community leader and members.

On June 4th, 2014. Rajamangala University of Technology Lanna , Chiangrai and Chiang Mai campus were conferenced with the affected communities leaders in 5 communities to have a discussion on disaster relief plan by Civil Engineer Department, Faculty of Engineering.

On 14-18 June 2014. The lecturer from University of Technology lanna held training on renovation and construction of the building after earthquake disaster call Dong Lan model. This group have surveyed, evaluate and level of damage database in the whole community by working with the community leader who has vision. And support by University network, ThaiPBS foundation and PTT group. This model encourage local contractors and building owners learn about the process from how to pick the materials to techniques and building process. According to meeting summary held by ThaiPBS on May 30th, 2014.

25-29 June 2014. After the first training sponsored by ThaiPBS. The second training held by Provincial office of Chiangrai. There were 4 communities attended in this model communities are 1) Toon Fa Pa Moo 7 Mae prik, Mae Sa ruay 2) Huay san plub pla Moo 6 Pong Phrae, Mae Lao 3) Pa-O Moo 1 Pa dad, Mae Sruay and 4) Huay San Pattana Moo 6 Wiang Sruay, Mae Sruay.

Main purpose of this training is educate local contractor how to reconstruct the domestic building which usually damages in 3 components are 1) Pillars 2) Walls 3) Extension parts such as bathroom and kitchen. Second purpose is create mechanism to make people in the community to have interaction. So, that they can survey the damages, prioritize issues and evaluate needed resources such as budget, labors, contractors, materials and equipment as well as other supports during the training as figure 4.8 shows community rehabilitation mechanism model.

Work Procedures

- 1) Villager have to meeting for sort and select the most vulnerble family which most need help.
- 2) Village leader have to provide materials and instruments from civil society network fund.
- 3) Villager and local construction artisan join the earthquake strengthen workshop and Training in 3 lesson as; Pillar, wall and Extend component reconstruction
- 4) Local building construction artisan who pass training are allowed to run the recovery process in the communities.



Figure 4.8 Community Rehabilitation Mechanism Model

Source: Chiangrai Civil Society Disaster Management Network, 2015.

The Overview of missions in recovery phase which operated by civil society networks along with other sectors in the first 3 months aftermath as Figure 4.9 shows 7 parts of activities are;

It start from 1) Team setting coordinate the helps from private sectors and mass media who shared the same vision in rehabilitate. 2) Survey collect data in affected communities that government sector couldn't survey in limited of time. 3) Work through public media. 4) After the network agreed with working direction, coordinate with government sector is needed. Contact related offices are Disaster prevention and mitigation office and public works office regards rehabilitate plan, missions and how to work with them. 5) Coordinate with the University of Technology Lanna before start working, as they have to inform and meeting with community leader beforehand. 6) Rehabilitate with community model. And extend the project to another areas. 7) Gather data and suggestions to create the lesson learnt of the recovery by the government and civil society on 3 months after the earthquake.

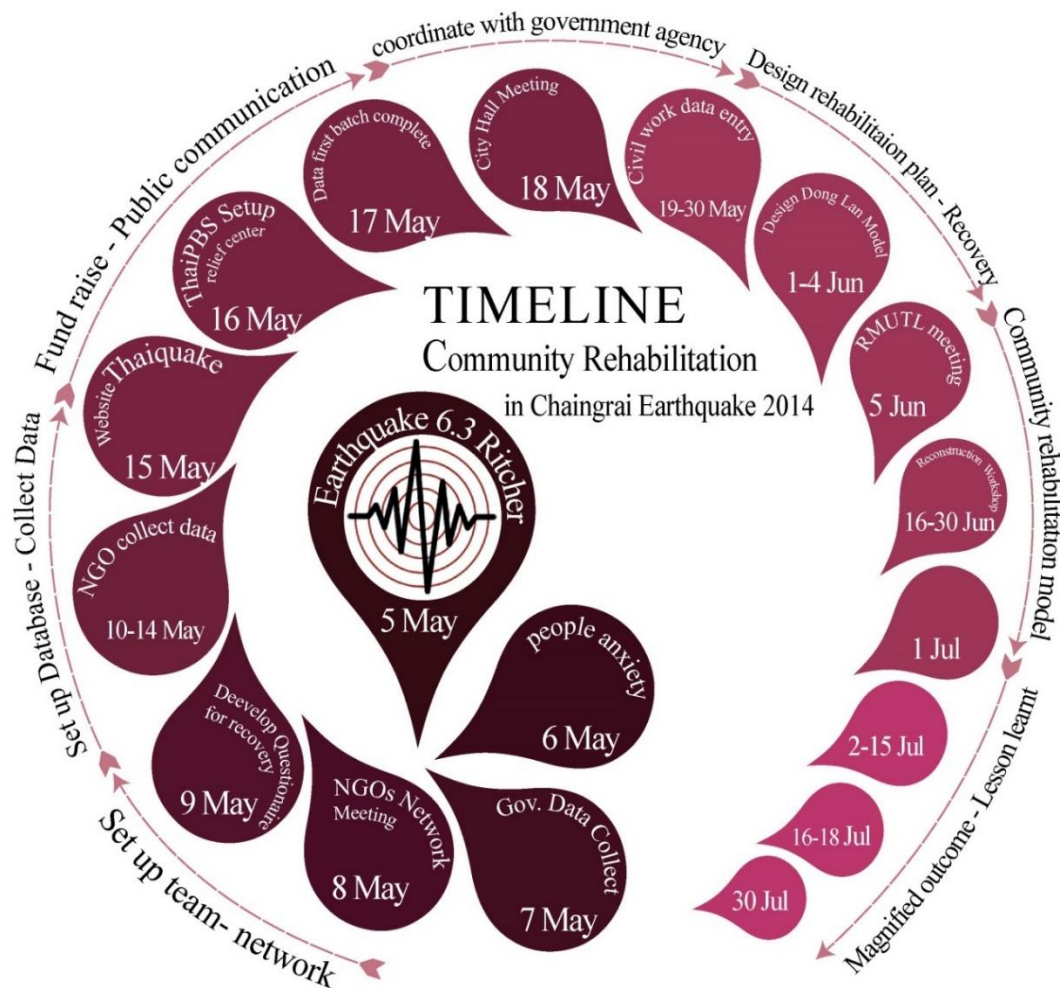


Figure 4.9 Timeline of Chiangrai Civil Society Disaster Management Network.

Source: Chiangrai Civil Society Disaster Management Network, 2015.

4.1.2.3 The Responses by the Organization in the Level above the Community during the Recovery Phase

After the emergency phase (3 days after the attack), Chiangrai disaster prevention and mitigation office (DPMCR) had set up Emergency Operations Center (EOC), the following mission after the passed emergency phase is damages assessment and grant-in-aid budget. And building inspection mission. The researcher would like to explain the structure of information exchange and operation of each mission herein.

Damages assessment and remedies Financials

This mission is operated under information linked between local administration office and sub-district administrative organizations. Chiangrai Disaster prevention and mitigation office (2015) reported, there was 4 step of the survey, assessment, and inspection between 4 steps of related organizations as figure 4.10.

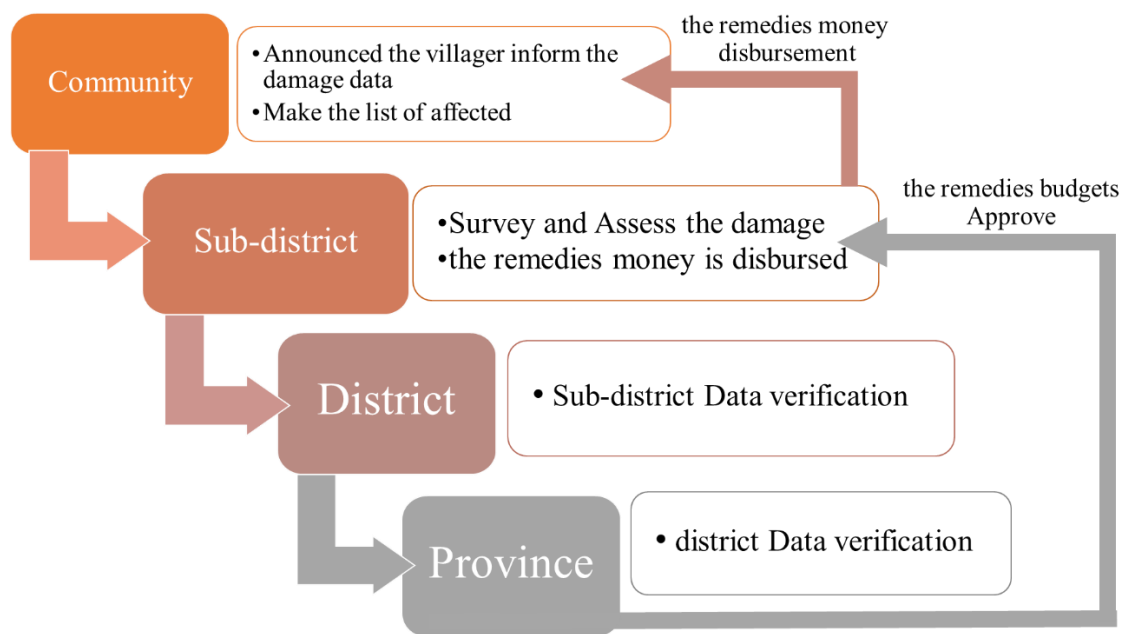


Figure 4.10 Budget Approval for Housing Rehabilitation Diagram

1) Village Leader Distribute news on rehabilitation budget application. And make a list of disaster victims.

2) Sub-district Administrative Organization (SAO) or municipality disaster prevention and mitigation committee in municipality level included Civil Engineer, public works technician, Municipality (SAO) members. Then thesis committee has to coordinate with village chief. Verify the list of disaster victims, observe and submit information to disaster prevention and mitigation committee for verification.

3) District office disaster prevention and mitigation committee for verification. Gather corrected information from every district. And submit the list to provincial disaster prevention and mitigation committee.

4) City Hall received the list from the district. Approve grant-in-aid from the advance budget for emergency incidence act 2013. The budget will be send to the victims through SAOs or municipality according to advance the budget for disaster relief announced on April 1st, 2013. This grant-in-aid has to be used for below purposes.

- Material for repairing or rebuilding the house actual cost or not over 33,000 THB/house.

- Material for repairing or rebuild the barns or stalls actual cost or not over 5,000 THB/house.

- For renters, receive 1,700 THB or less for maximum 2 months/family.

5) Sub-district Administrative Organization (SAO) or Municipality

Coordinate with village chief once informed regards the budget by provincial office, make an appointment for giving money to the disaster victims.

From budget approval procedure above, the researcher has collected data from official document and interview. The overview of the whole situation below.

On May 9th, 2014. (5 days after the attack) Disaster prevention and mitigation office coordinated with social development center unit 12 and village chief to inform them on grant-in-aid procedure.

Municipality/SAO which are commanded by the department of provincial administration to make damages list. They coordinated with village chief to collect the initial data without the template of damages and effects of the disaster.

May 11th, 2014 (6 days after the attack). District chief commanded the observation and data collection on damaged residences within 14 days (May 25th, 2014) Attached 4 sets of evidence document as well as picture and damages cost estimate. The District office has the damage claim form for the victims.

May 16th, 2014. Provincial operation center started to pay for the damage claims to disaster victims to fix their houses according to Ministry of Finance order and rules year 2013. Municipality/SAO have to submit payment agenda to village chiefs after the budget was granted.

May 24th, 2014. Since there are damaged houses due to the aftershocks and it was over data collection due date and some residence was busy and didn't submit the claim forms. The village chief had to run the second round of observation. And

submit the claims again. And if the damages are more than estimated cost submitted in the first observation, they have to submit additional cost (If the estimated claim cost more than 33,000 THB, they cannot submit the additional claim). The second grant-in-aid observation mission has to be done within 1 month.

May 28th, 2014. Provincial administration office has held Big cleaning day. The activities included rehabilitate and clean up buildings effected by the earthquake.

June 20th, 2014. There were conflicts between people in the area as the result of private sectors, volunteers and foundations started to work in the area without contacting related government offices. District office requested helping lists form before these volunteers start working in the area. And report working results to the district.

June 27th, 2014. Provincial operational center reviews the housing aids and the grant-in-aid total budget for housing.

Finally, Chiangrai have extended aid for rehabilitation in earthquake disaster until August 31st, 2014. EOC also finish the mission and submit the overview of situation, damages and aid in October 2014.

Building inspection for Safety assessment

While Municipality and SAO working on house damages observation and pay grant-in-aid, Public works and town planning office started to inspect the buildings at least twice each one from Public works and one from Municipality/SAO to make sure they are safe. These inspections are separately operated. However, both are under Emergency Operations center.

The researcher studied about the coping with the public disaster, which was the mission of the Office of Public Works and Urban Planning related Public Buildings Inspections to survey the building safety. Due to Thailand was hit by Tsunami before, they could use means and protocols from that disaster to observe the damage. On the first day, Public works officials have got the information from Emergency Operations Center about the damages on Temples, Schools, Hospitals in Dong ma da sub-district and another source of information are directly from the buildings' operators such as airport and hospitals. After receiving that information, they

can review and make the decision on operation and coordination with another organization. (Yossakorn Suksaart, personal communication, July 16, 2015)

Narin Kwangthong, Chiangrai Civil work and urban planning office personnel mentioned, Building Inspection Coordination Center was setup on May 7th, 2014. The main responsibilities are 1) Consult at Emergency Operations center and 2) Operation team at the Building inspection coordination center. Their missions start from mapping area information and number of damaged public buildings and residence. The next day (May 8th, 2014. They held a meeting between voluntary engineers from supported institutions and organizations. The result of this meeting is to distribute teams to inspect the damages in each area and protocols. They came up with 3 assessment criteria are;

- Green is minor damages (safe to use)
- Yellow is medium damages (not safe to use in some part of the building)
- Red is critical damages (must be rebuild, unsafe to use)

The volunteers used the spray-painted by criteria color codes on the inspected buildings. This mission is to prioritize the overall of the buildings to control not to have the worst damages such as took the concrete poles out of the footbridge to prevent it from collapse in case of another earthquake incident.

Officers and volunteer engineers have created Line group to coordinate and send the data to center. And these data will be sent to the Emergency Operations center for further action.

The mission of survey and evaluate the building and construction by the building inspection coordination center focused on the overall public building and constructions first, in order to prevent the major damages to follow, such as bringing down the concrete overpass beam which moved away from the overpass column would be the risk management that will reduce the risk of overpass falling down to crash the car on the street, should the earthquake happen again.

In transferring the data from the field survey back to the center, the officers and the volunteer engineers would use the Line Group to send the pictures of the building and the survey table back to the building inspection coordination center, which will gather the data together with the temporary administration center at the City

Hall. Both data sets will be put together, and whenever the building which is hard to inspect was found, the coordination center would forward the data to the specialists from the Department of Public Works and Urban Planning to analyze and reply back to the owner of the damaged buildings. (personal communication, June 18, 2015)



Figure 4.11 Color Marking of Building Inspector in the Communities

Since lots of engineers were willing to help as volunteers, it caused the confusion as each team has different approaches and inspection rules. On May 17th, 2014, The Engineering Institute of Thailand and Council of Engineers held a meeting at University of Technology Lanna. The result of this meeting is engineer's team refer to set up the same standard of building inspection.

After the volunteer team have been working for 3 weeks and they finished inspect the most building in the affected areas. They stopped the inspection mission on May 26th, 2014. They finalized the damages and changed the mission to education for rehabilitation. Summary of grant-in-aid budget also done by Municipality and SAOs as mentioned above.

June 2nd, 2014, Public Works office has held a training in "Earthquake resistance building design" at Rimkok Resort Hotel. The 200 participants are Officers, Technicians from SAO and local contractors. Main purpose of this training is related

people able to analyses the damages and find the solutions in case of the disasters. After the 1st training, public works office also held 20 trainings for local contractors. (Narin Kwangthong, personal communication, July 4, 2015)

4.1.2.4 Ministry of Public health's Agency Response in Recovery Phase

After sending medical team to treat people at the shelters, on May 16-21, 2014 (2 weeks after the attack) Public health office has sent the mobile team to affected areas to treated people mentally and physically, Mental Health Crisis Assessment and treatment team (MCATT) to assess their mental health during 2 weeks after the emergency. By coordinating with network nearby provinces are Saun Proong Hospital, Rajanagarindra Institute of Child Development and Mental Health Center unit 10, Chiang Mai.

4.1.3 The Response in Preparedness Phase

According to the damage situation report and assisting the Chiangrai Earthquake victims. (Chiangrai Disaster prevention and mitigation office, 2014) The researcher found out that most preparation support would be the role of the Chiangrai Office of Disaster Prevention and Mitigation, and the 15th District Center of Disaster Prevention and Mitigation, who were educated and equipped with resource and full authorization from the Ministry of Interior in coordination and commanding.

After basic needs aid were made, Chiangrai Disaster prevention and mitigation office (2015) report, there were demolished the critical damage buildings for safety reason. Needed materials and equipment come from donation as well as disburse grant-in-aid budget in the recovery phase. As well as plan for prevention by Chiangrai Disaster Prevention and Mitigation Regional Center 15 (DPMRC 15). They have held the drills and other prevention protocol after 7 months of the attack.

January-March 2015, Chiangrai Disaster prevention and mitigation office (DPMCR) and Chiangrai Disaster Prevention and Mitigation Regional Center 15 (DPMRC 15) held training "One School One Search and Rescue Team (OSOS)" in 65 schools along with educating people about disaster prevention.

March 2-6, 2015, DPMCR and DPMRC 15 coordinated with Thai army held disaster drills under ICS system and implemented test of National disaster prevention and mitigation operational manual year 2015. Training area is Mae Chan, Chiangrai

and Mae Jai, Phayao. The training was on building collapse incident management, bridge collapse, chemical truck leak, collapse road and fire on vehicles. As well as train on evacuate plan. And set up Emergency Operations center at Military Academy, Chiangrai military district. Training codes are JDMX 2015 and CREX 2015.

April 27th, 2015 (11 months after the attack) DPMCR had commanded Provincial office to make disaster prevention and mitigation plan according to new national strategic plan.

June 18th and 24th, 2015 DPMCR informed Municipality regards the new operation plan. And the chiefs have to get the acknowledgment sign done by July 31st, 2015.

4.1.4 The Overview of the Information Sharing in Emergency And Recovery Phase

Department of Disaster Prevention and Mitigation (2008) reported, The operation were strat according to basic needs in emergency phase was provided;

First 24 hours Food, water, cloth, first aid, search, rescue and situation primary report.

24 - 48 hours Shelters, search for valuable, search for family members, first aid, funeral, aid packages and medicines.

48 - 72 hours initial aid, claims, damage report and aid from related organizations.

72 hours and long-term rehabilitation Search for survivors, grant-in-aid, career rehabilitate and housing.

We can see that provincial level is the influence factor in the emergency. This earthquake is only level 2nd of 4. Provincial organizations able to cope with the situation themselves. (Chiangrai Disaster prevention and mitigation office, 2014). The help from outsiders is only short-term rehabilitate in the form of donations. Related organization in response to the situation very efficiently and quickly such as traffic police reported damages on the road. And send support there within 2 hours. Military district and disaster prevention and mitigation office also provided food, water, and shelter within 24 hours, however, public health couldn't send help within 24 hours as they were self-organize in their hospital at the same time.

The media started to report damages in the areas to outsiders. The donation started to flood in both at Emergency Operations center and directly to the area. The areas that interested in the media get more attention and donation. Hence, disaster prevention office suggested that villager chiefs from the nearby area should open donation spots and observe the damages and submit to provincial level to find the further solution.

Exchange of information and resources during emergency phase were done under the decision of the heads at that time. Provincial office is the center of information and resources in that situation before distributed to needed areas. After the emergency got better, the exchange of information and damage assessment for rehabilitation started. The coordination center and related scholars started to do safety assessment.

While civil society network has held training on repairing and rebuilding the houses, extend to 7 sub-districts. Gathered affected information and shared with Chiangrai Disaster prevention and mitigation office for budget disburse. Damages and aid as mentioned, Chiangrai Disaster prevention and mitigation office (2014) have summarized the damages and Emergency Operations center budget in table 4.1

Table 4.1 Overview of Disaster Relieve Cost of 17 October 2014

Damage	Number of case	Grant-in-aid budget		Total (THB)
		Government sector (THB)	Private Sector (THB)	
Death	1	30,000	15,000	45,000
Housing	16,894 houses	122,437,900	85,975,900 (consumer goods)	178,413,800
Religious building	160 places	163,175,700	39,358,539 (consumer goods)	202,534,239
Schools	126 places	57,137,700	97,180,881 (consumer goods)	154,318,581
Public building	12 building	16,462,300	-	16,462,300

Table 4.1 (continue)

Damage	Number of case	Grant-in-aid budget		Total (THB)
		Government sector (THB)	Private Sector (THB)	
Industrial factory	14 places	←→	Tax Exempt	←→
Government offices	57 office	59,122,070	-	59,122,070
Total cost		418,365,670	192,530,320	610,895,990

Source: Chiangrai Disaster prevention and mitigation office, 2014.

4.2 The Problem on Chiangrai's Earthquake Response

To point out the issues while responding to the disaster by the Network. The researcher used socio-technical elements for disaster management which look into the factors in 3 aspects are 1) Technical infrastructure which indicates the ability of information exchange as well as operation and risk management 2) The organizations flexibility which indicate the ability of organizations response with the emergency phase and complex incidence that need integration of coordination between organizations and 3) Cultural openness which indicate value and the openness of changes and operation process improvement. Conflicts solving which also the means to reform organizations to be more efficient in the emergency phase. The researcher uses these aspects to assess the issues and suggestions for the operation before.

4.2.1 The Problem in Organization Flexibility Dimension

In studying the problems of Chiangrai Earthquake management, the researcher had gather both the qualitative data and quantitative data. The quantitative data was gathered through the questionnaire which aim to study the success in the prevention and mitigation policy implementation within the local government level. The flexibility dimension of the organization was found (according to the data in the appendix D,

section 1.1.3) that the sampling group thought that the flexibility problem in the local government's operation impacted the earthquake coping in the high level. The amendment of the law involving the earthquake mitigation also highly impact the coping with the earthquake as well. The sampling group focused on the top three problem in operation which were 1) problem of earthquake management information sharing, 2) combination and linking information between the necessity and the assistance between SAOs. 3) Experiences in disaster management in SAOs staff. The mentioned results is consistent to the results from qualitative research.

4.2.1.1 The Self-organization in Organization Flexibility Dimension

The meaning of Self-organization is the process by which system components and agents mutually adjust their behaviors in ways needed to cope with changing internal and external environmental demands. Coordinate action in one direction to achieve objectives. Thus Chiangrai actors are less adjust their behaviors in same ways in recovery phase as;

The power structure in resource management did not correspond between the district level and the local level, since the hierarchical system in the government are separated by the government structure. Thananchai Naktue mentioned, while the community chiefs, village headmen and district officers are personals under District government act 1914, District organization personnel and municipality are local government personnel according to local personnel management act 1999. The coordination and command would face the Problem in acceptance. Furthermore, if there is a command for the drills in every areas, they might face the Problem in budget and equipment. In other words, the district chief-officers, the village headmen, and the community chiefs were the actor with the hierarchical power in district management but lack the resource in disaster management, while the provincial organization and the sub-district organization were the actors with resources in disaster management but could only authorize operation in the local level only. Therefore, the village headmen could not make any decision for they must still receive command under the district authorization structure hierarchy, which is separated from the local government organization structure. (personal communication, July 16, 2015) As a result, there were only few actors in the community level who could direct themselves towards the

resource coordination according to the community's need from the local government organization within the disaster area.

Suggestion The Department of Disaster Prevention and Mitigation should adjust their power structure and resource authorization in the community level and the local level to be consistent with the long term disaster risk management, together with increasing the relationship between the organizations in the provincial level. Therefore, whenever the disaster should happen, they would be familiar with the order in situation control, information forwarding, and information sharing within the commanding center. This should be done by learning lessons together and fix the problem at its root. (Thananchai Naktue, personal communication, July 16, 2015)

4.2.1.2 The Emergence in Organization Flexibility Dimension

The emergence in the complex system mean that after the system organize itself, there would be the emergence of the new structure, new behavior, or new process within the system, which would cause the change that led to the different output in the main system. Therefore, when the actors in Chiangrai province did the self-organization in the different ways, there would be no mutual structural change in coordination. This led to the following problems during the recovery phase.

Many organization's operations were redundant. The actors in the provincial level did not restructure their shared database. There was no database system for all units to store and show data together, in order to be decide on the shared recovery mission.

The traditional way in which each units gathered their data separately according to their particular mission would led to the redundancy in field survey by many units. They would enter the field many times and on different schedule. During the early period, the sub-district unit reflected that the provincial unit ordered them to survey without any data gathering forms, so they could only count the number of damaged buildings. Afterwards, the forms were changed and they had to re-enter the field to gather data in other issues according to the change in the forms. (Thananchai Naktue, personal communication, July 16, 2015) Most units would gather information by paper form, which is not suitable for information sharing. Most of the gathered data was hardly return to the area unless the village headmen would make a copy themselves.

An important case which confused the disaster victims and raised many concerns was the case of building inspection by the Chiangrai Office of Disaster Prevention and Mitigation and the Chiangrai Office of Public Works. Both office surveyed the buildings in the area but looked at the different aspects. The Office of Public Works would only inspect the building safety, while DPMCR would estimate the damage in terms of compensation value. Although both offices would share the reports with each other, but they did not merge the database and never send the survey report back to the community. Afterwards, it would be hard to bring any data surveyed by the government back to aid the recovery planning for the community. (Sombat Sriaun, personal communication, June 6, 2014)

Suggestion In order to enable each office to design their own mission in the shared operation, there should be a shared data system, which is accessible by every related offices. The data system should grant access to each office when the particular information is needed, so that they can design their own mission in accordance to another office's mission.

The electronic database would be useful in data management, sharing, and linking between offices. For example, the building damages data should be linked to the damage estimation value, with the address number and the geological coordinates, indicating the damage status and fixing status, along with the damage estimation value and the status of compensation fund. Then the database would be beneficial in showing the progress of the operation.

In each province, the Office of Public Works should be the initiator in the creation of electronic database system, and grant access to DPMCR to use the system in the survey and estimation of building damages. For example, if the volunteer engineer inspected the building and found that the three walls were all cracked, and the damages were in the yellow level, the detail should show that three walls were cracked while the rest of the building was safe. Then the fixing should be done on the cracked part only. Afterwards, when the Office of Disaster Prevention and Mitigation would estimate the damage values, they could use the same database to identify the amount of budget needed in fixing the building, into the data set of the particular address. If more offices could be granted access to the database, the community would gain the detail of damage history of each building to follow-up with the fixing progress, and they could

further estimate the risk or fragile spots of their own community. (Narin Kwangthong, personal communication, June 16, 2015)

4.2.1.3 The Relationship in Organization Flexibility Dimension

In considering the relationship structure between the actors through the information sharing, it seems that at first Chiangrai Province would command and operate together under the structure of the incident command system (ICS), which was the vertical structure from the commanding center into the disaster area, which is a suitable relationship in controlling the crisis. However, the relationship structure remained the same in the recovery phase. It was hard to find the horizontal relationship in resource sharing, for the commanding center would neither push the actors within the system to raise the resource nor convincing the local administer organization outside the disaster area, who might not be familiar or confident in cross-area assistance, to share their resources. As a result, many problems were found during the recovery phase as follow.

Central command center still in charge of coordination between the areas and distribute the resources. Information sharing to let the outsiders know that which areas still need help or what type of help required is one of the responsibilities the provincial command center need to arrange the central data and donation registration system. As well as be a part of rehabilitation process such as people who affected by this earthquake didn't need food or clothes but they needed know-how and budget to fix their houses. Provincial support units can help demolish the houses if needed as well as help moving goods from damaged public buildings. Or help repair public buildings. While the communities are receiving donations and manage themselves. Weerapong Kangwannawakul mentioned, the provincial command center was questioned about the responsibility as the mediator between the donators and resources distribution. The chief reflects on the issues that the provincial unit not able to control the donations or the help from private sectors direct to the affected areas. The conflicts between people in the area who feel discriminated and unfair treatment as they are in the areas that were not interested by the media. So, the donations did not get to them. (personal communication, July 8, 2014)

As the villagers initiated the request for help and passively receive the donation by themselves, the disaster victims thus questioned the administration center

who mediated between the donation and resource sharing, on why the provincial unit could not direct the donation and assistance from the private sector's actors towards the disaster area. By allowing the donators to distribute resource without equality concerns, it only led to the conflicts between the disasters victims. The comparison was apparent when each village receive unequal donations. There were complained the gap in government assistance and the donation which was only condensed in the area that receive mass media coverage only. (Sombat Sriam, personal communication, June 6, 2014)

Suggestion the provincial units who are in charge of central command centers should do the matching and fill the gap of donations and helps to the areas that truly need them. The private sectors who are willing to donate should coordinate with the central on the help requirement data in the affected areas. The assistance should be equally distributed towards those who really in need, so that there will not be the unequal donation only to the small number of people in the area which receives more media coverage. The central unit could take part in ensuring equality in resource access. (Weerapong Kangwannawakul, personal communication, July 8, 2014)

4.2.1.4 The Feedback in Organization Flexibility Dimension

There is hardly any reflection on the lesson learned, nor the follow-up of plan implementation, or using any feedback in order to reconsider the regulations or laws to suit the change in coping with Chiangrai earthquake. The vertical command and control structure hardly allow the feedback reflection from the disaster area back to the commanding center. The problems found during the recovery phases were as follow.

The process of using complaints and feedback data to adjust the operation process was slow. This issue was indicated by district and sub district organization reflect on the timeframe of damages observations and damages value evaluation process are very short. Thananchai Naktue mentioned, the first observation has closed even though the aftershocks still going on. A lot of people affected by the disaster feel hopeless and desperate as they feel like they wouldn't have the opportunity to receive the grant-in-aid. Although they have the lesson learned and the provincial organization has approve the observation period extension, the process still to rush. Local government both district and sub district levels are having the limitation of manpower. They were rushed to collect the data with the limited number of manpower,

it caused duplication work. The error data make them had to keep revising the report that caused delayed help or some of the people didn't get enough help as the aftershocks going on and the damages getting worst. (Thananchai Naktue, personal communication, July 16, 2015)

Suggestion either they have good intention by wanting to hurry grant-in-aid process to go through or local organizations got used to with orders from the top. Both organizations should adjust and improve the operation process after the lesson learned. They should keep assessing their working process and keep improving.

The central command center should be the center of data. If they are able to manage the database system, other organizations will be able to utilize those data. Narin Kwangthong mentioned, the solution to this issue should be "Damages approve handbook" which local organizations should be able to issue the damages handbook for each family such as grant-in-aid received to prevent from duplication aid receive. (personal communication, July 4, 2015) However, the process is slow as they are short of personnel, lack of commander and some areas did not give a copy to people as well as miscommunicate between organizations in aid system management to prevent from duplication.

4.2.1.5 The Adaptability in Organization Flexibility Dimension

Chiangrai disaster management still lacks flexibility and the attempt to understand each organization's role in the shared mission during crisis. Although the core of operation in crisis is the plans and laws that organizations have to adjust according to the situations, they hardly made themselves familiar with another organizations in the operation process. Both government and private sectors had to know their own responsibilities and who should get involve in the self-organize process. This limitation made it impossible to do inter-organization work, although they might exchange data between organizations. Each organization should learn about each other while operate together with the provincial unit and the local unit. They had to know their duty as well as knowing the whole team in the management system (self-organize).

Even if the technological advancement and the provincial operation plan could make it actually possible to share data between each organization, but it is still not possible to give the command across organization during the recovery phase. As most commanders are familiar with the management during the regular situation, when

they each had their own hierarchy of command. Therefore, they were unfamiliar with the design and operation in which the multi-organization had to tune the process together. This problem also link to the operation within the dimension of cultural openness, when it is important to understand the mission during crisis and adapt from the existing process to the new process in working with other organizations.

Suggestion They should have the talk on the responsibilities of organizations. To make organizations understand how and who should get involved in emergency situations. What kind of task should be done by whom? By using lesson learned in emergency situations and find the solution or improvement. The information is shared between organizations systematically both local and specialist levels. (Thananchai Naktue, personal communication, July 16, 2015)

4.2.1.6 The Non-linearity in Organization Flexibility Dimension

The meaning of nonlinear is the behavior that is unpredictably related to input Small changes in variables can have small impacts at some times, and large impacts under other condition. In the researcher's opinion, the disaster preparation drill is an important factor in coping with the unpredictable events from disaster. The organization's flexibility should come from the experiencing the crisis together. However, the earthquake preparation drill is still limited. The problem found during the preparation phase is described as followings.

The drills only for emergency phase do not focus on operation plan. And more focus on rescue people in the buildings more than command drill. The scenario trained on which organization should act first such as civil engineer inspects the safety of the structure and then rescue unit start to evacuate the victims before passing them to paramedic team. The command unit in this drill just read the transcript. This might cause difficulty in the real situation. And they don't know what to do in chaos. The disaster drills are at the provincial level. Local and communities level don't have opportunities to attend the drills. The breaking point is the incidence that strikes in the sub-district level, the drills should be held in that areas and the commanders should be community chiefs and the mayor.

Suggestion the command unit need to practice the decision-making process in the disaster drills as well. Kriengsak Pintatham, the Emergency Medical Doctor in Chiangrai Prachanukrah hospital mentioned, SAO should be trained to be the

commander in the drills. And they should know incident command system: ICS in the real situations. They shouldn't have to wait for the command from central government. Related parties in the area should know their own responsibility in the disaster. The mayors of the local administration organization should know their own duties and know what to command. The management person should practice the actual decision making and should not be told the role and hierarchy. Instead, they should be allowed to decide. And after the drill, there should be the reflection session that encourage the local administrative organization to be aware of the importance of their own roles as designated by laws. (personal communication, June 2, 2015)

4.2.2 The Problem in Technical Infrastructure Dimension

In studying the problems of Chiangrai earthquake management, the researcher had gathered both the quantitative and qualitative data. The quantitative data was gathered by the questionnaire which aim to study the success in the disaster prevention and mitigation policy implementation with the local administrative organization. As for the technical infrastructure dimension, the sampling group thought (as the data in appendix D, section 1.1.1 situation in technical infrastructure dimension) that the operation in this dimension would affect the earthquake preparation at the high level. The top three problems in the operation were 1) the renovation-rebuilding the damaged structures to endure another earthquake, 2) the safety inspection and risk evaluation, to aid the decision to demolish or reconstruct the building and 3) the producing of geographic data or the community map, which specify the house that need assistance. The above results is consistent to the qualitative results, which are explained as followings.

4.2.2.1 The Self-organization in Technical Infrastructure Dimension

The lack of understanding in the earthquake phenomenon, knowledge in survival technique, and the knowledge in situation control, made it hard to adjust the behavior in the same way to cope with the change. The problems found in the emergency phase are as followings.

Communities were lack of skills and experiences in the disaster. The communities lack of knowledge of procedure in the disaster. Hence, they did not know what to do in the emergency phase. The community leader also not able to give the

advice. They only able to warn people to be careful but do not have the knowledge to suggest them what to do. Most communities never have the experienced in disaster. Furthermore, the community were lacking of necessary equipment in the emergency phase. The electric cut as soon as the earthquake hit the areas. Hence, community leader not able to use the radio broadcast. The mobility equipment operated by the battery is the necessary equipment that they did not prepare. This limitation made it hard for the community members to change their behavior in the same direction. As a result, many communities were found chaotic after the earthquake. Some community members became anxious, had no resort, or flee separately, because there was no safe zone and assembly point designated in the community prior to the disaster. (Sombat Sriaun, personal communication, June 6, 2014)

The mentioned results is consistent to the quantitative results, in the issue of knowledge and skill in perceiving threats and the safety conduct. It was found that the sampling group had the medium level of threat perception, and could choose the correct answer about the risky spot in the building only 43.3 percent. They could choose only 47.2 percent of the correct answer about the threat perception from the appliances in the building, 70.6 percent of the correct answer on how to safely manage the appliances, and 79.4 percent of the correct answer about the outdoor risk.

Suggestion According to the quantitative data, it was found that after the earthquake, the villagers' perception about the threat and the chance that the earthquake would happen at the medium level only. Therefore, if the community is expected to do more self-organize, the capacity building must be done step-by-step. For example, it should start from being able to evaluate its own risk, know the basic safety protocol during the earthquake, and then develop more advance skills such as the community-based disaster management and the first-aid management.

4.2.2.2 The Emergence in Technical Infrastructure Dimension

Even if all the local administrative organization were required to create the geographical map that represents the risk and demographic data of the community, but few of them would forward the data to the community in order to restructure the system and allow the self-organization. The problems found during the preparation phase were described as followings.

Local officers still did not encourage the community participate in the planning of disaster management within the sub-district. Even if the local administrative organizations might already know the sub-district plan, most local administrative organization lack the officers with experiences in disaster management who could communicate its plan to the community leaders so that the affected villages' headmen could coordinate. Thus, the local administrative organization's protocol is still just the makeshift solution, which the community was separated. (Thananchai Naktue, personal communication, July 16, 2015)

Suggestion Currently the ability improvement is lacking the plan or proper course. The organizations can send their personnel to the training whenever they are ready. They also don't have the checklist of the courses to inform them about which training was done or which one they need to attend. The improvement extends to community level in very low achievement. SAO and Municipality should arrange CBDRM system for the communities. There are more than 1000 communities in Chiangrai area, disaster prevention and mitigation department of Chiangrai cannot handle all the training for all of them. Hence, they should train a training for each SAO. And this trained personnel have to create CBDRM system for the communities. (Yossakorn Suksaart, personal communication, June 16, 2015) Moreover, the communities also need to make disaster calendar 3 years back, set up the committee and hold the drills for their own areas. The provincial office will be the inspector and supporter. This model will help them to extend the management to communities faster. (Tawat ChaiThima, personal communication, July 7, 2015)

They should evaluate the risk in 3 years period back to use that data to improve disaster prevention and mitigation plan. While, use this evaluation to follow up policy process annually. (Burin Vechbanteong, personal communication, July 2, 2015)

4.2.2.2 The Relationship in Technical Infrastructure Dimension

In the time of major disaster, it would be necessary to gather and analyze the information from the village level simultaneously. In the case of Chiangrai Earthquake, there was the problem in data exchange, resource raising, and tangible network coordination in disaster management. The problems found during the recovery phase were as followings.

Resource raising or working across duty was quite impossible due to the limited data and resource sharing across department. Even if it was structurally designated that there should be the unit responsible for resource raising, network coordinating, and resource distributing in the time of disaster, but it was still not possible to actually follow the plan. Each unit would still share the data within itself. Thus, resource sharing would follow the relationship of each organization, instead of sharing according to the central data and distribute across network through the inter-organization coordination.

Suggestion There should be the system which serve as the support unit, to receive the resource request from every organization, and forward the resource to the front-end unit. For example, if the construction unit require the cement grout to dry pitch the building wall, the front end should not have to request directly from the donator. Instead, the donation receiving unit and the administrative center should be the support unit which would send the received cement to the construction unit. Therefore, the front end's work load can be reduced, while the support unit can raise resource and create thank document to the donator. (Narin Kwangthong, personal communication, July 4, 2015)

4.2.2.4 The feedback in Technical Infrastructure Dimension

There was the survey of damage, risky area, and risky building in Chiangrai Province with the support from the academic sector in fixing the house to endure the earthquake. However, there was no policy or master plan in recovery. The problems found during the recovery phase were as followings.

There was limited data connection between the actor with the policy authority and the actor from the professional engineering field, in order to improve the risk management plan. The informants from the academic sector thought that there should be the building inspection in order to estimate the damage should there be any major earthquake. There should be the risk analysis in many provinces, and each province should create the possible model of the earthquake, and use the result as the guideline in risk management, recovery, logistic, inventory, equipment, and resource moving in the rescue mission as well as the auditing of the emergency plan. There should especially be the identification of those who will be responsible for evacuating the elder and the handicapped, by the network coordination of the people sector in the

community level and the government sector, in order to mitigate or manage the earthquake risk at the policy level. (Ekachai Kittiwarakul, personal communication, July 23, 2014)

Suggestion The provincial office of disaster mitigation and prevention should incorporate the lesson learnt from the past earthquake disaster with the master plan or model which will be the frame of systematic recovery for the community, which will increase confidence and ease the anxiety of living in the earthquake area.

4.2.2.5 The Adaptability in Technical Infrastructure Dimension

Lifestyle adjustment and innovation usage to increase confidence in living within the area with earthquake risk of Chiangrai was still limited. The problems found during the preparation process were as followings.

Although Chiangrai province had tighten its building permit application process, there was no adjustment of local regulation in building control. After the safety inspection with the public buildings, commercial buildings, and the residential buildings, most villagers adjusted themselves and prioritize the building firmness by stop using the ready-made column as the main structure, and selecting the light-weight metal sheet roof instead of the tile roof. However, many people did not know the right principle of renovation or construction. Some of them performed the renovation according to their instinct or budget, for there was no technical training process. The builders from the government sector, at both the sub-district level and the village level, lack the technical knowledge and could not raise confidence in the construction process. (Surasit Sukmai, personal communication, June 5, 2014)

The result from qualitative method was consistent with the quantitative method, which found that the strength reinforcement and building renovation in the public building and residential building in most villages were still limited at the low level. There were as many as 60.7% of villages which had not receive residential building renovation. (See appendix D, topic 2.1.6, disaster mitigation)

Suggestion The informants suggested that if the provincial governor would not announce any amendment with the local regulations about building control, then the Department of Public Works and Urban Planning should be the initiator of the enforcement and amendment of the country-level law, in addition to the Building Control Act, 2007, and the related ministerial regulation. The law should be enforced

with the residential buildings, in addition to the public building, in the way that would not affect the commercial investment. And the local unit would have to adjust itself in terms of its formality in authorizing the construction plan. (Narin Kwangthong, personal communication, July 4, 2015)

4.2.2.6 The Non-linearity in Technical Infrastructure Dimension

As for the preparation for the unpredictable change, in terms of the technical infrastructure dimension, the researcher would like to argue that the agility in resource management, especially with the financial resource, is the major factor in preparing for the unpredictable earthquake disaster. In the case of Chiangrai province, dealing with this problem should be similar to other disaster area. The problems found during the preparation phase were as followings.

The budget Problem in prepared phase limitation the announcement of ministry of finance on the advance budget for emergency 2013 still limit the advance budget to be spent on the state after the disaster only. The budget for prevention state still come from SAO. However, the disaster is uncertainty incidence, they never able to predict the type of disaster, how critical it will be or when it's going to happen. The budget for prevention state is difficult to estimate if they have not made the prevention and mitigation plan beforehand. (Yossakorn Suksaart, personal communication, June 16, 2015) When the budget for the sub-district level organization was limited, the preparation for the disaster in the village level also became limited as demonstrated in the quantitative research (see appendix table 1.16), which found that the least supported activity in policy implementation at the village level was the budget support in disaster preparation.

Suggestion the budgeting regulations should be improved on an advance budget to be able to set the budget for the prepared phase. If this regulation is improved, organizations will be able to prepare themselves to handle the disasters and able to manage the risks better.

Disaster fund in sub-district level is another way out to gather volunteers to work in the team, create cooperation that more than insurance. Set up the fund committee to work on the database at sub-district level. The committee should be the stakeholders who were affected by the latest disaster. This fund is similar to the insurance, the community has to pay to the fund. However, this fund will not pay for

the damages that already paid by SAO. This fund fill the gap of the damages that does not count as the public disaster and SAO not able to pay grant-in-aid such as thunderbolts, buildings catch on fire or landslide. (Thananchai Naktue, personal communication, July 16, 2015)

4.2.2.7 The Other Problem in Technical Infrastructure Dimension

Apart from the mentioned problems in the technical and social dimension, the informants also identified the technical problems in Chiangrai earthquake coping, which could become the problem in the emergency phase as followings.

1) Lack of GIS data specialist to link the damages data

In risk assessment process of affected areas. Combine fault line data, and damaged building locations data that collected in the damaged observation process. However, there are errors in the location the data collection process as the affected areas are wide spread and lack of proper equipment as well. The majority of collected data are house numbers and evaluated the level of damages.

Suggestion ICT should send the specialist to support this data collection by using technology information to link the GIS data and the damaged areas from the observation. The database should be done in advance and design Platform of the data system. So, organizations able to record the level of damages detail (green, yellow and red). The data included locations and building numbers or location from the electricity authority matching with the damage data. This solution helps the organizations who collect the data on different platforms. (Narin Kwangthong, personal communication, July 4, 2015)

2) The limitation of building plan accessibility. Buildings in the areas are not properly keeping their building plans. Most of them are on papers. The accessibility in emergency phase for safety assessment before the rescue unit or civil engineers make the decisions on rescue process.

Suggestion the public buildings in risk areas such as hospitals and schools should have the proper process to keep the building plans in soft file. So the engineering team or rescue teams able to use them for safety assessment. (Kriengsak Pintatham, personal communication, June 2, 2015)

3) Lack of patients database during the disaster. The patients caused by the disaster increase in number, provincial hospitals not able to handle this large number of patients. They need to transfer them to nearby hospitals. The information system should be improved to be able to send the patient information between hospitals. Currently the patient information was collected manually.

Suggestion Public health unit should improve the referral process to nearby hospitals. The hospital able to check ICU capacity online. And provide resources database, paramedic, the rescue unit and spare communication system. And the relatives able to check the status of the patients online. (Kriengsak Pintatham, personal communication, June 2, 2015)

4) Communication radio signal does not cover the whole area. Due to geographic of Chiangrai is the mountain areas and far areas, the communication equipment still limited. Signal repeater equipment are lacking maintenance. Lots of time they found that the radio signal doesn't work in some areas. Telephone is still main communication equipment but they only going work in the normal situation. The 2nd channel of communication is still necessary for the worst case scenario which police, soldiers and local organization will need them.

Suggestion The paramedic center 1669 should in charge of communication system infrastructure improvement in the area. The department of disaster prevention and mitigation also should be working with them by making the coordination-system plan. IT center should be able to connect data in ability improvement. The medical unit and rescue unit should design the system to be able to connect all rescue networks and able to share the resources. The local medical team needs the radio signal during first 24 hours and they could not wait for CAT Telecom fix the line after the disaster. (Kriengsak Pintatham, personal communication, June 2, 2015)

5) Disaster alert system is limited. As Chiangrai Meteorological office are lack of staffs and their main mission is monitored the bad weather for aviation, agricultural and earthquake. The limitation is they have to analyze the situation as well as make the announcement at the same time.

Suggestion Create media network for communication and disaster alert process. They should rely on the science information and try to keep people in the areas calm down. (Burin Vechbanteong, personal communication, July 2, 2015)

4.2.3 The Problem in Cultural Openness Dimension

In the study of Chiangrai disaster management problems, the researcher gathered both the quantitative data and the qualitative data. The quantitative data was gathered by the questionnaire which aim to study the success in the implementation of disaster prevention and mitigation policy at the local administrative organization level. As for the structure of technical area dimension, it was found (see appendix D, topic 1.1.2, the situation of the cultural openness dimension) that the cultural openness problem in the operation of the local administrative organization highly affected the disaster coping. In the sampling group's opinion, the three most important problems in operation were 1) the understanding of each organization's role during the crisis, 2) the encouraging of the villagers' self-organization in the recovery of their own village, and 3) the conflicts from unequal distribution of money or utilities donation made it harder for the community recovery with the participation of people. The above results were consistent with the qualitative results as described below.

4.2.3.1 The Self-organization in Cultural Openness Dimension

In considering the behavior adjustment towards the same direction of the actor within the local-level operator system, it was reflected that the disaster risk management system in the provincial level still faced the attitude problems in coordination between the local-level organizations. The problems found during the recovery phase were described as followings.

Government sectors think that local organizations are weak and don't have the self-organization capacity. The management after the disaster are in the form of helping hands more than the support to move forward. The activities operated separately. They should instead strengthen local organizations to be able to manage themselves. Each activity would be operate separately, so the actors in the local level always had to depend on the resources from the higher level. Moreover, the operators of the local administrative organization posed some problems which led to the lack of confidence in decision-making. During the disaster, the actors within the local

administrative organization would wait for the orders because they were uncertain about their own authority, for there was no appointed mayor with the full authority in the district level. Most decision-making became hindered in terms of authority, for many SAOs had never practice the disaster management process before. They did not know that the damage data should be gathered first, that they waited for the district's command only, while the district itself had not set up the commanding center which would be responsible for the unity in management since day one. Then, most SAOs could only responded to the emergency problems. Many SAOs buildings were also damaged that they had to work in the temporary tent similar to the disaster victims. (Thananchai Naktue, personal communication, July 16, 2015)

Suggestion The government sector should adjust their attitude and give more priority with supporting the local sectors, so that they would become strong and active in the disaster management which will reduce the risk within their own area. They could then become the model of the self-organized community which can cope well with disaster.

4.2.3.2 The Emergence in Cultural Openness Dimension

During one year of the preparation phase, after the earthquake struck, the provincial unit should set up the specific coping plan for all of the risky area. The strategy for the preparation phase and the disaster phase should be consistent. However, the planning in each level would be done separately, in the way which the sense of commitment was missing. The problems found during the recovery phase were described below.

Disaster prevention and mitigation plans improvement in local and provincial levels are not continuity. The organizations have adjusted their operational plans. Chiangrai disaster prevention and mitigation operation plan 2015 shows the flexibility of organizations aspect. It shows that conformity of majority plans are in the structure of the ministry of interior. Meanwhile local and district levels plans are unconformity. The staffs in district and sub-district levels reflects on the mindset of plan creation that it comes from area management. However, the locals have make the plans without looking into provincial plans. Hence, it's impossible to conform local plan to the district and provincial levels at the same time. So these plans are isolated from other level's plans and didn't think of continuity. Also, lacking the evaluation of

the previous plans led to the difficulties in writing the local plan which would be consistent to the district plan and the provincial plan simultaneously. The final plans became separated, lacked of continuity, and lacked of the evaluation of the previous disaster management plan. (Thananchai Naktue, personal communication, July 16, 2015) Moreover, the contact lists of the government sectors, rescue team, the civil society, and the leaders of the community involved with the disaster were centralized in the provincial unit, instead of being shared to the operation unit in the local level and the community level. (Surachart Saardiam, personal communication, July 13, 2015)

Suggestion district and sub-district units suggested that the plans at every level should be conformity. The provincial level should be finished making their plan first and then coordinate with district level to confirm the plans. The branch of disaster prevention and mitigation office and ministry should send their soft copies of operation plan to the provincial level before sharing with local organizations.

In gathering the data of the fragile group within the community, there should be the location identification of those in needs of early evacuation such as children, elderly, pregnant women, and the handicapped, within the geographical information or the community map. As most communities had never experienced the major earthquake or disaster, there was never the central data of the fragile group's location. This data was scattered within different organization such as the Village Environment Volunteer, or the Village Health Volunteer and should be incorporate with the database of the community which to do the community-based disaster risk management (CBDRM). This will help realizing the operation plan better.

4.2.3.3 The Relationship in Cultural Openness Dimension

Although Chiangrai had the unity in management within organization and working inter-organization according to the command system during the crisis, the actors within the system did further not tune their operation process to achieve the goal in disaster mitigation together as the whole unit in the province. There was the lack of the integrated database of building safety and the damage evaluation for reimbursement, as mentioned in the emergence of inter-organization coordination. The problems were found during the recovery phase as described.

The government culture problems led to the lack of sense of commitment with other organization in the officers within the government system. As

it would be natural for the system to just follow the assigned duty, it was hard to initiate the coordination with other organization, when the commanding center which used to command and control many departments such as the public health, the public works, and the military, would be replaced by the regular communication and operation process after the crisis. Joining the operation group with the commanding center in the recovery phase merely meant the operation report by each department, rather than the data sharing and actually creating the recovery system together.

4.2.3.4 The Feedback in Cultural Openness Dimension

As the actors in Chiangrai were accustomed to following the vertical orders in responding to the problems, it was quite unacceptable for them to give priority to the unofficial actors who could become the partner which act as the mechanism in expanding the lesson learnt. Therefore, the lessons learnt from the community recovery based on the assistant from the actors in the engineering professions, the civil society, the business sectors, and the mass media cannot be systematically incorporate in the recovery process planning yet. The problems found during the recovery phase were described as followings.

Lack of giving priority in utilizing the lessons learnt from the unofficial actors in the system with the official operation. The local units reflected that the recovery operation by the province's Office of Disaster Prevention and Mitigation were mostly just the support of renovation instead of encouraging the community to recover itself, or bringing in the non-profit organizations or the private sectors to help. It seems that the provincial unit could not organize the recovery process for the community well, that the local unit did not receive construction material nor the budget systematically.

The community of the disaster victims thus encountered the problem of not being able to start the renovation due to the lack of renovation plan, budget plan, and the order of damaged buildings which required fixing first. The villagers could only demolished the damaged parts of their houses or bought the construction material, which they had no idea on how to use while no builder was available. Since there was no systematic operation plan, the material bought would be decayed during the wait. This problem could reflect that the provincial unit ignored the system planning in coping with the community level problems. As the community themselves also lack the

experience, the construction management after the earthquake in the community level became chaotic. (Sombat Sriaun, personal communication, June 6, 2014)

Suggestion the area should provide the master plan for rehabilitation process for the community. Since they were concern about the safety of living in the risk area. Local government should be stricter on construction license. (Narin Kwangthong, personal communication, July 4, 2015) The Chiangrai Province should learn the lesson and support the systematic recovery from the local administrative organization, by encouraging the community to self-organize, supporting the shared tool system for the whole community, providing the builders and central team which organize the sequence in renovation or construction, and providing the central budget for the community-level recovery. The provincial unit could be the mediator in raising and forwarding the resources from the private sector donation into the affected area. (Ekachai Kittiwarakul, personal communication, July 23, 2014)

Moreover, the front-end officers could take be the supporter for the local leaders and people in set up the rescue system and donation receiving system. They could start from organize the database of damage and needs of each affected victims, so that when the donation arrive, it would be forward to the suitable person. (Yossakorn Suksaart, personal communication, June 16, 2015)

4.2.3.5 The Adaptability in Cultural Openness Dimension

There was no designated structure of disaster management during 2010-2015 in the district level, as the structure of disaster management aimed to reform the government system by dissipating the authority in disaster management from the provincial level towards the community level directly. The problems found during the recovery phase could be described as followings.

Lack of acceptance of the additional mission in management of emergency data without the long-term structure in the district-level organization. There were few operating officers in the district level, and they did not understand their own role in managing the data related to the recovery after the disaster. Most officers in the district unit felt that the data gathering and verification from the local administrative organization towards the provincial unit was not their regular duty, and thus felt burden by the task for the district level.

Although the National Disaster Prevention and Mitigation Plan of 2015 had designated the commanding structure which would link all levels from the national, provincial, district, and the community, as well as the coping plan in the village level, but the district organization did not have any structure of regular officer in disaster management. If the disaster occur, the assistant deputy of security in the district unit would have to adjust their regular mission and assign the human resource to coordinate and manage the mission related to the disaster, including the management of donated resources, verification of damage data, and preparation of the operation plan in disaster prevention and mitigation at the district level. Even if there was the disaster prevention office at the district unit (added in 2013) to provide consulting and data management, but if the mission involve the area wider than one district, the office of disaster prevention would not be able to support them all due to the limited human resource. (interview with Surachart Saardiam, Deputy District Chief of Security, Mae Lao District, July 2015)

Suggestion The district unit should set up the office of disaster prevention and mitigation as the administration center, instead of assigning the existing personnel with additional duty. From the perspective of disaster management, the local unit is the most powerful one with the least resource. The district should then own the resource in disaster management instead of transferring to the municipality or the local administrative organization. (Anusorn Seeboonrueng, personal communication, July 28, 2015)

4.2.3.6 The Non-linearity in Cultural Openness Dimension

Although Chiangrai province had provided the basic amenities such as reserved food source, temporary shelter, and the reserved plan in set up the Emergency Operations Center (EOC) within the official regulations in the integrated operation during the emergency phase, but the drill in coping with earthquake incident still focus on the major of the provincial level, instead of preparation for the community to control the situation by themselves. The problem found during the preparation phase could be described as followings.

The disaster drills are at the provincial level. Local and communities level don't have opportunities to attend the drills. The breaking point is the incidence that strikes in the sub-district level, the drills should be held in that areas and the

commanders should be community chiefs and the mayor. Actually, the breaking point in operation was at the scene in the sub-district level and the community level. The point that should really get the drill is the sub-district level. The village headmen and the mayor of the local administrative organization should perform the commanding duty drill, such as evacuation of the people and coordinate with the outside organization on the way.

Suggestion SAO should be trained to be the commander in the drills. And they should know incident command system: ICS in the real situations. They shouldn't have to wait for the command from central government. Related parties in the area should know their own responsibility in the disaster.

The drills in local areas should come with ability improvement course in full scale 3-5 days. The provincial mediator should also join in the training. The drills should be held in every local area. They should focus on the disaster probability in the province and the link with the region. They should learn from other regions on how they support and manage their areas. Hence, the training course should be identified and focus on local organizations especially disaster management which classified into 3 courses are the course for commanders, the course for management level and the course for operational level. (Yossakorn Suksaart, personal communication, June 16, 2015)

The curriculum for the operating officers should start by especially focusing on the local administrative organization in disaster management. It could be divided into three curriculums for the commander, the management, and the operating officers, in order to reduce the gap between the commanding unit, the communicating unit, and the operating unit who would encounter the situation.

4.2.4 The Overview of the Operation and Problem in Chiangrai's Earthquake Response

The mentioned problems and suggestions in responding to the disaster by the network could be compiled within the element of social technique in earthquake responding of Chiangrai province as table 4.2.

Table 4.2 Compilation of Problems in Responding to the Earthquake.

Factor/Dimension	Organization Flexibility	Technical Infrastructure	Cultural Openness
Self-organization during the emergency phase		The community lack the skill and experience in self- organization during earthquake.	
Self-organization during the recovery phase	Power structure in resource management at the local level did not correspond to the community level.		The commanding unit at the provincial level perceived the local and community as the weak and passive unit, instead of a unit which is able to self-organize. And the officers operated under command only.
The emergence during the recovery phase	Many organization's work were redundant.		
The emergence during the preparation phase		The local officers did not encourage the community to participate in the disaster planning within the sub- district.	The adjustment of disaster prevention and mitigation plan in the local level and provincial level lack continuity.

Table 4.2 (continue)

Factor/Dimension	Organization Flexibility	Technical Infrastructure	Cultural Openness
Relationship during recovery phase	The commanding center within the province did not fully act as the mediator in raising resources and information sharing.	Resource raising cross-duty or work replacement were limited.	There was the cultural problem within the government where the officers lack the conscience in coordination with other organization.
Feedback in the recovery phase	The process of operation improvement according to feedback was slow.	The data connection between the actor with policy authority and the actor within the engineering field in the risk planning improvement was limited.	There was no attempt to bring the lesson learnt from the unofficial actors within the system to expand into the official operation.
Adaptation within the recovery phase	Chiangrai disaster management still lack adaptation and the attempt to understand the role of each organization in the shared mission during crisis.		There was the problem in acceptance of added mission in data management without long-term structure at the district-level organization.

Table 4.2 (continue)

Factor/Dimension	Organization Flexibility	Technical Infrastructure	Cultural Openness
Adaptation during the preparation phase		Chiangrai province became stricter with building permit application, but there was no adjustment of local regulations related to building control.	
The non-linear during the preparation phase	Chiangrai earthquake drill was more about practicing the indoor rescue skill than the commanding skill between the organization and the affected area.	There was the congestion in spending budget to prepare for the disaster.	There was limited attempt in the development of the community and the local's skill to cope with crisis

4.2.4.1 Evaluation of Policy Application in the Local Level.

In considering the big picture of the operation during the recovery and preparation phases, the researcher used the quantitative research method to evaluate the results of policy application in the local administrative organization through the Power Distribution Model, in order to find the level of management factors and the results of disaster mitigation according to the policy as followings.

Organization relationship would influence the policy application at the high level. In the sampling group's opinion, the three most important factors were

1) the coordination with the rescue and disaster management team during preparation phase, 2) the commanding and coordination between the local administrative organization and the community, and 3) the trust between people and their community leaders. (see appendix D, topic 1.1.4, organization relationship factors influencing the policy application)

Resources would influence the policy application at the medium level. In the sampling group's opinion, 1) most local administrative organizations had the personnel with experiences in disaster management only at the medium level, 2) most local administrative organizations had the leader with training and experiences in disaster management only at the medium level, and 3) most local administrative organizations had enough budget for the disaster mitigation work with community at the medium level. (see appendix D, topic 1.1.5, resource-related factors in policy application)

The organization's capability and condition would influence the policy application at the medium level. In the sampling group's opinion, even if the local natural resources were abundant, but the whole management structure only enable medium-level flexibility and medium-level direction in disaster management within their own area. (See appendix D, topic 1.1.6, organization capability and condition factors in policy application)

The success of policy implementation at the village level, especially the awareness creation, strength encouragement, communication and coordination, would influence the policy application at the medium level. There were just two activities with high-level support, which were the villagers' skill development in disaster management such as first-aid, safety practices during the earthquake, and training in safety practices during the earthquake within the affected area. (See appendix D, topic 1.1.7, success in policy implementation at the village level)

The success of self-organization policy implementation with the local administrative organization, in the development of data system and communication, would influence the policy application at the medium level. Most participants did not clearly know how their local administrative organization operated in communication and adjustment of disaster management protocol. (See appendix D, topic 1.1.8, success of self-organization policy implementation with the local administrative organization)

4.2.4.3 Evaluation of Policy Application in the Community Level

In considering the big picture of the operation during the recovery and preparation phases, the researcher used the quantitative research method to evaluate the results of policy application in the community administrative organization, in terms of operation framework between organizations during crisis, which included the independent variables of risk-awareness, communication, coordination, and disaster mitigation factors.

In studying the management factors and outcome of disaster mitigation according to the local-level and village-level policy, the results were consistent, that when most local administrative organization distributed the operation towards the community at the medium-to-low level. And the operation results which linked to the community, in terms of risk awareness, communication to cope with disaster, coordination in order to prepare for disaster, and disaster mitigation at the local administrative organization were all in the medium-to-low level as followings.

Risk awareness factors: The evaluation criteria reflected that the participants' level of risk awareness was medium. The average number of persons who gave the correct answer about the risky places and safe places was 60.1%. And most of the participants perceived the chance of earthquake at the uncertain level. (See appendix D, topic 2.1.3, risk awareness and chance of earthquake perception)

Communication factors: The evaluation criteria reflected that the participants' communication in coping with disaster was at the medium level. When consider the detail of questions according to the appendix 2.5, it was found that most participants lack the followings items; 1) the list of equipment and tools needed during crisis, 2) the disaster calendar which indicate the possible disaster which could happen throughout the year, 3) the map which indicate the risky area of the village, and 4) the historical data of natural disaster occurred in the village, especially the frequency and the damages. (See appendix D, topic 2.1.4, communication coping with disaster)

Coordination factors: The evaluation criteria reflected that the participants' coordination in coping with disaster was at the medium-to-low level, for most participants had the village's committee of disaster management who coordinate with other sectors within the community. And most participants were also equipped

with the existing Civil Defense Volunteer within the community. They were also able to rescue and evacuate the people promptly whenever the earthquake strikes

However, most participants still lack the essential items in coordination in order to cope with disaster. When consider the detail answer according to the appendix 2.6, the most needed items were 1) unofficial or official disaster management network, 2) cooperation from the volunteer from private sector, non-profit organization with the ability to cope with disaster, 3) cooperation from the organizations who should support the earthquake drill within the community. (See appendix D, topic 2.1.5, coordination in coping with disaster)

Disaster mitigation factors: The evaluation criteria reflected that the participants' disaster mitigation was at the medium-to-low level. When consider the detail answer according to the figure in appendix 2.7, the most needed items were 1) the disaster funds within the village, 2) the disaster fund which can be paid promptly during crisis, 3) equipment and tools needed if the earthquake strike, 4) emergency kit consisted of essential items need if there must be any evacuation, and 5) earthquake drill. (The last drill occurred over two years already)

The mentioned operation was also related to the building reinforcement and improvement of the public buildings and residential buildings. According to the appendix 2.8, the results of policy implementation, it was found that most villages had the low level of building improvement in order to withstand the earthquake. There were almost 60.7% of the villages which the residential buildings did not received any improvement. Only 25.4% of the villages consisted of more than a half of improved residential buildings, and 13.9% of the villages consisted of all improved residential buildings. (See appendix D, topic 2.1.6, disaster mitigation)

CHAPTER 5

THE NETWORK

According to the study of operation in each phase and the problem situation in each dimension as described above, the major factor which influence the operation was the management policies, which created the vertical relationship under the influence related policies and strategies. There were also the horizontal relationship which occurred from the support from the government organization and other social actors, in data sharing, knowledge sharing, and resource sharing in recovering the community after the earthquake as followings.

5.1 Policy Network Analysis of Public Hazard Management

The researcher studied the inter-organizational relation especially the power-dependence model. The relation between national and local governments was based on exchanging resources which each organization possess in terms of supporting regulations, budget, data, or information. The study began at the relation structure designated by the policy and strategy in disaster management prior to the disaster event

5.1.1 The Strategy related the Intergovernmental Cooperation Structure in Thailand Public Disaster Management

Operation plan in Thailand are related to inter-organization integration. The plans that related to disaster management come from 2 strategies are

- 1) Strategic national action plan (SNAP) on disaster risk reduction 2010-2019
- 2) Public Disaster Prevention and Mitigation strategic plan B.E. 2555-2559 (A.D. 2012-2016)

5.1.1.1 Strategic National Action plan on Disaster Risk Reduction 2010-2019

This plan is the result of agreement under The Hyogo Framework for Action (HFA) 2005-2015. This agreement give precedence to stakeholders under National Platform. In the joint operation of National disaster prevention and mitigation according to Public Disaster Prevention and Mitigation Act B.E. 2550 (A.D. 2007) National Prevention committee according to security act 1959. These are committee responsible for regulation the Disaster risk reduction strategic plan, which every sector has to join in this committee to coordinate and share resources, by distinguishing the resources type and disaster type. Include determined the chargeable ministry or department to create the comprehensive emergency plan in every disaster scale. Moreover, these organizations have duty to connect and support including The National Disaster Prevention and Mitigation Plan B.E. 2558 (A.D. 2015), Bangkok Metropolitan Administration Disaster Risk Management Plan, Disaster Management Action Plan of the Sub-district administration Organizations. Disaster Management Action Plan of the Municipal administration Organizations. Disaster Management Action Plan of Pattaya city administration Organizations follow Public Disaster Prevention and Mitigation Act B.E. 2550 (A.D. 2007) and national defense policy (Ministry of Defense)

5.1.1.2 Public Disaster Prevention and Mitigation Strategic Plan B.E. 2555-2559 (A.D. 2012-2016)

This strategic plan is the tool to create integration framework and direction for related Department of Disaster Prevention and Mitigation to achieve in making plan / project / activity. Related sectors from local government to national organization and people in the area to share the same development goal. Operation means to gain coordination between institution and technical institutions to work in the network are;

- Create mechanism to make the network agree that it is the joint benefit and they have to take responsibility to protecting it.
- Encourage the network to integrate their resources for disaster management.
- Educate local network about disaster prevention and mitigation.

- Encourage the network to realize about proper work procedure and integrate budget in operation process.

The network has to encourage, support and improve responsibility of network members both government sector (central, regional and local) and civil society. As well as other related organizations share the same goal and use the same mechanism are;

Central Government, Department of Disaster Prevention and Mitigation (DDPM) is the main department who coordinate and educate operation level in local government follows National Disaster Prevention and Mitigation Plan BE 2553-2557 (2010-2014).

Provincial, Disaster prevention center is responsible for operation and coordination according to strategic plan.

Local government are Provincial organization, SAOs and Municipality are local government who take responsibility in their own area. However, coordination among organization is critical to make it easier to achieve implementing the plan.

Private sector organization and volunteers, as civil society should be a part of social security. These organizations should be support to coordinate with government sectors to operate their own parts.

Education Institution is the main sector who have human resources and knowledge to help with disaster prevention and mitigation.

Civil society, according to Constitution of the Kingdom of Thailand, B.E. 2550 (A.D. 2007), the basic right of community is help with their community reservation, safety. They have the right to be educated to realize about the disaster.

5.1.2 The Policy related the Intergovernmental Cooperation Structure in Chiangrai Earthquake Response

There are 3 major plans that structure the coordinate between organizations in this disaster are;

- 1) Public Disaster Prevention and Mitigation Act B.E. 2550 (A.D. 2007)
- 2) National Disaster Prevention and Mitigation Plan B.E. 2553-2557 (A.D. 2010-2014)
- 3) Emergency operational plan under disaster in Chiangrai year 2014.

These plans are protocol for integration of coordination under the disaster which is the framework for indicating responsibility and resources exchange between these 3 levels of organizations;

1) National level, the Ministry of interior is the operational chief

2) Provincial level, the provincial governor will be in charge of the operation.

3) Local level, the district chief will take charge of the operation in the area they are responsible. The Chief Executive of the SAO are in charge of their own area as well.

Table 5.1 Level of Disaster Severity in Public Hazard Management

Level	Disaster Management	Person in Authority	Responsible organization
1	Small scale	Local Director District Director Control the situations	SAO/Municipality/District Prevention and Mitigation operational center.
2	Medium scale	Provincial director control the situation	Provincial disaster prevention and mitigation operational center.
3	Large scale	National disaster prevention and mitigation center control the situation	National disaster prevention and mitigation operational center
4	Critical scale	Prime Minister / Deputy Prime Minister control the situation	National disaster prevention and mitigation operational center

Source: Chiangrai Disaster Prevention and Mitigation Office, 2014.

Since the earthquake on May 5th, 2014 was Medium scale (Level 2). Resource distribution and information exchange was operated according to emergency protocol structure 2014. Which main purpose is related organization able to integrate their resource and structured.

5.1.3 The Role of the Actors in Each Level in Chiangrai Earthquake Response

The researcher uses active structure concept to look into the responsibility of each actor found that have the structural context of network and resources exchange, the majority of the actors able to take charge of their own responsibility, which commands come from provincial level. Also they had protocol according to emergency act 2014 which was announced before the disaster.

By using social network in 4.2.2 to analyses policy network in 5 types of sub network are 1) Policy community 2) Professional network 3) Intergovernmental network and 4) Issue network. As we can see that in the major structure, there are cluster which have various intense of member and resource distribution structure. In that clusters there is Policy community which is Group 1, Emergency Operations Center-EOC which in charge of regulations, budget and data. Hence, this cluster is the center of resource distribution. Professional network is Group 4 Building inspection coordination center. This cluster gathered by Engineer and Technician who are in charge of safety data.

Intergovernmental network are Group 2 Military District of Chiangrai, Group 3 Provincial Public Health Office, Group 4 Building inspection coordination center and Group 5 Civil society Network for Disaster Management of Chiangrai. This cluster has their own resources and has freedom in operation on the issues they are in charge of. Every group is their own center of resources management.

Last one Issue network are Group 6 Mae Lao area, Group 7 Pan area, Group 8 Mueang Chiangrai area Group 9 Pra Wiang Chai area Group 10 Pa dad and Mae Sruay area. Although local government has their own resources to make the decision, during an emergency situation, these areas haven't appointed their chief. So, nobody takes charge and people have limited knowledge on how to deal with this disaster. Therefore, they waited for the district chief to make the decision. These local organizations still dependence on central government

In this structure, the donators have to register with the EOC before operating in the area. And EOC will distribute the resource to effected areas. The majority of the aid is for the community such as schools and temples. During this 1 year after the attack,

the researcher hasn't come across private sector run the Requisition or operation that will help the disaster risk reduction.

5.1.4 The Relation of the Actor in Each Level

This topic the researcher concentrate on finding out which factors are the obstacle, which factors are supportive factors. By explaining relations between government offices and other actors in corporatism model type by supporting between groups which Rhodes (2006) suggested categorizing the actors into 3 levels are

1) Macro-Level, from the national relation with provincial organizations as policies implementation operator.

2) Meso-Level, look into the relationship between provincial organizations and district level organization to distribute resources between each other.

3) Micro-Level, look into the relationship between individual sectors.

The researcher studies the inter-organizational relation especially power-dependence model. The relation between national and local governments based on Resource exchange. The study started from relation structure before the disaster are

According to disaster prevention and mitigation act year 2007 which indicate structure for provincial, district and sub district to distribute the resources.to effected areas. The explanation of this relation depends on “Resource exchange” Between Macro-level, Meso-level and Micro level) according to Rhodes’s concept (2006) These 3 level of networks, Meso-level policy connected to Micro-level because of depended. Macro-level is the network that makes the rules of power for all networks.

5.1.4.1 Macro Level

Macro-level is relationship between provincial level and national level the dependence in policies aspect. Provincial dependence of budget resource to the national level, which is Disaster aid committee of Northern region. The relation depends on emergency phase, which needs the budget for grant-in-aid within 15 days and finds long-term solution as well. Estimated budget is 500 million Baht in damages observation process. This damages observation were done on transportation lines, dam, and buildings. Identify risk areas, sinkholes, and landslide under the responsibility of public works and town planning and other related organizations. The budget comes from the advance budget from Ministry of Finance.

Furthermore, provincial units also have relation outside disaster management policy with The Engineering Institute of Thailand. They help with building inspection by volunteer engineers. Coordinate with Public Works and Town planning department held training for local contractors and relevant parties. Make understanding of the fault lines that have chances to create the earthquakes, monitor, inspect the buildings and find the solutions as well as building design for the risk areas. They also sent specialist engineers to observe and analyze method to reconstruct Mae Sruay dam. As well as hold the academic seminar and observe the opinions of communities and Royal Irrigation department for the renovation design and install alarm tower.

The relation between the provincial unit and regional unit. The majority of this relation occurs in emergency phase to rescue and mitigate in the affected areas. This regional unit is nearby areas units both in Chiangrai and neighbor provinces. They help in a front-line unit such as water supply, set up the shelters and demolish damaged buildings. Sub district organizations rely on the help of the Provincial organization and military district. Meanwhile, private sectors and organizations that have informal relation also support financially and donations to provincial organization center. However, when the provincial unit announced that this earthquake is level 2 from 4, the commands were centered in the provincial unit. We found that the relation of organizations was centered at the provincial level. During the emergency phase, sub district able to coordinate with provincial organizations to request assists and rescue such as equipment's, excavators or dozers without having to go through district level. After the emergency phase, sub district organizations have a closer relationship with provincial level than district level. Before recovery phase, provincial organizations commanded district and sub district organizations to collect the damages data for long-term treatment.

Provincial organizations able to request coordination from another organizations in the case of disaster occur in wide area cross over from district to district. They take responsibility in resources distribution, distribute donations as well as work as a front-line to demolish public buildings and shelters. This phase was operated in unity as there have divided the zones and coordination in prior. The following rehabilitation's relation comes from formal structure between data

management. The relation between district organizations and sub district are command and control form.

Relation between the provincial organization and sub district organization. Since the damages from the earthquake on May 5th, 2014 happened with the residences. And didn't have any effect on food or agricultural products. After they have finished mitigation process by supporting with food and water supply to the shelters by the provincial organization. Observation data and damages assessment for residences was the Main resources that provincial organization exchange with district and sub district organizations. The researcher emphasizes that this is the core of resources exchange for recovery phase in the next topic.

5.1.4.2 Meso Level

Local governments are a district, sub district and communities have relationships with the provincial organization as they rely on the provincial unit. And as mentioned above that the researcher emphasizes Observation data and damages assessment for residences as the main resources exchange with other organizations. The further explanation of resources exchange will not focus on humanity and short-term mitigation aspects but will focus on data management of each organization start with;

District Organization this unit directly rely on the provincial unit in authority and resources to rehabilitating the district office. However, Public Disaster Prevention and Mitigation Act B.E. 2550 (A.D. 2007) regulated the authority go to sub districts. Hence, there are no disaster prevention and mitigation office at the district level. They do not have resources, equipment and budget to manage the situations. However, they have authority as a command center in district level to coordinate with the provincial unit. They operate according to commands from the provincial level in damages value evaluation data verification for residences.

District level doesn't have a human resource in charge of disaster prevention and mitigation. They have to be in charge of the duties outside formal structure which is the mediator between sub district and provincial units.

The gap of management structure in this level comes from government service system reformation, which focuses on the relation between local and provincial. Disaster management structure in 2010-2014 did not define management structure in district level. While district office personnel are not enough and do not understand their

own responsibilities. However, the branch of disaster prevention and mitigation, which established in 2013 is in charge of supporting district level in planning and consult in the preparation phase. Although the branch was not clearly in charge of supporting district organization in the latest earthquake as it was level 2 disaster. In this situation, the supporting function is centralized in provincial disaster prevention and mitigation office.

Sub-district organization, Although the structure and principle of sub district organizations, is self-organization and have their own authority, the assist on resources still have to go through the mediator, district organization. Otherwise, they can directly coordinate with other organizations, which is an informal relation. As the matter of fact, sub district at the very least take charge of self-authorize and resources in the emergency phase. The coordination between outside organizations is less as well. It happens as they don't have formal commander since they haven't appointed the new mayor on May 5th, 2014. And May 22nd, 2014 still on the coup. Hence, the appointment process had to postpone until August that year after the legislative assembly had voted to appoint General Prayuth Chan-o-cha to be the prime minister.

The relation between sub district unit and district unit. Since local unit did not have the formal commander, municipality clerk or district organization clerk have to take charge. However, they did not feel like they have full right to be in charge. The commands waited until the district unit properly gave orders. Meanwhile, district unit does not have to specialize manpower in disaster management, they also have to wait for the provincial organization. When the order on damages data collection was made, they did not have observation form. The district organizations then pass the order to community chiefs to report only the effected houses. Later on, the district unit has ordered the setup of operational administration center in sub district level in charge of damages evaluation and data collection on damages house. The team has to repeatedly collect the data and revise the detail many times such as pictures and copies of house registrations. They spent more than 2 months to collect the data in the whole area as there were errors. They did not have the specialist to help with data and evaluation. After verified by the district office and have to revise. This process back and forth took time. And it caused delayed grant-in-aid for people in the area.

The relation between community unit and sub district unit. While district and community are area units (The organizations under Department of the interior), the municipality and district organization are local organizations (Organization under Department of Local Administration). The authorities in the structure are different that lead to limitation of data accessibility and distribution. The damages observation and evaluation of the buildings in the rehabilitation process, the local organization coordinate with community chiefs. However, consider the preparation phase, the communication of disaster management plan from district unit to community unit was limited. Since the authority and resources structure in disaster prevention and mitigation stop at sub district unit. They don't have enough resource; SAO has arranged temporary shelters for some of the communities. The decision making and awareness of dissemination of news in local level is directly affected disaster management in community level.

Furthermore, the disaster drills held by central government but regional and provincial level didn't hold the drill for the local unit for the disaster that never happened in the area. These local units don't know their own responsibilities and self-organization capacity.

5.1.4.3 Micro Level

From the relation between organization and individual or sub organizations. The disaster shows that sub organizations are very important.

“Community” The first command is local radio broadcast in the areas. The community chief will have to make the announcement on safety procedures are get out of the house and find safety zone, turn off the electricity, water supply and gather at the assembly point.

The next one is Community and donators, which can be private sectors or civil sector. The donation can be directly made for the people who affected by the disaster in the form of money or donations. The coordination go through Emergency Operations Center who distribute to public places such as schools or temples.

Community and support units at the provincial level, the provincial level is in charge of demolition but as a coordination in central level. In this crisis, there is no resource exchange in horizontal relation. On the other hand, there is no resource

exchange between district and district or district organization to district organization who did affected by the earthquake.

For rebuild the houses for people who affected by the earthquake, the process are only happen in Mae Lao and Pan Districts were interested by the media. The civil network for disaster management, which come from Private Development Organization who supported the rehabilitation process by systematically train local contractors. However, the researcher us Observation data and damages evaluation of residences affected by the earthquake as a resource in sub system to show the duplication of communication and data collection in the area of this topic.

The relation between community and damaged data collection unit. The community chiefs have reflected on the issue in the lesson learned in community level that after the disaster, the community mandated agent more than requested did. There are a lot of organizations collected the data for their own organization which they have to re-work many times as they only collected the data that related to themselves such as social development office, Bank of Agriculture and Agricultural Cooperative. Alternatively, even the same department such as Disaster Prevention and Mitigation Department and Public Works and Urban Planning department, they could not coordinate and ask for data collection at the same time.

The clear example of Duplicated work in this situation is residential damages data collection that observed by Disaster Prevention and Mitigation Department and residential damages data collection for safety assessment done by Public Works and Town Planning department. Both organizations requested the same data but different purposes.

The building inspection center collected the data for safety assessment. While Disaster Prevention and Mitigation Department collected the data for grant-in-aid purpose in the rehabilitation process. The data collection process needed to be done twice started form assessment and evaluation by engineer team, which took 3 weeks for the data collection process. Meanwhile the 3-Richter aftershock continuously happened for 3 months. The medium damaged buildings have turned to critical damage or the low damages buildings turned into medium damages. The observation to evaluate damage value to conform to the grant-in-aid has to be repeated or revise the values. If this 2 organizations learn from this disaster and understand the nature of the disaster as well

as communicate with the affected areas on framework such as inspect the safety of the buildings as well as the damage values at the same time. In addition, if there were more damage, we can report additional damage in the second round.

Policy Network analysis found that earthquake disaster management in emergency phase in Chiangrai is quite ready. Since they have been getting ready by holding the drills before. The responsibility was clearly defined in the provincial plan. The provincial able to response with the emergency phase cross jurisdictions the whole area. The interdependence in resources and information exchange. However, they did not design the coordination structure and data management in recovery phase. As well as unexpected aftershocks that caused more damages in the area. The designation and improvement of data-data collection at the same time caused difficulties for local operation level. The operation unit in regional level did not design the structure for cross-function caused duplicated work in data collection between Disaster Prevention and Mitigation Department and Public Works and Town Planning Department. There are limitation of data system improvement.

The improvement of management should be done not only emergency management plan at provincial level, the provincial unit who is in charge of prevention should also design model for self-organization in the rehabilitation process. Design and improve information system between organizations to reduce duplicated work and have procedure for coordination between organizations.

5.2 Social Network Analysis in Recovery Phase

The researcher has collected the data by interviewing and official reports in exchange of information and resources mission between organizations then compile both formal and informal relationships among provincial and district levels. And analyses with NodeXL Excel Template 2014 version 1.0.1.340 program formulated undirect link graph and use Harel-Koren Fast Multi scale layout algorithm layout. The study are displayed with topographic of relationship between organizations that response in the earthquake in emergency and recovery phase. The form of relationship is decentralize which is conformed to National disaster management plan and policy as shows in figure 5.1

The analysis shows the actors in the network are 265 organizations. The edge of activities between organizations are 355 lines. Graph density is 0.009634077. And using Girvan–Newman to categorize the cluster. There are 10 groups of actors in the network are;

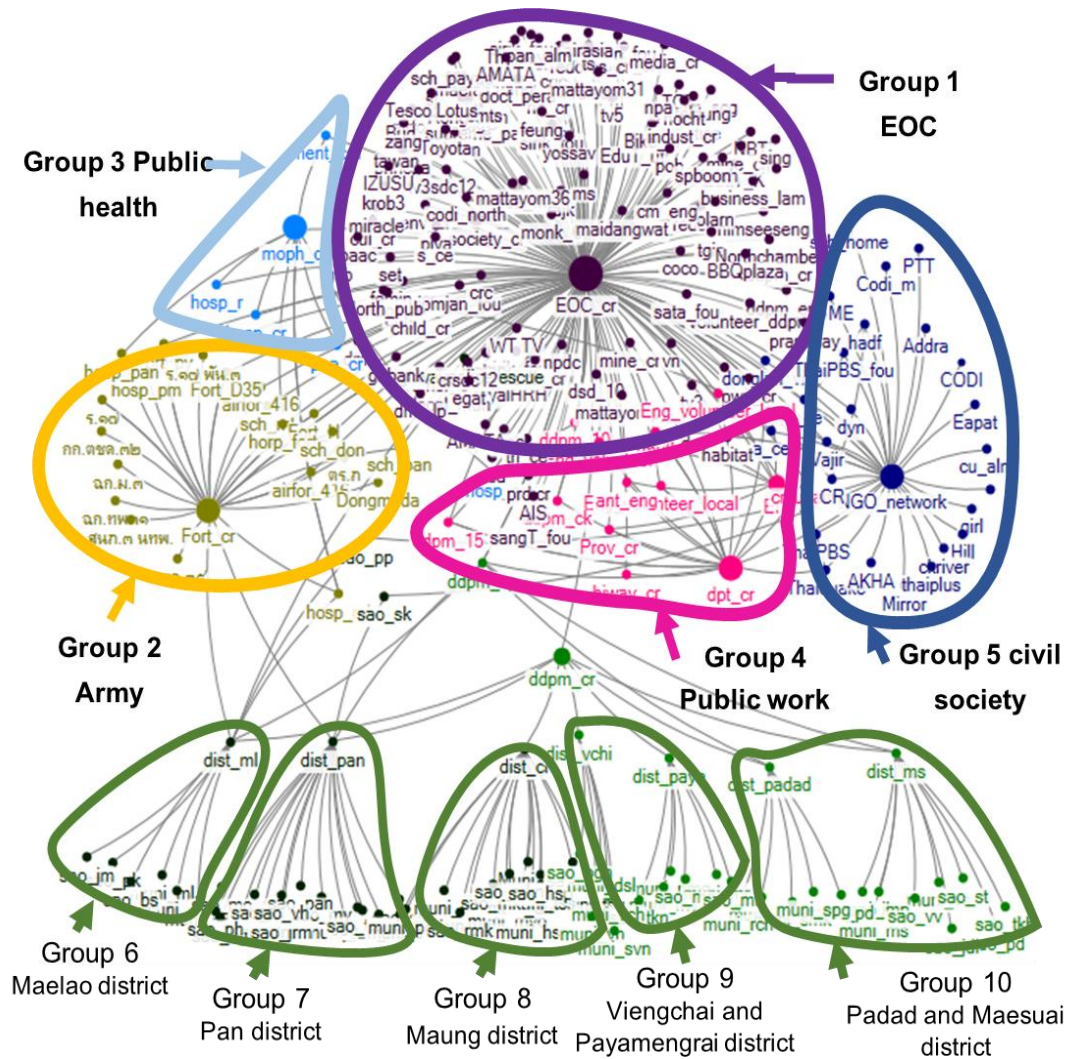


Figure 5.1 Social Network Graph of Recovery Response's Organization.

Group 1 Emergency operations center at Disaster prevention office, 3rd Floor City Hall of Chiangrai. This actor that has communication and exchange of resources activity.

Group 2 of Chiangrai Military district disaster mitigation center. This actor that has communication and exchange of resources activity

Group 3 Provincial Public health, this actor that has communication and exchange of medical resources activity

Group 4 Building inspection center operated by Public works office, this actor that has communication and exchange of resources activity

Group 5 Chiangrai civil society disaster management network. This actor that has communication and exchange of resources activity

Group 6 Mae Lao, effected area. This actor that has communication and exchange of resources activity

Group 7 Pan District, effected area. This actor that has communication and exchange of resources activity

Group 8 Mueang Chiangrai , effected area. This actor that has communication and exchange of resources activity

Group 9 Phaya Mengrai and Wiangchai districts, effected area. This actor that has communication and exchange of resources activity

Group 10 Pa-Dad and Mae Sruay districts, effected area. This actor that has communication and exchange of resources activity

5.2.1 The Relation among the Actor Group

The actors mentioned above are the organizations that involved in disaster management. The emergency operations center is the center of the operations since emergency phase to recovery phase as well as disburse the grant-in-aid for the victims, along with the vertical relationship with the actors under the Ministry of Interior in deciding the reimbursement for the residential shelter during recovery phase.

Group 1, 2 and 3 are the actors that response to the situation from emergency phase till recovery phase. The situation that connect actors in group 1 and group 2 is coordination in horizontal relation (government-government) in Mae Lao district affected area (Group 6) and Pan District (Group 7) which critically effected by the earthquake. As a result of Chiangrai-Chiang Mai road collapse, they set up front line operation center in Huay San Yao community and Military district's disaster mitigation center at Mae Lao Wittayakhom School as well. These groups has communication or exchange of resources with EOC.

Meanwhile, **Group 3** is the actor in medical aid and public health. Which supposed to be working in the affected areas. However, they had to stay in the hospital to manage the hectic situation in the hospitals. This situation, the actors that interact with group 2 and group 3 are Mae Lao Hospital and Pan Hospital. This mentioned situation is personnel from Mae Lao (Group 6) help with set up the shelter and field hospital and military (Group 2) helped them move the patients in the hospital to safety zone.

Group 4 and 5 are horizontal relation along the building inspection, safety assessment after emergency phase part, which are public work's Chiangrai office, The Engineering Institute of Thailand, the north engineer volunteer and engineer from provincial administration's Chiangrai office. These actors included institutions, volunteers, technicians and engineers from different organizations. They are an important actor in Group 1 and have informal relationships with website ThaiQuake which is an actor in Group 5 who supported the IT resources and website.

Group 6, 7, 8, 9, 10 are a group of district and SAO in the affected areas In emergency phase in Group 6 and Group 7 which were reported that critically effected So, related organization directly run the operation with the area. While Group 8, Group 9 and Group 10 are not directly affected by the earthquake. So there are less aid and operation in these areas.

Most of them had the vertical relation with the provincial organization in aiding and remedy during the recovery phase. These five groups of actors were related vertically to the provincial organization in rescue and aiding during the recovery phase. All of them received residential building inspection and damage evaluation, in order to receive the subvention. The Chiangrai office of disaster management would coordinate with the Chiangrai office of social development to communicate with the village headmen about the aiding of disaster victim. Then the local administrative organization would be coordinated in the survey and estimation of damage, data gathering, and data forwarding to the district administration center to verify before sending to the Chiangrai office of disaster management. Then the fund would be reimbursed through the Chiangrai specific administrative center in earthquake and building collapse prevention and remedy, and then it would be forward back to the local administrative organization to distribute to the disaster victims.

5.2.2 The Relation Factors Indicate the Information Sharing role

The researcher analyses by using correlation to find out position of the actors are degree Centrality, Betweenness Centrality, Closeness Centrality and Eigenvector Centrality. (Prell, 2011). Which formulated by network analysis are;

1) Degree Centrality which shows the actor who is in the center of network. By looking into the link with another network members in the same group or outside the group. Equation is

$$d(i) = \sum_j m_{ij}$$

$m_{ij} = 1$ connected between nodes and $m_{ij} = 0$ if there are not connectivity

Degree Centrality will be indicator shows that the actors is the center of network.

2) Betweenness Centrality to find out which actor is the connector between each groups. Equation is

$$b(i) = \sum_{j,k} \frac{g_{jik}}{g_{jk}}$$

g_{jk} is number of the shortest way from node j to node k ($j, k \neq i$) and g_{jik} is the number of shortest way from node j to node k through node i

Betweenness Centrality is the indicator shows that which actor is the connector between each network member and how. The actor that got high betweenness centrality is the high connector between other members.

3) Closeness Centrality is the indicator that shows **which actor is the center of the network that network members are close and shortest way to access**. The researcher use number of connect line from 1 member to another member. The equitation is

$$c(i) = \sum_j d_{ij}$$

$d_{ij} = 1$ is number of the shortest line that connect one member to another member

Closeness Centrality is the indicator shows that how close is one member to another member. The member that got high Closeness Centrality means that actor is close to another actor.

4) Eigenvector Centrality to find out how an actor decentralized from the center and its node influence the network. The Equation is.

$$x_v = \frac{1}{\lambda} \sum_{t \in M(v)} x_t = \frac{1}{\lambda} \sum_{t \in G} a_{v,t} x_t$$

$G=(V,E)$ when $|V|$ is the number of actor interact with. And $A=(a_{v,t})$ is the adjacency matrix example, $a_{v,t}=1$ if the actor v connected with t and $a_{v,t}=0$

While degree centrality concentrate on the “size” (Number of connected actors) focal actor, Eigenvector centrality concentrate on decentralization of the actor. The actor that got high Eigenvector centrality is the actor who have the ability to interact with far away actors. Table 5.2 shows study result by the first 20 items of the correlation

Table 5.2 Status of Influence Actors in the Network

Organizations	Degree Centrality	Betweenness Centrality	Closeness Centrality	Eigenvector Centrality
Emergency Operations Center (EOC)	164	29300.098	0.002	0.065
Chiangrai Military District	32	4465.866	0.002	0.012
Chiangrai civil society disaster management network	30	4368.445	0.002	0.011
Pan district	19	3481.629	0.001	0.002
Mueang Chiangrai district	16	3840.000	0.001	0.000
Chiangrai Public Works and Urban planning office	15	562.673	0.002	0.012
Mae Lao district	12	1464.806	0.001	0.003
Provincial office	12	812.713	0.002	0.008
Mae Sruay district	11	2337.000	0.001	0.001

Table 5.2 (continue)

Organization	Degree Centrality	Betweenness Centrality	Closeness Centrality	Eigenvector Centrality
Chiangrai Public health office	8	184.969	0.001	0.007
Chiangrai DPPM office	8	9453.986	0.002	0.006
The Engineering Institution of Thailand	7	104.936	0.002	0.008
Phaya Mengrai district	7	1563.000	0.001	0.000
Pa dad district	7	1099.476	0.001	0.001
Chiangrai Disaster prevention and mitigation office, Wiang Pa Pao Branch	6	2638.853	0.002	0.006
Wiangchai district	6	1305.000	0.001	0.000

The study to find out Center of information exchange with Degree Centrality shows Emergency Operations Center (EOC) has degree Centrality = 164. That's mean it's the most influential in the network as a lot of members in the network connected with the most. The 2nd influential actor is Military district of Chiangrai and Civil society Network for disaster management of Chiangrai with degree Centrality = 32 and 30

The study to find out which actors work as the connector between network by finding Betweenness Centrality found that EOC has got Betweenness Centrality = 29300.098 which is the highest. The 2nd influential actor is Disaster Prevention Office of Chiangrai with Betweenness Centrality = 9453.986 and the 3rd one is Military district of Chiangrai with Betweenness Centrality = 4465.866 and Civil society Network for Disaster Management of Chiangrai got Betweenness Centrality = 4368.445.

The study to find out which actor has the ability to access the number of information exchange the most by using Closeness Centrality. Found that the networks don't have the gap more than 0.002 are the closed networks and all actors in the network are accessibility with the gap on 1-2 connectors.

The study to find out which actor have the ability to connect with another actors that far away by using Eigenvector Centrality found that EOC has got Eigenvector Centrality = 0.065, 2nd one is military district of Chiangrai and Public Works Office has got Eigenvector Centrality = 0.012 and the next one is Chiangrai civil society disaster management network has got Eigenvector Centrality = 0.011.

That's mean the correlations mentioned above are the indicators shows how influential each actor in the network in each aspect. On the other hands Emergency Operations Center: EOC is the most influential actor in the network.

Disaster Prevention office is influential as a connector of district and SAO. Meanwhile, Chiangrai Military District and public works officials are the influential actors as a connector between the center and another actor in observation and damage assessment. While Chiangrai civil society disaster management network supported in the recovery phase.

5.2.3 The Overview of the Relation in Social Network Analysis

The graph shows actors network and connecting type which mentioned above. We can see that the centralize group is EOC (Building Inspection and Earthquake Relief Emergency Operation Center of Chiangrai Province). This is most influence actor which had command center role by inter-organization coordination both affected areas and aid organizations on donation, resource allocation, information exchange.

Marginal groups in this situation are affected areas Pa Dad, Phaya Mengrai, Wiangchai and Mae Sruay districts as they weren't spot by the mass media because this area are not critical affected. Thus it less interaction with other groups in the same level.

Furthermore, we can tell the marginalized of this area by the look at the level of an aid organization in observation, an assessment which the area that not critical affected have to coordinate with 3 levels of organizations start from Village chief, SAO, and Provincial office.

Moreover, the graph illustrated the actors which were the hub between the commanding center and the affected area, due to their qualification in thoroughly relating the remote actors and the major actors within the network. These actors consisted of the following units.

- **Chiangrai Office of Disaster Prevention and Mitigation** was an influential actor within the network, for its role of bridging the district actors and the local administrative organization according to the Minister of Interior's structure. This actor has the resources and authorization power according to the policy network.

- **Chiangrai Provincial Army** was an influential actor within the network, for its role as the direct bridge to the actors within the affected area, through their rescue mission during crisis according to the Minister of Defense's framework. Their strength include the decision power, human resources, budget, flexibility in operation, and owning their resources.

- **Chiangrai Office of Public Works and Urban Planning** was the actor who could bridge the relationship with other remote actors by getting in the area to help and inspect the damage buildings. As it also has the members from the clear professional network with the Engineering Institute of Thailand, this actor might be the secondary hub of front coordination with the affected area, as another professional network.

- **Chiangrai Citizen Disaster Management Network** was the actor which support the development of skill in community recovery. This actor has the quality of being the secondary coordination hub with the affected area. However, its limitation included the knowledge, resources, budget, and human resources. The suitable role could be the resource coordination, knowledge coordination, and brining in the donators and the specialized persons from other sectors to fill the gap instead.

It could be infer that these actors had multiple relations across sectors, either the relations which the commanding center may give the command, such as the case of Chiangrai Office of Disaster Management and other organizations which coordinate according to the structure in figure 5.1, such as the Chiangrai Provincial Army, Chiangrai Office of Public Works and Urban Planning, and Chiangrai Citizen Disaster Management Network. However, the interactions were mostly self-organized within the organization, by acknowledging the mission and sharing the data instead of coordinating their mission. Thus, the system without the emergence of new structure in coordination, in order to respond with the event, was the system with the medium-to – low level of adaptation within the complex phenomenon. The behaviors which should occur next, such as relation building, adaptation, feedback, and non-linear coping, were then occurred limitedly.

CHAPTER 6

SUMMARY, DISCUSSION AND SUGGESTION

Disaster Mitigation: The integration of inter-organizational according to public disaster prevention and mitigation strategy plan to encourage earthquake readiness in Chiangrai province. The purposes of this study are 1) To study current situation, issues and obstacle to deal with earthquake disaster policies 2) To study policy network on local level, provincial level and national level to prepare for earthquake disaster and 3) To study integration process between organizations to earthquake mitigation in Chiangrai

This study is a survey research by using mix method. Started from qualitative research than quantitative research. The quantitative survey teams are volunteers and participant observation during the first 1 year after the earthquake. Followed by quantitative data collection by using questionnaires in community and district levels 2 years after the earthquake. The contents of this chapter have 3 parts are;

6.1 Summary

6.2 Discussion

6.3 Suggestion

6.1 Summary

The results of this study could be summarized according to the objective of the study, which started from the study of policy problems and obstacles in disaster preparation of Chiangrai Province, according to the disaster prevention and mitigation strategic plan. The problems and limitation in the social technical dimension were found as followings.

1) Organization Flexibility Dimension. It was found that the power structures in resource management at the local level and the community level were inconsistent. Many organization's works were redundant. The provincial commanding center did not

fully act as the mediator in resource raising and information sharing. The operation process improvement according to the complaint was slow. The Chiangrai disaster management lack the adaptation and the attempt to understand the role of each organization when coordination was needed during the crisis. The Chiangrai earthquake drill was mostly the drill for indoor rescuing mission instead of the drill for commanding between the organizations and the affected area.

2) Technical Infrastructure Dimension. It was found that the community lacked the skill and experience in self-organization during the disaster. The local officers lack the encouragement of the community's participation in disaster management planning within the sub-district. The cross-duty resource raising or working as the replacement was limited. There was limited data connection between the actors with policy authority and the professional engineer actors in adjusting the risk management plan. Chiangrai province increased their strictness in building permit application approval, but did nothing in amending the local regulations related to building control. And spending budget in disaster preparation was still obstructed.

3) Cultural Openness. It was found that the provincial commanding center perceived the local and community as the weak and passive one, instead of the unit able to self-organize. And their officers still operate under command only. The disaster prevention and mitigation plan adjustment and operation in the local level and provincial level lack continuity. There was the government culture problem, which the officers lack the conscience in building relationship with other organization, the attempt in expanding the lesson learnt from the unofficial actors towards the official operation, the acceptance of added mission in data management without any long-term organization structure at the district level, and the limited attempt to develop the local community's skill in coping with emergency.

By using the evaluation of sociotechnical as a disaster management element which refers to Louise K. Comfort (2000) have 4 levels of disaster. The response of earthquake disaster in Chiangrai is level 2 as **Emergent adaptive system**. As shows in table 6.1 because the flexibility of organizations is low-medium. The technical infrastructures are low-medium. The cultural openness is low-medium.

Table 6.1 Level of the Responses of Earthquake Disaster in Chiangrai

Level of Response	Flexibility of Organization	Technical infrastructure	Cultural openness
Emergent adaptive system	low-medium	low-medium	low-medium

The structure of the network to response to the earthquake in Chiangrai form up by the center of relation are provincial organizations. Start from rescue units respond to the emergency state by severity base response. The topographic of the relation between organizations that responded to the earthquake in emergency state and rehabilitation state is decentralize according to disaster management plans and policies which encourage the local organization to take responsibility in the areas. Meanwhile, emergency situation level 2 from 4 according to national disaster prevention and mitigation plan defined provincial administration as the center of command in most missions. The relations between organizations depends on the provincial office. As well as the volunteer, academics and private sectors.

The result of policies network analysis found that the command center in paramedic service, rescue and salvation units have responded in the emergency state very well as decentralization of commands and communication. However, they are the limitation of human resources, budget and time frame caused delayed rehabilitation. The safety assessment and damages of the buildings are limited. Furthermore, other organizations who are not under disaster prevention and mitigation department got involved in rehabilitation state in formal form. The local government face delayed assistances from these organization in damages data collection in provincial organizations, lacking coordination in data collection process between organizations. Hence, these organizations are lacking information exchange and coordination between each other.

The success of disaster mitigation policy implementation at the sub-district level, which was the result of the provincial management, was reflected through the primary factors of relationship between organizations at the high level. The operational resource was at the medium level. The capability and condition of the organization was

at the medium level. As for the operation results towards the village in terms of awareness, strength, and operation within the village, the participants thought that the distribution towards community was unclear. The communication and coordination occurred at the medium level, similar to the management of the local administrative organization. In terms of data and communication system development, the participants said that the operation was unclear, while the development of preparation measurement also occurred at the medium level only.

When study the results of policy implementation in disaster mitigation at the village level, it was found that the people's risk awareness in the risky area was at the medium level. The people was not certain about the chance of earthquake. As for the communication factors in coping with the disaster, the villages in the risky area had the communication in coping with the disaster at the medium level. As a result, the coordination in coping with the disaster occurred at the medium-to-low level. Finally, the success of policy implementation in disaster mitigation at the village level only occurred at the medium-to-low level too.

Although the experience in the formation of the structure of command unit is a good support factor, the decentralized network is the obstacle to the recovery process. On the other hand, the coordination under hierarchy reflects on the delayed response of the damages of the area in Aftershock. It caused less chance to pair up the shortest relation to assisting people in the area. The mediator such as disaster prevention and mitigation depart which is the mediator who is in vertical in the structure. They have to take responsibility for processing the data and data verification. That makes them not able to support the horizontal relationship with the local government as the interdependence agency. They were dependent on resource exchange from local government outside affected areas as well as other organizations to corporatism model.

The direction of integrate coordination between the organizations which support disaster mitigation in Chiangrai should then start at the problem of coordination, by changing the government culture so that the officers would share the conscience in building relationship with other organization. They should incorporate the soft skill in relationship building and leadership in creating connection to solve the problem in sharing data or raising resources among the organizations. Meanwhile, the provincial commanding center should adjust the top-down structure into the bottom-up structure,

in parallel with developing the community's capability in self-organization with autonomy in decision making, resources in operation, and organizing the community-based disaster risk management (CBDRM) as the base for its self-organization.

6.2 Discussion

The researcher would like to discuss the result of the comparison between the principle of disaster management and the actual findings of the network and inter-organization coordination within each phase of the event, in order to point out the gap and suggest the possible solution as followings.

According to Baran (1964), the distributed network management, which exists with the node of direct connection instead of mediator, is the form of the network which allow the shortest route of connection and swift communication. Tavida Kamolvej (2006) also suggested that the most suitable network in raising emergency aid in disaster management is the distributed network which could coordinate the aid from the closest actors instead of only waiting for the central resource. However, the network in the case of Chiangrai earthquake management was still centralized and depended mainly to the central authority. This led to the problem of slow aid and communication of needs from the affected area towards the commanding center. Even if the civil society actors, who could be the mediator in inter-organization aid, existed in the Chiangrai network system, but the affected area covered wide area that the civil society's limited resources and personnel could only assisted a few affected community due to their far distance from each other. Meanwhile, there was a gap in the provincial data management responsibility, which there was no officer who would regularly be responsible to the disaster prevention and mitigation.

Therefore, in considering the solution of the inter-organization coordination problem, we need to discuss the results through **1) the sub-system** which the actors from each level including the community, sub-district, district, and the province, would had the operation and problems within the sub-system according to the concept of complex adaptive system. Then we should further discuss **2) the whole-system** of the interaction during crisis according to the incident commanding system (ICS) concept and the disaster risk governance concept, in the good governance of disaster risk

management, in order to find the solution to fill the gap of inter-organization coordination during the recovery phase as followings.

6.2.1 Discussion on the Operation and Problem in Sub-system

After comparing the lessons learnt from the most important disaster of Thailand after the government reform, according to the report of problems found in coping with Tsunami event by Surichai Wankaew, Usha Kanokpan, Boonyong Chuensu, Pavika Sriratanabal, Thitpol Pakdeevanich, Supaporn Pokaew (2006) and the record of the problems found in coping with the major flood in 2011 by Sirirak Singhasem (2015), it was found that many problems still reoccurred. When considering the operational situation within the subsystem and classifying the problems according to the six elements of the concept of complex adaptive system by Andrus (2005), consisted of self-organization, emergence, relationship, feedback, adaptability, and non-linearity, to analyze the learning process and adaptation to the dynamic system follow as.

6.2.1.1 The community's self-organization

The system with self-organization is the system which the actors adapted their behaviors towards the same direction by themselves, in order to cope with the change within the system. The researcher found that the self-organization of the subsystem usually occurs after the leading actors of the subsystem decided to do something and ordered the member of the system to do the new and different things. This characteristic suggested the autonomy, which each community should have the disaster preparation system such as the community-based disaster risk management be able to control the emergency situation which they must be the first to confront.

However, the study pointed out that there still were problems for the community within the affected area to self-organize. When analyzing the self-organization at the community level during the recovery phase, the problem found with the technical infrastructure dimension was that, in the community leaders' opinion, most community member lack the skill and experience in self-organization during the disaster. This led to the panic and chaos in the primary stage, for the people did not know what to do to stay safe. As for the cultural openness dimension, there was the problem in the willingness to share crucial information. The local was perceived by the provincial commanding center as weak and passive, rather than able to self-organize.

This problem also affected the organization flexibility dimension. The attempt to drive the problem solving by the community according to its own need was obstructed due to the condition of separated power structure and resources. In the recovery phase, the village headmen acted as the representative of need from the community towards the local administrative organization and the department above them. The resource moving in self-organization went in the direction which was hardly matched with the community's actual need, for the actors from each unit did not know the information of resources, nor the management plan of the local administrative organization which they could be connected. The actors of each level were accustomed to the existing vertical commanding structure, which the village headmen is only the command follower according to the structure of local management. And the sub-district headmen and the district chief officer were the personnel according to the characteristic of the district governing act, 1914, while the local administrative organization officers and municipality were the local personnel according to the local personnel management regulation act, 1999. And the resources essential for the community recovery after disaster were designated under the management structure of the local administrative organization.

This collective problems could lead to the limitation in community-based disaster risk management. Conceptually, the government sector should encourage the community to be able to self-organize. However, the conflicting power structure could led to the obstruction of resource raising. Practically, it would be hard to induce trust and coordination with the government.

6.2.1.2 The Emergence of the Provincial Problem Solving Unit

The emergence is the system's entrance to the new structure in order to cope with the change after the system had already self-organized. The new behavior of each sub-unit would led to the new outcome into the main system to respond with change. In coping with Chiangrai disaster, there were the emergences of many actors who clearly reorganized, such as the volunteers, the civil society network, the building safety inspection team, and the local administrative organization building damage evaluation team.

The actors mentioned above were the local authoritative actors and professional actors who restructured themselves together in order to evaluate the

building damages, starting at the Chiangrai Office of Disaster Prevention and Mitigation that asked for the Provincial Office of Social Development to communicate with the village headmen about aiding for the disaster victims. Then it coordinated with the local administrative organization to set up the committee of building damage evaluation within the sub-district, which consisted of the chief civil workers of the local administrative organization, local builders, and the members of the local administrative organization. The team would survey each house, estimate the damage value, record data, gather the data, and forward the data to the district commanding center for verification. The verified data would be forwarded to the Chiangrai Office of Disaster Prevention and Mitigation to suggest the aid budget for the ad hoc directing center of earthquake and building collapse problem prevention and solving, who would finally approve the aid budget for the disaster victims.

In the study of the problems found during the emergence of the building damage survey and evaluation after the earthquake, in the recovery phase, it was found that most authoritative actors lack the unified behavioral change. Therefore, the structural change in coordination was also limited. When reflected at the multi-direction data sharing among the organization within the organization flexibility dimension, it was found that there was the data sharing of the building inspection by the safety inspection team and damage evaluation team. However, the data was not integrated together. The works were redundant. The provincial actors did not adjust the structure of inter-organization database to prepare for the shared recovery mission. Each unit gathered data separately according to their original mission.

During the preparation phase within a year after the earthquake, the problems found were mostly about the technical support, in the technical infrastructure dimension, and the acceptance of shared objectives in the cultural openness dimension. As the actors were accustomed to the vertical relationship and the separated authority, the design and planning of disaster prevention and mitigation at the sub-district level in the year 2015 lack the participation from the village leaders. The officers in the local administrative organization lack the communication and process in working with the community. Meanwhile, the provincial officers also lack the unified design and planning of disaster prevention and mitigation at the provincial level, district level, sub-district level, and the sector that should be regards practically.

It should be noted that in the emergence of inter-organization coordination towards the adjustment of new structure in the system, there might be the relationship between the organization flexibility and the cultural openness, because the problems found in the Chiangrai Earthquake were very similar to what happened in the Tsunami event and the 2011 Flood. There were the problems of policies gap that lack the conscience towards the same target group. Each unit was designated to have their own performance to show. The operation would then be focused on their organization's productivity instead of assisting the other organizations. The separated operation as described resulted in the work redundancy (Surichai et al, 2006). As the separated operation had been continuing for a while, it led to the narrow culture, which did not allow each sector to experience the stage through their own volunteering and the willingness to serve the public together. Then the organization flexibility would be hard to adjust too.

6.2.1.2 The relationship between actors in the provincial level

In coping with the Chiangrai earthquake, although the multi actors would officially and unofficially interact, share the data, coordinate, and negotiate in resources exchange, but the inter-organization relationship in community recovery after the earthquake in Chiangrai still faced the problem of mission flexibility to cope with the changing situation. For example, the Chiangrai commanding center could wholly respond to the emergency phase, but it still operated vertically during the recovery phase, instead of mediating between the private sector, private development organization, and the local administrative organization of the unaffected area to continue their assistance.

According to the study results, the Chiangrai Province's responses to the earthquake were in the low-medium level. One of the most important factors contributing to the result could be the commanding and coordinating problems within the organization flexibility dimension, which the relationship structure between the provincial actors were mostly the vertical command from the center towards the affected area during the emergency phase. The command and control relationship continue to exist during the recovery phase. There were very few resource sharing through the horizontal relationship, for the commanding center did not encourage the actors within the system to raise their resources. The local administrative organizations

outside the affected area were not encourage to participate in the aiding. Even if the Minister of Interior would already enact the regulations which allow the local administrative organizations within the same province to move their machines to the affected area in the aiding mission, it was not possible to match the help to those who need because there was no data available on the resources possess or needed. This problem already occurred previously in the 2011 Flood and in the Southern Tsunami, when the problem situation and the need from the affected area already changed while the policy department did not adapted accordingly and still continued to operate in the same way they did during the crisis management for a long time. (Surichai et al, 2006)

Moreover, there were the problem of secondary operating system design within the technical infrastructure dimension. The acting in duty or inter-organization resource raising were limited. And there was especially the problem of accepting the shared mission within the cultural openness dimension, which the government officers lack the sense of commitment with other organization. Therefore, the network expansion and resource distribution could only happen through the central matching instead of the community and the local matching. The community which was able to self-organize would have their own donation receiving unit and coordinate for the aids by themselves, while the community which was unable to do so would not raise the donation and led to the inequality and conflicts.

6.2.1.3 Feedback of the Provincial Actors

Operation development during recovery and preparation phase according to the feedback of data or the lesson learnt was unclear. There were few applications of the lesson learnt during the recovery phase to adjust the master plan in the community recovery or regulations amendment and few participations of the community and the people sector in reflecting the lessons towards the recovery process design in the Chiangrai Earthquake management.

The actors who should take the important role in the mentioned data feedback, including the Chiangrai Office of Disaster Prevention and Mitigation, Local administrative organizations, the Chiangrai Office of Public Works and Urban Planning, the communities within the affected area, and the Civil Society were limited in feedback with each dimension as following.

There was the problem of slow application of data and lesson feedback during the community recovery in the disaster mitigation and risk prevention during the first three months after the earthquake. The participation in policy adjustment in that time was not easy, because of the organization flexibility problem within the vertical commanding structure which did not allow the local organizations to communicate upwards. As for the preparation phase, there was the problem in the technical infrastructure dimension in connecting the data between the actors with policy authority and the professional engineering actors to improve the risk management plan. Thus, there was no shared situation model in risk management during the coping of crisis, in terms of logistics, inventory, machine preparation, and transportation of aiding resources as well as the rechecking of the emergency plans. Moreover, there was the problem within the cultural openness dimension, especially the low willingness to reflect on the recent operation and outcome, to accept and improve the error, and to bring the lesson learnt from the unofficial actors within the system to improve the official operation. There was also no tangible participation from the unofficial actors in the mechanism of the further disaster preparation.

6.2.1.5 The Adaptation of the Actors within the Community and the Province.

Although the people might have the cognition in preparation for the disaster, acceptance of their own structural vulnerability, and behavioral adaptation in the long term to reduce the risk from earthquake, that they were aware of their risk and learned to stay safe personally and even accept the renovation technique so that their residential building may withstand the seismic activity by reinforcing the wall with wire mesh or replacing the tile roof with metal sheet, but there was still the problem in coordination during the recovery phase. The Chiangrai Office of Disaster Prevention and Mitigation and the local administrative organization lack the understanding of each other, while the Chiangrai Office of Public Works and Urban Planning was limited in building safety regulations amendment to reduce risk from building collapse.

As for the officers in the district level, such as the Deputy District Chief of Security, there were the problems of the role and duty understanding adjustment and the law adjustment which could reduce risk, the problems in the cultural openness dimension, including the willingness to serve the public by accepting the additional

mission of the community's damage assessment data verification. The officers felt that the additional works, which actually need the long-term responsible structure of the provincial organization, were the burden which fell on their shoulder. As for the problems in the cultural flexibility dimension, there was no inter-organization coordination that only the data sharing was possible but not the commanding across organization. The provincial unit and the community unit should know not only their own duties but also the whole structure of the system. Most commanders were used to the management during the regular situation and lack the knowledge in crisis management, while their perception of disaster seems vague and far away. In the dimension of technical infrastructure, Chiangrai province had no support in amending the local building control regulations. Even if each local administrative organization were strict in approving the building permit application, but there was no amendment of the local building control regulations which require the residential building constructed after 2014 to withstand the seismic activity according to the standard, nor require the local builders gain the seismic resistant reconstruct skill. Public Works and Urban Planning's Chiangrai office had no authority in this matter.

6.2.1.6 The Non-Linearity of the Provincial Actors

In terms of coping with the unpredictable major change within the system which could expand from the minor change, all actors in all level should be ready to self-management in controlling the impact. The actors which should be emphasized were the communities, the local administrative organization, and the provincial office of disaster prevention and mitigation, who should be prepared for the non-linear situation. The problems considered were mostly concern the experience, the flexibility, and the skill development as followings.

The problem of coping with non-linearity in the preparation phase started at the training of the leaders and the officers to be skilled. The informants reflected of the problems in the organization flexibility dimension, that the Chiangrai earthquake drill was mostly about interior rescue rather than the commanding drill between the organization and the affected area or the practice of decision making as the team leader and the team member in coping with the crisis, so that they know what to do practically by heart and understand what could follow, who should enter the area first, and what should they be responsible for. Therefore, they were not ready enough.

Meanwhile the infrastructure provided in the technical infrastructure dimension were limited. There was the obstruction in spending the budget to prepare for the disaster according to the Ministry of Finance's regulation about the government advance payment to aid the victim disaster, 2013, which designated the advance payment to be reimbursed after disaster only. This was a major obstacle in the previous flood in 2011 as well. Finally, the self-development in the dimension of cultural openness was limited. The community and local skill development in coping with the emergency lack the drill within the area, even if there was the provincial rehearsal of disaster coping in 2015, and the breaking point of the operation was at the community and sub-district area.

6.2.1.7 The Problem and Stage of Sub-System Actor Assessment

In order to explain how the problem within the sub-system could affect the major system, the researcher would assess the problems in each dimension by differentiating the criteria that affect the unsafe condition, according to the Disaster crunch model (Ian, 2015), consisted of three essential items which were 1) the management policy, 2) the connection to the operation with the civil society, 3) the budget and the machines, 4) the decision making, 5) the government structure, 6) the coordination, 7) the education, 8) the agreement in preparation of the community level, 9) the law which supports mitigation, and 10) the adaptation to respond to the change from the disaster.

The mentioned criteria would be used to differentiate the problems affecting the vulnerability of the government management in mitigation at the provincial level, sub-district level, and the community level as shown in table 6.2, to consider the problem of Disaster risk governance of Thailand in the next topic.

Table 6.2 Criteria Affecting the Unsafe Condition of the Management in Each Level

Criteria affecting the unsafe condition	Community	Sub-district	District and Province
Education	1) Community lack the skill and knowledge of disaster coping 2) Community training was limited.	1) Limited emphasize on the training in order to cope with emergency situation.	1) Limited usage of technology and academic knowledge by the government organizations
Government structure	1) The local community was just the command follower only. 2) The power structure in resource management differs in the locality and the region level		1) Vertical command 2) Lack of permanent structure in the district level
Decision making	1) The community had to follow command from above organization rather than communicate their needs upward.	1) The officers operated under the command only and dared not making decision by themselves.	1) The provincial commanding center emphasis the commanding downward to the local community rather than the support of self-organization. 2) Bringing feedback to improve the operation process happened at the slow rate.

Table 6.2 (continue)

Criteria affecting the unsafe condition	Community	Sub-district	District and Province
Coordination	1) The local officers did not let the community to participate in the risk management planning within the sub-district.	1) Many organizations' works were redundant. 2) The provincial commanding center did not mediate the aiding to the affected area. 3) Lack the adaptation and understanding the each organization's role.	
Agreement in preparation in the community level	1) Most community lack the community based disaster risk management		
Management Policy	1) The aiding policy did not cover the community's need.	1) The plan adjustment and the operation of disaster prevention and mitigation in the local-provincial level lack continuity.	
the disaster risk reduction's law enforcement		1) Found no amendment of the local building control regulations.	
Connecting the operation to the civil society	1) The government cultural problem which the officers lack the conscience in building relationship with other organizations 2) Lack the application of the lesson learnt from the unofficial actors to improve the official operation.		
Adaptation to the change from disaster	1) There was no earthquake drill to practice the commanding skill of the local unit and the affected community unit.		
Condition of the budget and the machines	1) Cross-duty resource raising or acting in place was limited. 2) Obstruction in spending budget to prepare for disaster.		

It can be seen that the shared criteria affecting the unsafe condition by the actors in all levels were the educational criteria, which they all lack the knowledge, skills, technology, budget, adaptation to the disaster, and operation connection with the civil society. As for the government management structure criteria, the local community was the one facing problem from the management style which the provincial unit would operate with the vertical power structure, that it would be hard to make a decision by themselves. As a result, the policy adjustment and resource raising were obstructed. The inside and outside coordination was not flexible.

The above condition was the vulnerability of the subsystem under the disaster management within the government system which needed the internal change and the external relationship adjustment. Relationship adjustment with the existing actors in the system could help filling the gap found in many problems, including knowledge support, resource support, and brainstorming to bring the different perspective in the management.

The actors who could reduce the management vulnerability were the group of disaster management network from the people sector and the mass media. The researcher tried to organize the important actors in coping with the Chiangrai earthquake according to the communication interaction into the group with one-way or two-way interaction with the commanding center as figure 6.1

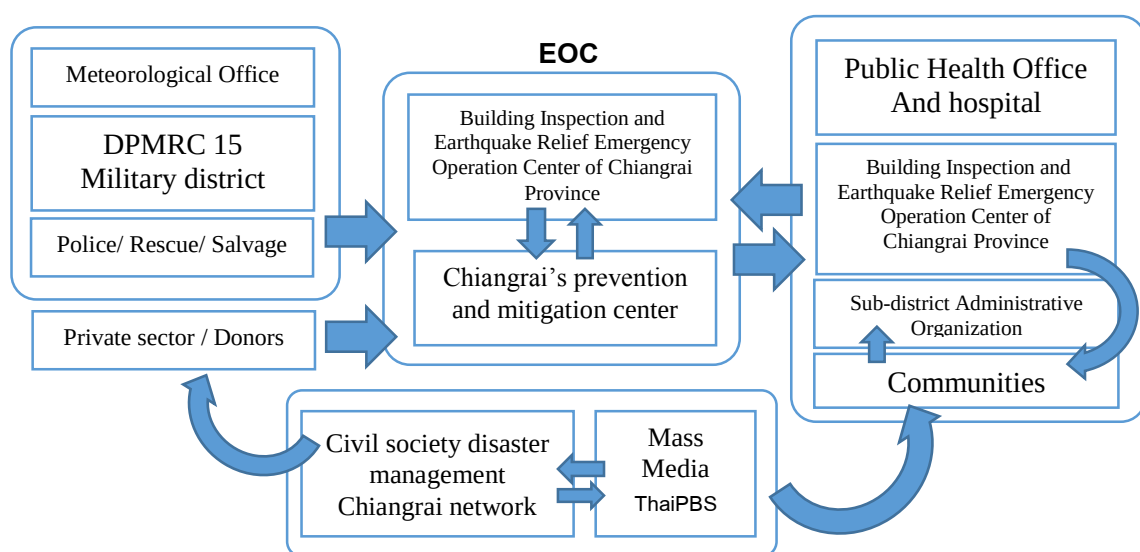


Figure 6.1 Group of Actors in the Earthquake Response According to the Relationship Direction.

It was found that the actors who did not directly interact with the commanding center such as the Chiangrai people network of disaster management and the ThaiPBS television station were the group whose structures were loose. Thus, they could connect the relationship between the actors who interact one-way with the commanding center and the actors in the system who interact two-way with the commanding center. As the actors close to the commanding center such as the provincial office of Disaster Prevention and Mitigation might not be able to cover some mission, such as the training of knowledge and skill in community recovery as well as the technology application, the researcher believe that if the provincial actors could coordinate with more variety of involving actors such as the business sector, the situation of budget and resource raising could be better as a whole. Or if the partner came from the academic sector, the preparation for the disaster and the community-based risk management capability development could be more flexible. The subsystem such as the community, the locality, and the province could then reduce their internal vulnerability. Therefore, the researcher is interested in the lessons and the concept of inter-organization coordination in the whole system as discussed below.

6.2.2 Discussion on the Inter-organization Relation Structure in Whole-System

The international disaster management tended to evolve from setting up a representative organization to cope with disaster towards the participation by all sectors who self-organize with flexibility. The international coordination in disaster risk management viewed that the suitable structure for the commanding during the disaster is the structure with the system to control situation for each organization, and the flexibility to adapt the mission. During the recovery phase, the network should be the distribution type, which the most actors could connect to each other horizontally. However, the network condition of Chiangrai recovery phase was the decentralization type which was not the most suitable type yet, as it was influenced by the collective management structure and culture as following.

6.2.2.1 The Impact of Government System to the Disaster Management

Thailand's government management had been centralized since the government reform following the western model in the reign of King Rama V, until the

decentralization in 2002, when the Department of Disaster Prevention and Mitigation was found. The commanding structure of disaster management in Thailand was thus tied to the commanding structure of the Minister of Interior, which governed with the complex regulations, formal standard, and hierarchical status and roles. The condition of Chiangrai earthquake mitigation still then followed the results of the criteria affecting the unsafe condition in the figure 6.1, which reflected the problem of coordination mechanism between all sectors during the regular situation, although the coordination and mutual operation occurred systematically according to the emergency operation plan, 2014. The coordination problems were described as followings.

1) The problem of government culture in which the officers lack the conscience in building relationship with other organizations was similar to the case of Kenya. (Barasa, E. W., Molyneux, S., English, M., Cleary, S., 2017) Where the actors were struck in the government culture. The officers only use the hard skill in operation, but lack the soft skill in building relationship and leading in creative coordination to solve the problem. Then, it would be hard for the new structure in the inter-organization data sharing or resource raising to emerge. There was very few creation of new coordination form, for the coordinator lack the soft power in responding to the sensitivity within the affected area as they focused on following the procedure instead of the outcome which should occur within the community.

However, during the first three months after the earthquake when the researcher was the participant-observer, the inter-organization coordination was found in the recovery phase training for the community builders, so that they could reconstruct the residential buildings to withstand the earthquake. The training was possible through the coordination between the provincial administrative organization, the Rajamangkala Lanna University, Thai PBS station, and the Chiangrai civil society's network of disaster management. All partners help providing the training lecturer and the budget for the tools and construction material, especially the mortar mixing solvent, for the 5 prototype communities. The activities was possible due to the relationship between actors who trusted in each other, including the master-student relationship between the chief builder of the provincial administrative organization and the lecturers from the Rajamangkala Lanna University who taught him previously, and the relationship between the public media and the private development organization. There was also the

interested in learning new things to fix the community problems together among the private development organization and the academic sectors, all of which led to the horizontal relationship to create the community recovery model called “Dong Lan Model”.

2) The management and coordination structure in disaster management of Thailand was mostly vertical (top-down), according to the commanding structure in disaster management of Thailand that tied to the administrative commander structure within the Ministry of Interior. Although the provincial disaster prevention and mitigation operating plan, 2004, already designated the coordination structure for each level of the government organization and allowed the participation of the civil sector and the private sector to operate together with the officers during the disaster since 2007, there was very few cultural openness which the government would actively seek the horizontal participation from the private sectors, the business sectors, and the civil sectors.

While the Department of Disaster Prevention and Mitigation’s strategic plan, 2012-2016, designated the frameworks to support the inter-network coordination in developing the area-level disaster management skill development, that there should be the mechanism for all sectors to be aware of the importance of disaster prevention and mitigation, and the encouragement of the conscience among the organization within the network to plan the project in disaster prevention and mitigation by integrating the budget, but the inter-government coordination was limited. Each organization had their own vertical structure and worked separately. The officers were only the command followers according to the policy, so they focused on the procedural success rather than the actual problems within the affected area. (Sirirak Singhasem, 2015)

3) The autonomy structure problem. The management which focused on the command and control of the sub-unit together with the lack of autonomy in self-organization by the local administrative organizations and the lack of essential resources for management had resulted in the rigid structure and formality that obstructed the flexibility in the local level. They could not change, and their capabilities in coping with the disaster was low. As a result, the trust from the people in their disaster management would also decreased. The autonomy structure problems existed in terms of budget and the authorization power as described below.

Budget for the situation which need the immediate decision making was one limitation in the self-organization of the community and the local administrative organization. The problem of disaster management budget flexibility had a root from the dependency of the local administrative organization's budget to the provincial budget. The similar problem also occurred during the major flood in 2011. Sirisak Singhasem (2015) reflected that during the regular situation, the budget in preparation and mitigation would be spent by the Department of Disaster Prevention and Mitigation, according to the mission in the master plan of strategic integrated coordination. But during the period of disaster, the budget would be authorized by the provincial governor (Ministry of Interior), who was tied to the condition of the situation commander according to the law. The role of disaster prevention and mitigation was then governed politically and did not allow the actual local commanding to happen, for the budget could only be approved through the management leaders in each level. Power and role in resources management would therefore follow the regular situation model, rather than to play the part in the crisis according to the budget acquisition.

Authorization power was another issue which hindered the disaster risk governance. The local organization which was the most important actor in the disaster risk governance should receive more power, skills, and resources altogether. There should be more flexibility, unlike the provincial center unit. Power and resources distribution in the crisis control need both the essential resources and the negotiation skill, in order to coordinate with the affected sectors who would responsible from the bottom-up when they receive the resources and capabilities development.

The resources and power should also be distributed from the local administrative organization towards the community. The community-based disaster risk management (CBDRM) was the process which would be the connecting hub between the community, the private sector, the business sector, and the civil sector. It would also be the mechanism in empowering the community through the resource raising and utilizing of the self-organization capabilities while the provincial and local organization could not distribute the aid to the community yet.

4) Incident Command System

The Incident Command System (ICS) is the management system which command and control according to the hierarchy borrowed from the military

management, which adjust itself according to the dynamic situation with many organizations who operate together in the same mission through the dynamic responses. The commanding system in the country with strategic plan in situation control through the inter-organization coordination suitable to their own context was possible, for each organization had their own autonomy and enough resource in self-management. However, the actors within the Chiangrai system could not demonstrate such behavior because the local community still lack the autonomy in resource and power, due to the government system in disaster management which did not focus on the capabilities development for the local community.

The researcher argued that our commanding system was the command and control without adjusting the internal detail to suit the context of the community within each region. And there was not enough data management for decision making within each area which might have different community context, for Chiangrai's communities were far apart. Some area was geographically suitable for agriculture, while some area was remotely hidden in the mountain. Some community was urbanized and their residential buildings were built closed together. If the earthquake would strike all area in the same time, the operating officers should have the scenarios of what could happen in each area as well as the coordination plan to consult with the specialization about how to cope with the situation which could follow each type of disaster.

In order to adjust the command system to be more flexible and respond better to the unpredictable situation, the researcher suggested that the command system in each situation should follow the context and culture in the area. In Boersma, Comfort, Groenendaal, Wolbers (2014) studied, each command system of the western and eastern countries were compared. And it was found that in the western system, there would be more focus on the encouragement of flexible movement forward. The country with small communities locating closed together such as France would use the ICS as soon as any emergency occur, as the strategy to control the situation quickly, with full usage of capability to prevent the situation to escalate and expand to affect another community. As for the country with communities locating far apart from each other such as the United States, there was lower risk for the situation escalation. Thus, the situation control strategy would be more independent according to the community context. While Norway would emphasize the importance of data flow between

organizations and the administration boundary which manage the crisis together. The emergent operation structure of Norway would be based on the management plan which use different geographical data and respond to the crisis differently according to the control structure.

The eastern countries such as Japan would emphasize the development of sufficient system. There was the evolution of commanding system and data system through the strong hierarchical organization, but there was also the coordination and sharing of information efficiently through the civil sectors and the private sectors participation in the national disaster management system. There was also high flexibility for the volunteer organization to participate in the management.

The balance of commanding system in each country thus depends on the type of system and the suitable flexibility according to each cultural context that would allow each organization to adapt towards the shared objectives in coping with the complex situation swiftly. It would be possible to prepare the strategic plan and the connection with those who have the ability to cope with the situation prior to the disaster, in order for the emergence of structural adjustment during the crisis to happen, if the government would learn the mechanism of the phenomenon and prepare the skills while lessen the control and limiting the system. It should allow the learning process and self-organization to happen upwards, as Boin, McConnell and 't Hart (2008) wrote that the mono power command during the crisis does not exist, but there were the negotiation between organizations and the directing through the inter-organization problem solving that would connect the social actors, the economic, and the political power in different level altogether.

6.2.2.2 Cross-boundary Learning of the Actors within the System

The inter-organization relationship structure within the major system of Chiangrai earthquake management was also influenced by the cross-boundary learning that led to the inter-organization coordination in the major system, the horizontal interaction of the resource trading from each sector, and the expansion of learning process between the academic sector, the government sector, and the private development network.

An important phenomenon of the cross-boundary learning in Chiangrai was the integration between the engineering knowledge and the community

organization process that led to the community recovery model “Dong Lan Model”. In the model, the community members including the villagers and the local builders, who were the actual actors in residential building renovation, went together to organize the damage order of the buildings within the community, the vulnerability of the affected families, and decided together on the order of renovation according to the vulnerability. There was also the foundation of the community committee who monitor the building construction tools and material inventory, the compilation of the resources needed in recovery including budget, manpower, builders, materials, tools, and the food and beverage preparation team, so that the volunteer trainers and builders during the early phases could focus on their works.

Such coordination led to the team and the mechanism in the community recovery, as the builders and the members agreed with the renovation system, and the community received training of earthquake knowledge, residential building construction with the appropriate material and technique. They also received the construction tools and materials. There was the mechanism in exchanging labor, that each house owner would asked for help from the neighbors who received the basic training skills, and then returned the favor by helping the neighbors when they reconstruct the next house, until every houses in the community were all reconstructed.

Such exchange and learning stems from the trust between actors from the academic sector, government sector, mass media, the private development organizations, and the community who came together and exchange their knowledge in order to efficiently solve the problem within the affected area. It started when the mass media was interested in supporting the negotiation model in solving problem by the community themselves and encouraged the private development firm to transfer their experiences in community management. Then the actors from the private development organization were connected with the academic sector and learnt about the renovation technique to withstand the seismic activity. Meanwhile the academic sector accepted the concept of building the committee for the community-based disaster risk management in designing the renovation mechanism as a whole. Afterwards, the actors within the provincial administrative organization who were the students of the academic sector also participated in learning of the community recovery mechanism, until the officers were aware of the importance in filling the gap of management knowledge and

support the budget, resources, and manpower that the training of model community in renovating the house through the community's participation was expanded.

The cross-boundary learning from the outsider mediators, who had the loose relationship in the system is consistent with the concept to social network within the heterophilly theory, which explained that the unofficial connection would create trust that will enable the information sharing. When the stranger from one group enter another group, the person would be both the insider and outsider of the community, and would be able to bridge both community together. The strength of the loose relationship would create the bridge that would weave the small groups together. And there would be the exchange of new information and new resources through the actors with the new role who enter the system. (Prell, 2011)

The actors in the group of provincial administrative organization, private development organization, the community, and the professional engineering would learn cross-boundary through the awareness of the importance in creating innovation in the community recovery training after the earthquake. There would be the adjustment of the rigid structure in the government system towards the flexible structure that allow the inter-organization work during the disaster damage database together with the Building Inspection Coordination Center of the Chiangrai Office of Public Works and Urban Planning, which let the information technology specialists to help developing the building damage estimation database while also learned about the engineering assessment of the disaster damage in the same time.

6.2.2.3 Disaster Risk Governance of the Inter-organization Coordination

The inter-organization coordination in the major system of Chiangrai province received the influence from the management mechanism, which emphasis the following of technique or procedures. However, the concept which should be the mechanism in disaster risk management would be the disaster risk governance.

Governance is different from management that management would focus on using technique and process to encourage the operation according to the designated step to reach the goal, while governance would emphasis on the strategy or frame of coordination, on the direction and responsibility in reaching the mutual goals. The word governance here would mean the directing of operation with coordination between the government in the local-provincial level, provincial-national level, and international

level based on trust, mutual help, and responsibility through the participation of those involved in planning and writing regulations. (Tierney, 2012)

The disaster risk governance is the good mechanism of coordination as a whole. It is the governance of disaster risk management involving the utilization of resources, classified information, knowledge, technology, and the capabilities of people involved from many sectors including the political, the economic institution, the civil sector, the market and business, the military organization, and the people from all level of society, in order to protect the safety of life and assets from the disaster, and to enable the society to decide of the mutual understanding, agreement, and the conduct. It would help united the differences, and let the people to express their interest and exercise their legal rights involving the risk from disaster. (Blanco, 2015)

According to the concept in social sciences which consider the human as the creator of the cultural, organization, and social systems while being shaped by those systems, it is crucial to reflect the social action within the subsystem of the human in order to examine the structure which is the condition in adaptation. The researcher had found that the sub-phenomenon in the slow and rigid system would obstruct the capability development in the community and only reinforced the rigidity of the system. For example, there were the village headmen and the officers of the local administrative organization who were active in learning and inter-organization coordination, that they actively solved the problems instead of just depended on the central power and resources. However, they would be punished verbally when their work crossed the boundary. The leader's capabilities development would be obstructed by the officers they had to cooperate.

In order to adjust the government system's flexibility, it would be important to adjust the value, morality, and the standard in caring of working together first. Then there could be the partners building through trust instead of relating to each other as the rivals or the auditors.

Meanwhile, there should be the building of disaster risk governance in the dimension of affected community participation. The people's trust in the government sector was also very important. For it could be seen when looking back to the Chiangrai Earthquake management that the root causes were the vertical politic relationship between the provincial unit and the local administrative organization which

obstructed the latter's self-organization. The dynamic pressures were the slowness of policy adjustment and the aiding which match the need. The unsafe condition was the slowness in operation and the low participation by the affected persons.

These collective problems would led to the trustworthiness problem of the government's disaster management. It could be learned from the case study of Chile, which the disaster management commanding structure would follow the Ministry of Interior's structure similar to Thailand. Sandoval and Voss (2016) found that in the volcano disaster risk governance, the scouring of trust was the vulnerability in the government's disaster management. In the emergency evacuation of 8,000 citizen from the risky area, the officers commanded the people to abandon their assets, animals, and houses, and evacuated to the shelter that located 50 km away without anything. In doing so, the officers promised to bring the people back to their houses afterwards, but the promise was not fulfilled. And the people were angry that they had to left much of their life's memories behind. They also felt deserted, for the recovery went without any dignity. The evacuee had no participation in their own self-organization. The government only provided the budget but did nothing in career providing. Being in debt finally, the evacuee lost their savings, dignity, and their trust towards the government. The people's anger escalated into the demonstration and evacuation back to seize back their lands. In this case, the decision from the central unit without any participation from the community was the root cause of vulnerability increase in the risk management, because the mitigation and preparation for the next disaster by the government would be hard without the trust and cooperation from the people.

6.2.2.4 The Sustainable Disaster Risk Reduction Measurement.

According to the sustainable disaster risk reduction under the Hyogo Framework for Action : HFA 2005-2015, towards the Sendai Framework for Disaster Risk Reduction : SFDRR 2015-2030, the Chiangrai earthquake management in 2014 would be the operation influenced by the international policy under the HFA 2005-2015. The HFA 2005-2015 emphasis the disaster risk management operation as a whole and required the member countries to have the National Platform designated by law in the mutual operation of the national committee of disaster prevention and mitigation. It also emphasis the participation by all of the involved partners through the Appropriate Governance concept as the mechanism which prioritize the institutional system

adjustment and the amendment of laws in coordination prior to the disaster. The good governance was also encouraged through the disaster risk management participation of the civil society and the private sector who were the actors in good governance.

If the Chiangrai operation would be considered through the lenses of the Hyogo Frameworks of Action, it could be said that, It followed the frameworks by having the laws, the emergency operation plan, and the disaster prevention and mitigation committee. However, there was few participation from all of the involving partners. Therefore, the next step in the Chiangrai's disaster risk reduction according to the Sendai Framework of Action, there should be the preparation which could be differentiated in two phases (United Nation, 2015).

1) Governance during the regular situation. There should be the culture of disaster prevention, preparation, and mitigation that would allow the community to become resilience in the face of disaster. Currently, the world is using the mission from the Sendai Framework for Disaster Risk Reduction 2015-2030, which consisted of 1) understanding the risk from disaster 2) building capabilities in disaster risk management 3) investment in disaster mitigation in order to prepare to cope and become resilience with short timeframe and high efficiency 4) development of capabilities in the efficient preparation for disaster to designate what the government in the national-local level and the region-international level should do in order to reduce the disaster risk.

2) Governance during the crisis. Each organization must behave differently and change their role from coping with the disaster and responding to a single situation into the building of short-term and long-term recovery process, by adjusting their management policy to directly and indirectly incorporate the coordination with the national government, local government, private organization, and private development organization.

As a result, the paradigm of sustainable disaster reduction would change the goal in reducing the loss from disaster towards the disaster risk reduction according to the Sendai Framework. The initiation question would need to replaced "What to do" by "how to", for the new action framework would cover the risk from the minor disaster, major disaster, infrequent disaster, frequent disaster, slowly-occur disaster, swiftly-occur disaster, natural disaster, and man-made disaster. The responsibility in

disaster risk reduction would be encouragement of understanding among the involving persons and the culture in disaster prevention. The Sendai Framework of Action gave the top priority to the participation by the people, the local administrative organization, the academic sector, the business sector, and the mass media, as well as the national strategic planning to build the awareness of disaster risk towards the personal health, the society, the animals, the environment, the lifestyles, the business, the industries, and the important historical places. The impact control would need the power of the local administrative organization, the business sector, and the volunteer, who would find the way to cope with the problems in their own area together with the preparation and the build-back-better.

6.3 Suggestion

As the guideline to integrate the inter-organization on earthquake recovery and mitigation in Chiangrai province, the researcher would like to suggest that the relationship adjustment between organizations, which would help reducing the risk from earthquake, should be considered according to the principles of disaster risk governance. The three important principles were the governments supervise, the technology, and the education, which led to the suggestions for this research.

6.3.1 Disaster Governance

1) Structural change – the power distribution is crucial for the emergence.

There should be the relationship adaptation from the decentralized power structure into the distribution structure, which the local administrative organizations could trade their resources or coordination by themselves when the situation unfolded. This change could only happen through the push towards replacing the top-down command and control into the bottom-up relationship through the mediated channel, that would allow the local to communicate with the province to update the situational data, reflect the problems, and express their need, so that all partners involved could see the whole perspective together. Then they could see the opportunity to coordinate and respond continuously. The emergence of the efficient distribution management and coordination structure could only then be possible to occur.

There should be less command and control in the system, and more trust and respect among the team members as well as the respect in their own autonomy. Self-organization building to empower the internal members to be strong and ready to share information could be possible through the rewards and positive reinforcement. There should also be the reflection and the adjustment according to the lessons learnt together, with the mutual goal of the better skills, better planning, and better operation. For the policy decision-making process and the actors during the crisis need to change creatively together.

2) Giving autonomy to the locality and community.

The local administrative organization should have the responsibilities, power, skills, resources, and the budget altogether, consistent to the suggestion by Sirirak Singhasem (2015), that the power of the Department of Disaster Prevention and Mitigation should be transferred entirely to the locality in the area level. If the suitable power and resource distribution to the local administrative organization is possible, the negotiation with the other sectors to participate in the sub-district risk management will be easier.

The community should also organize their risk management with the CBDRM, the operation team, the information management system, the community members caring system, the support network from the civil society, and the ability to raise resource and accept the external aid systematically.

3) The leaders might enhances their learning and adaptability.

There should be the leader's capabilities development, so that they could be responsible and decide flexibility according to the situation. They would be trustworthy, visionary, able to initiate self-organization, clear in designation of problem solving agenda, able to adjust their strategy, and able to solve the problems.

4) Inter-organization coordination

The government culture should be developed towards the conscience in the sense of commitment with other organizations, whether they would be the government organization, civil society, or the private sectors. The operation should focus on the appropriate outcome rather than just following the designated protocols.

According to the strategic plan of the Department of Disaster Prevention and Mitigation for 2012-2016, the provincial unit was responsible to match the aid with the

affected area. The inter-organization coordination is necessary for such resources distribution. And the coordination could happen through the communicative initiation by the leaders, who would bring the involved partners within the system and encourage each sector to update information, share the problems, and share the resources. Forum building to open the temporary and permanent communication space is another option to create the inter-organization coordination

Moreover, the matching or filling the gap in aiding would require the damage database from the affected area that the aiding team could access. Then they would be equipped with enough information to make a decision, and they could feedback the progress in aiding in real-time. Then the resources sharing would become more flexible.

5) Regulations enactment

The provincial unit should emphasis on the development and enactment of the building control regulations in order for the building to withstand the seismic activities. The scope should include the new residential buildings which were built after 2014. And the process of authorizing the building permit application should stricter and rely more on the local building control regulations.

6.3.2 Technological Support

1) The GIS data should be linked to the damage data received from the survey, with the prepared central standard database. The Chiangrai Office of Public Works should design the system platform for all units involved to input the data about the level and detail of damages. There should be the standard protocol in safety inspection that linked to the coordinated location of the address in the Provincial Electricity's database and the damage value assessment. This database could be used to identify the risky area and the fragile group, which would be beneficial in the estimation of the community's capabilities and risks. According to Blanco's suggestion (2015), the country with the risky geography similar to Philippines should create the geo-hazard mapping, in order to estimate the risk for the local administrative organization with the specific and accurate information.

2) Solving the problem of hierarchy and redundancy in data gathering by using the national single window system.

The analog data system on paper should be replaced by the electronic paperless database system, so that all organizations who require the information would be able to access and store their data within the same system, whether the technical information of the affected area mapping, building damage assessment, essential risk estimation system and other essential risk information.

6.3.3 Education

1) Education of the people within the risky area

The local administrative organization should publicize the knowledge in safety conduct during the earthquake for the citizen, together with the training of risk estimation and building renovation to withstand the seismic activity for the local builders and the community leaders.

2) Training for the officers

There should be the team leaders and the operators who are experienced in risk estimation, commanding, and responding to the emergency situation, in parallel with the practical drill of coping with the crisis.

3) Research and development risk management plan

The IT data should be integrated with the damage and vulnerability data from different databases, in order to develop the scenario to manage the risk and create a better risk management plan in accordance to the scenario and how to cope with the crisis within each area, including the design of the secondary transportation system, logistics, inventory, machinery, and resource transportation during the crisis as well.

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APPENDIX A
RESPONDENTS LIST OF THE INTERVIEW

List of Key Informant

1. **Mr.Yossakron Suksaard**, Head of Strategy and Management, Chiangrai Office of Disaster Prevention and Mitigation
2. **Mr.Manas Kamtai**, Head of Operation, Chiangrai Office of Disaster Prevention and Mitigation
3. **Mr.Taveep Cheawsuwan** Head of Disaster Prevention and Mitigation, Provincial Administration Office.
4. **Mr.Anusorn Seeboonrueng**, Head of Public Danger Prevention, Chiangrai Office of Disaster Prevention and Mitigation, Wiang Pa Pao branch,
5. **Mr.Tawat Chaithima**, Chiangrai Disaster Prevention and Mitigation Regional Center 15. (DPMRC 15)
6. **MissNantawan Kankam**, Expert Public Relations Officer, Chiang Rai Public Relations Office.
7. **Dr.Kriangsak Pintatham**, Emergency Medical Department, Chiangrai Prachanukroh Hospital
8. **Dr. Sarawut Herabut**, National Institute for Emergency Medicine.
9. **Mr.Narin Gwangthong**, Specialized Civil Engineer, Chiangrai Office of Public Works and Urban Planning
10. **Mr.Peerat Reungsuksai**, Director of Meteorological Chiangrai Office.
11. **Mr.Burin Vechbanteong**, Deputy Director-General of Meteorological Department
12. **Mr. Surachart Sa-ard-iam**, Deputy District Chief of Security, Mae Lao District.
13. **Mr.Thananchai Naktue**, Deputy Chief Administrator of Sub-district Administration Office, Pong Prae Sub-district.
14. **Mr.Weerapong Kangwannawakul**, Civil Society Disaster Management Network Coordinator.
15. **Mrs.Tuenjai Deetet**, Civil Society Disaster Management Network Chief.
16. **Mr.Srisak Pikulkeaw**, Website ThaiQuake Coordinator
17. **Mr.Sombat Sriaun**, Village Headman of Moo 17 Dong Lan, Sai-kao Sub-district, Pan District

18. **Mr.Chum Kukkong**, Village Headman of Moo 6 Huai San Patana, Measruay sub-district, Measruay district
19. **Mr.Sakda Yoobo**, Village Leader of Moo 9 Huai San Akha, Member of Administrator of Sub-district Administration Office Pong Prae Sub-district.
20. **Mr.Surasit Sukmai**, Village leader of Moo 13 Huai San Yao, Member of Municipality, Dongmada sub-district, Mealao District.
21. **Mrs. Nattaya Wawweerakupt**, Public Policy News Editor of ThaiPBS
22. **Mr.Ekachai Kittiwarakul**, Faculty of Engineering Instructor, Rajamangala University of Technology Lanna, Chiangmai area

APPENDIX B
QUESTION OUTLINE OF THE INTERVIEW

**เค้าโครงคำถามเกี่ยวกับการจัดการภัยแผ่นดินไหวของ
เจ้าหน้าที่ป้องกันและบรรเทาสาธารณภัยจังหวัด, ศูนย์เขตฯ
ด้านความร่วมมือในระยะฉุกเฉิน ระยะฟื้นฟู และการสร้างแผนเตรียมพร้อมป้องกันภัย**

คำถามเกี่ยวกับการแลกเปลี่ยนข้อมูล

1. บทบาทของหน่วยงานท่านในการรับมือกับเหตุการณ์แผ่นดินไหวเป็นอย่างไร
2. หน่วยงานของท่านมีการแลกเปลี่ยนข้อมูลข่าวสารกับหน่วยงานอื่นอย่างไร (ข้อมูลขาเข้า ข้อมูลขาออก มีอะไรบ้าง) แลกเปลี่ยนกับหน่วยไหนบ้าง
3. ข้อมูลอะไรที่เป็นตัวกลางในการสื่อสารแลกเปลี่ยนข้อมูลระหว่างหน่วยเรา กับหน่วยงานอื่น
4. ในเหตุแผ่นดินไหวปีที่แล้ว ท่านหรือหน่วยงานของท่านเกิดการสานเครือข่ายใหม่ๆ (หน้าใหม่) ที่เข้ามาทำงานด้านการจัดการภัยหรือไม่ หน่วยไหนบ้าง

คำถามเกี่ยวกับการทำงานร่วมกับ EOC

1. หน่วยงานของท่านมีการแลกเปลี่ยนข้อมูลการศูนย์บัญชาการภัยตอบโต้ภาวะฉุกเฉิน ส่วนกลาง Operation Center- (EOC) และศูนย์ประสานงานต่าง ๆ อย่างไรบ้าง
 - 1) ศูนย์อำนวยการเฉพาะกิจแก้ไขปัญหภัยจากแผ่นดินไหวและอาคารถล่ม จังหวัดเชียงราย
 - 2) ศูนย์ปฏิบัติการส่วนหน้า ทหาร ปก. หน่วยแพทย์
 - 3) ศูนย์ประสานงานตรวจสอบอาคารจากเหตุแผ่นดินไหวจังหวัดเชียงราย
2. จากเหตุการณ์ที่ผ่านมา EOC ได้ทำหน้าที่ประสาน หรือ ลดข้อขัดแย้งหรือไม่ ท่านคิดว่าการสื่อสารระหว่างหน่วยงานด้านการจัดการภัยที่เป็นอยู่ มีเอกภาพแล้วหรือไม่ สภาพความร่วมมือระหว่างหน่วยงานเป็นอย่างไร มีปัญหาการเหตุด้วยความร่วมมือระหว่างหน่วยงานอย่างไร
3. ตอนนั้น EOC มีการใช้เทคโนโลยีสารสนเทศ GIS และ ภาพถ่ายดาวเทียมมาประกอบการบริหารจัดการหรือไม่ มีการ internet social media ฯลฯ มาเชื่อมโยงการสื่อสารอย่างไร
5. ท่านพบปัญหาหรืออุปสรรค ในการแลกเปลี่ยนข้อมูลระหว่างหน่วยงาน หรือความร่วมมือระหว่างหน่วยงานหรือไม่ อย่างไร หากมี ท่านพบว่านโยบาย หรือ กฎหมายใดที่เป็นอุปสรรคต่อการสร้างความร่วมมือระหว่างจัดการภัย
6. อะไรเป็นปัจจัยสำคัญของการสร้างความร่วมมือระหว่างหน่วยงาน (ภาวะผู้นำ อำนาจการตัดสินใจ ทรัพยากร แผนนโยบาย ทักษะคติ ความยืดหยุ่นของหน่วยงาน)

คำถามเกี่ยวกับข้อเสนอในการพัฒนาความร่วมมือในการจัดการภัยพิบัติ

1. ประสบการณ์แผ่นดินไหวเมื่อปีที่แล้ว ทำให้ความคิด ความรู้สึกของท่านเกี่ยวกับความเสี่ยงของภัยพิบัติเปลี่ยนไปอย่างไร
2. การซ้อมแผนครั้งล่าสุดเมื่อเดือนมีนาคมที่ผ่านมา ท่านพบข้อกังวลเกี่ยวกับ "ความร่วมมือ" ในการบัญชาการระหว่างหน่วยงานบ้างหรือไม่ หากมีท่านกังวลกับหน่วยไหนอย่างไร

**เค้าโครงคำถามเกี่ยวกับการรับมือแผ่นดินไหวของฝ่ายสาธารณสุข
ด้านความร่วมมือในระยะฉุกเฉิน ระยะฟื้นฟู และการสร้างแผนเตรียมพร้อมป้องกันภัย**

คำถามเกี่ยวกับความร่วมมือระดับ Micro Level ของการแพทย์ฉุกเฉิน

1. ปฏิบัติการร่วม (ความสัมพันธ์) ระหว่าง ฝ่ายเวชกรรมฉุกเฉิน สภช และ หน่วยกู้ชีพ กู้ภัยในท้องถิ่น ของหน่วยงานท่านเป็นอย่างไร
2. ปัญหา อุปสรรค เกี่ยวกับโครงสร้างการสื่อสารที่พบ ในเหตุการณ์แผ่นดินไหวเมื่อ 1 ปีที่ผ่านมา เป็นอย่างไร

คำถามเกี่ยวกับความร่วมมือระดับ Meso Level ของการแพทย์ฉุกเฉิน

1. ระบบบัญชาการร่วม ระหว่าง ฝ่ายเวชกรรมฉุกเฉิน สภช และ หน่วยงานระดับจังหวัด - หน่วยงานระดับภูมิภาค ของหน่วยงานท่านเป็นอย่างไร
2. หน่วย งานของท่านมีการใช้ข้อมูล แลกเปลี่ยนข้อมูล อะไรบ้างกับส่วนกลางในระดับ จังหวัด (อะไรเป็นข้อมูลกลางที่ใช้ในการเชื่อมโยงกับทำงานร่วมกับภาคส่วนอื่น)
3. ปัญหา อุปสรรค เกี่ยวกับโครงสร้างการสื่อสารที่พบ ในเหตุการณ์แผ่นดินไหวเมื่อ 1 ปีที่ผ่านมา เป็นอย่างไร

คำถามเกี่ยวกับความร่วมมือระดับ Macro Level ของการแพทย์ฉุกเฉิน

1. บทบาทของ สภช กับการจัดการภัยปีที่แล้ว
2. ในเหตุการณ์แผ่นดินไหวเมื่อ 1 ปี ที่ผ่านมา หน่วยงานของท่านได้รับการสนับสนุน (หรือการประสานความร่วมมือ) ในการปฏิบัติงานหรือการสนับสนุนเชิงนโยบายจาก หน่วยงานระดับชาติ ระดับนานาชาติ บ้างหรือไม่

คำถามเกี่ยวกับการเตรียมพร้อมรับมือภัยพิบัติ

1. ในหนึ่งปีที่ผ่านมา หน่วยงานของท่านได้นำบทเรียนที่ผ่านมา นำมายกระดับระบบการจัดการเตรียมพร้อมรับภัยในอนาคตอย่างไร
2. หน่วยงานของท่านมีบทบาทหน้าที่ใดในการซ้อมใหญ่ของแผนเผชิญเหตุแผ่นดินไหวที่ ทหาร กับ ปก จัดร่วมกันเมื่อเดือนมีนาคมที่ผ่านมา
3. ท่านพบเห็นอุปสรรค ขัดจำกัด หรือบทเรียนที่สะท้อนความพร้อมในการรับภัยใน ภาคปฏิบัติในประเด็นใดบ้าง
4. ท่านมีข้อเสนอแนะในการยกระดับความร่วมมือกับหน่วยงานต่าง ๆ อย่างไร

เค้าโครงคำถามขององค์กรปกครองส่วนท้องถิ่น
ด้านความร่วมมือในระยะฉุกเฉิน ระยะฟื้นฟู และเตรียมพร้อมรับมือแผ่นดินไหว

คำถามเกี่ยวกับความร่วมมือกับอำเภอ

1. อปท.ของท่านมีบทบาทในการรับมือกับเหตุการณ์แผ่นดินไหวเป็นอย่างไร (กรุณาสะท้อนความร่วมมือระหว่างท้องถิ่นกับอำเภอในภาวะฉุกเฉินและการฟื้นฟูในเหตุการณ์ที่ผ่านมา)
2. ปัญหาที่พบในการบัญชาการระดับอำเภอ ที่มีผลกับ อปท.ของท่านมีอะไรบ้าง (กรุณาอธิบายปัญหาด้านการจัดการข้อมูลการเยียวยา)

คำถามเกี่ยวกับความร่วมมือกับจังหวัด

1. อปท.ของท่านมีการแลกเปลี่ยนข้อมูลข่าวสารกับ EOC ระดับจังหวัดอย่างไร (ข้อมูลขาเข้า ข้อมูลขาออก มีอะไรบ้าง) นอกจากนั้นหน่วยงานของท่านมีการแลกเปลี่ยนกับหน่วยไหนบ้าง ข้อมูลอะไรที่เป็นตัวกลางในการสื่อสารแลกเปลี่ยนข้อมูลระหว่างหน่วยของท่านกับหน่วยงานอื่น
2. อปท.ของท่านได้รับการแชร์ข้อมูลทรัพยากรที่ใช้ในการบริหารจัดการสาธารณภัย (จำนวนเครื่องมือ รถตัก ฯลฯ บุคลากร ช่างเทคนิค แรงงานในการก่อสร้าง) ของทาง ปก.จังหวัด และ อปท. ข้างเคียง ที่จะให้ยืมกันในภาวะฉุกเฉินหรือไม่
3. อปท.ของท่านได้รับการแชร์ข้อมูลการสรุปประมวลความเสียหายหรือบทเรียนของการบริหารสถานการณ์ภัยพิบัติจากทาง ปก. จังหวัด และ อปท. ข้างเคียง หรือไม่

คำถามเกี่ยวกับความร่วมมือกับภายในท้องถิ่น

1. อปท. ของท่านได้นำประสบการณ์ที่ผ่านมา มาพัฒนาแผนบริหารจัดการภัยพิบัติในปีนี้อย่างไร
2. อปท. ของท่าน มีวิธี สื่อสาร และเผยแพร่แผนรับมือภัยพิบัติ (แผ่นดินไหว) ลงสู่ชุมชนอย่างไร
3. จากประสบการณ์ที่ผ่านมา ท่านพบว่าหน่วยงานไหนมีการตอบสนองกับการจัดการภัยในภาวะฉุกเฉินได้สอดคล้องที่สุด

คำถามเกี่ยวกับความร่วมมือกับข้ามภาคส่วน

1. ในปีที่ผ่านมา อปท.ของท่านมีการสานเครือข่ายใหม่ๆ ด้านการจัดการภัยหรือไม่ อย่างไร
2. ท่านพบปัญหาหรืออุปสรรค ในการแลกเปลี่ยนข้อมูลระหว่างหน่วยงาน หรือความร่วมมือระหว่างหน่วยงานหรือไม่ มีนโยบาย หรือ กฎหมาย ที่เป็นอุปสรรคต่อการสร้างความร่วมมือระหว่างจัดการภัยหรือไม่ อย่างไร
3. อะไรควรจะเป็นปัจจัยในการสร้างความร่วมมือระหว่างหน่วยงาน (ยกตัวอย่างเช่น ภาวะผู้นำ อำนาจการตัดสินใจ ทรัพยากร แผนนโยบาย ทัศนคติ ความยืดหยุ่นของหน่วยงาน)

ด้านการพัฒนาศักยภาพการบริหารจัดการภัย

1. อปท.ของท่านได้เข้าร่วมการซ้อมใหญ่ของ ปก. เมื่อเดือนมีนาคมที่ผ่านมาหรือไม่ หากได้ร่วมท่านมีข้อกังวลเรื่อง "ความร่วมมือ" การบัญชาการกับหน่วยงานไหนบ้างหรือไม่ อย่างไร
2. ท่านคิดว่า แผนรับมือภัยพิบัติในระดับท้องถิ่นของ อปท. ของท่านมีความจำเพาะและสอดคล้องเพียงพอต่อการรับมือสาธารณภัยที่อยู่ในท้องถิ่นของท่านหรือยัง
3. ที่ผ่านมา อปท. ของท่านมีกิจกรรมพัฒนาขีดความสามารถในการจัดการภัยอย่างไรบ้าง
4. ประสพการณ์แผ่นดินไหวเมื่อปีที่ผ่านมา ทำให้ความคิด ความรู้สึกของท่านเกี่ยวกับ ความเสี่ยงของภัยพิบัติเปลี่ยนไปอย่างไร
5. ท่านมีข้อเสนอแนะในการยกระดับความร่วมมือที่เกี่ยวข้องกับการปฏิบัติงานด้านการจัดการภัยพิบัติอย่างไร

APPENDIX C
QUESTIONNAIRE OF THE QUANTITATIVE COLLCTION

**แบบสอบถามสำหรับศึกษาความสำเร็จในการนำนโยบายป้องกัน
และบรรเทาสาธารณภัยไปปฏิบัติในระดับองค์กรปกครองส่วนท้องถิ่น
เพื่อสนับสนุนการรับมือกับเหตุแผ่นดินไหวของจังหวัดเชียงราย**

ข้อมูลพื้นฐานของผู้ตอบแบบสอบถาม

เทศบาล / องค์การบริหารส่วนตำบล.....อำเภอ.....

จำนวนหมู่บ้านที่องค์กรปกครองส่วนท้องถิ่นรับผิดชอบ.....หมู่บ้าน

ชื่อ-นามสกุล.....ตำแหน่ง.....หมายเลขโทรศัพท์.....

เพศ ☐ ชาย ☐ หญิง อายุ.....ปี ระดับการศึกษา.....

ข้อคำถามทั้งหมดมี **22 ข้อ** กรุณาเขียนคำตอบ หรือ ทำเครื่องหมาย ☒ เพื่อตอบ
คำถามในข้อคำถามที่ท่านเห็นว่าท้องถิ่นของท่านมีกิจกรรมหรือเหตุการณ์ดังกล่าวเกิดขึ้น
ในช่วง 2 ปีที่ผ่านมา (ข้อมูลของท่านจะถูกเก็บเป็นความลับ เพื่อใช้ในการวิจัยเท่านั้น)

ส่วนที่ 1 ปัญหาที่พบระหว่างการฟื้นฟูชุมชนหลังแผ่นดินไหวของจังหวัดเชียงราย

1) ท่านคิดว่าปัจจัยเหล่านี้ส่งผลต่อความสามารถในการฟื้นฟูและเตรียมพร้อมรับมือภัยพิบัติในระดับหมู่บ้านมากน้อยเพียงใด

ข้อคำถาม	ไม่มี เลย	น้อย	ปาน กลาง	มาก
ท่านคิดว่าทักษะของประชาชนในการปฏิบัติตนให้ปลอดภัยขณะ แผ่นดินไหว ช่วยให้หมู่บ้านในพื้นที่เสี่ยงมีความสามารถในการรับมือกับ ภัยมากขึ้น (1)	1	2	3	4
ท่านคิดว่าการมีคณะทำงานการจัดการภัยพิบัติโดยชุมชนเป็นฐาน (community based disaster risk management: CBDRM) ของหมู่บ้าน ที่เสี่ยงภัย ช่วยให้หมู่บ้านในพื้นที่เสี่ยงมีความสามารถในการรับมือกับ ภัยพิบัติมากขึ้น (2)	1	2	3	4
ความขัดแย้งจากการบริจาคเงินและสิ่งของเพื่อซ่อมบ้านหลัง แผ่นดินไหวทำให้การฟื้นฟูชุมชนโดยการมีส่วนร่วมของประชาชนทำได้ ยากขึ้น (3)	1	2	3	4

ข้อคำถาม	ไม่มี เลย	น้อย	ปาน กลาง	มาก
การขาดข้อมูลวิชาการเกี่ยวกับรอยเลื่อนของแผ่นดินไหว สำหรับ ระบุพื้นที่เสี่ยง พื้นที่ปลอดภัยหรือสร้างแผนอพยพในระดับหมู่บ้านและ ตำบลทำให้การเตรียมพร้อมรับภัยของชุมชนทำได้ยากขึ้น(4)	1	2	3	4
การทำข้อมูลภูมิศาสตร์หรือผังชุมชน ระบุบ้านที่ต้องให้ความ ช่วยเหลือหรือช่วยอพยพเป็นอันดับต้นๆ เช่น เด็ก ผู้สูงอายุ สตรีมีครรภ์ คนพิการ ช่วยให้หมู่บ้านในพื้นที่เสี่ยงมีความสามารถในการรับมือกับ ภัยมากขึ้น (5)	1	2	3	4
การนำเสนอข้อมูลที่เป็นวิทยาศาสตร์เกี่ยวกับสาเหตุและผลกระทบ ของแผ่นดินไหว รวมถึงตัวอย่างในการรับมือกับภัยพิบัติทางสัณยวิทยา และโทรทัศน์ ช่วยให้หมู่บ้านในพื้นที่เสี่ยงมีความสามารถในการรับมือ กับภัยมากขึ้น (6)	1	2	3	4
การซ้อมและทดสอบความพร้อมในการสื่อสารและบัญชาการเหตุ ของหมู่บ้านกับหน่วยงานระดับจังหวัด ช่วยให้หมู่บ้านในพื้นที่เสี่ยงมี ความสามารถในการรับมือกับภัยมากขึ้น (7)	1	2	3	4

2) ท่านคิดว่าปัจจัยเหล่านี้ส่งผลต่อความสามารถในการฟื้นฟูและเตรียมพร้อมรับมือภัยพิบัติของ
องค์กรปกครองส่วนท้องถิ่นมากน้อยเพียงใด

ข้อคำถาม	ไม่มี เลย	น้อย	ปาน กลาง	มาก
ความชำนาญในการจัดการภัยพิบัติของเจ้าหน้าที่องค์กรปกครองส่วน ท้องถิ่น ทำให้การบริหารจัดการภัยพิบัติของ อปท. ดำเนินไปได้อย่าง คล่องตัว (8)	1	2	3	4
ความมั่นใจในการใช้อำนาจตัดสินใจของผู้บริหาร อปท. ในการใช้ บริหารสถานการณ์หรือบัญชาการเหตุในภาวะฉุกเฉิน ทำให้การบริหาร จัดการภัยพิบัติของ อปท. ดำเนินไปได้อย่างคล่องตัว (9)	1	2	3	4
ความไม่สอดคล้องกันระหว่างท้องที่กับท้องถิ่นในการจัดการภัย พิบัติ เนื่องจาก อปท. มีงบประมาณและทรัพยากรแต่ไม่มีอำนาจสั่งการ ขณะที่ฝ่ายท้องที่ (หมู่บ้าน) มีอำนาจสั่งการแต่ไม่มีทรัพยากร ทำให้ ฟื้นฟูชุมชนหลังภัยพิบัติทำได้ไม่คล่องตัว (10)	1	2	3	4
การสนับสนุนความรู้ด้านเทคนิคในการซ่อมสร้างอาคารเพื่อฟื้นฟู พร้อมกับทำให้ทนกับแผ่นดินไหว มีผลต่อการฟื้นฟูของ อปท. (11)	1	2	3	4

3) ท่านคิดว่าปัจจัยเหล่านี้ส่งผลต่อความสามารถในการฟื้นฟูและเตรียมพร้อมรับมือภัยพิบัติของหน่วยงานระดับอำเภอและจังหวัดมากน้อยเพียงใด

ข้อคำถาม	ไม่มีเลย	น้อย	ปานกลาง	มาก
การไม่มีหน่วยงานป้องกันและบรรเทาสาธารณภัยระดับอำเภอ ทำให้การตรวจสอบข้อมูลความเสียหายและการเยียวยาผู้ประสบภัยทำได้ล่าช้า (12)	1	2	3	4
การกำหนดกรอบเวลาในการเก็บ-รวบรวมข้อมูลความเสียหายที่สอดคล้องกับสภาพปัญหาและระยะเวลาในการฟื้นฟู เป็นปัจจัยที่สำคัญต่อการปฏิบัติงานฟื้นฟูพื้นที่ประสบภัย (13)	1	2	3	4
การใช้แบบฟอร์มสำหรับเก็บข้อมูลความเสียหายหลังแผ่นดินไหวที่สอดคล้องกับหลักวิศวกรรม มีความสำคัญต่อการวางแผนการฟื้นฟูพื้นที่ประสบภัย (14)	1	2	3	4
การสำรวจ ประเมินความเสี่ยงและความปลอดภัยของอาคาร เพื่อตัดสินใจรื้อหรือซ่อมอาคารที่ได้รับความเสียหายจากแผ่นดินไหวมีความสำคัญต่อการวางแผนการฟื้นฟูพื้นที่ประสบภัย (15)	1	2	3	4
การซ่อม-สร้างอาคารที่ได้รับความเสียหายให้สามารถทนแผ่นดินไหวได้ไปพร้อมกัน มีความสำคัญต่อการเตรียมพร้อมป้องกันภัยพิบัติ (16)	1	2	3	4
การหนุนเสริมให้ชาวบ้านรวมกลุ่มกันฟื้นฟูหมู่บ้านด้วยระบบการจัดกาตนเองมีความสำคัญต่อการเตรียมพร้อมป้องกันภัยพิบัติ (17)	1	2	3	4

4) ท่านคิดว่าการสื่อสารและแบ่งปันข้อมูลมีผลต่อการจัดการภาวะฉุกเฉินและการฟื้นฟูอย่างไร

ข้อคำถาม	ไม่มีเลย	น้อย	ปานกลาง	มาก
การทำความเข้าใจเกี่ยวกับบทบาทหน้าที่ของแต่ละหน่วยงานที่ปฏิบัติงานร่วมกันในภาวะวิกฤติมีความสำคัญต่อการรับมือภาวะฉุกเฉิน (18)	1	2	3	4
การแบ่งปันข้อมูลทรัพยากรด้านการจัดการภัยพิบัติ เช่น ข้อมูลเครื่องจักร ข้อมูลพื้นที่เสี่ยงภัย หมายเลขโทรศัพท์ของผู้ประสานงาน เพื่อช่วยเหลือกันข้าม อปท. สำคัญต่อการรับมือกับภาวะฉุกเฉิน (19)	1	2	3	4
การบริหารบัญชาการจากบนลงล่าง (top-down) ที่เป็นเอกภาพของหน่วยงานระดับจังหวัด ทำให้การรับมือกับภาวะฉุกเฉินของจังหวัดทำได้คล่องตัว (20)	1	2	3	4

ข้อคำถาม	ไม่มี เลย	น้อย	ปาน กลาง	มาก
การรายงานปัญหาในการปฏิบัติงานจากล่างขึ้นบน (Bottom-up) จาก หน่วยงานระดับท้องถิ่นสะท้อนสู่จังหวัดทำให้การฟื้นฟูชุมชนจากภัย พิบัติทำได้ทั่วถึง (21)	1	2	3	4
การจับคู่ เชื่อมประสานข้อมูล ระหว่างความต้องการและความช่วยเหลือ จาก อปท. ที่ปลอดภัยส่งทรัพยากรมาให้ความช่วยเหลือ อปท. เป็น ปัจจัยที่สนับสนุนการฟื้นฟูชุมชนจากภัยพิบัติ (22)	1	2	3	4

5) ท่านคิดว่า ขั้นตอนการดำเนินงานของตามระเบียบราชการต่อไปนี้ ส่งผลอย่างไรกับการ
เตรียมพร้อมป้องกันภัยพิบัติ

ข้อคำถาม	ไม่มีผล	เป็น ข้อจำกัด บ้าง	เป็น ข้อจำกัด มาก	เป็นข้อจำกัด จนไม่สามารถ ทำงานได้
การตรวจสอบข้อมูลความเสียหายและการเยียวยาที่ เกิดขึ้นจากแผ่นดินไหวมีขั้นตอนมากเกินไป (23)	1	2	3	4
การที่ อปท. ต้องตั้งงบประมาณประจำปีสำหรับเตรียม รับมือไว้ล่วงหน้าก่อนที่จะเกิดภัย ทำให้การรับมือกับ ภาวะฉุกเฉินจากภัยที่คาดการณ์ไม่ได้ ทำได้ไม่คล่องตัว (24)	1	2	3	4
การเบิกจ่ายเงินอุดหนุนราชการเพื่อเตรียมพร้อม รับมือภัยพิบัติที่คาดว่าจะเกิดขึ้นในระดับจังหวัดยังไม่ ครอบคลุมการเตรียมพร้อมรับมือกับแผ่นดินไหว เพราะ แผ่นดินไหวเป็นภัยพิบัติที่คาดการณ์ไม่ได้ (25)	1	2	3	4

6) ท่านคิดว่าปัญหาเหล่านี้เป็นข้อจำกัดต่อการฟื้นฟูและการป้องกันภัย มากน้อยเพียงใด

ข้อคำถาม	ไม่มีผล	เป็น ข้อจำกัด บ้าง	เป็น ข้อจำกัด มาก	เป็นข้อจำกัด จนไม่สามารถ ทำงานได้
การขาดข้อมูลสารสนเทศทางภูมิศาสตร์ (GIS) และ ภาพถ่ายทางอากาศ ทำให้การฟื้นฟูพื้นที่ประสบภัยไม่ คล่องตัว (26)	1	2	3	4
แบบแปลนอาคารสำคัญ ถูกจัดเก็บไม่เป็นระบบ การจัดเก็บไม่เป็นไฟล์ดิจิทัล การจัดหาข้อมูลเหล่านี้ให้ วิศวกร หน่วยงาน ภัย ใช้ตัดสินใจในภาวะฉุกเฉินทำได้ ยาก (27)	1	2	3	4

ข้อคำถาม	ไม่มีผล	เป็น ข้อจำกัด บ้าง	เป็น ข้อจำกัด มาก	เป็นข้อจำกัด จนไม่สามารถ ทำงานได้
การที่ระบบวิทยุสื่อสารของจังหวัดเชียงรายมีสัญญาณไม่ครอบคลุมทั่วทั้งจังหวัด ทำให้การจัดการภาวะฉุกเฉินติดขัด (28)	1	2	3	4
การขาดเทคโนโลยีสารสนเทศสำหรับจัดระบบฐานข้อมูลร่วมระหว่างหน่วยงาน และการใช้ฐานข้อมูลหน่วยงานร่วมกันมีผลต่อการฟื้นฟูพื้นที่ประสบภัย (29)	1	2	3	4

7) เมื่อเปรียบเทียบกับก่อนแผ่นดินไหว ท่านคิดว่าปัจจุบันการบังคับใช้กฎหมายในระดับท้องถิ่นและในระดับจังหวัดมีการเปลี่ยนแปลงมากน้อยเพียงใด

ข้อคำถาม	น้อย ที่สุด	น้อย	เท่า เดิม	มาก	มาก ที่สุด
มีความเข้มงวดในการบังคับใช้ข้อบัญญัติท้องถิ่นเกี่ยวกับการควบคุมอาคารของ อปท. ให้มีการเสริมความแข็งแรงแก่อาคารที่สร้างใหม่ให้ทนกับแรงแผ่นดินไหวตามระเบียบมากขึ้น (30)	-2	-1	0	1	2
มีความเข้มงวดในการบังคับใช้พระราชบัญญัติควบคุมอาคารของสำนักงานโยธาธิการจังหวัดในการขออนุญาตก่อสร้างอาคารหลังแผ่นดินไหวตามระเบียบมากขึ้น (31)	-2	-1	0	1	2

ส่วนที่ 2 ปัจจัยของการนำนโยบายป้องกันและบรรเทาสาธารณภัยไปปฏิบัติ

8) องค์กรปกครองส่วนท้องถิ่นของท่านมีปัจจัยตั้งต้นในการประสานความร่วมมือข้ามภาคส่วนระดับใด

ข้อคำถาม	ไม่มี เลย	น้อย	ปาน กลาง	มาก
ท่านคิดว่า อปท.ของท่านมีความร่วมมือกับหน่วยงานด้านการกู้ชีพและจัดการสาธารณภัยในเตรียมพร้อมป้องกันภัยหลังแผ่นดินไหว เพื่อปกป้องชีวิตและทรัพย์สินของประชาชนมากน้อยเพียงใด (32)	1	2	3	4
ท่านคิดว่า อปท.ของท่านมีความไว้วางใจกันระหว่างผู้นำองค์กรกับประชาชนในการจัดการภัยพิบัติมากน้อยเพียงใด (33)	1	2	3	4
ท่านคิดว่า อปท.ของท่านได้รับความร่วมมือจากชุมชนและหน่วยงานที่เกี่ยวข้องในการจัดการภัยพิบัติมากน้อยเพียงใด (34)	1	2	3	4

9) องค์กรปกครองส่วนท้องถิ่นของท่านมีการแลกเปลี่ยนข้อมูลข่าวสารระหว่างองค์กรในระดับใด

ข้อคำถาม	ไม่มี เลย	น้อย	ปาน กลาง	มาก
ท่านคิดว่า อปท.ของท่านสามารถแลกเปลี่ยนข้อมูลข่าวสารที่จำเป็นต่อ การเตรียมพร้อมรับมือกับเหตุแผ่นดินไหวกับหน่วยงานที่เกี่ยวข้อง กับการจัดการสาธารณสุขระดับจังหวัดมากน้อยเพียงใด (35)	1	2	3	4
ท่านคิดว่า อปท.ของท่านสามารถแลกเปลี่ยนข้อมูลข่าวสารที่จำเป็นต่อ การเตรียมพร้อมรับมือกับเหตุแผ่นดินไหวกับหมู่บ้านในพื้นที่เสี่ยงภัยมากน้อย เพียงใด (36)	1	2	3	4
ท่านคิดว่า อปท.ของท่านสามารถทำหน้าที่เตือนภัยให้กับหมู่บ้านที่ เสี่ยงภัยแผ่นดินไหวได้มากน้อยเพียงใด (37)	1	2	3	4
ท่านคิดว่า เมื่อเกิดภัย อปท.ของท่านสามารถสั่งการและประสานงาน กับชุมชนได้มากน้อยเพียงใด (38)	1	2	3	4

10) องค์กรปกครองส่วนท้องถิ่นของท่านมีการเรียนรู้ภายในองค์กรและระหว่างองค์กรในระดับใด

ข้อคำถาม	ไม่มี เลย	น้อย	ปาน กลาง	มาก
ท่านคิดว่า บุคลากรใน อปท.ของท่านเรียนรู้ถึงสาเหตุและวิธีรับมือกับ เหตุการณ์แผ่นดินไหวได้มากน้อยเพียงใด (39)	1	2	3	4
ท่านคิดว่า อปท.ของท่านมีความพร้อมต่อการรับมือภาวะฉุกเฉินหาก เกิดแผ่นดินไหวขึ้นฉับพลันมากน้อยเพียงใด (40)	1	2	3	4
ท่านคิดว่า อปท.ของท่านมีการปรับปรุงข้อบัญญัติท้องถิ่น เพื่อลด ผลกระทบจากแผ่นดินไหวได้มากน้อยเพียงใด (41)	1	2	3	4

11) องค์กรปกครองส่วนท้องถิ่นของท่านมีความรู้และทรัพยากรในการดำเนินงานในระดับใด

ข้อคำถาม	ไม่มี เลย	น้อย	ปาน กลาง	มาก
ท่านคิดว่า อปท.ของท่านมีบุคลากรที่มีประสบการณ์ในการรับมือภัย พิบัติแผ่นดินไหวมากน้อยเพียงใด (42)	1	2	3	4
ท่านคิดว่า อปท.ของท่านมีหัวหน้าหรือผู้บริหารที่ผ่านการฝึกฝนจนมี ความชำนาญในการรับมือกับเหตุแผ่นดินไหวมากน้อยเพียงใด (43)	1	2	3	4
ท่านคิดว่า อปท.ของท่านมีบุคลากรจำนวนเพียงพอต่อการปฏิบัติงาน รับมือเหตุแผ่นดินไหวมากน้อยเพียงใด (44)	1	2	3	4

ท่านคิดว่า อปท.ของท่านมีงบประมาณเพียงพอต่อการดำเนินงานลดผลกระทบจากเหตุแผ่นดินไหวกับชุมชนมากน้อยเพียงใด (45)	1	2	3	4
ท่านคิดว่า อปท.ของท่านมีวัสดุอุปกรณ์ เครื่องมือเครื่องใช้เพียงพอต่อการรับมือเหตุแผ่นดินไหวมากน้อยเพียงใด (46)	1	2	3	4
ท่านคิดว่า อปท.ของท่านมีความรู้ทางวิชาการหรือเทคโนโลยีที่เพียงพอต่อการรับมือเหตุแผ่นดินไหวมากน้อยเพียงใด (47)	1	2	3	4

12) องค์การปกครองส่วนท้องถิ่นของท่านมีโครงสร้างการบริหารราชการที่คล่องตัวในระดับใด

ข้อคำถาม	ไม่มีเลย	น้อย	ปานกลาง	มาก
ท่านคิดว่าโครงสร้างการบริหารราชการของการจัดการภัยพิบัติใน อปท.ของท่านมีความคล่องตัวมากน้อยเพียงใด (48)	1	2	3	4
ท่านคิดว่าโครงสร้างการบริหารราชการของการจัดการภัยพิบัติของจังหวัดเชียงรายมีความคล่องตัวมากน้อยเพียงใด (49)	1	2	3	4

13) องค์การปกครองส่วนท้องถิ่นของท่านมีปัจจัยสิ่งแวดล้อมในการกำหนดนโยบายในระดับใด

ข้อคำถาม	ไม่มีเลย	น้อย	ปานกลาง	มาก
ท่านคิดว่า ท้องถิ่นของท่านเปิดโอกาสให้ผู้นำชุมชนผู้มีส่วนร่วมในการกำหนดแผนรับมือภัยพิบัติของ อปท. มากน้อยเพียงใด (50)	1	2	3	4
ท่านคิดว่า ผู้ใหญ่บ้านทั้งหมดใน อปท.ของท่าน ทราบและเข้าใจแผนการป้องกันและบรรเทาสาธารณภัยประจำองค์กรปกครองส่วนท้องถิ่นของตนเองมากน้อยเพียงใด (51)	1	2	3	4
ท่านคิดว่า อปท.ของท่านให้ความสำคัญกับความคิดเห็นของผู้มีส่วนได้ส่วนเสียจากผลกระทบของภัยพิบัติมากน้อยเพียงใด (52)	1	2	3	4
ท่านคิดว่าประชาชนใน อปท.ของท่านให้ความสำคัญต่อการกำหนดทิศทางการจัดการภัยพิบัติในพื้นที่ของตนเองมากน้อยเพียงใด (53)	1	2	3	4
ท่านคิดว่า อปท.ของท่านมีผู้นำที่ให้ความสำคัญกับการยกระดับการเตรียมพร้อมรับมือภัยพิบัติมากน้อยเพียงใด (54)	1	2	3	4
ท่านคิดว่า อปท.ของท่านใช้สื่อมวลชนเป็นเครื่องมือในการขยายความรู้ด้านการบริหารจัดการภัยพิบัติได้มากน้อยเพียงใด (55)	1	2	3	4
ท่านคิดว่าประชากรในท้องถิ่นของท่านมีความตื่นตัวต่อการรับมือภัยพิบัติมากน้อยเพียงใด (56)	1	2	3	4

ข้อคำถาม	ไม่มีเลย	น้อย	ปานกลาง	มาก
ท่านคิดว่าท้องถิ่นของท่านมีการพัฒนาสาธารณูปโภคมากน้อยเพียงใด (57)	1	2	3	4
ท่านคิดว่าท้องถิ่นของท่านมีการพัฒนาเศรษฐกิจดีในระดับใด (58)	1	2	3	4
ท่านคิดว่า ท้องถิ่นของท่านมีทรัพยากรธรรมชาติและสิ่งแวดล้อมอุดมสมบูรณ์เพียงพอต่อการยังชีพของประชากรมากน้อยเพียงใด(59)	1	2	3	4
ท่านคิดว่า ท้องถิ่นของท่านมีการบันทึกประวัติศาสตร์เกี่ยวกับการเกิดภัยพิบัติเอาไว้มากน้อยเพียงใด (60)	1	2	3	4
ท่านคิดว่า ท้องถิ่นของท่านมีวัฒนธรรมท้องถิ่นที่เอื้อต่อการร่วมแรงร่วมใจกันรับมือภัยพิบัติอยู่มากน้อยเพียงใด (61)	1	2	3	4

ส่วนที่ 3 การลดผลกระทบจากแผ่นดินไหวขององค์กรปกครองส่วนท้องถิ่นและชุมชน

14) องค์กรปกครองส่วนท้องถิ่นของท่านสนับสนุนให้ประชาชน ตื่นตัวและตระหนักรู้กับความเสี่ยงจากภัยแผ่นดินไหวมากน้อยเพียงใด

ข้อคำถาม	ไม่มี	มี	ไม่ทราบ
อปท.ของท่านมีการถอดบทเรียนหรือจัดเวทีแลกเปลี่ยนเรียนรู้กับหมู่บ้านที่ประสบภัย(62) จำนวน..... ครั้ง	-1	1	0
อปท.ของท่านมีการให้ความรู้เกี่ยวกับสาเหตุของปรากฏการณ์แผ่นดินไหวแก่หมู่บ้านที่ประสบภัย(63) จำนวน..... ครั้ง	-1	1	0
อปท.ของท่านมีการอบรมให้ความรู้ด้านการปฏิบัติตัวให้ปลอดภัยขณะเกิดแผ่นดินไหวแก่ชาวบ้านในพื้นที่ประสบภัย(64) จำนวน..... ครั้ง	-1	1	0
อปท.ของท่านสนับสนุนการรวบรวมองค์ความรู้ การสร้างนวัตกรรม-เทคนิคในการจัดการภัยพิบัติ (65) จำนวน..... ครั้ง	-1	1	0

15) ปัจจัยด้านการสนับสนุนความเข้มแข็งของหมู่บ้านต่อการรับมือกับแผ่นดินไหว

ข้อคำถาม	ไม่มี	มี	ไม่ทราบ
อปท.ของท่านสนับสนุนการทำบัญชีผู้ประสบภัยแก่หมู่บ้านที่ประสบภัย (66) จำนวน..... หมู่บ้าน	-1	1	0
อปท.ของท่านสนับสนุนการทำข้อมูลบัญชีความเสียหายของทรัพย์สินแก่หมู่บ้านที่ประสบภัย (67) จำนวน..... หมู่บ้าน	-1	1	0

ข้อคำถาม	ไม่มี	มี	ไม่ทราบ
อปท.ของท่านสนับสนุนการรวมกลุ่มของประชาชนในหมู่บ้านที่ประสบภัยเพื่อฟื้นฟูตนเองหลังจากประสบภัยแผ่นดินไหว (68) จำนวน..... หมู่บ้าน	-1	1	0
โรงเรียนในพื้นที่ตำบลของท่านมีการบรรจุหลักสูตรเกี่ยวกับการรับมือภัยแผ่นดินไหวลงในหลักสูตรการศึกษาของโรงเรียน(69) จำนวน.....โรงเรียน	-1	1	0
อปท.ของท่านสนับสนุนงบประมาณในการจัดตั้งทีมรับมือภัยพิบัติแก่หมู่บ้านที่ประสบภัย(70) จำนวน..... หมู่บ้าน	-1	1	0

16) ปัจจัยด้านการเชื่อมโยงข้อมูลระหว่างท้องถิ่นกับหน่วยงานส่วนภูมิภาค

ข้อคำถาม	ไม่มี	มี	ไม่ทราบ
อปท.ของท่านสามารถเชื่อมโยงข้อมูลระหว่างหน่วยงานที่เกี่ยวข้องกับการรับมือกับเหตุแผ่นดินไหว เช่น ฐานข้อมูลการให้ความช่วยเหลือผู้ประสบภัยจากเหตุแผ่นดินไหวในการฟื้นฟูชุมชนหลังแผ่นดินไหวได้ (71) จำนวน.....แห่ง	-1	1	0
อปท.ของท่านสามารถใช้ข้อมูลร่วมกับระหว่างหน่วยงานต่าง ๆ เช่น ฐานข้อมูลความเสียหายของอาคารที่ได้รับผลกระทบจากเหตุแผ่นดินไหวในการวางแผนการลดผลกระทบจากแผ่นดินไหวได้ (71) จำนวน.....แห่ง	-1	1	0
อปท.ของท่านมีการพัฒนาขีดความสามารถในการจัดระบบข้อมูล การกระจายข้อมูล ให้สามารถสืบค้น ติดต่อ ประสานงาน ขอคำแนะนำและขอความช่วยเหลือจากหน่วยงานต่างๆ ได้อย่างทันทั่วทั้งที่กับหน่วยงานต่างๆ (73)	-1	1	0
หากโทรศัพท์ที่ไม่มีสัญญาณ อปท.ของท่านมีช่องทางฉุกเฉิน เช่น วิทยุสื่อสาร ในการติดต่อขอความช่วยเหลือจากหน่วยงานระดับจังหวัดได้ (74) จำนวน.....แห่ง	-1	1	0
หากโทรศัพท์ที่ไม่มีสัญญาณ อปท.ของท่านมีช่องทางฉุกเฉินสำหรับติดต่อขอความช่วยเหลือกับหน่วยกู้ชีพ กู้ภัย (75) จำนวน.....แห่ง	-1	1	0
อปท.ของท่านสร้างศูนย์การเรียนรู้ และระบบการเรียนรู้ให้แก่บุคลากรและประชาชนให้มีทางเลือกในการรับมือกับเหตุแผ่นดินไหว (76) จำนวน.....แห่ง	-1	1	0

17) ปัจจัยด้านการดำเนินงานเพื่อลดผลกระทบจากเหตุการณ์แผ่นดินไหวระดับท้องถิ่น

ข้อคำถาม	ไม่มี	มี	ไม่ทราบ
บุคลากรใน อปท.ของท่านได้รับการพัฒนาศักยภาพจาก ปก.สาขา ครั้ง กรณีการบูรณาการที่เข้ารับการอบรมหากท่านจำได้.....(77)	-1	1	0

ข้อคำถาม	ไม่มี	มี	ไม่ทราบ
บุคลากรใน อปท.ของท่านได้รับการพัฒนาศักยภาพจาก ปก.จังหวัด.....ครั้ง กรุณาระบุเวลาที่เข้ารับการอบรมหากท่านจำได้.....(78)	-1	1	0
บุคลากรใน อปท.ของท่านได้รับการพัฒนาศักยภาพจาก ปก.ศูนย์เขต 15 ...ครั้ง กรุณาระบุเวลาที่เข้ารับการอบรมหากท่านจำได้.....(79)	-1	1	0
อปท.ของท่านมีการประเมินและทำแผนที่เสี่ยงภัยระดับตำบล (80)	-1	1	0
อปท.ของมีเจ้าหน้าที่หรืออาสาสมัครกู้ภัยที่ปฏิบัติงานได้ทันทีอยู่ในตำบล (81)	-1	1	0
อปท.ของท่านผ่านการอบรมระบบการบัญชาการสาธารณภัยในภาวะวิกฤติ (ICS: incident command system) กรุณาระบุเวลาที่เข้ารับการอบรมหากจำได้(82)	-1	1	0
อปท.ของท่าน มีการจัดตั้งกองทุนจัดการภัยพิบัติ (ตอบได้มากกว่า 1 ข้อ) (83) ☐ มีกองทุนระดับตำบล ☐ มีกองทุนระดับหมู่บ้าน	-1	1	0
อปท.ของท่านมีการวิจัยและพัฒนาวิธีการจัดการความเสี่ยงจากภัยพิบัติ (84) ได้แก่	-1	1	0

18) ปัจจัยด้านการดำเนินงานเพื่อลดผลกระทบจากเหตุการณ์แผ่นดินไหวระดับชุมชน

ข้อคำถาม	ไม่มี	มี	ไม่ทราบ
อปท.ของท่านมีการประเมินความเสี่ยงจากแผ่นดินไหวระดับหมู่บ้าน (86)	-1	1	0
อปท.ของท่านมีการทำแผนที่พื้นที่เสี่ยงภัยแผ่นดินไหวในระดับหมู่บ้าน (87)	-1	1	0
อปท.ของท่านมีส่วนร่วมในการพัฒนาศักยภาพในการจัดการภัยพิบัติของ ประชาชนในหมู่บ้าน เช่น การปฐมพยาบาล การปฏิบัติตัวให้ปลอดภัยขณะเกิด แผ่นดินไหว (88)	-1	1	0
โรงเรียนในพื้นที่ อปท.ของท่านมีการอบรมหนึ่งโรงเรียนหนึ่งทีมกู้ภัย (89)	-1	1	0
อปท.ของท่านมีการอบรมการจัดการภัยพิบัติโดยอาศัยหมู่บ้านเป็นฐาน (community base disaster risk management : CBDRM) แก่หมู่บ้านที่เสี่ยงภัย (90)	-1	1	0
อปท.ของท่านมีการฝึกซ้อมรับมือกับแผ่นดินไหว (ตอบได้มากกว่า 1 ข้อ) ☐ มีการซ้อมโดย ปก.จังหวัด ☐ มีการซ้อมโดย ปก.ท้องถิ่นจัดขึ้นเอง ☐ มีการซ้อมโดยหน่วยงานอื่น ได้แก่..... (91)	-1	1	0

19) ปัจจัยด้านการสื่อสารระหว่างท้องถิ่นกับชุมชนในการเตรียมพร้อม-ลดผลกระทบจากภัย

ข้อความถาม	ไม่ทราบ	ไม่มีเลย	น้อย	ปานกลาง	มาก
อปท.ของท่านสามารถเข้าถึงข้อมูลรายงานแผ่นดินไหวที่เชื่อถือได้ (93)	0	1	2	3	4
อปท.ของท่านสามารถให้ข้อมูลเกี่ยวกับเหตุการณ์แผ่นดินไหวแก่ประชาชนได้ละเอียด ชัดเจน และต่อเนื่อง (94)	0	1	2	3	4
อปท.ของท่านมีระบบเตือนภัยที่มีประสิทธิภาพ แม่นยำรวดเร็ว (95)	0	1	2	3	4
อปท.ของท่านสามารถเตือนภัยแก่ผู้ใหญ่บ้านและประชาชนในหมู่บ้านที่ประสบภัยได้อย่างชัดเจนและทั่วถึง (96)	0	1	2	3	4
อปท.ของท่านสามารถเผยแพร่แผนป้องกันและบรรเทาสาธารณภัยประจำ อปท. แก่ผู้ใหญ่บ้านได้อย่างชัดเจนและทั่วถึงทุกหมู่บ้าน (97)	0	1	2	3	4
อปท.ของท่านสามารถเผยแพร่แผนป้องกันและบรรเทาสาธารณภัยประจำ อปท. แก่ประชาชนในหมู่บ้านเสี่ยงภัยได้ชัดเจนและทั่วถึงทุกหมู่บ้าน (98)	0	1	2	3	4
หากโทรศัพท์ไม่มีสัญญาณ อปท.ของท่านมีช่องทางฉุกเฉินสำหรับติดต่อกับผู้ใหญ่บ้าน (99)	0	1	2	3	4
อปท.ของท่านมีฐานข้อมูล-รายชื่อแกนนำในพื้นที่เสี่ยงภัยที่ติดต่อได้ในยามฉุกเฉินอยู่ล่วงหน้า (100)	0	1	2	3	4

20) ปัจจัยด้านความร่วมมือระหว่างท้องถิ่นกับหน่วยงานส่วนภูมิภาค

ข้อความถาม	ไม่ทราบ	ไม่มีเลย	น้อย	ปานกลาง	มาก
อปท.ของท่านมีการพัฒนาความร่วมมือกับสถาบันวิชาการองค์กรเอกชนและภาคประชาชนเพื่อการพัฒนาศักยภาพของเครือข่ายในการรับมือกับเหตุแผ่นดินไหว (101)	0	1	2	3	4
อปท.ของท่านส่งเสริมให้หน่วยงานทุกภาคส่วน ต้องร่วมมือกันและเห็นความสำคัญของการรับมือกับแผ่นดินไหว (102)	0	1	2	3	4
อปท.ของท่านมีการแลกเปลี่ยนทรัพยากร เช่น การให้ยืมเครื่องจักร ให้บุคลากรช่วยเหลือ อปท.อื่นในการฟื้นฟูพื้นที่ประสบภัย (103)	0	1	2	3	4

อปท.ของท่านได้รับการแลกเปลี่ยนทรัพยากร เช่น การยืมเครื่องจักร หรือมีบุคลากรจากหน่วยงานระดับจังหวัดหรือภูมิภาคอื่นมาช่วยในช่วงฟื้นฟู (104)	0	1	2	3	4
อปท.ของท่านมีการสานเครือข่ายระดับท้องถิ่นกับภูมิภาคเพื่อการแลกเปลี่ยนทรัพยากรสำหรับการจัดการภัยพิบัติ (105)	0	1	2	3	4

21) ปัจจัยด้านความร่วมมือระหว่างท้องถิ่นกับชุมชนในการเตรียมพร้อม-ลดผลกระทบจากภัย

ข้อคำถาม	ไม่ทราบ	ไม่มีเลย	น้อย	ปานกลาง	มาก
อปท.ของท่านส่งเสริมให้ชุมชนสร้างเครือข่ายในการช่วยเหลือหรือแลกเปลี่ยนทรัพยากร เพื่อการรับมือกับเหตุแผ่นดินไหวกับชุมชนข้างเคียง ชื่อเครือข่าย..... (106)	0	1	2	3	4
อปท.ของท่านสนับสนุนงบประมาณด้านการพัฒนาความรู้ความเข้าใจในการเตรียมพร้อมรับมือกับเหตุแผ่นดินไหวแก่ประชาชนในหมู่บ้านที่ประสบภัย จำนวน.....บาท (107)	0	1	2	3	4
อปท.ของท่านสนับสนุนงบประมาณด้านอุปกรณ์กลางเครื่องมือกลางในการซ่อมสร้างบ้านหลังแผ่นดินไหวแก่หมู่บ้านที่ประสบภัยจำนวน.....บาท (108)	0	1	2	3	4
อปท.ของท่านสนับสนุนงบประมาณด้านการพัฒนาศักยภาพของประชาชน ด้านทักษะการกู้ชีพกู้ภัยขั้นพื้นฐานเพื่อรับมือแผ่นดินไหวแก่หมู่บ้านที่ประสบภัย จำนวนงบ.....บาท (109)	0	1	2	3	4
อปท.ของท่านสนับสนุนงบประมาณด้านการทำแผนลดความเสี่ยงและแผนรับมือกับเหตุแผ่นดินไหวแก่หมู่บ้านที่ประสบภัย จำนวน.....บาท (110)	0	1	2	3	4

22) ปัจจัยด้านการสร้างมาตรการเพื่อลดผลกระทบจากเหตุการณ์แผ่นดินไหวโดย อปท.

ข้อคำถาม	ไม่ทราบ	ไม่มีเลย	น้อย	ปานกลาง	มาก
อปท.ของท่านมีการทบทวนกฎหมาย ระเบียบ นโยบาย มาตรการที่เกี่ยวกับการลดความเสี่ยงจากภัยพิบัติ (111)	0	1	2	3	4
อปท.ของท่านเปิดโอกาสให้ประชาชนและภาคเอกชนมีส่วนร่วมในปรับปรุงข้อกฎหมายหรือข้อกำหนดในการจัดการภัยพิบัติ (112)	0	1	2	3	4

อปท.ของท่านบรรจุแผนงานด้านการจัดการความเสี่ยงจากแผ่นดินไหว เข้าไปในแผนปฏิบัติการการป้องกันและบรรเทาสาธารณภัยประจำปี (113)	0	1	2	3	4

อปท.ของท่านมีการพัฒนาศักยภาพด้านการรับมือแผ่นดินไหวและภัยอื่นๆอีก ได้แก่ (114)

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**แบบสอบถามสำหรับศึกษาความสำเร็จในการ
นำนโยบายป้องกันและบรรเทาสาธารณภัยไปปฏิบัติในระดับหมู่บ้าน
เพื่อสนับสนุนการรับมือกับเหตุแผ่นดินไหวของจังหวัดเชียงราย**

ข้อมูลพื้นฐานของผู้ตอบแบบสอบถาม

หมู่บ้าน.....ตำบล.....อำเภอ.....
ชื่อ-นามสกุล.....ตำแหน่ง.....หมายเลขโทรศัพท์.....
เพศ ☐ ชาย ☐ หญิง อายุ.....ปี ระดับการศึกษา.....

ข้อคำถามทั้งหมดมี **10 ข้อ** กรุณาเติมคำตอบ หรือ ทำเครื่องหมาย ☒ เพื่อตอบ
คำถามในข้อคำถามที่ท่านเห็นว่าหมู่บ้านของท่านมีกิจกรรมหรือเหตุการณ์ดังกล่าวเกิดขึ้น
ในช่วง 2 ปีที่ผ่านมา (ข้อมูลของท่านจะถูกเก็บเป็นความลับ เพื่อใช้ในการวิจัยเท่านั้น)

1. ความเสียหายในหมู่บ้านที่เกิดขึ้นจากเหตุการณ์แผ่นดินไหว

- หมู่บ้านของท่านมีบ้านเรือนทั้งหมด จำนวน.....หลัง (1)
หมู่บ้านของท่านมีบ้านเรือนที่เสียหายระดับสีแดง(เสียหายสิ้นเชิงจนต้องรื้อถอน) จำนวน.....หลัง (2)
หมู่บ้านของท่านมีบ้านเรือนที่เสียหายระดับสีเหลือง(เสียหายปานกลางซ่อมแซมได้) จำนวน.....หลัง (3)
หมู่บ้านของท่านมีบ้านเรือนที่เสียหายระดับสีเขียว (เสียหายเล็กน้อยซ่อมแซมได้) จำนวน.....หลัง (4)
หมู่บ้านของท่านมีผู้บาดเจ็บจากเหตุการณ์แผ่นดินไหว จำนวน.....คน (5)
หมู่บ้านของท่านมีผู้เสียชีวิตจากเหตุการณ์แผ่นดินไหว จำนวน.....คน (6)
หมู่บ้านของท่านพบรอยแยกของพื้นดินหลังเกิดเหตุแผ่นดินไหว จำนวน.....รอย (7)
หมู่บ้านของท่านพบหลุมยุบหรือพื้นดินทรุดหลังเกิดเหตุแผ่นดินไหว จำนวน.....จุด (8)
หมู่บ้านของท่านพบทรายผุด (โคลนผุด) หลังเกิดเหตุแผ่นดินไหว จำนวน.....จุด (9)
หมู่บ้านของท่านได้รับผลกระทบด้านอื่นๆ จากแผ่นดินไหวอีก ได้แก่ (10)

- ☐ ระบบประปาหมู่บ้านเสียหายเกิดโคลน-ทรายอุดตัน ☐ ถนนในหมู่บ้านแตกร้าวเสียหาย
☐ สะพานในหมู่บ้านแตกร้าวเสียหาย ☐ อื่นๆ.....

2. การรับรู้และความคิดเห็นเกี่ยวกับความเสี่ยงจากเหตุการณ์แผ่นดินไหว

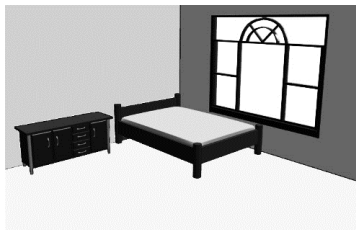
ท่านกำลังจะเข้าพักในโรงแรมแห่งหนึ่งซึ่งอยู่ในพื้นที่เสี่ยงต่อแผ่นดินไหว มีห้องว่างให้เลือก 4 ห้อง ท่านคิดว่า จะเข้าพักห้องไหนที่จะได้รับผลกระทบหากเกิดแผ่นดินไหวขึ้นในคืนนี้น้อยที่สุด (11)



☐ ห้องที่ 1



☐ ห้องที่ 2

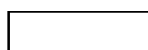


☐ ห้องที่ 3

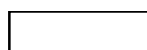


☐ ห้องที่ 4

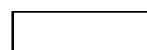
ท่านกำลังจะไปทานข้าวที่บ้านเพื่อนซึ่งเพิ่งย้ายของเข้ามา จึงยังไม่ได้ยัดเฟอร์นิเจอร์และตู้ต่างๆ เข้ากับผนังไว้ ท่านคิดว่า แกอี้ในตำแหน่งใดมีความเสี่ยงที่จะได้รับบาดเจ็บหากเกิดแผ่นดินไหวมากที่สุด (12)



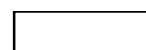
เก้าอี้ตัวที่ 1



เก้าอี้ตัวที่ 2

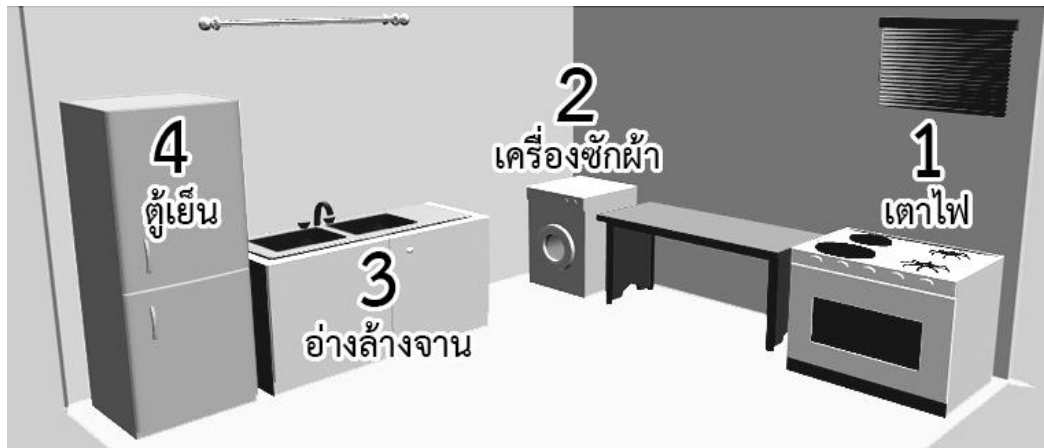


เก้าอี้ตัวที่ 3



เก้าอี้ตัวที่ 4

แผ่นดินไหวหยุดแล้ว ท่านกำลังจะออกจากบ้านไปยังที่โล่งด้านนอก ระหว่างนั้นท่านคิดว่า
เครื่องใช้ในชีวิตใด ต้องแน่ใจได้ว่าปิดการใช้งานเรียบร้อยแล้วก่อนออกจากบ้าน(13)



1 เตาไฟ

2 เครื่องซักผ้า

3 อ่างล้างจาน

4 ตู้เย็น

ท่านเข้าไปทำธุระในเมืองแล้วอยู่ๆ ก็เกิดแผ่นดินไหว เมื่อการสั่นสะเทือนหยุดแล้ว ท่าน
คิดว่า ท่านควรไปอยู่ที่จุดใด จึงจะปลอดภัยจากอาฟเตอร์ช็อค (Aftershock) ของ
แผ่นดินไหวที่อาจเกิดขึ้นตามมา (14)



ตำแหน่งที่ 1

ห้างสรรพสินค้า

ตำแหน่งที่ 2

ปั้มน้ำมัน

ตำแหน่งที่ 3

สวนสาธารณะ

ตำแหน่งที่ 4

อาคารสำนักงาน

ท่านเชื่อว่ามีโอกาสที่จะเกิดแผ่นดินไหวความรุนแรงขนาด 6 มาตราริกเตอร์เกิดขึ้นอีก(15)

มากที่สุด	มาก	ไม่แน่ใจ	น้อย	น้อยที่สุด

ท่านเชื่อว่าหมู่บ้านเคยเผชิญกับแผ่นดินไหวมาแล้ว จะมีประสบการณ์และความสามารถในการรับมือกับแผ่นดินไหวที่อาจเกิดขึ้นอีกในอนาคตมากกว่าหมู่บ้านที่ไม่เคยเผชิญกับแผ่นดินไหวมาก่อน (16)

มากที่สุด	มาก	ไม่แน่ใจ	น้อย	น้อยที่สุด

ท่านคิดว่าการการอบรม-ฝึกทักษะในการจัดการตัวเองให้ปลอดภัยเมื่อเกิดเหตุแผ่นดินไหวเป็นสิ่งที่จำเป็นต่อการเตรียมพร้อมรับมือกับภัยพิบัติของหมู่บ้าน (17)

มากที่สุด	มาก	ไม่แน่ใจ	น้อย	น้อยที่สุด

3. การรวบรวมข้อมูลที่เป็นต่อการช่วยเหลือผู้ประสบภัยในหมู่บ้าน

ข้อคำถาม	มี	ไม่มี
ท่านมีข้อมูลบัญชีรายชื่อ-ตำแหน่งที่ตั้งของครัวเรือนที่ต้องช่วยเหลือ-อพยพก่อนเป็นลำดับแรก เช่น ครอบครัวที่มีคนพิการ คนชรา หญิงตั้งครรภ์ เด็กอ่อน (18)		
ท่านมีรายการเครื่องมือ-อุปกรณ์ที่จำเป็นต้องใช้ในภาวะฉุกเฉิน (19)		
ท่านมีสำเนาข้อมูลการสำรวจคน ทรัพย์สิน สาธารณูปโภคที่เคยเสียหายจากแผ่นดินไหว(20)		
ท่านมีการจัดทำข้อมูลอาชีพ-รายได้ของหมู่บ้าน (21)		
ท่านมีการจัดทำข้อมูลปฏิทินการผลิตพืชผลทางการเกษตรและการประกอบอาชีพต่าง ๆตามฤดูกาลของสมาชิกในหมู่บ้าน (22)		

4. การรวบรวมข้อมูลที่สำคัญต่อการจัดการภัยพิบัติในหมู่บ้าน

ข้อความ	มี	ไม่มี
หมู่บ้านของท่านมีแผนที่ซึ่งระบุพื้นที่เสี่ยงภัยของหมู่บ้าน (เช่น ทางน้ำหลาก จุดเสี่ยงดินสไลด์ จุดที่เคยเกิดทรายผุด แผ่นดินแยก แผ่นดินทรุด (23)		
หมู่บ้านของท่านมีการกำหนดจุดปลอดภัยของหมู่บ้านที่ชาวบ้านทุกคนทราบตรงกันว่าเป็นจุดที่ต้องอพยพมาอยู่รวมกัน (24)		
หมู่บ้านของท่านมีแผนที่เส้นทางจราจรสำหรับอพยพประชาชน (25)		
หมู่บ้านของท่านมีการทำปฏิทินภัยพิบัติ ว่าใน 1 รอบปี ในแต่ละฤดูกาล หมู่บ้านของท่านมีโอกาสที่จะเผชิญกับภัยพิบัติชนิดใดบ้าง (26)		
หมู่บ้านของท่านมีการทำข้อมูลประวัติการเกิดภัยพิบัติของหมู่บ้านว่านับตั้งแต่มีการตั้งหมู่บ้าน หมู่บ้านของท่านเคยเผชิญกับภัยพิบัติมาแล้วในปีใด ภัยพิบัติที่เกิดขึ้นมีความถี่ ความรุนแรงและความเสียหายแค่ไหน (27)		

5. หมู่บ้านของท่านสามารถติดต่อสื่อสารกับภาคส่วนต่าง ๆ นอกหมู่บ้านขณะเกิดภัย

ข้อความ	มี	ไม่มี
ท่านมีช่องทางในการรับข้อมูลแจ้งเตือนภัยจากทางราชการ ☐ สำนักงานป้องกันและบรรเทาสาธารณภัยจังหวัดเชียงราย ☐ ศูนย์เตือนภัยพิบัติแห่งชาติ ☐ กรมทรัพยากรธรณี ☐ กรมทรัพยากรน้ำ ☐ กรมอุตุนิยมวิทยา หน่วยงานอื่น..... (28)		
ท่านมีบัญชีรายชื่อ-หมายเลขโทรศัพท์บุคคลสำคัญในหมู่บ้านที่มีบทบาทในการจัดการภัยพิบัติในหมู่บ้าน (29)		
ท่านมีบัญชีรายชื่อ-หมายเลขโทรศัพท์หน่วยราชการในการจัดการภัยพิบัติ(30)		
ท่านมีบัญชีรายชื่อ-หมายเลขโทรศัพท์มูลนิธิ คุ้มภัยภัย (31)		

ข้อคำถาม	มี	ไม่มี
ท่านมีความสัมพันธ์กับหน่วยราชการระดับจังหวัด เพื่อขอความช่วยเหลือได้ทันทีเมื่อประสบภัย (ระบุหน่วยงาน) (32)		
ท่านมีความสัมพันธ์กับหน่วยราชการระดับอำเภอ เพื่อขอความช่วยเหลือได้ทันทีเมื่อประสบภัย (ระบุหน่วยงาน.....) (33)		
ท่านมีความสัมพันธ์กับหน่วยงานเอกชน องค์การการกุศล กู้ชีพ กู้ภัย เพื่อขอความช่วยเหลือโดยตรงเมื่อประสบภัย (ระบุองค์กร.....) (34)		
หากโทรศัพท์ที่ไม่มีสัญญาณ ท่านมีช่องทางฉุกเฉิน-เครื่องมือสื่อสารสำรองในการสื่อสารกับองค์การบริหารส่วนตำบลหรือเทศบาลตำบลของท่าน เพื่อขอความช่วยเหลือได้ทันทีเมื่อประสบภัย (35)		
องค์การบริหารส่วนตำบลหรือเทศบาลตำบลของท่าน มีการให้ข้อมูล-ทำความเข้าใจแผนการจัดการภัยพิบัติประจำตำบลแก่ผู้ใหญ่บ้านเป็นอย่างดี (36)		
ปัจจุบันท่านมีหน้าที่ในฝ่ายใดของกองอำนวยการป้องกันและบรรเทาสาธารณภัยประจำองค์การบริหารส่วนตำบลหรือเทศบาลตำบล (ท่านสามารถตอบได้มากกว่า 1 ข้อ) (37) ☐ ฝ่ายป้องกันและปฏิบัติการ/สื่อสาร ☐ ฝ่ายอำนวยการ ☐ ฝ่ายแผนและโครงการ ☐ ฝ่ายฟื้นฟูบูรณะ ☐ ฝ่ายอื่น..... ☐ ไม่มีหน้าที่ในฝ่ายใด		

6.การจัดการความเสี่ยงจากภัยพิบัติโดยหมู่บ้านเป็นฐาน

ข้อคำถาม	มี	ไม่มี
การตั้งคณะกรรมการจัดการภัยพิบัติประจำหมู่บ้าน ☐ ไม่มี การตั้งคณะกรรมการฯประจำหมู่บ้าน (หากไม่มี ไม่ต้องตอบข้อต่อไป) ☐ มี การตั้งคณะกรรมการฯประจำหมู่บ้านอย่างไม่เป็นทางการ ☐ มี การตั้งคณะกรรมการฯโดยสำนักงานป้องกันและบรรเทาสาธารณภัยจังหวัดเชียงราย ☐ มี การตั้งคณะกรรมการฯ โดยหน่วยงานอื่น คือ.....(38)		

ข้อคำถาม	มี	ไม่มี
หมู่บ้านของท่านมีคณะกรรมการจัดการภัยพิบัติประจำหมู่บ้านฝ่ายต่างๆ ได้แก่ (ท่านสามารถตอบได้มากกว่า 1 ข้อ) ☐ ฝ่ายป้องกันและเตรียมความพร้อม ☐ ฝ่ายเฝ้าระวังและแจ้งเตือนภัย ☐ ฝ่ายสื่อสารและประชาสัมพันธ์ ☐ ฝ่ายอพยพ ☐ ฝ่ายกู้ภัย ☐ ฝ่ายสงเคราะห์ผู้ประสบภัย ☐ ฝ่ายรักษาความสงบเรียบร้อย ☐ ฝ่ายรักษาพยาบาล ☐ ฝ่ายประสานงาน ☐ ฝ่ายฟื้นฟูบูรณะ ☐ ฝ่ายยานพาหนะ ☐ ฝ่ายจัดการอาหาร ☐ ฝ่ายจัดการภัยพิบัติด้านอื่นๆอีก ได้แก่ (39)		
หมู่บ้านของท่านมีมิสเตอร์เตือนภัย ที่ผ่านการอบรมจากกรมป้องกันและบรรเทาสาธารณภัยในการทำหน้าที่เฝ้าระวัง ติดตามสถานการณ์ แจ้งเตือนภัยน้ำท่วม-ดินถล่มอยู่ในหมู่บ้าน (40)		
หมู่บ้านของท่านมีผู้ที่ผ่านการฝึกอบรมอาสาสมัครป้องกันภัยฝ่ายพลเรือน (อปพร.)อาศัยอยู่ในหมู่บ้าน(41)		
หมู่บ้านของท่านมีอาสาสมัครป้องกันภัยฝ่ายพลเรือน (อปพร.) ที่สามารถให้ความช่วยเหลือ-อพยพประชาชนได้ทันทีหากเกิดเหตุการณ์แผ่นดินไหวขึ้นในหมู่บ้าน (42)		
หมู่บ้านของท่านมีคนที่สามารถประเมินความปลอดภัยของอาคาร รวมถึงให้คำแนะนำในการซ่อมสร้างอาคารให้ทนแรงแผ่นดินไหวอยู่ในหมู่บ้าน (43)		
หมู่บ้านของท่านมีอาสาสมัครหรือเจ้าหน้าที่ที่มีความสามารถในการดับเพลิง และการช่วยชีวิตผู้ประสบภัยใต้อาคารถล่มอยู่ในหมู่บ้าน (44)		
หมู่บ้านของท่านมีอาสาสมัครเอกชน จากมูลนิธิ องค์กรการกุศล ที่มีความสามารถด้านการจัดการภัยพิบัติ ได้แก่ มูลนิธิ.....(45)		

7. การฟื้นฟูหมู่บ้านไปพร้อมกับสร้างเครือข่ายในการรับมือกับภัยพิบัติ

ข้อคำถาม	มี	ไม่มี
หมู่บ้านของท่านมีการแลกเปลี่ยนข้อมูลข่าวสารกับหมู่บ้านอื่นๆ เช่น ข้อมูลความเสียหาย ความช่วยเหลือ วิธีซ่อมสร้างอาคารหลังแผ่นดินไหวและการฟื้นฟู ได้แก่ หมู่บ้าน..... (46)		

ข้อคำถาม	มี	ไม่มี
หมู่บ้านของท่านได้รับการสนับสนุนงบประมาณจากหน่วยงานต่างๆ เพื่อซื้อวัสดุ-เครื่องมือส่วนกลางในการซ่อม-สร้างบ้านที่ได้รับความเสียหายจากแผ่นดินไหว จากหน่วยงาน..... (47)		
หมู่บ้านของท่านได้รับการสนับสนุนของหน่วยงานต่างๆ ในการอบรมทักษะการซ่อม-สร้างบ้านที่ได้รับความเสียหาย ให้ทนกับแรงแผ่นดินไหว จากหน่วยงาน. (48)		
หมู่บ้านของท่านได้รับการสนับสนุนของหน่วยงานต่างๆ ในการแลกเปลี่ยนหรือให้ยืมเครื่องมือ-อุปกรณ์ ทรัพยากรที่จำเป็นระหว่างการฟื้นฟูหมู่บ้านหลังแผ่นดินไหว จากหน่วยงาน..... (49)		
หมู่บ้านของท่านได้รับการสนับสนุนจากหน่วยงานต่างๆ ในการอบรมให้ความรู้และวิธีปฏิบัติตัวให้อยู่รอดปลอดภัยขณะเกิดแผ่นดินไหวแก่ชาวบ้าน จากหน่วยงาน (50)		
หมู่บ้านของท่านได้รับการสนับสนุนจากหน่วยงานต่างๆ ในการทำข้อมูลกลุ่มเปราะบาง เช่น คนพิการ คนชรา คนท้อง เด็กอ่อน สำหรับเตรียมรับมือแผ่นดินไหว จากหน่วยงาน.....(51)		
หมู่บ้านของท่านได้รับการสนับสนุนจากหน่วยงานต่างๆ ในการทำข้อมูลรอยเลื่อน จุดเสี่ยงดินสไลด์ภายในหมู่บ้านสำหรับเตรียมรับมือแผ่นดินไหว จากหน่วยงาน (52)		
หมู่บ้านของท่านได้รับการสนับสนุนของหน่วยงานต่างๆ ในการซ่อมแผนรับมือกับแผ่นดินไหวให้กับชาวบ้านและอาสาสมัครในหมู่บ้าน จากหน่วยงาน..... (53)		
หมู่บ้านของท่านสร้างเครือข่ายที่เป็นทางการด้านการจัดการภัยพิบัติ ชื่อเครือข่าย..... (54)		
หมู่บ้านของท่านสร้างเครือข่ายที่ไม่เป็นทางการด้านการจัดการภัยพิบัติ ชื่อเครือข่าย..... (55)		

8.หมู่บ้านของท่านมีเครื่องมือ – อุปกรณ์ที่จำเป็นต่อการจัดการภัยพิบัติ

ข้อคำถาม	มี	ไม่มี
หมู่บ้านของท่านมียานพาหนะที่ใช้งานไต่ระหว่างแผ่นดินไหว (56)		

ข้อคำถาม	มี	ไม่มี
หมู่บ้านของท่านมีเครื่องมือสื่อสารสำรองที่ใช้แทนโทรศัพท์ได้ขณะเกิดภัยได้แก่ (ท่านสามารถตอบได้มากกว่า 1 ข้อ) ☐ วิทยุสื่อสารเครื่องดำ 144-145 MHz ☐ วิทยุสื่อสารเครื่องแดง 245 MHz ☐ อุปกรณ์อื่นๆ..... (57)		
หมู่บ้านของท่านมีเครื่องมือในการกระจายข่าวสาร-แจ้งเตือนภัย ได้แก่ (ท่านสามารถตอบได้มากกว่า 1 ข้อ) ☐ หอกระจายข่าวที่ใช้ไฟฟ้าตามปกติ ☐ หอกระจายข่าวที่ใช้กับเครื่องปั่นไฟสำรองได้เมื่อเกิดไฟดับในหมู่บ้าน ☐ รถกระจายเสียง ☐ อุปกรณ์อื่นๆ..... (58)		
แต่ละครัวเรือนในหมู่บ้านของท่านมีการเตรียมกระเป๋าดูแลเงิน สำหรับใส่สิ่งจำเป็นเพื่ออพยพอย่างฉับพลันเมื่อเกิดภัย (59)		
หมู่บ้านของท่านมีเครื่องมือ – อุปกรณ์อื่นๆ ที่จำเป็นต่อการใช้งานของเกิดเหตุแผ่นดินไหว คือ.....(60)		

9. การพัฒนาศักยภาพสมาชิกในหมู่บ้านเพื่อรับมือกับแผ่นดินไหว

ข้อคำถาม	มี	ไม่มี
สมาชิกในหมู่บ้านของท่านได้รับการพัฒนาขีดความสามารถในการรับมือแผ่นดินไหวในระยะฉุกเฉิน ได้แก่ ☐ ความรู้พื้นฐานเกี่ยวกับสาเหตุของการเกิดแผ่นดินไหว ☐ ความรู้พื้นฐานเกี่ยวกับวิธีปฏิบัติตัวขณะเกิดแผ่นดินไหว ☐ การฝึก-อบรมการปฐมพยาบาลหรือกู้ชีพขั้นพื้นฐาน (61)		
สมาชิกในหมู่บ้านของท่านได้รับการพัฒนาขีดความสามารถในการรับมือแผ่นดินไหวในระยะฟื้นฟูและเตรียมพร้อมป้องกันภัย ได้แก่ ☐ การอบรมให้ความรู้ในการซ่อม-สร้างบ้านให้ทนกับแรงแผ่นดินไหว ☐ การติดตามข้อมูลการเตือนภัยของกรมอุตุนิยมวิทยา ☐ การอบรมการใช้วิทยุสื่อสาร ว.ดำ หรือ ว.แดง สำหรับแจ้งข้อมูลภัย ☐ การอบรมอื่นๆ ได้แก่.....(62)		

10. การดำเนินงานลดผลกระทบที่อาจได้รับจากเหตุการณ์แผ่นดินไหว

ข้อความ	มี	ไม่มี
หมู่บ้านของท่านมีการประชุม กำหนดวิธีปฏิบัติตัวของสมาชิกในหมู่บ้านเมื่อเผชิญกับเหตุแผ่นดินไหว เช่น การปิดแก๊ส ปิดน้ำ ปิดไฟ แล้วออกมาจากบ้านเรือนตามเส้นทางที่กำหนดเมื่อเกิดแผ่นดินไหว(63)		
หมู่บ้านของท่านมีการตั้งกองทุนจัดการภัยพิบัติ (64)		
หมู่บ้านของท่านมีกองทุนจัดการภัยพิบัติที่สามารถเบิกจ่าย-ใช้เงินได้ทันทีในภาวะฉุกเฉิน (65)		
หมู่บ้านของท่านมีการซ้อมเผชิญแผ่นดินไหว ในช่วง 2 ปีที่ผ่านมา(66)		
หมู่บ้านของท่านมีการซ้อมเผชิญเหตุแผ่นดินไหวร่วมกับองค์กรปกครองส่วนท้องถิ่นหรือเทศบาลตำบล (67)		
หมู่บ้านของท่านมีการซ้อมเผชิญเหตุแผ่นดินไหวร่วมกับสำนักงานป้องกันและบรรเทาสาธารณภัยจังหวัดเชียงราย (68)		
หมู่บ้านของท่านมีการซ้อมเผชิญเหตุแผ่นดินไหวร่วมกับหน่วยงานอื่นใดได้แก่ (69)		
หมู่บ้านของท่านมีบ้านเรือนที่ปรับปรุงให้แข็งแรงทนต่อแผ่นดินไหวเพียงพอ (70) ☐ ส่วนใหญ่ยังไม่มีปรับปรุง ☐ ปรับปรุงแล้วมากกว่าครึ่ง ☐ ปรับปรุงแล้วทั้งหมด		
หมู่บ้านของท่านมีโรงเรียนที่ปรับปรุงให้แข็งแรงทนต่อแผ่นดินไหวเพียงพอ (71) ☐ ส่วนใหญ่ยังไม่มีปรับปรุง ☐ ปรับปรุงแล้วมากกว่าครึ่ง ☐ ปรับปรุงแล้วทั้งหมด		
หมู่บ้านของท่านมีวัดที่ปรับปรุงให้แข็งแรงทนต่อแผ่นดินไหวเพียงพอ (72) ☐ ส่วนใหญ่ยังไม่มีปรับปรุง ☐ ปรับปรุงแล้วมากกว่าครึ่ง ☐ ปรับปรุงแล้วทั้งหมด		

☐ หมู่บ้านของท่านมีการทำกิจกรรมลดผลกระทบจากภัยแผ่นดินไหวด้านอื่นๆ ได้แก่ (73)

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ชุดคำถาม

การรับรู้ (ข้อที่ 1-2) การสื่อสาร (ข้อที่ 3-4-5) การร่วมมือ (ข้อที่ 6-7) การควบคุม (ข้อที่ 8-9-10)

APPENDIX D
RESULT OF STATISTIC ANALYSIS

QUANTITATIVE RESULT

This study on Earthquake disaster management policy implementation in Chiangrai, the conductor gathered quantitative data by interviewing and gathering the document disaster. Then created a questionnaire for quantitative data collection to study inter-organizations according to Earthquake crisis prevention and mitigation strategy plan in Chiangrai which categorize into 2 sections are;

- 1) Policy implementation in District Administration Office level study
- 2) Policy implementation in Community level study

1) Policy implementation in District Administration Office level study

1.1 General information of population in District level.

The conductor sent out verified questionnaires to District Administration Staffs by mail and gave the questionnaires to the staffs in District Governmental Office supervisors meeting as well as Pan, Mae Lao and Mae Sruay Community Chiefs and Village Headmen meeting during May-July 2015, the respondents from 65 District Administration Offices returned 41 questionnaire. Which analyzed by using SPSS version 20 Program found that basis statistic of samplings are;

General information of the 41 samplings are 3 females, 38 males. Majority of the respondents are 36-45 years old which is 58.5% of the respondents and 24.4% of the respondents are 26-35 years old. The most responded district is Pan District which is 26.9% of the respondents and Muang Chiangrai District is 19.5%. Educational level, the respondents with Bachelor's degrees is 59% of the respondents and the respondents with high school level is 22%. DDPM's officers have responded the most which is 43.9% of the respondents and their officers in supervisor is 17.1% of the respondents. See below appendix table 1.1

Appendix table 1.1 Number and percentage of general information of the respondents in district level

General	Number	Percentage (%)
Gender		
Male	38	92.7
Female	3	7.3
Total	41	100
Age group		
under 25	1	2.4
26-35	10	24.4
36-45	24	58.5
46-55	4	9.7
Over 55	2	5
Total	41	100
Districts		
Pan	11	26.9
Mae Lao	7	17.1
Mae Sruay	5	12.2
Muang Chaingrai	8	19.5
Vieng Chai	4	9.8
Phaya Mengrai	2	4.9
Pa Dad	4	9.8
Total	41	100
Education		
High School	9	22.0
Bachelor's degree	24	59.0
Higher than Bachelor's degree	8	20.0
Total	41	100

Appendix table 1.1 (continue)

General Information	Number	Percentage (%)
Position		
DDPM's officer	18	43.9
DDPM's supervisor level	7	17.1
General Management	5	12.2
DDPM' assistant	3	7.3
Sub-District Office Chief	2	4.9
Fire fighter	1	2.4
Human resource officer	1	2.4
District Office Mayor	1	2.4
District Office Secretary	1	2.4
Legal officer	1	2.4
Assistant Sub district Headman	1	2.4
Total	41	100

The study of operational condition and obstacle according to sociotechnical elements and policy implementation in district level factors, the conductor have categorize the contents below;

1.1.1 Operational condition in Technical Infrastructure aspect

According to operational level, officers of SAO on the operation the effect earthquake disaster preparedness in sociotechnical aspect (According to Appendix table 1.2) found that $\bar{x} = 3.15$ and S.D. = 0.733 shows that the operational in this aspect is highly effect the earthquake disaster preparedness.

Appendix table 1.2 Level of the factor that effect earthquake disaster preparedness in Technical Infrastructure aspect.

Operational aspect	$\bar{x}$	S.D.	Level
Technical Infrastructure	3.15	0.733	High

The samplings variously prioritized the operation according to Appendix table 1.3 are fixing-building earthquake resistant buildings ($\bar{x} = 3.63$), risk and safety inspection ($\bar{x} = 3.59$), create geography and community plan to indicate affected houses ($\bar{x} = 3.41$), Scientific information on the earthquake and reduce the effect of the earthquake method ($\bar{x} = 3.37$), the damage data collection which collide to engineering principle ($\bar{x} = 3.32$), prepare the data on fault lines from academic institutes to indicate risk areas ($\bar{x} = 3.27$), technical methods to fix earthquake resistant buildings ($\bar{x} = 3.2$).

The samplings agreed that these factors effect disaster management in medium level are prepare building plans for emergency phase ($\bar{x} = 2.9$), information technology for database management between organizations ($\bar{x} = 2.88$), Population skills to react to the earthquake disaster ($\bar{x} = 2.83$), radio networks cover all areas in the province ($\bar{x} = 2.71$), Geography information technology to recover affected areas ($\bar{x} = 2.37$).

Appendix table 1.3 Operation result in technical infrastructure by item.

Item	Question	$\bar{x}$	S.D.	Level
1	Do you agree that population skills to react to the earthquake disaster helps the risk areas to be able to prepare for the disaster?	2.83	0.83	Medium
2	Do you agree that community based disaster risk management: CBDRM) helps the risk areas to be able to prepare for the disaster?	3.41	0.71	High

Appendix table 1.3 (continue)

Item	Question	$\bar{x}$	S.D.	Level
4	Do you agree that lacking of fault lines information to indicate risk areas, safety areas or evacuate plan in community level and district level caused the difficulty to disaster prepared?	3.27	0.71	High
5	Do you agree that creating geography data or community plans to indicated damaged areas to prioritize the assistant for those in need such as children, elders, pregnant women and handicaps helps risk areas to prepare for the disaster?	3.49	0.81	High
6	Do you agree that showing scientific information on the cause of disaster and the effects as well as samples of disaster preparedness on mass medias helps risk areas to prepare for the disaster?	3.37	0.80	High
11	Do you agree that supporting technical knowledge for earthquake resistant buildings helps SAO in recovery phase?	3.20	0.84	High
14	Do you agree that damage report form for data collection collide to engineering principle is important for recovery planning?	3.32	0.82	High
15	Do you agree that observation to inspect the risk and safety of the buildings to make the decision on demolish or fix the damaged buildings is important for affected areas recover plan?	3.59	0.77	High
16	Do you agree that fixing or rebuild the earthquake resistant buildings is important for disaster prevention?	3.63	0.66	High

Appendix table 1.3 (continue)

Item	Question	$\bar{x}$	S.D.	Level
26	Do you agree that lacking of GIS aerial photographs caused the difficulties for recovery?	2.37	0.77	Medium
27	Do you agree that lacking of system to collect important building plans or lacking of digital files caused the difficulties for the engineer, paramedic and rescue teams to use them in emergency phase?	2.90	0.70	Medium
28	Do you agree that radio system doesn't cover all areas in Chiangrai is the obstacle for emergency phase management?	2.71	0.87	Medium
29	Do you agree that lacking of information technology for data management between organizations and data usage inter-organizations effect damaged areas recovery?	2.88	0.75	Medium

1.1.2 Operational condition in Cultural Acceptance aspect

The study on SAO's operational level's views about the operation effect disaster preparedness in Cultural Acceptance aspect (According to Appendix table 1.3) found that $\bar{x} = 3.17$ and S.D. = 0.533. This result indicated level of operation in this aspect highly effect earthquake disaster preparedness.

Appendix table 1.4 Level of the factor that effect earthquake disaster preparedness in Cultural Acceptance aspect

Operational Aspect	$\bar{x}$	S.D.	Level
Cultural Acceptance	3.17	0.533	High

The samplings variously prioritized the operation according to 5.4 are the understanding of each organization's roles in emergency phase ($\bar{x} = 3.49$), support the

communities to be able to self-organize in recovery phase ($\bar{x} = 3.46$) and prevent the conflicts as a result of donation distribution ($\bar{x} = 2.56$).

Appendix table 1.5 Operation result in Cultural Acceptance aspect by item.

Item	Question	$\bar{x}$	S.D.	Level
3	Do you agree that the conflicts that happened as a result of donations for recovery phase caused the difficulties in community participation?	2.56	0.84	Medium
17	Do you agree that supporting the communities to be able to self-organize in recovery phase is important for disaster preparedness phase?	3.46	0.71	High
18	Do you agree that the understanding of each organization's roles in emergency phase is important for emergency preparedness?	3.49	0.81	High

1.1.3 Operational condition in Flexibility of Organization aspect

The study of SAO's operational level's views in inter-organizations operation in this aspect (According to appendix table 1.6) found that $\bar{x} = 3.17$ and S.D. = 0.38. This result indicated level of operation in this aspect highly effect earthquake disaster preparedness. Meanwhile, the flexibility of organization in law adjustment found $\bar{x} = 3.99$ and S.D. = 0.86. This result indicated level of operation in this aspect which effect earthquake disaster preparedness in medium level.

Appendix table 1.6 Level of the factor that effect earthquake disaster preparedness in flexibility of organization aspect.

Operational Aspect	$\bar{x}$	S.D.	Level
Flexibility of Organization in inter-organization operation aspect.	3.17	0.38	High
Flexibility of organization in law adjustment aspect	3.99	0.86	Medium

As we can see the study result by item according to appendix table 1.7, we found that the samplings variously prioritized the operation by highly prioritize disaster management information resources sharing ($\bar{x} = 3.68$), pairing, data coordination and assistant between SAO ($\bar{x} = 3.54$), SAO's officers have knowledge in disaster management ($\bar{x} = 3.49$), Management level in SAOs able to make the decision and make the commands in the emergency phase ($\bar{x} = 3.49$), preparedness in communication and command in the situation of community level and provincial level ($\bar{x} = 3.46$), damaged data observing and collecting timeframe collide with actual damages ($\bar{x} = 3.46$), bottom-up working method in actual situations and problem reporting ($\bar{x} = 3.37$), top-down command management ($\bar{x} = 3.22$), lacking of conformation between provincial level and district level in disaster management ($\bar{x} = 3.12$)

The operation that put in medium priority are lacking of DDPM in district level ($\bar{x} = 2.98$), governmental advance budget for disaster preparedness ($\bar{x} = 2.63$), complicated process in information verification and compensation ($\bar{x} = 2.54$) and SAO have to set annual budget for disaster before it happens ($\bar{x} = 2.24$)

Appendix table 1.7 Operation result in flexibility of organization by item.

Item	Question	$\bar{x}$	S.D.	Level
7	Do you agree that preparedness in communication and command of community and provincial levels helps risk areas increase their ability to prepare for the disaster?	3.46	0.78	High
8	Do you agree that if SAO have specialized officers in disaster management, the process will be easier?	3.49	0.71	High
9	Do you agree that management level in SAOs should be able to make the decision and make the commands in the emergency phase?	3.49	0.64	High

Appendix table 1.7 (continue)

Item	Question	$\bar{x}$	S.D.	Level
10	Do you agree that non-conformation between provincial level and district level caused the obstacle in recovery phase as district level have the budget and resources but do not have the power. Meanwhile, provincial level do have the power but do not have resources?	3.12	0.81	High
12	Do you agree that lacking of DDPM in district level caused delayed compensation process as they are slow in damage observation process?	2.98	0.88	Medium
13	Do you agree that damaged data observing and collecting timeframe that conformed to actual damages and recovery is an important factor in recovery phase?	3.46	0.78	High
21	Do you agree that bottom-up working method in actual situations and problem reporting from district office to provincial office helps recovery phase cover all affected areas?	3.37	0.86	High
22	Do you agree that paring and coordinate the data and requirement from SAOs that not in the affected areas to the affected areas helps in recovery phase?	3.54	0.67	High
23	Do you agree that information verification and compensation are complicated?	2.54	0.78	Medium
24	Do you agree that SAOs have to set annual budget for disaster before it happens makes it difficult to estimate the budget for emergency phase?	2.24	0.97	Medium

Appendix table 1.7 (continue)

Item	Question	$\bar{x}$	S.D.	Level
25	Do you agree that the definition of advance budget in provincial level doesn't cover earthquake disaster preparedness as earthquake is an unpredictable disaster?	2.63	1.02	Medium

Meanwhile, the operation in flexibility of organization aspect in law adjustment is highly prioritized. Law adjustment are strictly enforce local Building Control Act ($\bar{x} = 3.90$) and strictly enforce Building Control Act issued by provincial Department of public works and town planning ($\bar{x} = 4.07$).

Appendix table 1.8 Operation result in flexibility of organization aspect in law adjustment by item

Item	Question	$\bar{x}$	S.D.	Level
30	Do you agree that local building control act should be strictly enforced, new buildings should be earthquake resistant?	3.90	1.09	High
31	Do you agree that Department of Public Works and Town Planning should be stricter on issuing the licenses for new buildings?	4.07	0.87	High

1.1.4 Policy implementation factor in Organizations relation

The study on organizations relation that effect policy implementation (according to appendix table 1.9) found that $\bar{x} = 3.20$ and S.D. = 0.45. This indication shows organization relation is highly influenced policy implementation.

Appendix table 1.9 Level of organizations relation factor influenced policy implementation.

Factor influenced policy implementation	$\bar{x}$	S.D.	Level
Organizations relation factor	3.20	0.45	High

When we look into study result by item according to appendix table 1.10, samplings variously operate in each question. Items that organization have high capacity are Sub-district Administration Office (SAO). The samplings coordinate with paramedic team and manage the disaster in preparedness phase ($\bar{x} = 3.44$), The sampling SAO will be able to make the command and coordinate with community in emergency phase ($\bar{x} = 3.44$), there is trust to work together between organization leaders and population in the area ($\bar{x} = 3.41$), communities and relevant units well cooperate with SAO in disaster management ($\bar{x} = 3.34$) SAO able to exchange necessity data and news for preparedness phase. ($\bar{x} = 3.27$), SAO prepared for emergency phase if unexpected earthquake hit the area ($\bar{x} = 3.12$), SAO able to alarm earthquake risk areas ($\bar{x} = 3.05$).

Meanwhile, medium level items are officers who work under SAO were acknowledged on causes and preparedness of the earthquake ($\bar{x} = 3.00$) and SAO have revised district act to reduce the effect of the earthquake ($\bar{x} = 2.66$).

Appendix table 1.10 Level of organization relation influenced policy implementation by item.

Item	Question	$\bar{x}$	S.D.	Level
32	How much SAO in your area coordinate with paramedic units and manage the disaster in preparedness phase in your opinion?	3.44	0.55	High
33	How much SAO in your area is trusted to work together between organization leaders and population in the area in your opinion?	3.41	0.71	High

Appendix table 1.10 (continue)

Item	Question	$\bar{x}$	S.D.	Level
34	How much SAO in your area coordinate with communities and relevant units in disaster management in your opinion?	3.34	0.66	High
35	How much SAO in your area able to exchange necessity data and news with relevant provincial public disaster organizations for preparedness phase in your opinion?	3.29	0.78	High
36	How much SAO in your area able to exchange necessity data and news communities in risk areas for preparedness phase in your opinion?	3.27	0.74	High
37	How much SAO in your area able to alarm communities in the risk areas in your opinion?	3.05	0.80	High
38	How much SAO in your area will be able to make the command and coordinate with community in emergency phase in your opinion?	3.44	0.59	High
39	How much officers who work under SAO in your area acknowledged on causes and preparedness of the earthquake in your opinion?	3.00	0.63	Medium
40	How much SAO in your area prepared for emergency phase if unexpected earthquake hit the area in your opinion?	3.12	0.64	High
41	How much SAO in your area have revised district act to reduce the effect of the earthquake in your opinion?	2.66	0.76	Medium

1.1.5 Policy implementation factor in Resources.

When we look into the study result of resources influenced policy implementation according to appendix table 1.11, found that $\bar{x} = 2.46$ and S.D. = 0.46. This indicator shows resources influenced policy implementation in medium level.

Table 1.11 Level of resources influenced policy implementation.

Factor influenced policy implementation	$\bar{x}$	S.D.	Level
Resources	2.46	0.46	Medium

As we looked into the study result by item according to appendix table 1.12, found that the sampling has resources for their operation in medium level. That's mean SAO in average have experienced staffs ready for earthquake disaster in medium level ($\bar{x} = 2.78$), Sampling SAO, officers in supervisor level or management level have been trained to prepare for the earthquake disaster in medium level ($\bar{x} = 2.61$), Sampling SAO have enough budget for the operation to reduce the effect of earthquake disaster for communities in medium level ($\bar{x} = 2.49$), Sampling SAO have enough human resources for preparedness operation in medium level ($\bar{x} = 2.39$), Sampling SAO have enough knowledge and technology enough for preparedness phase in medium level ($\bar{x} = 2.39$) and Sampling SAO have enough material and equipment enough for preparedness phase in medium level ($\bar{x} = 2.12$)

Appendix table 1.12 Level of resources influenced policy implementation by item.

Item	Question	$\bar{x}$	S.D.	Level
42	How much SAO in your area have experienced staffs ready for preparedness phase in your opinion?	2.78	0.69	Medium
43	How much SAO in your area have officers in supervisor level or management level have been trained to prepare for the earthquake disaster in your opinion?	2.61	0.77	Medium

Appendix table 1.12 (continue)

Item	Question	$\bar{x}$	S.D.	Level
44	How much SAO in your area have enough human resources for preparedness operation in your opinion?	2.39	0.63	Medium
45	How much SAO in your area have enough budget for the operation to reduce the effect of earthquake disaster for communities in medium level in your opinion?	2.49	0.68	Medium
46	How much SAO in your area have enough material and equipment enough for preparedness phase in your opinion?	2.12	0.51	Medium
47	How much SAO in your area have enough knowledge and technology enough for preparedness phase in your opinion?	2.39	0.70	Medium

1.1.6 Policy implementation factor in Capacity and conditions of organization

As we look into study result of capacity and conditions of organization influenced policy implementation (According to appendix table 1.13) found that $\bar{x} = 2.94$ and S.D. = 0.19. The indicator shows that capacity and conditions of organizations influenced policy implementation in medium level.

Appendix table 1.13 Level of capacity and conditions of organization influenced policy implementation.

Factor influenced policy implementation	$\bar{x}$	S.D.	Level
Capacity and conditions of organization	2.94	0.19	Medium

When we look into the study result by item according to appendix table 1.13, found that according to recommendation from the specialist to include all the questions on capacity and conditions of organization. The factors influenced policy implementation are high-medium. On the other hand, sampling SAO have natural resources and rich environment enough for population in the area in high rate ($\bar{x} = 3.27$), sampling SAO have high level of public utilities development ($\bar{x} = 3.20$), sampling SAO highly open for participation of community leaders in disaster preparedness plan ($\bar{x} = 3.17$), sampling SAO listen to stakeholders on the effect of disaster in high level ($\bar{x} = 3.1$), sampling SAO have leaders who realize about the importance of disaster preparedness improvement. ($\bar{x} = 3.05$)

Medium level factors are sampling SAO have medium level of command structure ($\bar{x} = 3.00$), sampling SAO have local custom that support coordination on disaster preparedness in medium level ($\bar{x} = 3.00$), sampling SAO think that Chiangrai command structure that make it easy for operation in medium level ($\bar{x} = 2.98$), sampling SAO have medium level of economic development ($\bar{x} = 2.90$), sampling SAO have medium level of population who aware of disaster preparedness ($\bar{x} = 2.80$), sampling SAO have medium level of population realize that importance of disaster management direction in their own areas ($\bar{x} = 2.73$), sampling SAO have village headmen who understand and aware of public disaster prevention and mitigation plan in their own district in medium level ($\bar{x} = 2.71$), sampling SAO able to utilize mass media to extend knowledge on disaster management in medium level ($\bar{x} = 2.71$) and sampling SAO have medium level of disaster history and statistic record ($\bar{x} = 2.56$).

Appendix table 1.14 Level of capacity and conditions of organization influenced policy implementation by item.

Item	Question	$\bar{x}$	S.D.	Level
48	How mobilize does District office's command structure for disaster management in your area in your opinion?	3.00	0.55	Medium

Appendix Table 1.14 (continue)

Item	Question	$\bar{x}$	S.D.	Level
49	How mobilize does command structure for disaster management in Chiangrai in your opinion?	2.98	0.47	Medium
50	How open does your area for participation of community leaders in disaster preparedness plan in your opinion?	3.17	0.74	High
51	How do you think about level of village headmen who understand and aware of public disaster prevention and mitigation plan in their own district in your opinion?	2.71	0.78	Medium
52	How do you think District office in your area make stakeholders participation important on the effect of disaster in in your opinion?	3.10	0.94	High
53	How do you think population realize the importance of disaster management direction in their own areas in your opinion?	2.73	0.90	Medium
54	How do you think SAO in your area have leaders who aware of the importance of disaster preparedness improvement in your opinion?	3.05	0.71	High
55	How do you think SAO in your area able to utilize mass media to extend knowledge on disaster management in your opinion?	2.71	0.84	Medium
56	How do you think population in your area aware of disaster preparedness in your opinion?	2.80	0.93	Medium
57	How do you think level of public utilities development in your area?	3.20	0.64	High
58	How do you think level of economic development in your area?	2.90	0.58	Medium

Appendix Table 1.14 (continue)

Item	Question	$\bar{x}$	S.D.	Level
59	Do you think that level of natural resources and richness of environment in your area enough for usage of population?	3.27	0.55	High
60	Do you think your area have disaster history and statistic record?	2.56	0.87	Medium
61	Do you think how much your local custom that support coordination on disaster preparedness?	3.00	0.71	Medium

1.1.7 The succession of policy implementation to community level

When we look into study result of policy implementation in community level, Awareness of capacity building and operation in the community aspect found that $\bar{x} = 0.18$ and S.D. = 9.02. This indicator shows the respondents do not aware of operation in their areas. For Result of policy implementation in community level: Communication and participation the study shows $\bar{x} = 2.41$ and S.D. = 0.65. This indicator shows that the respondent realize about the operation in medium level.

Appendix table 1.15 Level of policy implementation in community level.

Result of policy implementation	$\bar{x}$	S.D.	Level
Result of policy implementation in community level: Awareness of capacity building and operation in the community.	0.55	0.25	Medium
Result of policy implementation in community level: Communication and participation.	2.41	0.65	Medium

SAO's policy on reduce the effect of disaster that distribute power to community in operation level. By looking into study result by item according to appendix table 1.16, found that there are 2 activities that highly supported are disaster

management capacity improvement for population in the community such as primary nursing care and safety protocol in emergency phase ($\bar{x}=0.73$) and safety protocol training for population in the affected areas ($\bar{x}=0.71$)

Majority of the respondents say that level of support is medium are list of affected population in the affected areas ($\bar{x}=0.66$), create list of damaged for affected areas ($\bar{x}=0.63$), acknowledge the cause of earthquake for population in the affected areas ($\bar{x}=0.63$), create risk areas map in community level ($\bar{x}=0.56$), Community base disaster risk management: CBDRM in risk areas ($\bar{x}=0.56$) and earthquake disaster drills ($\bar{x}=0.56$). While the least support activity is budget for disaster preparedness group for affected areas ($\bar{x}=0.32$)

Appendix table 1 . 16 Level of policy implementation in community level: Awareness of capacity building and operation in the community.

Item	Question	$\bar{x}$	S.D.	Level
62	SAO in your area have lesson learnt discussion or seminar exchange experiences with population in the affected areas.	0.61	0.49	Medium
63	SAO in your area have training or class to acknowledge about cause of earthquake for affected areas.	0.63	0.49	Medium
64	SAO in your area have training on safety protocol in emergency phase for population in affected areas.	0.71	0.46	High
65	SAO in your area support knowledge center, innovation and technic in disaster management.	0.49	0.51	Medium
66	SAO in your area support creating list of affected population in the affected areas.	0.66	0.48	Medium
67	SAO in your area support creating list of damaged for affected areas	0.63	0.49	Medium

Appendix table 1.16 (continue)

Item	Question	$\bar{x}$	S.D.	Level
68	SAO in your area support setting up group of population in the affected areas for self-organize in recovery phase.	0.51	0.51	Medium
69	Schools in your area included earthquake disaster preparedness in their curriculum.	0.39	0.49	Medium
70	SAO in your area support the budget for disaster preparedness group for affected areas.	0.32	0.47	Low
86	SAO in your area evaluate earthquake disaster risk areas in community level.	0.54	0.50	Medium
87	SAO in your area create risk areas map in community level.	0.56	0.50	Medium
88	SAO in your area participate in capacity improvement for disaster management of population in communities such as primary nursing aid and safety protocol in emergency phase.	0.73	0.45	High
89	Schools in your area have One School One Safety team program (OSOS)	0.41	0.50	Medium
90	SAO in your area set up community base disaster risk management : CBDRM training for communities in the risk areas	0.56	0.50	Medium
91	SAO in your area have earthquake disaster drills to prepare for the disaster.	0.56	0.50	Medium

On the other hand, the operation to reduce the effect of disaster run by SAO in raising awareness, capacity building and operation in the communities still unclear in operational method. As well as result of policy implementation in community level in Communication and participation aspect according to appendix table 1.17. Majority of

them have medium level results are SAO able to share public disaster prevention and mitigation plan to village headmen in all communities in the area. ($\bar{x} = 2.88$), SAO able to share public disaster prevention and mitigation plan to population in risk areas ($\bar{x} = 2.83$), SAO set up the budget to support equipment for fixing the building in affected areas ($\bar{x} = 2.83$), SAO continually share accurate earthquake situation in detail to population ($\bar{x} = 2.71$), SAO able to access trustworthy report sources ($\bar{x} = 2.66$), SAO clearly alarm village headmen and population in all affected areas. ($\bar{x} = 2.66$), SAO support the budget for knowledge improvement for preparedness phase to population in all affected areas ($\bar{x} = 2.61$), SAO support the budget for basic rescue training for population in the affected areas. ($\bar{x} = 2.46$), SAO support the budget for making reduce the effect of the earthquake plan and preparedness protocol plan for affected areas ($\bar{x} = 2.44$), SAO encourage communities to set up assistant and exchange resources networks for nearby communities to prepare for the disaster ($\bar{x} = 2.24$) and operation in low level are improve effective alarm system, accurate and fast ($\bar{x} = 1.93$).

The activity that operate in high level are SAO have data base and leaders in risk areas contact list beforehand ($\bar{x} = 3.15$) and SAO have emergency channel to contact village headmen ($\bar{x} = 3.12$)

Appendix table 1.17 Result of policy implementation in community level:
Communication and participation by item.

Item	Question	$\bar{x}$	S.D.	Level
93	SAO in your area able to access trustworthy report sources.	2.66	0.88	Medium
94	SAO in your area continually share accurate earthquake situation in detail to population	2.71	0.87	Medium
95	SAO in your area have effective, accurate and fast alarm system.	1.93	1.10	Low
96	SAO in your area clearly alarm village headmen and population in all affected areas.	2.66	1.04	Medium

Appendix table 1.17 (continue)

Item	Question	$\bar{x}$	S.D.	Level
97	SAO in your area able to share public disaster prevention and mitigation plan to village headmen in all communities in the area.	2.88	0.81	Medium
98	SAO in your area able to share public disaster prevention and mitigation plan to population in risk areas	2.83	0.92	Medium
99	SAO in your area have emergency channel to contact village headmen apart in case of no service situation.	3.12	0.64	High
100	SAO in your area have data base and leaders in risk areas contact list beforehand	3.15	0.99	High
106	SAO in your area encourage communities to set up assistant and exchange resources networks for nearby communities to prepare for the disaster.	2.24	0.97	Medium
107	SAO in your area support the budget for knowledge improvement for preparedness phase to population in all affected areas.	2.61	1.12	Medium
108	SAO in your area provide the budget to support equipment for fixing the building in affected areas	2.83	0.97	Medium
109	SAO in your area provide the budget for basic rescue training for population in the affected areas.	2.46	1.12	Medium
110	SAO in your area provide the budget for making reduce the effect of the earthquake plan and preparedness protocol plan for affected areas.	2.44	0.84	Medium

1.1.8 The success of policy implementation by District Administration Office

The success of policy implementation by District Administration Office in database improvement and communication $\bar{x} = 3.65$ and S.D.= 5.98. This indicator shows the respondents don't know for sure if their District office have database improvement or not. For communication and improve preparedness method $\bar{x} = 19.82$ and S.D.= 6.32. This indicator shows that the respondents realize that there is operation in medium level.

Appendix table 1.18 The success of policy implementation by District Administration Office in database improvement and communication by item.

Result of policy implementation	$\bar{x}$	S.D.	Level
The success of policy implementation by District Administration Office in database improvement and communication.	0.56	0.65	Medium
The success of policy implementation by District Administration Office in improvement of preparedness phase.	2.20	0.77	Medium

The success of policy implementation by District Administration Office in database improvement and communication, the study result by item according to appendix table 1.19, found that this indicator shows the respondents realize the operations run by SAO in high level are prepare emergency channel to communicate with paramedic and rescue teams ($\bar{x} = 0.90$), provide emergency communication equipment to contact provincial office ($\bar{x} = 0.88$), provide rescue staffs or volunteers who promptly reach the areas in need stationed in the sub-districts ($\bar{x} = 0.83$), Risk evaluation and create risk areas map in sub-district level. ($\bar{x} = 0.71$). The operations that considered in low level are build learning center and study system for their human resources and population to prepare them for the earthquake. ($\bar{x} = 0.29$), establish

disaster management fund ($\bar{x} = 0.22$) and research and improve disaster risk management ($\bar{x} = 0.17$).

Appendix table 1.19 The success of policy implementation by District Administration Office in database improvement and communication.

Item	Question	$\bar{x}$	S.D.	Level
71	SAO in your area able to link data to relevant organizations in preparedness phase such as affected area data for recovery phase database.	0.54	0.50	Medium
72	SAO in your area able to share data with relevant organizations such as damaged building database that can be used for reducing the effect of earthquake plan.	0.56	0.50	Medium
73	SAO in your area improve their capacity in database and data distribution to be able to search, coordinate and ask for advices from other organizations.	0.54	0.50	Medium
74	SAO in your area provide emergency communication channel in case of no service such as radio to contact provincial offices.	0.88	0.33	High
75	SAO in your area provide emergency communication channel to contact paramedic and rescue teams.	0.90	0.30	High
76	SAO in your area build learning center and study system for their human resources and population to prepare them for the earthquake	0.29	0.46	Low
77	SAO in your area provide facilities for their human resources to improve their capacity from district DDPM.	0.61	0.49	Medium

Appendix table 1.19 (continue)

Item	Question	$\bar{x}$	S.D.	Level
78	SAO in your area provide facilities for their human resources to improve their capacity from DPMCR	0.66	0.48	Medium
79	SAO in your area provide facilities for their human resources to improve their capacity from DPMRC15	0.59	0.50	Medium
80	SAO in your area operate risk evaluation and create risk areas map in sub-district level.	0.71	0.46	High
81	SAO in your area provide rescue staffs or volunteers who promptly reach the areas in need stationed in the sub-districts.	0.83	0.38	High
82	SAO in your area have been trained in ICS: incident command system program.	0.56	0.50	Medium
83	SAO in your area establish disaster management fund.	0.22	0.42	Low
84	SAO in your area research and improve disaster risk management.	0.17	0.38	Low
85	SAO in your area improve public buildings to decrease the risk from earthquake disaster.	0.37	0.49	Medium

The success of policy implementation by District Administration Office in improvement of preparedness phase. The indicator shows all operations are in medium level are encourage all sectors to cooperate and aware of preparedness phase ($\bar{x} = 2.83$), resources exchange such as lending the equipment or staffs to other SAO for recovery phase. ($\bar{x} = 2.68$), resources exchange such as borrow their equipment or provincial office or other region send their staffs to help in recovery phase ($\bar{x} = 2.61$), link local level and regional level network to exchange resources between each other

for disaster management ($\bar{x} = 2.46$), law, regulation, policy and mean assessment in decreasing risk from disaster ($\bar{x} = 2.44$), population and private sector have an opportunity to participate in revising law or plan in disaster management ($\bar{x} = 2.32$), improve coordination with academic institutes, private sector and population for improve the network's capacity to prepare for the earthquake ($\bar{x} = 2.24$), Earthquake disaster risk management must be included in public disaster prevention and mitigation operation plan in sub-district level ($\bar{x} = 2.24$)

Appendix table 1.20 Level of policy implementation by District Administration Office in improvement of preparedness phase.

Item	Question	$\bar{x}$	S.D.	Level
101	SAO in your area improve coordination with academic institutes, private sector and population for improve the network's capacity to prepare for the earthquake.	2.24	0.97	Medium
102	SAO in your area encourage all sectors to cooperate and aware of preparedness phase	2.61	1.12	Medium
103	SAO in your area have resources exchange such as lending the equipment or staffs to other SAO for recovery phase.	2.83	0.97	Medium
104	SAO in your area have resources exchange such as borrow their equipment or provincial office or other region send their staffs to help in recovery phase	2.46	1.12	Medium
105	SAO in your area link local level and regional level network to exchange resources between each other for disaster management.	2.44	0.84	Medium
111	SAO in your area have law, regulation, policy and mean assessment in decreasing risk from disaster	2.24	1.07	Medium

Appendix table 1.20 (continue)

Item	Question	$\bar{x}$	S.D.	Level
112	DADO in your area let population and private sector to participate in revising law or plan in disaster management.	2.32	1.15	Medium
113	DADO in your area put earthquake disaster risk management in public disaster prevention and mitigation operation plan in sub-district level.	2.68	1.13	Medium

2) Result of policy implementation in community level study

2.1 General information of population in community level

The conductor gave the verified questionnaires in District Governmental Office supervisors meeting as well as Pan, Mae Lao and Mae Sruay Community Chiefs and Village Headmen meeting during May-July 2015. We cut off 10% of incomplete questionnaires from the analysis. We have 252 completed questionnaires from 425 sampling communities. Which analyzed by using SPSS version 20 Program found that basis statistic of samplings are;

According to appendix table 2.1, general information of 252 respondents. Included 20 females and 232 males. Majority of the respondents are 46-55 years old which is 49.21% of the respondents and 56-65 years old which is 26.98%. This most responded district is Pan which is 58.33% of the respondents and Mae Sruay 27.78% of the respondents. Educational level, high school responded 35.71% and primary school 30.1% of the respondents. Village headmen responded the most which is 53.57% and Village headmen assistants 37.30%

Appendix table 2.1 Number and percentage of general information of the respondents in community level

General Information	Number	Percentage (%)
Gender		
Male	232	92.06
Female	20	7.94
Total	252	100
Age		
Below 35 years old	8	3.17
36-45 years old	52	20.63
46-55 years old	124	49.21
56-65 years old	68	26.98
Total	252	100
District		
Pan	150	58.33
Mae Lao	35	13.89
Mae Sruay	70	27.78
Total	252	100
Education		
Primary school	76	30.16
Middle school	43	17.06
High school	93	35.71
Bachelor's degree	16	6.35
Higher	1	0.40
N/A	26	10.32
Total	252	100
Position		
Village headmen	138	53.57
Village headmen assistant	94	37.30
Community Chief	4	1.59

General Information	Number	Percentage (%)
District Public health Committee	2	0.79
Community Chief	2	0.79
Member of SAO	1	0.40
N/A	1	0.40
	13	5.16
Total	252	100

2.1.1 Analysis description on community level data

The conductor have analyzed total of content data, damages and effects of the communities from earthquake incident which sum up from the samplings according to appendix table 2.2

Appendix table 2.2 General Information and damages detail in the communities as a result of the earthquake.

Detail	Unit
Total housing in the communities	33,857 (House)
Red-Critical damaged houses (Demolish)	345 (House)
Yellow- Medium damages (Allowed to fix some parts)	2536 (House)
Green-Minor damages (Small fix)	4762 (House)
Injured in total communities.	32 (Person)
The ground split after the earthquake	427 (Spot)
Sink holes found after the earthquake	30 (Spot)
Mud spring found in all affected areas after the earthquake	80 (Spot)
Other effects from the earthquake	
Total damaged water supply, mud and sand blocked the pipes	42 (Spot)
Total damaged roads	53 (Spot)
Damaged bridges	10 (Spot)
Other damages such as greenhouse, community hall etc.	36 (Spot)

2.1.2 Risk awareness and earthquake incident possibility

The analysis on risk awareness and earthquake incident possibility, this indicator shows risk awareness of the sampling is in medium level, average percentage of the respondents who gave correct answer $\bar{x} = 60.12$. Views on earthquake incident possibility is $\bar{x} = 3.59$ and S.D.= 8.35. This indicator shows the sampling uncertain about earthquake incident possibility.

The measurement of risk awareness of the sampling, the conductor used correct or wrong questions in each issue which the results show in appendix table 2.3. On the other hand, 43.3% of the respondents gave the right answer on risk spot in the building awareness question and 57.7% was wrong on this question. Risk awareness from equipment in the building question, 47.2% was right and 52.8% was wrong. Risk management awareness from household equipment, 70.6% was right and 29.4% was wrong on this question. Risk awareness outside of the building, 79.4% was right and 20.6% was wrong on this question.

Appendix table 2.3 Level of risk awareness by item.

Item	Question	Correct	Wrong
11	Risk spot in the building	109 (43.3)	143 (57.7)
12	Risk awareness from equipment in the building	119 (47.2)	113 (52.8)
13	Risk management awareness from household equipment	178 (70.6)	74 (29.4)
14	Risk awareness outside of the building	200 (79.4)	52 (20.6)

Views on earthquake possibility in the future shows in Appendix table 2.4. The sampling are uncertain on the possibility ($\bar{x} = 3.41$), the sampling uncertain that they are going to have experience and skill to prepare for the incident although it happened

before ($\bar{x} = 3.45$), the sampling think that training-skill development is necessity for preparedness in high level ($\bar{x} = 3.91$).

Appendix table 2.4 Opinion level of earthquake possibility by item.

Item	Question	$\bar{x}$	S.D.	Level
15	Do you think there is a possibility to have 6 magnitude earthquake again?	3.41	0.83	Uncertain
16	Do you think that the communities affected by the earthquake before will be prepared with experiences and skills more than the areas that never face the earthquake?	3.45	0.99	Uncertain
17	Do you think necessity to have trainings and skill development for self-organized to prepare for the disaster?	3.91	1.10	High

2.1.3 Communication for preparedness

The analysis on communication for disaster preparedness found that there is $\bar{x} = 0.53$ and S.D. = 0.47. This indicator shows samplings have communication for disaster preparedness in medium level.

Majority of sampling have medium level of communication for disaster preparedness. Considering the study result by item according to Appendix table 2.5 found that majority of the samplings are lacking of tools and equipment in emergency phase checklist ($\bar{x} = 0.18$), lacking of disaster calendar to show them in 1 year and each season, what kind of disaster your community might come across ($\bar{x} = 0.27$), lacking of risk areas map ($\bar{x} = 0.26$) and lacking of disaster statistic record ($\bar{x} = 0.32$)

The factor that sampling agreed that they have a lot of them are, warning channel from the government ($\bar{x} = 0.78$), Name and contact detail of person in charge of the communities ($\bar{x} = 0.72$), relation between their communities and district office to ask for help as soon as they face the disaster ($\bar{x} = 0.70$).

Appendix table 2.5 Level of communication for disaster preparedness by item.

Item	Question	$\bar{x}$	S.D.	Level
18	Do you have name-location list of population you need to evacuate first such as handicap, elder, pregnant woman or children.	0.66	0.52	Medium
19	Do you have list of tool-equipment for emergency phase?	0.18	0.39	Low
20	Do you have copy of population, asset or public utilities that damaged by the earthquake?	0.46	0.50	Medium
21	Do you have profession-income of your community?	0.63	0.48	Medium
22	Do you have agricultural season or jobs of community member calendar?	0.50	0.50	Medium
23	Do you have risk area map in your community? (such as landslide area, sink hole, liquefaction or flashflood)	0.26	0.44	Low
24	Have your community survey safety zone for a meeting point in case of evacuation?	0.53	0.50	Medium
25	Have your community done evacuation trail?	0.46	0.50	Medium
26	Do you have disaster calendar to show them in 1 year and each season, what kind of disaster your community might come across?	0.27	0.44	Low
27	Do you have disaster statistic record from the day population settled down in this area, when the disaster happened, how often, what kind of damage that done?	0.32	0.47	Low
28	Do you have channel to be informed in case of the disaster?	0.78	0.41	High
29	Do you have name and contact detail of person in charge of the communities	0.72	0.46	High

Appendix table 2.5 (continue)

Item	Question	$\bar{x}$	S.D.	Level
30	Do you have name and contact detail of person in charge of the government office?	0.63	0.48	Medium
31	Do you have name and contact detail of the rescue or paramedic unit?	0.64	0.48	Medium
32	Do you have relation with provincial government office to ask for help as soon as you face the disaster?	0.46	0.50	Medium
33	Do you have relation with district government office to ask for help as soon as you face the disaster?	0.70	0.46	High
34	Do you have relation with rescue unit or paramedic to ask for help as soon as you face the disaster	0.48	0.51	Medium
35	Do you have emergency communication equipment in case there are no service during the emergency phase?	0.64	0.49	Medium
36	Do government such as SAO or municipality inform or share the information on district disaster management plan to village headmen?	0.71	0.47	High
37	Do the respondent in charge of any position in Sub-district DDPM ?	0.66	0.47	Medium

2.1.4 Coordination for disaster preparedness

This analysis on coordination for disaster preparedness found that $\bar{x} = 0.39$ and S.D. = 0.22. This indication shows majority of sampling are in medium to low level of coordination for disaster preparedness. On the other hand, most of the samplings have community committee who are in charge of coordination with other sectors. Most of the samplings are ready for volunteering self-defense force which already exist in the

community ($\bar{x}=0.83$) and they have ability to evacuate population as soon as the disaster hit their areas. ($\bar{x}=0.79$)

However, most of the samplings still lacking of necessity for coordination. Study result shows on Appendix table 2.6 found that they are lacking of informal network in disaster management ($\bar{x}=0.11$), lacking of formal network in disaster management ($\bar{x}=0.14$), lacking of coordination from private volunteer or charity group who have skills in disaster management ($\bar{x}=0.14$), lacking of coordination from organizations who supposed to help them training or disaster drills ($\bar{x}=0.26$), lacking of coordination from organizations who supposed to help with fault lines, landslide or other risk areas survey ($\bar{x}=0.20$), They are not able to have resources exchange with other organizations ($\bar{x}=0.29$), lacking of coordination from other organization in risk group survey for disaster preparedness. ($\bar{x}=0.31$)

Appendix table 2.6 Level of coordination for disaster preparedness by item

Item	Question	$\bar{x}$	S.D.	Level
38	Set up disaster management committee of the community	0.44	0.50	Medium
39	Distribute roles of person in charge of communities' disaster management.	0.65	0.48	Medium
40	Do your community have Mr.Alarm (Tuen Pai) who were trained by DDPM who is in charge of follow up the risk areas such as flood-landslide in the community	0.35	0.48	Medium
41	Do your community have volunteering self-defense force in your community?	0.83	0.38	High
42	Do your community have who will be able to help evacuate population in emergency?	0.79	0.41	High

Appendix table 2.6 (continue)

Item	Question	$\bar{x}$	S.D.	Level
43	Do your community have anyone can be building inspector as well as have engineering knowledge to give advice for earthquake resistant building?	0.38	0.49	Medium
44	Do your community have volunteer or officer who were trained in rescue unit and be able to do fire fighter or rescuer?	0.38	0.49	Medium
45	Do your community have volunteer from foundation, charity who have disaster management skill?	0.14	0.36	Low
46	Do you have information exchange with another communities such as damages, assistant or engineering knowledge for recovery phase?	0.45	0.50	Medium
47	Do your community receive any budget from organizations for recovery phase in fixing the damage buildings?	0.60	0.49	Medium
48	Do your community receive any training to fix-build earthquake resistant building?	0.45	0.50	Medium
49	Have you received any help from organizations to lend you tools-equipment needed for recovery phase?	0.29	0.46	Low
50	Have you received any support from organizations on training or safety protocol in emergency phase?	0.42	0.49	Medium
51	Have you receive any help on survey special care needed group of people?	0.31	0.46	Low
52	Have you received any help on survey risk areas such as fault lines or landslide?	0.20	0.41	Low

Appendix table 2.6 (continue)

Item	Question	$\bar{x}$	S.D.	Level
53	Have you received any support from organizations to set up earthquake drills in the area?	0.26	0.44	Low
54	Do you build up formal network for disaster management?	0.14	0.35	Low
55	Do you build up informal network for disaster management?	0.11	0.31	Low

2.1.5 Controlling the effects of disaster

The analysis of controlling the effects of disaster found that if they have necessity tools, capacity improvement and decrease the effects is $\bar{x} = 0.34$ and S.D. = 0.21. This indicator shows that majority of samplings don't have controlling the effects of disaster.

This study shows that majority of samplings don't have controlling the effects of disaster. Meanwhile building improvement for earthquake resistant is in medium and high level. The study by question according to Appendix table 2.7 found that the samplings still lacking of disaster management fund establishment ($\bar{x} = 0.08$), they don't have budget for disaster which should be able to spend this budget in emergency phase. ($\bar{x} = 0.12$), Lacking of necessity tools-equipment in earthquake disaster ($\bar{x} = 0.12$), lacking of emergency kit preparation for necessity in case of evacuation ($\bar{x} = 0.16$), lacking of emergency drills, they don't have any earthquake drills or training in past 2 years ($\bar{x} = 0.18$), Lacking of short range radio training for communication when normal services don't work ($\bar{x} = 0.19$), lacking of coordinate training or emergency drills with provincial DDPM ($\bar{x} = 0.23$), lacking of training on primary nursing care and basic paramedic knowledge ($\bar{x} = 0.23$), lacking of vehicles that will be able to use in the earthquake ($\bar{x} = 0.25$), Lacking of technical knowledge to fix or build earthquake resistant buildings ($\bar{x} = 0.29$).

Appendix table 2.7 Level of effects of disaster controlling by item

Item	Question	$\bar{x}$	S.D.	Level
56	Your community have usable vehicle in the emergency phase	0.25	0.43	Low
57	Your community have communication device while normal services don't work in emergency phase.	0.60	0.49	Medium
58	Your community have equipment to distribute news and alarm people in the area.	0.81	0.39	High
59	Households prepare emergency kit in case of evacuation.	0.16	0.37	Low
60	Your community have necessity tools-equipment for the emergency phase.	0.12	0.32	Low
61	Community member were trained to prepare for emergency phase.	0.56	0.50	Medium
61.1	Basic knowledge on the causes of earthquake.	0.33	0.47	Low
61.2	Basic knowledge on safety protocol in emergency phase.	0.42	0.49	Medium
61.3	Primary nursing care and basic paramedic skills	0.23	0.42	Low
62	Community member were trained to improve their skills for preparedness phase and recovery phase.	0.57	0.50	Low
62.1	Training on technical knowledge for fixing-building earthquake resistant buildings.	0.29	0.45	Low
62.2	Follow up news and announcement by MET	0.38	0.49	Medium
62.3	Training on short range radio training for communication when normal services don't work.	0.19	0.39	Low

Appendix table 2.7 (continue)

Item	Question	$\bar{x}$	S.D.	Level
63	Your community have announcement and discussed on safety protocol in the emergency phase such as turn off the gas, water and electricity supply and evacuate along the safety trail you have trained your member beforehand.	0.48	0.50	Medium
64	Establish disaster management fund.	0.08	0.26	Low
65	Your community have disaster fund that can be spend in the emergency phase.	0.12	0.32	Low
66	Your community have emergency drill in the past 2 years.	0.18	0.38	Low
67	Your community coordinate with SAO or municipal for emergency drills.	0.35	0.48	Medium
68	Your community coordinate with Provincial DDPM for earthquake drills.	0.23	0.43	Low

The operations mentioned above influenced decrease the effects of earthquake which an important issue is strengthen and improve old public buildings and private buildings according to appendix table 2.8. The result of policy implementation in this aspect we found from the samplings that most of the communities prepare by strengthen their buildings and earthquake resistant is still low ($\bar{x}=1.50$), there are 60.70% of housing that haven't been reconstructed. Communities where the houses been reconstructed more than half of them is 25.4% and the communities that the whole village have been reconstruct is only 13.9% of the communities. The communities that started to reconstruct school buildings are in medium level ($\bar{x} = 2.33$), the communities that have done the renovation more than half of the schools in the area is 53.20% of the communities. Communities that reconstructed all school buildings in their areas are

39.70% of the communities. Communities that haven't started to reconstruct school buildings is 7.10% of the communities.

Meanwhile, temples were reconstructed in high to medium level ($\bar{x}=2.35$), the communities where they have done the renovation for more than half of temples in the area is 56.0% of the communities. Some communities have done all renovation in their area is 39.70% and 4.40% of the communities haven't started renovation process.

Appendix table 2.8 Level of Earthquake Resistant Building Improvement by item.

Item	Question	$\bar{x}$	S.D.	Level
70	Level of improved housing in the community. Your community have earthquake resistant building.	1.50	0.77	Low
71	Level of improved public building in the community. Your community have earthquake resistant school building.	2.33	0.60	Medium
72	Level of improved public building in the community. You community have earthquake resistant building in the temples.	2.35	0.56	High

BIOGRAPHY

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