Community-based Practices to Cope with Coastal and River Floods in Semarang City, Indonesia

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Acknowledgment

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COMMUNITY-BASED PRACTICES TO COPE WITH COASTAL AND RIVER FLOODS IN SEMARANG CITY, INDONESIA

Aprillia FINDAYANI

Key Words: Community-based Practices, Coastal and River Floods

1. BACKGROUND AND OBJECTIVES

Flood disaster, by number and economic losses, account for about a third of all natural catastrophes throughout the world. Semarang, as a waterfront city has been suffering from floods since historic time. Flooding within the city is still a major problem for the local government of Semarang City. Many areas in Semarang City, especially along the rivers and along the shore, are suffering from flooding.

This research aims to capture people's perception and response to two different kind of flood. The study focused on two objectives: the first main objective is to identify and analyze community response and its relation to their knowledge, preparedness and action level. The second objective is to propose a framework of community based-disaster education to enhance the resilience to flood.

2. METHODOLOGY

This is an exploratory case study based on primary and secondary data. The primary data were collected through observational study, questionnaires, semi structured interviews, and focus group discussions. Literature review and contextual data from the Semarang city government were used as a secondary data. A sample size of 128 was chosen with 87 questionnaires administered to the respondents in coastal area, and 41 questionnaires administered to the respondents in riverside. The selection of respondents was based on purposive sampling methods. Semi structured interviews were conducted to Semarang Water Management Agency, Semarang Planning and Development Board, Semarang City Planning Agency, Head of District and Sub District Offices
in research areas.

3. FINDINGS

The findings of the study indicated that people in the coastal areas have a high level of knowledge about floods (64%). This knowledge is comparatively high on amount of their past experiences of floods; however they lack in preparedness (43%) because most of the residents are fishermen who have low income so they could not must much effort to adapt their building to flood.

On the other hand, people in the inland, they lack in knowledge (18%) because flood is comparatively recent in their area; but they have a good level of preparedness (24%) because they belong to high and middle level income strata. Furthermore, both communities in the coastal area and inland have a high level of action because of a high knowledge and experience for coastal residents and a good preparedness for inland residents.

4. CONCLUSION

This research leads to recommendation to improve the adaptive capacity of the people to cope with the floods. The recommendation is to develop Community-based Disaster Education (CBDE) Framework with the main purpose is to increase community knowledge about disaster and to enhance community resilience to flood. An active participation of the community, local government agency, community organization as well as schools is needed to reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events as the part of Disaster Risk Reduction.

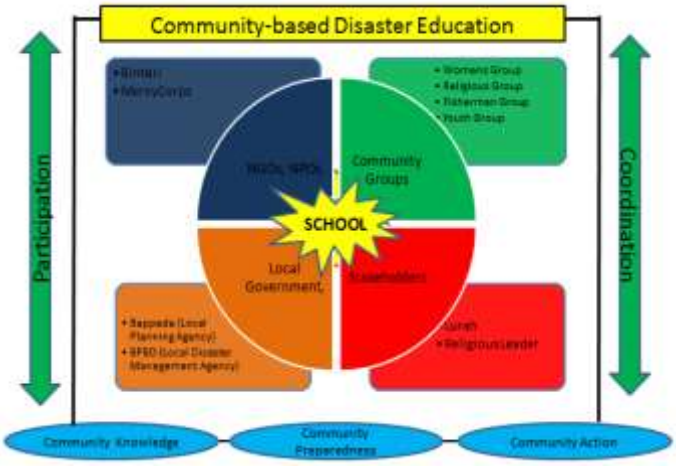


Figure 1. Community-based Disaster Education framework

インドネシア・セマラン市における沿岸及び河川洪水対策としてのコミュニティ活動に関する研究

Aprillia FINDAYANI

キーワード：コミュニティ活動、沿岸及び河川洪水

１．背景と目的

発生数と経済的損失の点から言えば、世界の大規模災害のうち3分の1を洪水が占めている。インドネシア・セマラン市は、歴史的に洪水の被害を受けてきた沿岸に位置する都市である。市内での洪水は、セマラン市役所にとっては大きな課題となっており、市内の多くの場所、特に河川沿いや沿岸の地域は洪水の被害を受けてきた。

本研究は、2種類の異なる洪水に対する人々の認識と対応を明らかにすることを目標としており、本研究の目的は、1) コミュニティの対応と、知識、準備、行動の3要素の関係性を明らかにすること、2) 洪水に対するレジリエンスの向上のためのコミュニティベースでの防災教育の枠組みを提案することである。

２．研究手法

本研究は、一次及び二次データを用いた事例研究である。一次データの収集は、観察、アンケート、半構造化面接、フォーカスグループディスカッションで実施した。過去の研究やセマラン市役所からの提供データは二次データとして活用した。アンケートのサンプルサイズは128で、沿岸地域の住民が87人、河川沿いの住民が41人である。回答者の抽出は意図的サンプリング手法を基にした。半構造化面接は、セマラン市水管理局、セマラン市計画開発委員会、セマラン市計画局、各ディストリクト及びサブディストリクトの長に対して実施した。

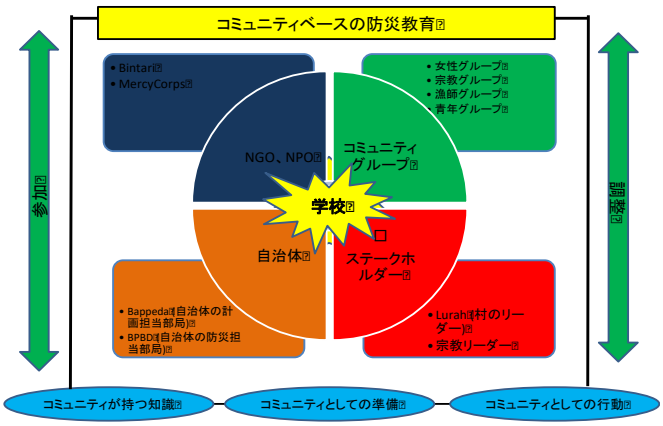
３．研究結果

沿岸域の住民は、洪水に関して高い水準の知識を持っている（64％）。過去の洪水の経験があるため、知識のレベルは比較的高いが、準備はできていない（43％）。住民の多くは漁師であり、収入が多くない。そのため、住居等を洪水に適応させることができていない。

一方、内陸部の住民は、知識を持っている住民は多くないが（18%）、これは洪水が比較的近年に発生したためである。しかし、住民は中程度もしくは高水準の収入を得ており、準備の水準は高くなっている（24%）。さらに、どちらの地域においても、行動の水準は高くなっているが、これは沿岸域の住民は知識と経験を持っており、内陸部の住民は準備ができていることがその理由である。

４．結論

本研究は、洪水に対応するための人々の適応能力の向上に寄与するものである。研究結果から、災害に対するコミュニティの知識と洪水に対するレジリエンスを高めるためのコミュニティベースの防災教育の枠組みを提案した。ハザードにさらされる機会の減少、人々と資産の脆弱性減少、効果的な土地及び環境のマネジメント等組織的に災害の原因となる要素を分析・管理することで災害リスクを減少させ、また準備のレベルを向上させるには、コミュニティ、自治体、コミュニティ組織、学校の積極的な参加が必要である。



図―1　コミュニティベースの防災教育の枠組み

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Abbreviations

BMKG	Meteorology and Climatology Agency
Bappeda	Regional Development Planning Agency
BPBD	Badan Penanggulangan Bencana Daerah
Bappenas	National Development Planning Agency
Bakosurtanal	Indonesian National Agency of Survey and Mapping Coordination
BPS	Central Bureau of Statistics
PSDA	Water Management Agency
CBDRR	Community Based Disaster Risk Reduction
CBDRM	Community Based Disaster Risk Management
DRR	Disaster Risk Reduction

Chapter 1

Introduction

This chapter describes the introduction of the research consisting of the background of the research, the research problem, objectives of the research, research questions and research structure.

1.1 Research Background

In last three decades, there is the phenomenon of the increasing trend of natural disasters, especially disasters that cannot be predicted when it happened. Over the period 1980-2010, more than four billion people were affected by extreme natural events. The main factors or drivers behind rising economic losses are changes in land use and increases in the concentration of people and capital in high-risk areas, for example in coastal region exposed to windstorm, in fertile river basin exposed to floods and in urban areas exposed to earthquakes (Dutta, 2004).

During 1980-2010 the disaster trend of flood was significant increase. It is shown in the following graph that, the number of flood disaster event increases gradually year by year.

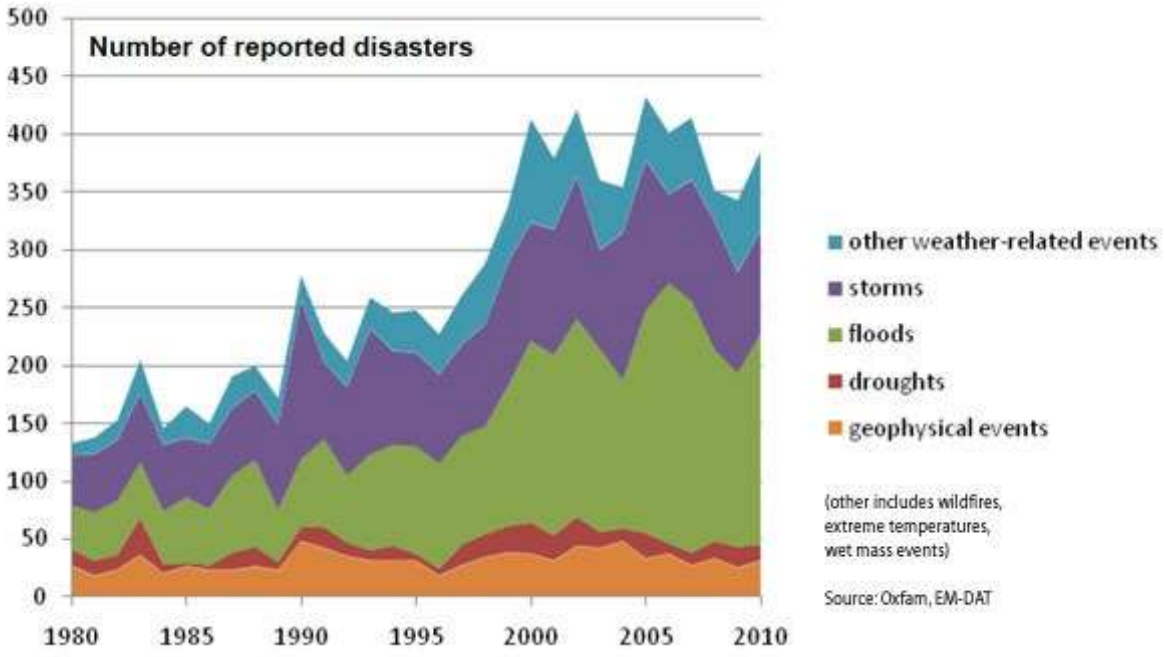

Figure 1.1 Flood disaster trend compared to other disasters
Source: EM-DAT (2011)

The flood disaster is a natural occurrence that can happen any time and often results in loss of life, property and objects. Losses due to flood damage to the building are the calculation of loss of valuables, until the opportunity cost of the time everyone cannot go to work and school. Flooding cannot be prevented, but can be controlled and reduced the impact of losses they cause. Since the advent of relatively quickly, to reduce the losses caused by the disaster need to be prepared quickly and precise handling.

Indonesia's territory is classified as one of the country prone to disasters, both natural and man-made disasters. Indonesia is an archipelago, geographically located at the intersection of three major plates, the Eurasian plate in the north and East Pacific plate and Indo-Australian plate in the south causing Indonesia prone to natural disasters such as earthquakes, volcanic eruptions, and tsunami. In addition, about 13 percent of the world's active volcanoes are located along the islands of Indonesia, which threat Indonesian community with danger of varying intensity.

On the other hand, Indonesia has a large population of more than 230 million peoples with uneven distribution, comprising a wide range of ethnic, religion / belief, culture, politics, which can lead to the emergence of horizontal and vertical conflicts that will eventually lead to displacement. Besides natural disasters, Indonesia has the potential emergence of man-made disasters as risks of some activities that can damage the environment, including deforestation, wild fires, and industrial disasters.

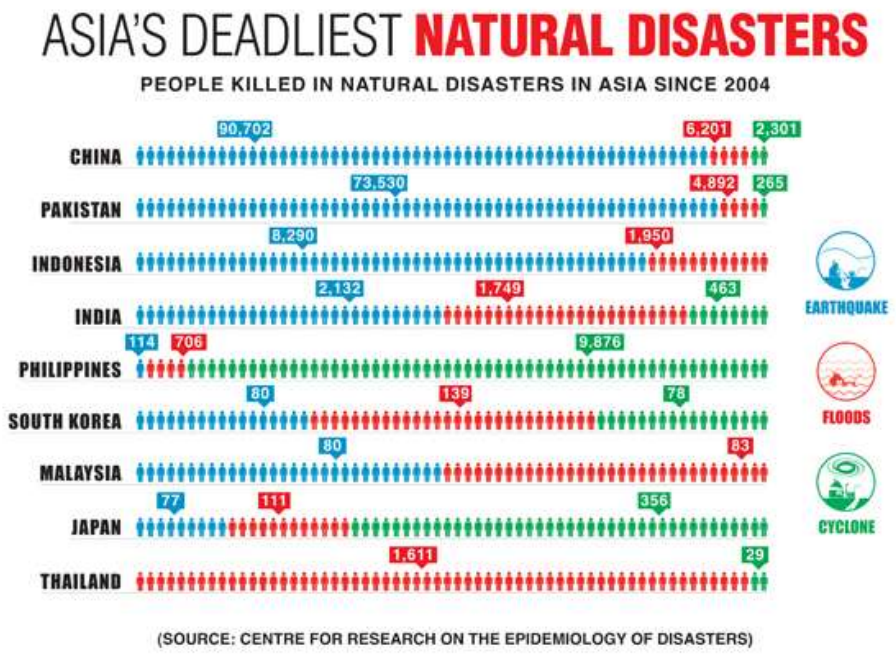

Figure 1.2 Number of people killed due to flood hazard in Asia
Source: Centre for Research on the Epidemiology of Disaster (2013)

Geographic location and physical condition of Indonesian naturally cause of this nation very vulnerable to natural disasters. The flood disaster is the most common disaster in Indonesia. The flood disaster that occurred in 2013 there were 152 events, or 60% of the total incidence of natural disasters in Indonesia, so that the disaster was ranked first in the case of natural disasters in Indonesia (BNPB, 2014). Flooding is the inundation land due to river overflow, caused by heavy rainfall or flooding as a result of submissions from other areas that are in a higher place. Indonesia has high rainfall, which ranges between 2000-3000 mm / year, so that floods easily occur during the rainy season, which is between October to January. The number of large rivers which owned the long list of flood events in Indonesia. There are 600 major rivers are scattered throughout the

territory of Indonesia whose condition often causes flooding, of which only a small fraction of the total river owned, as many as 5,590 of the river (Bakornas.2007).

On the other hand, coastal flooding is flooding caused by tidal sea water that flooded the mainland, is a problem that occurs in the area that is lower than sea level. In Semarang Rob problems this has happened quite a long time and is getting worse due to land subsidence are rising sea levels as a result of the warming of the earth. Coastal flood is a major problem in cities such as Semarang, Jakarta and the cities that are on the northern coast of Java, and will be a big problem in the future in line with the global warming and the uncontrolled extraction of ground water that lands face down.

1.2 Research Problem

Semarang as the capital city of the Central Java Province is a city which has growth and development rapidly. The development of the city was influenced by the rate of population growth. With the increasing growth of this population, the higher the need for urban land. Therefore, the level of density in urban areas tends to be higher than in the rural region because of the level of activity in urban population is likely to be higher. Development of urban areas with vegetation cover change land becomes impermeable surfaces with a water storage capacity is small or nonexistent. Activity against the most dominant land use is the residential activity. This activity takes up more than 50% of the total area, so that now many emerging residential areas with vertical concept to reduce the problem of the limitations of residential land.

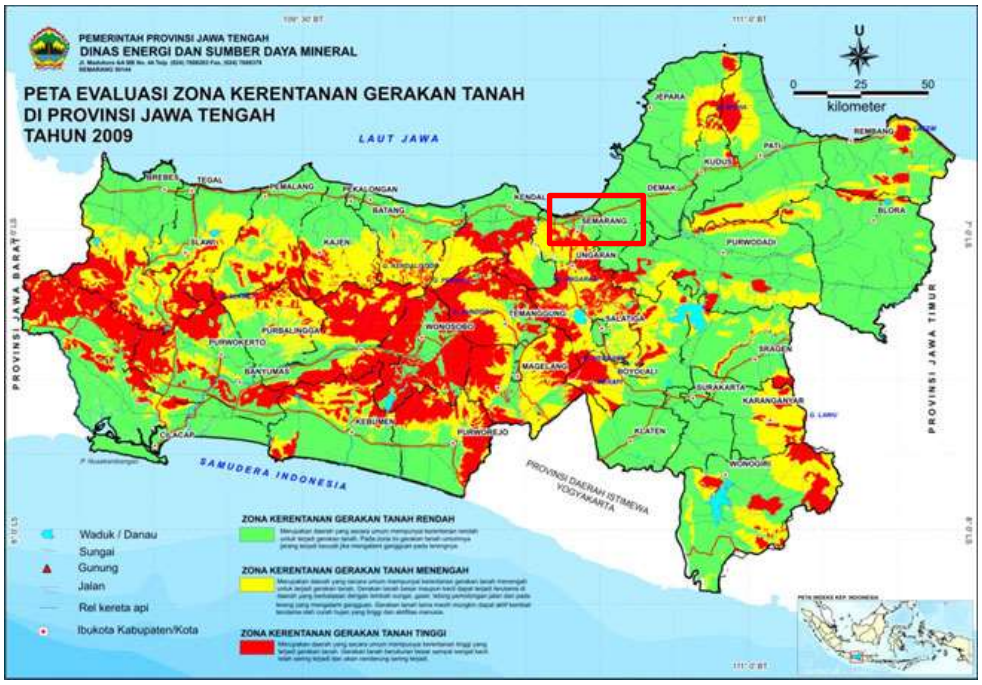

Figure 1.3 Location of the Semarang City
Source: Bappenas (2009)

In general, the construction of residential neighborhoods will avoid areas prone to flooding. In line with the growth of cities and the problems of land, new residential areas and centers of commercial activity expanded

into the flood-prone areas that were previously avoided. In addition, the sharp rise in land requirement, of course, affects the price of urban land. For people who can afford it, this is not a complicated issue, but the people of the city are not only composed by middle and upper income people, but also there are the families of the poor who also need a place to stay. Fulfillment of the poor / low income to live has its own area; where the area has affordable land value but of course with the facilities and conditions tend to be modest even "bad" is often referred to as a slum. This slum has problems against low socioeconomic conditions and environmental degradation. Poor environmental conditions resulted in an area prone to hazards and disasters, such as floods, fire and diseases.

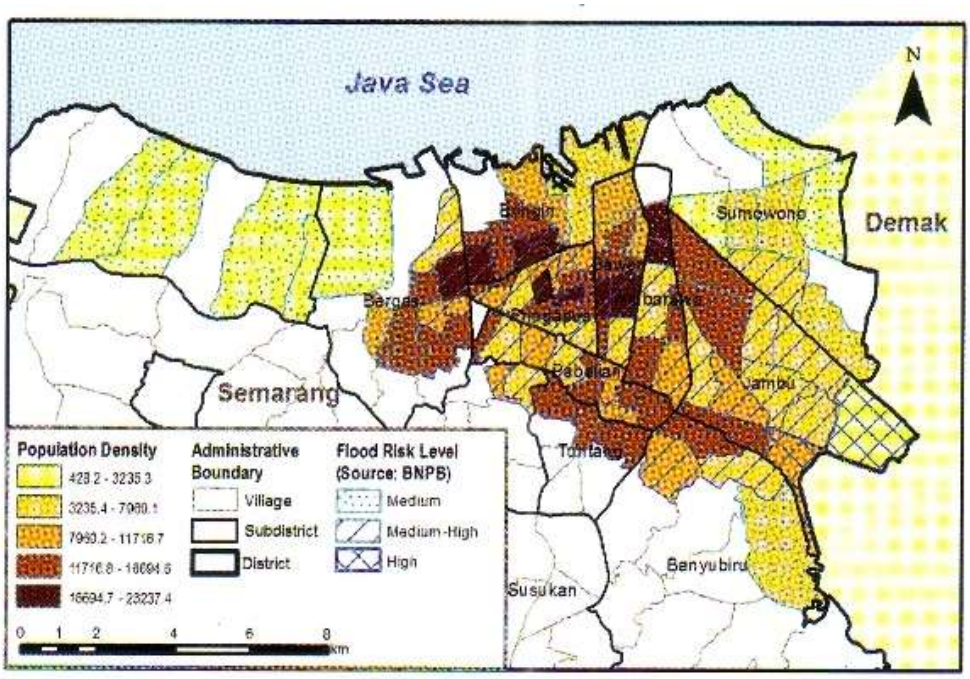

Figure 1.4 High flood risk and population density in Semarang City
Source: Bappenas (2012)

As a result of this rapid development, the more lands areas are covered by roads and buildings, so the amount of water seeps into the ground is reduced. Flood is a problem that often occurs in Semarang City as the result of flat topography and low land in the northern region and surrounded by the mountains in the south makes one cause of flooding in Semarang.

In the rainy season, inundation is often caused by flood which occurs due to upstream land receives large rain flowing to the downstream area. While in the dry season, flooding is caused by the presence of water tide which more popularly called *"rob"*. Tidal flood or *rob* is a flood caused by sea water elevation is equal to or even exceeding the high elevation of the land, so that at the time of tidal inundation occurs, seawater flow will comes to the river water flow and has been endure for a certain time.

When rainy season, Semarang is faced with the problem of flooding that comes every year. Topographically, Semarang has a natural beauty that is rarely the potential possessed by other cities in Indonesia, which has a waterfront area and the hills. On the other hand, the physical state which is also a threat as well as challenges

in the development of Semarang. If it is not well managed, would backfire for Semarang because it will lead to the disaster as is happening today is in the form of annual catastrophic flooding. Such circumstances would be very disturbing development of Semarang. Addition would result in material losses, flooding create the impression of discomfort and interfere with activities that would interfere with the growth of the city.

Northern part of Semarang has some areas that are prone to tidal flood, because the average soil water level does not vary much with surface seawater. Puddle is not only happening during the season rain, but also occurs when no rain is caused by tidal or tide. The tide may be pooled due to contact with the mainland through a river or channel that leads to the beach. Dimensions channel is not sufficient to accommodate the discharge of rain water, municipal waste water, and the incoming tide into the river causing water to overflow onto the mainland. Inundation occurs in areas that are not productive not pose a problem, but for the productive areas can result in losses.

Although disaster relief efforts have been made both by the government through the department, agencies, institutions, non-governmental organizations and by the community; however disaster events are increasing in the intensity and impacts. Therefore, efforts in disaster risk reduction must be done and always improved. One of the efforts is to provide practical knowledge about the characteristics of disasters and mitigation efforts to all stakeholders and the community, which are the main actors when disaster strikes. In addition, other institutions also play an important role in the provision of knowledge as well as disaster relief efforts through educational institutions both in formal and informal systems.

Community-based practices as part of disaster management is a best practice that is packed with the aim of providing knowledge to the people to be more aware and more concern about the environmental issues, problems, and disaster. The level of knowledge, attitudes, skills and motivation to work has to be acquired first to solve the current problems. Being able to do that, often the education is focusing on the formal education such as schools, boarding schools or non-formal education, which is mostly done by the institutions concerned the preservation of nature, such as NGOs or government agencies that are directly related to that business in various groups.

In general, the disaster issues in Indonesia, especially in Semarang City is complicated due to their occurrences in remote areas and thus is not able to locate vulnerable people, which are located far from the central and local government. Therefore, a new paradigm for disaster management should be able to overcome these problems, towards community-based disaster management, who are people/community that are independent, able to recognize hazards in the environment, and able to help themselves during a critical time of a disaster, when outside helps have not arrived yet. Based on the above background, the author there is a continual desire to make a research on community-based practices to cope with coastal and river floods Semarang, Indonesia.

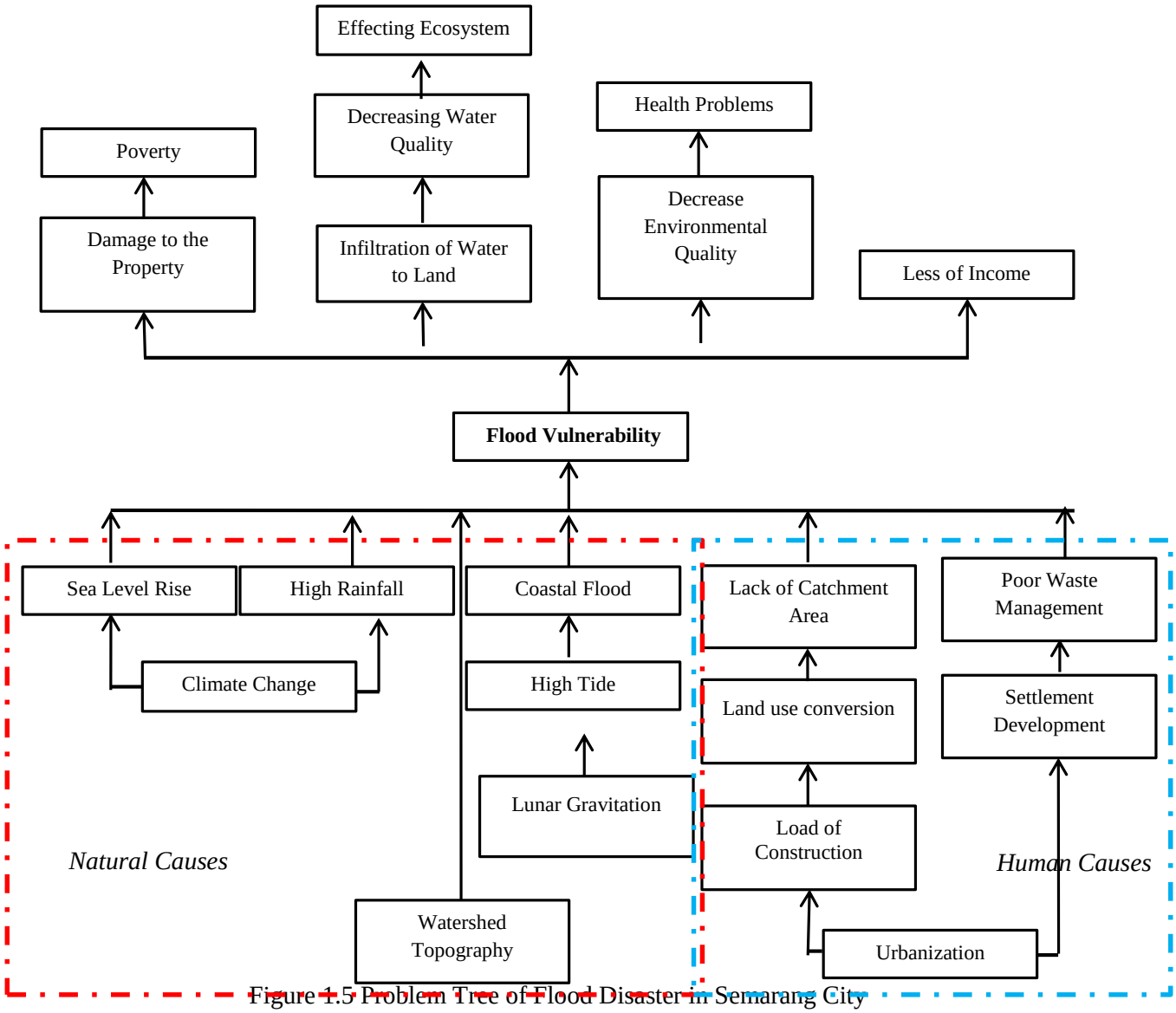

Figure 1.5 Problem Tree of Flood Disaster in Semarang City

1.3 Research Objective

This activity aims to generate recommendations community-based education on flood prevention, based on data obtained from survey and review of the literature. The expected output is a community based disaster education model that can be one of the education models on disaster risk reduction.

Based on this background, the objectives of this research are:

1. To identify and analyze community response and its relation to their knowledge, preparedness and action level.
2. To propose a framework of community based disaster education to enhance the resilience to flood.

1.4 Research Question

To achieve the research objectives, the research question are:

1. How does the community responses to coastal and river flood?

2. Is there positive relationship between community's knowledge with community preparedness as well as community's reaction to floods?

   The initial hypothesis in this research is "people who have a good knowledge of disaster will lead to have a good preparedness as well as action to flood disaster". In the other word, there is significant relationship between the level of knowledge and the level of preparedness. And the seconds is there is significant relationship between the level of preparedness and the level of action.
3. What is the recommendation framework to enhance the resilience to flood through community-based disaster education?

1.5 Thesis Structure

This research thesis comprises of five chapters. These chapters are as follows:

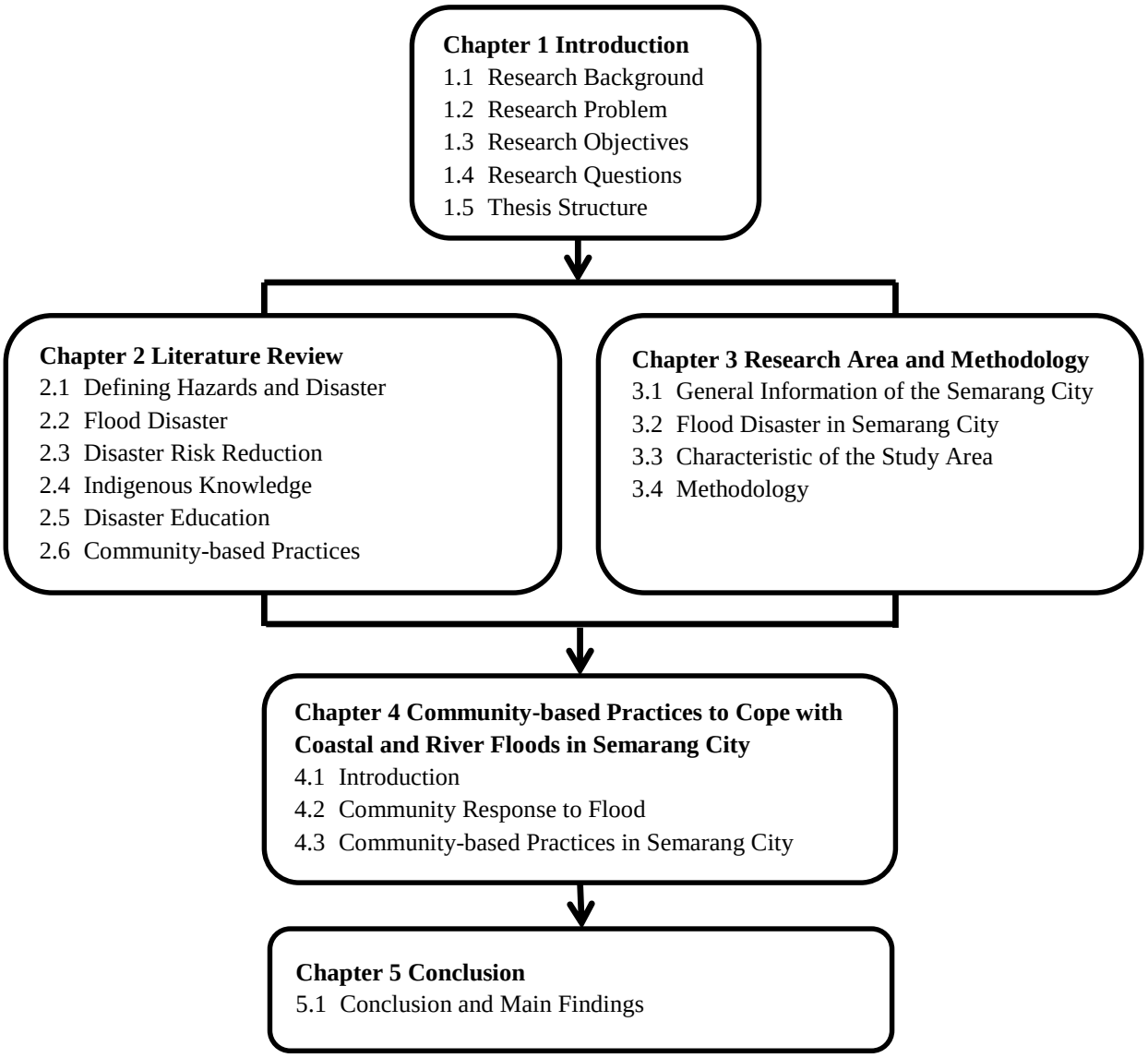

Figure 1.6 Framework of the Thesis

Chapter 1

This chapter discusses the background of the research, research problems, research objectives, research question and structure of the thesis.

Chapter 2

This chapter discusses about literature review related to the study by reviewing of relevant literature.

Chapter 3

Characteristic of the study area discussed in this chapter focusing on physical and social aspects of the study area and also the methodology used in this research.

Chapter 4

Community's coping strategies as the main topic of this research discussed in this chapter. This chapter focuses on the discussion about community response to flood related to their knowledge about flood, preparedness to the future flood disaster event and action during flood. Furthermore, a community based disaster education can be built by compiling some of the result from survey, interview and Focus Group Discussion.

Chapter 5

This chapter presents the conclusions of the research

References

Amendola, Aniello, et al. *"Towards integrated disaster risk management: case studies and trends from Asia."* Natural Hazards 44.2 (2008): 163-168.

Dewi, Anggraini. *"Community-based analysis of coping with urban flooding: a case study in Semarang, Indonesia."* International Institute for Geo-Information Science and Earth Observation, Msc Thesis, Enschede, The Netherlands (2007).

Dutta, Dushmanta, and Srikantha Herath. "Trend of floods in Asia and flood risk management with integrated river basin approach." *Proceedings of the 2nd international conference of Asia-Pacific hydrology and water resources Association, Singapore*. Vol. 1. 2004.

Hiwasaki, Lisa, Emmanuel Luna, and Rajib Shaw. *"Process for integrating local and indigenous knowledge with science for hydro-meteorological disaster risk reduction and climate change adaptation in coastal and small island communities."* International Journal of Disaster Risk Reduction (2014).

Marfai, Muh Aris, et al. *"The impact of tidal flooding on a coastal community in Semarang, Indonesia."* The Environmentalist 28.3 (2008): 237-248.

Smith, Keith, and Roy Ward. *"Floods: physical processes and human impacts."* 1998

Sunarto, Muh Aris Marfai, Djati Mardiatno, and Lies Rahayu. *"Strategi Pengurangan Risiko Multibencana Melalui Mitigasi dan Adaptasi: Studi Kasus Zona Utara Jawa bagian Tengah."* Jurnal Kebencanan Indonesia 2.2010 (2010).

Yodmani, Suvit. *Disaster risk management and vulnerability reduction: Protecting the poor.* The Center, 2001.

Chapter 2

Literature Review

This chapter explains theoretical review related to the topic and based on the objectives of the study. Therefore it is related to different theories and concepts of coastal and river flooding. This chapter also discusses about indigenous knowledge as one of the supporting factor to the local community's knowledge.

2.1 Defining Hazard and Disaster

There are different definitions of hazards and disaster. According to Twigg, (2004), hazard can be defined as potentially damaging physical event, phenomenon and/or human activity, which may cause loss of life or injury, property damage, social and economic disruption or environmental degradation, while disaster defines as what occurs when the impact of a hazard on a section of society (causing death, injury, loss of property or economic losses) overwhelms that society's ability to cope. Cutter, (1993) argued that "hazard is a broader concept that incorporates the probability of an event happening, hut also includes the impact of the magnitude of the event on the society and environment". Blaikie, (1994) states that hazard refer to "extreme natural events which may affect different places singly or in combination at different times over a varying return period".

Tobin, et. al., (1997) states that hazard is an "interaction between the human system and the events." They further state that hazard overlap with disaster where hazard is the potential event and disaster is the result of the hazard.

Blaikie, et. al., (1994) state that "there is a disaster when significant number of people had been affected by the hazard, be it to their livelihood, lives and properties, that made then incapable of regaining or coping with losses". According to Smith, et. al., (1998), the detailed way to define disaster is " an event, concentrated in time and space, in which the community experience severe danger and disruption of its essential functions, accompanied by widespread human, material or environmental losses, which often exceeds the ability of the community to cope without external assistance.

A disaster is an event or series of events that threaten and disrupt the lives and livelihoods caused by both natural factors and or non-natural factors, as well as human factors, thus resulting in the emergence of human casualties, environmental damage, property loss, and psychological impact (UURI No.24/2007 Article 1, point 1). From the definition above, the disaster is an event, which is occurring due to the threat vulnerability to human life. In short, when the threat makes human and environmental adverse impact and not increasing the ability of communities to cope with, then

catastrophic event is called. The relationship between hazards, vulnerabilities and capacity can be described as follows:

$$\frac{\text{Hazardst x Vulnerability}}{\text{Capacity}} = \text{Disaster Risk}$$

From the formula above, it shows that the level of community capacity is inversely related to disaster risks. In other words, the lower the ability of communities and knowledge of disaster management, then disaster risk will be even greater. These definitions of disaster have in common that the difference between the hood event (hazard) and disaster depends on the coping capacity of the community affected. Apparently floods in well-prepared communities with a strong social structure are less disastrous than the unprepared communities.

2.2 Flood Disaster

A natural events only becomes a disaster when it has an impact on human settlement and activities (Andjelkovic, 2001). Floods are natural disasters that have been affecting human lives since time immemorial. Defining a flood is rather difficult, partly because floods are complex phenomena and partly because they are viewed differently by different people. Yevjevich, (1992) defined floods as extremely high flows or levels of rivers, whereby water inundates flood plains or terrain outside the water-confined major river channels. The more general definition of flood was introduced by Ward, (1978) by incorporating the rarer coastal and the more common valley-bottom inundations. He defined a flood as a body of water which rises to overflow land which is not normally submerged. In local context, floods are defined based on its causes.

Flood is claimed as one of the common hazards that affects more people than any other (Ward,1978). Floods account for approximately forty percent of natural disasters and may become more frequent and severe due to global warming (Reacher, et al, 2004). There are many of research surveys conducted regarding with flood and its impacts, covering social, economic and health impacts. A survey of impacts of flooding in association with illness of the flood victims was conducted in the town of Lewes in Southern England following severe river flooding on 12 October 2000 (Reacher, et al, 2004). A historical study was conducted by telephone interview for new episodes of illness in all age groups, and for psychological distress in adults. Two hundred and twenty seven residents of 103 flooded households and 240 residents of 104 non-flooded households in the same postal district were interviewed by random selection of addresses from a post flooding survey and a commercial database respectively. The result of the study showed that there is association between flooding and new episodes of physical illness in adults diminished after adjustment for psychological distress.

According to the result of the study, association with physical illnesses affirms the need for advice and assistance with individual, household and environmental hygiene and access to medical services. Figure 2.1 below describes the flood damage categorized by Parker (2000). As shown in table, flood damage can be divided into three classes: tangible direct losses, tangible indirect losses and intangible human and other losses. The losses causing by flooding are not only economic but also can be physical, ecological and social.

Direct damages arc those that occur due to the physical contact of floodwater with humans, property or any other objects. These can include damage to buildings, economic assets, loss of crops and livestock, immediate health impacts. Loss of lives and loss of ecological goods. They are often measured as damage to stock values. Indirect damage is a damage that is induced by the direct impact, but occurs outside of the space and/or time of the flood event. Examples of indirect damage include disruption of traffic, trade and public services. Indirect damages are often measured as loss of (low values. Tangible damages are those that can he relatively easily evaluated in monetary terms (e.g. damage to assets, loss of production, etc.). They can he subdivided into direct damages (such as physical damage to properties, contents and infrastructure), and indirect damages (which can be more difficult to estimate and include damages such as traffic or industrial disruption, and emergency costs). Intangible damages are more difficult to evaluate in monetary terms. There are fewer studies on their valuation than for tangible damages. However, some authors still provide information on their valuation. Intangible damages include social and environmental impacts of floods: again, they can he subdivided into direct and indirect intangible damages. Social impacts include health or psychological impacts (Smith and Ward, 1998), as well as loss of human lives. When describing flood damage, information on loss of lives is usually given separately from the calculated economic damage.

It is clearly acknowledged in the flood damage assessment literature that direct intangible damage or indirect damage can play an important role in evaluating flood damage. However, by far the largest part of the flood damage literature focuses on direct tangible damages, which are considered as a good indicator of the severity of flood disasters.

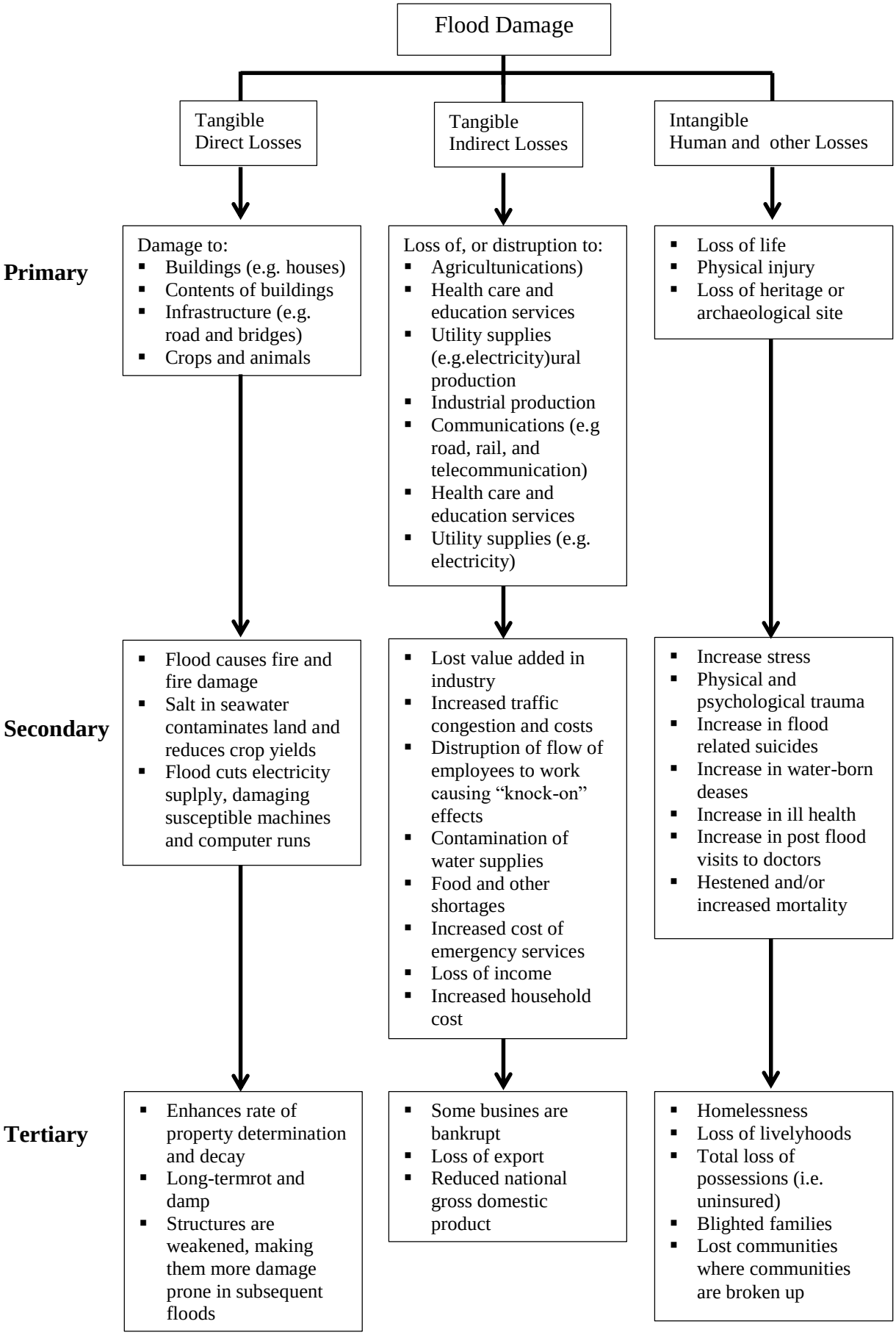

Figure 2.1 Categorization of Flood Damage (Parker,2000)

2.2.1 River Flood

Yevjevich, (1992) defined floods as extremely high flows or levels of rivers, whereby water inundates flood plains or terrain outside the water-confined major river channels. A flood occurs when water overflows or inundated land that's normally dry. This can happen in a multitude of ways. Most common is when rivers or streams overflow their banks. Excessive rain, a ruptured dam or levee, rapid ice melting in the mountains, or even an unfortunately placed beaver dam can overwhelm a river and send it spreading over the adjacent land, called a floodplain.

Most floods take hours or even days to develop, giving residents ample time to prepare or evacuate. Others generate quickly and with little warning. These flash floods can be extremely dangerous, instantly turning a babbling brook into a thundering wall of water and sweeping everything in its path downstream.

Disaster experts classify floods according to their likelihood of occurring in a given time period. A hundred-year flood, for example, is an extremely large, destructive event that would theoretically be expected to happen only once every century. But this is a theoretical number. In reality, this classification means there is a one-percent chance that such a flood could happen in any given year. Over recent decades, possibly due to global climate change, hundred-year floods have been occurring worldwide with frightening regularity (Acreman, M.2000) .

Moving water has awesome destructive power. When a river overflows its banks or the sea drives inland, structures poorly equipped to withstand the water's strength are no match. Bridges, houses, trees, and cars can be picked up and carried off. The erosive force of moving water can drag dirt from under a building's foundation, causing it to crack and tumble.

River flooding occurs when precipitation falls on saturated soil or dry soil that has poor absorption ability. The runoff collects in gullies and streams and, as they join to form larger volumes, often forms a fast flowing front of water and debris. The increase in flow may be the result of sustained rainfall, rapid snow melt, monsoons, or tropical cyclones. Localized flooding may be caused or exacerbated by drainage obstructions such as landslides, ice, or debris.

Floods can also bring many benefits, such as recharging ground water, making soil more fertile and increasing nutrients in some soils. Flood waters provide much needed water resources in arid and semi-arid regions where precipitation can be very unevenly distributed throughout the year and kills pests in the farming land. Freshwater floods particularly play an important role in maintaining ecosystems in river corridors and are a key factor in maintaining floodplain biodiversity. Flooding can spread nutrients to lakes and rivers, which can lead to increased biomass and improved fisheries for a few years.

For some fish species, an inundated floodplain may form a highly suitable location for spawning with few predators and enhanced levels of nutrients or food. Fish, such as the weather fish, make use of floods in order to reach new habitats. Bird populations may also profit from the boost in food production caused by flooding.

Periodic flooding was essential to the well-being of ancient communities along the Tigris-Euphrates Rivers, the Nile River, the Indus River, the Ganges and the Yellow River among others. The viability of hydropower, a renewable source of energy, is also higher in flood prone regions.

Preventative Measures

a. Dams

   Many dams and their associated reservoirs are designed completely or partially to aid in flood protection and control. Many large dams have flood-control reservations in which the level of a reservoir must be kept below a certain elevation before the onset of the rainy season to allow a certain amount of space in which floodwaters can fill. The term dry dam refers to a dam that serves purely for flood control without any conservation storage.

b. Diversion canals

   Floods can be controlled by redirecting excess water to purpose-built canals or floodways, which in turn divert the water to temporary holding ponds or other bodies of water where there is a lower risk or impact to flooding.

c. Self-closing flood barrier

   The self-closing flood barrier (SCFB) is a flood defense system designed to protect people and property from inland waterway floods caused by heavy rainfall, gales or rapid melting snow. The SCFB can be built to protect residential properties and whole communities, as well as industrial or other strategic areas. The barrier system is constantly ready to deploy in a flood situation, it can be installed in any length and uses the rising flood water to deploy.

d. River defenses

   In many countries, rivers are prone to floods and are often carefully managed. Defenses such as levees, bunds, reservoirs, and weirs are used to prevent rivers from bursting their banks. When these defenses fail, emergency measures such as sandbags, hydro sacks or portable inflatable tubes are used (Parker,2000).

2.2.2 Coastal Flood

Coastal flooding occurs when normally dry, low-lying land is flooded by sea water. The extent of coastal flooding is a function of the elevation inland flood waters penetrate which is controlled

by the topography of the coastal land exposed to flooding. The sea water can inundate the land via several different paths; these are:

- Direct inundation, where the sea height exceeds the elevation of the land, often where waves have not built up a natural barrier such as a dune system
- Overtopping of a barrier, the barrier may be natural or human engineered and overtopping occurs due to swell conditions during storm or high tides often on open stretches of the coast. The height of the waves exceeds the height of the barrier and water flows over the top of the barrier to flood the land behind it. Overtopping can result in high velocity flows that can erode significant amounts of the land surface which can undermine defense structures.
- Breaching of a barrier, again the barrier may be natural or human engineered, and breaching occurs on open coasts exposed to large waves. Breaching is where the barrier is broken down by waves allowing the sea water to extend inland.

Coastal flooding is largely a natural event, however human influence on the coastal environment can exacerbate coastal flooding. Extraction of water from groundwater reservoirs in the coastal zone can enhance subsidence of the land increasing the risk of flooding. Engineered protection structures along the coast such as sea walls alter the natural processes of the beach, often leading to erosion on adjacent stretches of the coast which also increases the risk of flooding.

Causes

Coastal flooding can result from a variety of different causes including storm surges created by storms like hurricanes and tropical cyclones, rising sea levels due to climate change and by:

a. Storms and storm surges. Storms can cause flooding through storm surges which are waves significantly larger than normal and if a storm event corresponds with the high astronomical tide extensive flooding can occur. Storm surges occur during storm events, including hurricanes and tropical cyclones due to three processes: (1) wind setup, (2) barometric setup, and (3) wave setup.

   Winds blowing in an onshore direction (from the sea towards the land) can cause the water to ‘pile up’ against the coast. This is known as wind set up. Low atmospheric pressure is associated with storm systems and this tends to increase the surface sea level, this is barometric set up. Finally increased wave break height results in a higher water level in the surf zone which is wave set up. These three processes interact to create waves that can overtop natural and engineered coastal protection structures thus penetrating sea water further inland than normal.

b. Sea level rise. The Intergovernmental Panel on Climate Change (IPCC) estimate global mean sea-level rise from 1990 to 2100 to be between nine and eighty eight centimeters. It is also

predicted that with climate change there will be an increase in the intensity and frequency of storm events such as hurricanes. This suggests that coastal flooding from storm surges will become more frequent with sea level rise. A rise in sea level alone threatens increased levels of flooding and permanent inundation of low lying land as sea level simply may exceed the land elevation. This therefore indicates that coastal flooding associated with sea level rise will become a significant issue into the next 100 years especially as human populations continue to grow and occupy the coastal zone.

c. Tsunami. Coastal areas can be significantly flooded as the result of tsunami waves. Tsunamis are waves which propagate through the ocean as the result of the displacement of a significant body of water through earthquakes, landslides, volcanic eruptions and glacier carvings. There is also evidence to suggest that significant tsunami have been caused in the past by meteor impact into the ocean. Tsunami waves are so destructive due to the velocity of the approaching waves, the height of the waves when they reach land and the debris the water entrains as it flows over land can cause further damage.

Preventative Measures

It has been said that one way to prevent significant flooding of coastal areas now and into the future is by reducing global sea level rise. This could be minimized by further reducing greenhouse gas emissions. However, even if significant emission decreases are achieved there is already a substantial commitment to sea level rise into the future. International climate change policies such as the Kyoto Protocol are seeking to mitigate the future effects of climate change, including sea level rise.

In addition to this, more immediate measures of engineered and natural defenses are put in place to prevent coastal flooding.

a. Engineered Defenses. There are a variety of ways in which humans are trying to prevent the flooding of coastal environments. Typically this is through so called hard engineering structures such as seawalls and levees. This armoring of the coast is typically to protect towns and cities which have developed right up to the beachfront. Enhancing depositional processes along the coast can also help prevent coastal flooding. Structures such as breakwaters and artificial headlands promote the deposition of sediment on the beach thus helping to buffer against storm waves and surges as the wave energy is spent on moving the sediments in the beach than on moving water inland.

b. Natural Defenses. The coast does provide natural protective structures to guard against coastal flooding. These include physical features like gravel bars and sand dune systems but also ecosystems such as salt marshes and mangrove forests have a buffering function.

Mangroves and wetlands are often considered to provide significant protection against storm waves, tsunamis and shoreline erosion through their ability to attenuate wave energy. Therefore to protect the coastal zone from flooding, these natural defenses should be protected and maintained (Parker,2000).

2.3 Disaster Risk Reduction

Disasters often follow natural hazards. A disaster's severity depends on how much impact a hazard has on society and the environment. The scale of the impact in turn depends on the choices we make for our lives and for our environment. These choices relate to how we grow our food, where and how we build our homes, what kind of government we have, how our financial system works and even what we teach in schools. Each decision and action makes us more vulnerable to disasters - or more resilient to them.

Disaster risk reduction is the concept and practice of reducing disaster risks through systematic efforts to analyze and reduce the causal factors of disasters. Reducing exposure to hazards, lessening vulnerability of people and property, wise management of land and the environment, and improving preparedness and early warning for adverse events are all examples of disaster risk reduction (UNISDR:2010).

Disaster Risk Reduction (DRR) aims to reduce the damage caused by natural hazards like earthquakes, floods, droughts and cyclones, through an ethic of prevention. Disaster risk reduction includes disciplines like disaster management, disaster mitigation and disaster preparedness, but DRR is also part of sustainable development. In order for development activities to be sustainable they must also reduce disaster risk. On the other hand, unsound development policies will increase disaster risk - and disaster losses. Thus, DRR involves every part of society, every part of government, and every part of the professional and private sector.

The evolution of disaster management thinking and practice since the 1970s has seen a progressively wider and deeper understanding of why disasters happen, accompanied by more integrated, holistic approaches to reduce their impact on society. The modern paradigm of disaster management and disaster risk reduction (DRR) represents the latest step along this path. DRR is a relatively new concept in formal terms, but it embraces much earlier thinking and practice. It is being widely embraced by international agencies, governments, disaster planners and civil society organizations.

DRR is such an all-embracing concept that it has proved difficult to define or explain in detail, although the broad idea is clear enough. Inevitably, there are different definitions in the technical literature, but it is generally understood to mean the broad development and application of policies, strategies and practices to minimize vulnerabilities and disaster risks throughout society. The term

'disaster risk management' (DRM) is often used in the same context and to mean much the same thing: a systematic approach to identifying, assessing and reducing risks of all kinds associated with hazards and human activities. It is more properly applied to the operational aspects of DRR: the practical implementation of DRR initiatives.

Some issues and challenges in DRR

It is unrealistic to expect progress in every aspect of DRR: capacities and resources are insufficient. Governments and other organizations have to make what are in effect 'investment decisions', choosing which aspects of DRR to invest in, when, and in what sequence. This is made more complicated by the fact that many of the interventions advocated are developmental rather than directly related to disaster management. Most existing DRR guidance sidesteps this issue. One way of focusing is to consider only actions that are intended specifically to reduce disaster risk. This would at least distinguish from more general efforts toward sustainable development. The concept of 'invulnerable development' attempts this: In this formulation, invulnerable development is development directed toward reducing vulnerability to disaster, comprising 'decisions and activities that are intentionally designed and implemented to reduce risk and susceptibility, and also raise resistance and resilience to disaster'.

Partnerships and inter-organizational co-ordination

No single group or organization can address every aspect of DRR. DRR thinking sees disasters as complex problems demanding a collective response. Co-ordination even in conventional emergency management is difficult, for many organizations may converge on a disaster area to assist. Across the broader spectrum of DRR, the relationships between types of organization and between sectors (public, private and non-profit, as well as communities) become much more extensive and complex. DRR requires strong vertical and horizontal linkages (central-local relations become important). In terms of involving civil society organizations, it should mean thinking broadly about which types of organization to involve (i.e., conventional NGOs and such organizations as trades unions, religious institutions, amateur radio operators (as in the USA and India), universities and research institutions).

2.4 Indigenous Knowledge

Indigenous communities have long been recognized as being particularly vulnerable to the impacts of climate change due to the close connection between their livelihoods, culture, spirituality and social systems and their environment. At the same time, however, this deep and long-established relationship with the natural environment affords many indigenous peoples with knowledge that they

have long used to adapt to environmental change, and are now using to respond to the impacts of climate change.

The potential of indigenous knowledge for informing observations of, and responses to climate change is an area of growing interest, particularly for those working at community level where access to other forms of "scientific" knowledge are inaccessible or incomplete, but increasingly in international forums such as the UNFCCC (United Nations Framework Convention on Climate Change) and IPCC (Intergovernmental Panel of Climate Change) as well. While this potential is exciting and may offer new ways to directly engage local communities in action on climate change, it also brings with it important concerns about power, rights, and ethics in engaging with these kinds of partnerships. This key issues guide provides resources for better understanding the relationship between indigenous knowledge and climate change, the potential this relationship may hold, and the challenges that may underlie it.

According to the participatory discourse, taking local knowledge into consideration in terms of practices and contexts can help implementing organizations improve their planning for and implementation of disaster preparedness activities; and it can help improve project performance and project acceptance, ownership, and sustainability specifically. This means that understanding, accounting for, and respecting local knowledge contribute to cost-effectiveness in the long-term, from both a financial and a social point of view– especially in the context of complex, changing, and growing hazards.

Firstly, from a financial point of view, economies of scale are based on the assumption that people perform better on some scales than on others and that different resources are found on different scales (Berkes 2004). Solutions in resource management, development, and disaster management need to go beyond the dichotomy between local versus state management levels and integrate cross-scale institutional linkages. Understanding local knowledge and practices can help identify what is needed and acceptable locally and how people's participation can be solicited to ensure their support for external action. Building on local knowledge and practices (i.e., capitalizing on local strengths), when it is relevant to do so, can decrease dependency on external aid. Local people provide continuity and can monitor the actions taken (Wisner and Luce 1995).

Secondly, from a social point of view, taking local knowledge and practices into account promotes mutual trust, acceptability, common understanding, and the community's sense of ownership and self-confidence. Understanding local knowledge, practices, and contexts helps development and research organizations to tailor their project activities and communication strategies to local partners' needs. It also enables development research organizations to act as intermediaries in translating messages from government level to communities in a way that is understandable and credible. Hence,

communication tools for disaster preparedness, such as official warning messages or hazard maps, need to incorporate local references.

The inclusion of local people in disaster management and preparedness activities is challenging. In practice, participation and decentralization involve complex processes and the devolution of power to local levels does not always transfer into power being given to the most marginal groups, mainly because increased access to (political) resources does not always translate into increased benefits from those resources. Chambers and Richards (1995) argue that development practitioners use jargon, such as empowerment and participation, easily but have not changed their attitudes towards rural people and still undervalue their knowledge. The renewed interest in local knowledge does not mean that outside economic interests in benefiting from local knowledge have disappeared, as demonstrated by controversies about intellectual property rights over medicinal plants and pharmaceutical commercialization. These aspects illustrate how the use of local knowledge raises complex issues.

There are various classifications of knowledge, in general, and local knowledge, in particular, in the literature, reflecting the complexity and diversity of different modes of knowing by communities, households, and individuals. Importantly, this classification of local knowledge types (or knowledge dimensions) is not comprehensive. Other types of knowledge that are not well studied include, for example, local knowledge about conflict resolution or management and organizational and management knowledge. Overall this classification tries to simplify the reality and presents a false dichotomy between various knowledge types, which are, in the context of local knowledge, not separate but closely intertwined. The important lessons here are that a diversity of local knowledge exists and that most of it remains untapped despite growing evidence in the literature that it can play a valuable role in disaster risk reduction, directly or indirectly.

According to Shaw et al. (2009), the four primary arguments for including local and indigenous knowledge in disaster risk reduction policies are:

- Indigenous knowledge can be transferred and adapted to other communities in similar situations;
- Incorporating indigenous knowledge encourages community participation and empowers communities in reducing disaster risk;
- Indigenous knowledge can provide invaluable information about the local context; and
- The non-formal means of disseminating indigenous knowledge can serve as a model for education about disaster risk reduction.

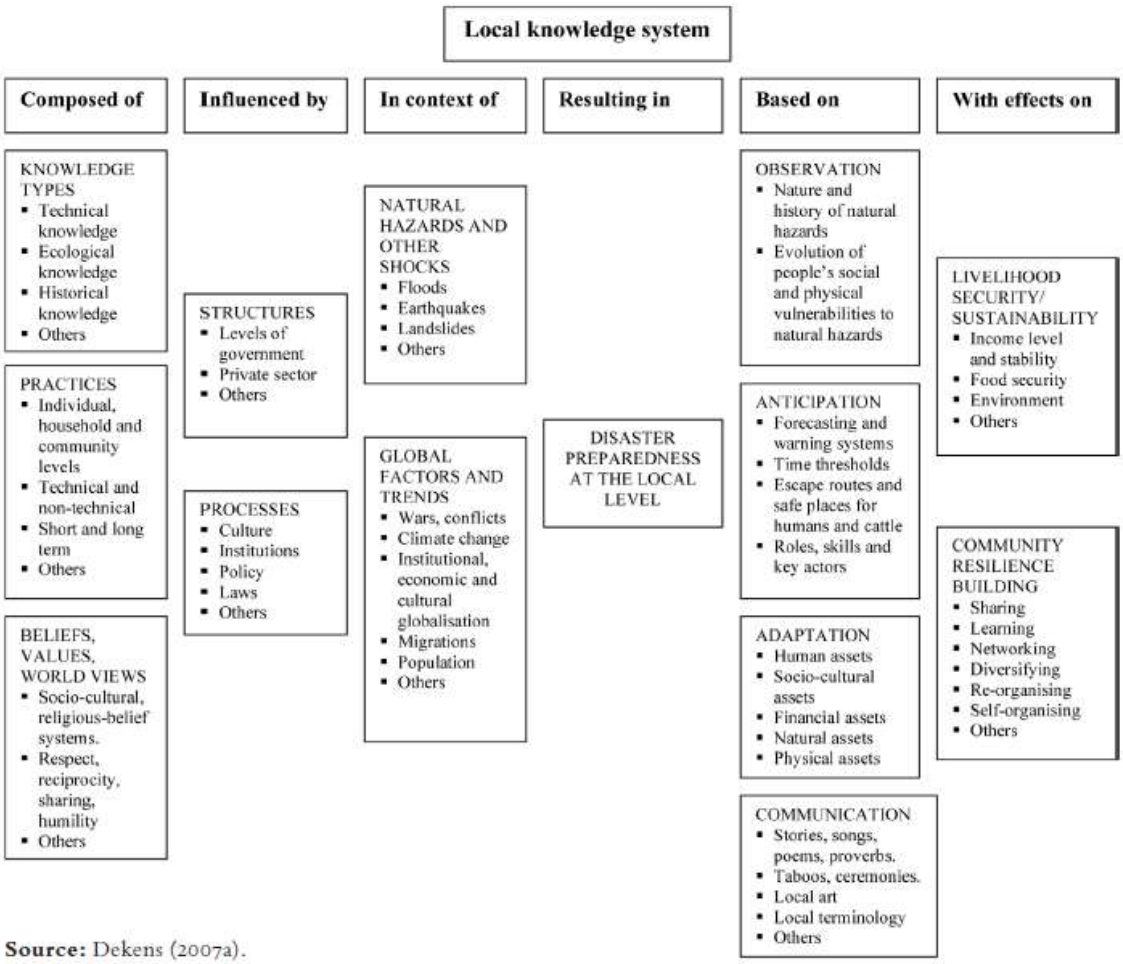

Figure 2.2 Framework for Local Knowledge on Disaster Preparedness
Source: Dekens (2007a)

2.5 Disaster Education

The key to education and disaster risk reduction is sharing and using information and knowledge in a productive way through awareness-raising and educational initiatives so that people make informed decisions and take action to ensure their resilience to disasters.

It encompasses both formal education at schools and universities and informal education such as the recognition and use of traditional wisdom and local knowledge for protection from natural hazards. Education is conveyed through experience, established learning arrangements, information technology, staff training, electronic and print media and other means that facilitate the sharing of information and knowledge to citizens, professionals, organizations and policymakers, among a range of other community stakeholders.

Education is a crucial means within local communities around the world to communicate, to motivate, and to engage, as much as it is to teach. Awareness and learning about risks and dangers needs to start in early education, continuing through generations.

Role of Education in Disaster Risk Reduction

The importance of education in promoting and enabling Disaster Risk Reduction (DRR) has already been identified by researchers and policy makers. In doing so, there is a renewed focus on disaster risk education in primary and secondary schools. Mainstreaming DRR into school curricula aims to raise awareness and provide a better understanding of disaster management for children, teachers and communities. Accompanying structural changes to improve safety in building schools will not only protect children and their access to education, but will also minimize long term costs.

There is increasing evidence that students of all ages can actively study and participate in school safety measures, and also work with teachers and other adults in the community towards minimizing risk before, during and after disaster events. Methods of participatory vulnerability assessment, capacity assessment and hazard mapping have been be used with broader communities surrounding schools and other institutions of education and research. Government can effectively reach out to communities and protect them by focusing on schools in DRR initiatives to achieve greater resilience to disasters.

2.6 Community-based Disaster Risk Reduction

It is common knowledge that people in the community level have more to lose because they are ones directly hit by disasters, whether it is a major or a minor one. They are the first ones to become vulnerable to the effects of such hazardous events. The community therefore has a lot to lose if people do not address their own vulnerability. On the other hand, they have the most gain if they can reduce the impact of disasters on their community. The concept of putting the communities at the forefront gave r

Shaw (2009) has concluded that the key point in the role of local actors is partnership and collaboration. Each group has its own resources, knowledge base, and information. Sharing of information is extremely important. A proper information management system is required to utilize to the idea of CBDM. At the heart of the CBDM is the principle of participation. CBDM had been a popular term in later 1980s and 1990s, which gradually evolved to community-based disaster risk management (CBDRM) and then to CBDRR. CBDRM and CBDRR are often used in similar meaning. While CBDRR focuses more on pre-disaster activities for risk reduction by the communities, CBDRM focuses a broader perspective of risk-reduction-related activities by communities, both during, before and after the disaster.

With the analysis from CBDRR Shaw concluded that the following are a few general statements that are applicable to different contexts of community activities: (1) local institutions (both formal and informal) play a critical role in sustaining the community initiatives, (2) integration of community initiatives in the government policies and practices is important to upscale the efforts, (3) local change agents play crucial roles in grassroots implementation, and (4) synergy of grassroots efforts with the development policy is regarded as the measure of the success of project implementation (Shaw, 2012).

Following is a list of the factors that enhance the sustainability of CBDRR:

1. Promote and strengthen a "culture of coping with crisis"
2. Enhance people's perception on vulnerability
3. Recognize motivation of community initiative
4. Increase community participation and empowerment through institutionalization
5. Focus on need-based training approaches
6. Involve diverse stakeholders based on the needs and objectives in both formal and/or informal ways
7. Promote tangible and intangible accumulation of physical technological, and economic assets as the project outputs
8. Promote the integration of community initiatives into regular development planning and budgeting to ensure sustainability

Community-based Disaster Risk Reduction in Indonesia

Most of the disasters in Indonesia are natural while in some cases, the occurrence of these disasters is aggravated by the people's inability to eliminate potential hazards or prevent these hazards from emerging. But as complex as the causes might be, concern toward disaster should be focused more on the impact and how to manage it.

A top-down approach in viewing disaster management tends to overlook local resources that may have the potential to build a disaster prevention or recovery program. But in some cases, this kind of approach also increases the vulnerability of local people to disaster risks.

Such gaps in disaster management efforts serve as lessons in creating a new and better approach. After evaluating several possibilities, experts in the field concluded that a new risk management program must have more opportunities to involve local people. In creating bigger roles for the people, the new approach shall be community-based and will focus on ways to encourage and invite more active participation from the members of the community to propose ideas in the planning, implementation, and evaluation of the program. Stakeholders at various levels, including the government, will work in a single, coordinated effort.

Community-Based Disaster Risk Management (Pengelolaan Risiko Bencana Berbasis Masyarakat) consists of steps of actions encompassing prevention of risks, emergency preparedness, emergency procedures, and recovery after a disaster. The term "community-based" means that disaster management is jointly dealt with by the community. Although the role of the community varies, it is agreed that under this approach, communities are the main actors that develop and implement important policies in relation to disaster management. This argument bears implication on the role of CBDRM practitioners as the "outsider," although they may come from and live in the community. Their contribution in assisting community members in dealing with disaster management are defined by limited spatial dimension and time availability. Furthermore, this has implications for practitioners to build their awareness on entry and exit strategies. The NAP-DRR 2006–2009 sets five priority activities:

1. Incorporating DRR into national and local priority policies with a strong institutional basis for implementation;
2. Identifying, assessing, and monitoring disaster risks, and enhancing early warning system;
3. Using knowledge, innovation, and education to build a safety culture and resilience at all administrative and community level;
4. Reducing underlying risk factors; and
5. Strengthening disaster preparedness for effective response at all level.

References

Abbot.,Chambers.R., Dunn, C., Harris, T., de Merode. E., Porter, J., Twonsend, J., and Weiner, D.(2001). Participatory GIS: opportunity or oxymoron?. Source: PLA flotes (1998), Issue 33, pp.27-34, lIED. London.

Acreman, M. (2000). Managed flood releases from reservoirs, issues and guidance. Environment Research Programme Infrastructure and Urban Development Division. Center for Ecology and Hydrology, UK.

Allen, Katrina M. "Community-based disaster preparedness and climate adaptation: local capacity building in the Philippines." Disasters 30.1 (2006): 81-101.

Andjelkovic, I. (2001). Guidelines on Non-Structural Measures in Urban Flood Management. Technical Documents in Hydrology, UNESCO, Paris

Antweiler, C. (1998) 'Local Knowledge and Local Knowing. An Anthropological Analysis of Contested 'Cultural Products' in the Context of Development'. In Anthropos, 93(4-6):469-494

Baas, 5. (1995). Introducing PRA (Participatory Rural Appraisal) for poverty analysis among pastoral herders in rural areas of Mongolia. Institute of Administration and Management Development (Ulaan Baatar, Mongolia)

Bappeda. (2005). Handbook for Disaster Management in Central Java: Flood, Land Slides, Drought and Tsunami.

Berkes, Fikret. "Rethinking community-based conservation." Conservation biology 18.3 (2004): 621-630.

Blaikie, P., Cannon, T., Davis, 1. and Wisner, B., (1994). At Risk Natural Hazards, People's Vulnerability and Disaster; Published by Routledge, London Carter, N, (1992). Disaster Management: A Disasters Manager Handbook; Published by Asian Development Bank, Manila, Philippines

Cutter, S. L., (1993). Living with Risk: Published by Edward Arnold, London de Dios. Honorio, B. (2002). Participatory Capacities and Vulnerabilities Assessment : Finding the link between the Disaster and Development. Oxfam Great Britain - Philippine Program.

D. and Herath, S., (2003). Trend of Floods in Asia and Flood Risk Management with Integrated River Basin Approach. RNUS/WEM, School of Civil Engineering, Asian Institute of Technology P.O Box 4, Klong Luang, Pathumthani 12120, Thailand: ESD, United Nations University,53-70. Jingumae 5-chome. Shibuya-ku, Tokyo 150-8925, Japan.

Dekens, J. (2007a) Local Knowledge for Disaster Preparedness: A Literature Review. International Centre for Integrated Mountain Development, Kathmandu.

Elaine Enarson, P G Dhar Chakrabarti. 2009. Women, Gender and Disaster. SAGA. GeoJournal, 30(2): 127-140

Guarin, G.P.(2003). Flood Risk Assessment for the town of San Sebastian in Guatemala. ITC,International Institute for Geo-Information Science and Earth Observation, MSc Thesis , Enschede, The Netherlands. 1-loes, O; Frans van Kruiningen.(2005). Risk assessment to quantify the interaction between land use and water management, ERSA-congre ss. Amsterdam.

Junk, Wolfgang J., Peter B. Bayley, and Richard E. Sparks. "The flood pulse concept in river-floodplain systems." Canadian *special publication of fisheries and aquatic sciences* 106.1 (1989): 110-127.

Marfai, M,A.(2003). GIS Modeling of River and Tidal Flood Hazards in a Waterfront City : a Case Study in Semarang City, Central Java, Indonesia. ITC, International Institute for Geo Information Science and Earth Observation. MSc Thesis, Enschede, The Netherlands.

McCall. M.K.(2004).Can Participatory GIS Strengthen Local-level Spatial Planning ? Suggestion for Better Practice. Dept. of Urban & Regional Planning and Geoinformation Management, ITC, International Institute for Geo-Information Science and Earth Observation. Enschede, The Netherlands.

Mercer, Jessica, et al. "Framework for integrating indigenous and scientific knowledge for disaster risk reduction." *Disasters* 34.1 (2010): 214-239.

Mitigation and Recovery. Paper Prepared for a Panel on World Views and Belief Systems at the 23rd Annual Natural Hazards Research and Applications Workshop, Boulder,Colorado, 12-15 July 1998

Montello, D. R. and Sutton, P. C (2006). An Introduction to Scientific Research Methods ¡n Geography. Sage Publication. Inc. 2455 Teller Road, Thousand Oaks, California.

Parker,D.J (ed). (2000). Floods, Volume I., Routledge, London, UK.

PSDA, (2003). Draft System Planning, East Banjir Kanal Planning Project, Semarang City.

Quan,J :Oudwater, N:Pender, J. and Martin. A (2001). GIS and Participatory Approach in Natural Resources Research, The University of Greenwich.

Reacher, M., et al. "Health impacts of flooding in Lewes: a comparison of reported gastrointestinal and other illness and mental health in flooded and non-flooded households." Communicable disease and public health/PHLS 7.1 (2004): 39-46.

Richards, Rebecca T., Jeanne C. Chambers, and Christopher Ross. "Use of native plants on federal lands: policy and practice." Journal of Range Management (1998): 625-632.

Shaw, Rajib, Anshu Sharma, and Yukio Takeuchi. Indigenous knowledge and disaster risk reduction: From practice to policy. New York, NY, USA: Nova Science Publishers, 2009.

Shaw, Rajib, et al. "Disaster education: an introduction." *Community, Environment and Disaster Risk Management* 7 (2011): 1-22.

Shaw, Rajib, ed. Community *based disaster risk reduction*. Vol. 10. Emerald Group Publishing, 2012.

Smith, K, and Ward, R, (1998). Floods Physical Processes and Human Impact: Published by John andWiley and Son LTD., West Sussex. England

Tobin, Graham A. *Natural hazards: explanation and integration*. Guilford Press, 1997.

Twigg, John. *Disaster risk reduction: mitigation and preparedness in development and emergency programming*. Humanitarian Practice Network, Overseas Development Institute, 2004.

Undang Undang Republik Indonesia Nomer 24 Tahun 2007 Tentang Penanggulangan Bencana

United Nations International Strategy for Disaster Reduction (UNISDR). 2010. ―Policy Brief 3: Strengthening Climate Change Adaptation through Disaster Risk Reduction‖. Geneva, United Nations.

Ward, Roy C. "Floods- a geographical perspective." *Publ. by: Macmillan* (1978).

Wisner, B. (1998) World Views, Belief Systems, and Disasters: Implication for Preparedness,

Wisner, B.; Luce, H.R. (1993) ‘Disaster Vulnerability: Scale, Power and Daily Life’. In

Yevjevich, Vujica. "Water and civilization." *Water international* 17.4 (1992): 163-171.

Chapter 3
Research Area and Methodology

This chapter is contain general information of Semarang City including demographic and climate, social and economic condition, and also description about three research area. In the end of this chapter will explain about the methodology used in this research.

3.5 General Information of the Semarang City

Semarang is located in the northern part of Central Java about 558 km east of Jakarta. Geographically located at coordinates 6º58' Latitude and 110º25' Longitude (Figure 3.1) and located very close to the north coast of Java. Administrative boundaries of Semarang are west to Kendal, east to Demak, south to Semarang Regency and north bounded by Java Sea coastline with a length of 13.6 kilometers.

Figure 3.1: Location Map of Semarang City
Source: www.semarangkota.go.id

The city has a tropical climate with two seasons, rainy and dry. Marfai and King (2008a) revealed annual rainfall of about 2065-2460 mm with maximum rainfall in December and January, the general temperature 24 – 30º C with an average of 28,4º C per year. Currently, the city has a total area of Semarang 373.67 km2 the number of population of about 2 million, making Semarang is the fifth largest city in Indonesia (Kota Semarang Dalam Angka: 2011).

Table 3.1 Characteristics of the Semarang City

Characteristics of the Semarang City	
Geographic location	6º58' Latitude 110º25' Longitude
Boundaries	West to Kendal East to Demak South to Semarang Regency North bounded by Java Sea
Area	373.67 km^2
Population	1,506,924 (census 2010)
Average temperature	28,4º C
Elevation	0.75-348

Source: semarangkota.go.id

Semarang as this administratively divided into 16 sub-districts and 177 villages. Of the 16 existing sub-district, there are two sub-districts which has the largest area Mijen Sub-district with an area of 57.55 km^2 and Gunungpati Sub-district with an area of 54.11 km^2. Both the sub-district is located in the southern part of the region and mostly hilly territory is which still has the potential of agriculture and plantation. While the Sub-district that has the smallest area is the Semarang Selatan Sub-district, with an area of 5.93 km^2 followed by the Semarang Tengah Sub-district, with an area of 6.14 km^2.

In the process of its development, the city of Semarang is strongly influenced by its natural state forming a city that has a characteristic, called the City of Mountains and City of Beach. In mountain areas have a height of 90-359 meters above sea level while in low-lying areas have a height of 0.75 to 3.5 meters above sea level. Semarang city has a geostrategic position because it located on the path of economic traffic of Java Island, and Central Java is a development corridor which consists of four vertices gate the North coast corridor; South corridor towards the vibrant cities such as Magelang regency, Surakarta is known as Merapi-Merbabu corridor, East corridor toward Demak / Grobogan; and West towards Kendal. In the development and growth of Central Java, Semarang City is very instrumental especially with the ports, overland transport network such as rail and road as well as air transport is the potential for regional transportation node of Central Java and Central Java Regional Transit City. Another position that is not less important is the strength of the relationship with the outside Java, directly as the center of the central part of the national territory.

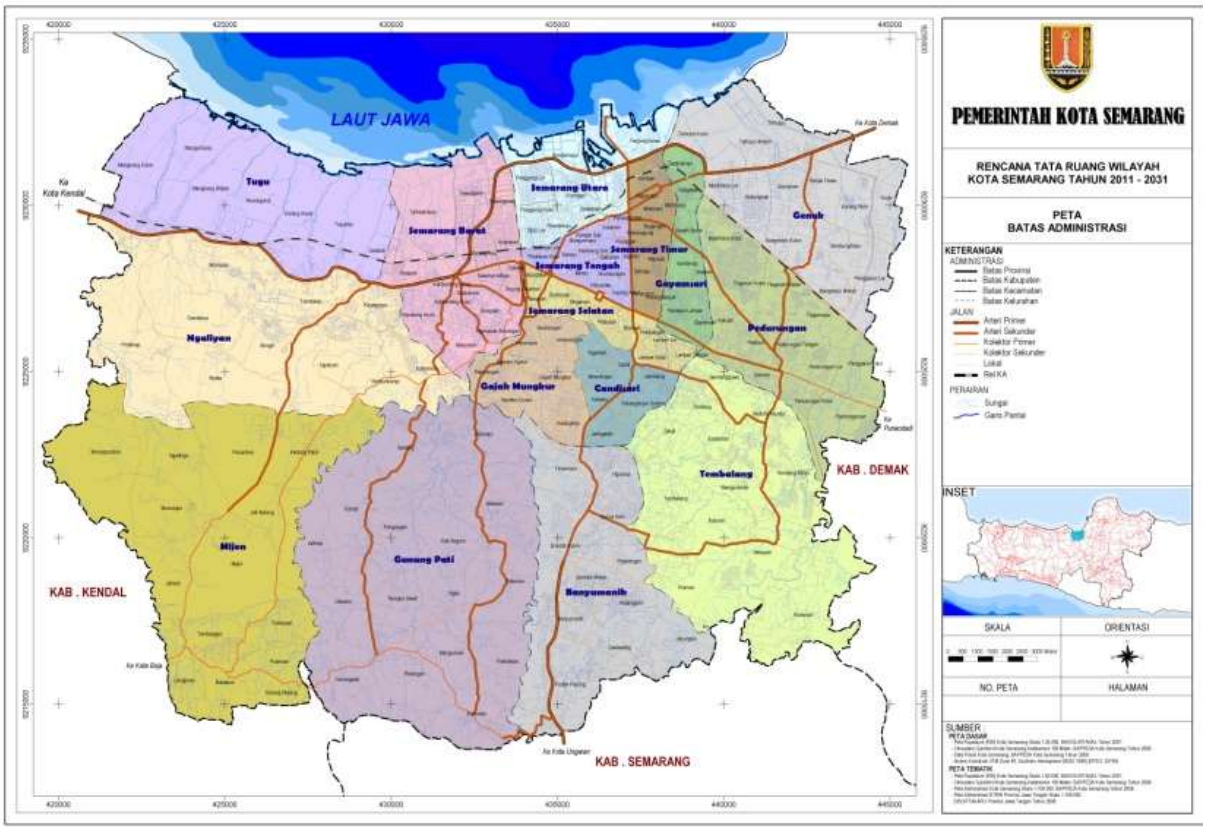

Figure 3.2 Administrative Map of Semarang City
Source: www.semarangkota.go.id

3.5.1 Topography and Climate

Topographically Semarang consists of the hills, plains and coastal areas, thus topography indicate various slope and protrusion. Semarang City Region is located between 0 to 348.00 meters above sea level. In topography consists over coastal areas, plains low and hilly, so it has an area called the lower city and the upper city. In the hilly areas have 90.56 to 348 heights from sea level represented by the high point located at the Jatingaleh and Gombel, Semarang Selatan. On the other hand the lowest level located in the Sub-districts of Tugu which have a height 0.75 meters above sea level.

The map in figure 3.3 shows that the beach area 65, 22% of its territory is plains with a slope of 25% and 37.78% is an area hills with 15-40% slope. Ground slope conditions Semarang City is divided into 4 types slope is the Slope I (02%) includes the Sub-district Genuk, Pedurungan, Gayamsari, Semarang Timur, Semarang Utara and Tugu, as well as some areas of Sub-district Tembalang, Banyumanik and Mijen. Slope II (2-5%) include Sub-district Semarang Barat, Semarang Selatan, Candisari, Gajahmungkur, Gunungpati and Ngaliyan, Slopes III (15-40%) consisting region around Kaligarang and Kali Kreo (Gunungpati Sub-district), partially Sub-district Mijen (area Wonoplumbon) and part of the Banyumanik Sub-district, and the Candisari Sub-district.

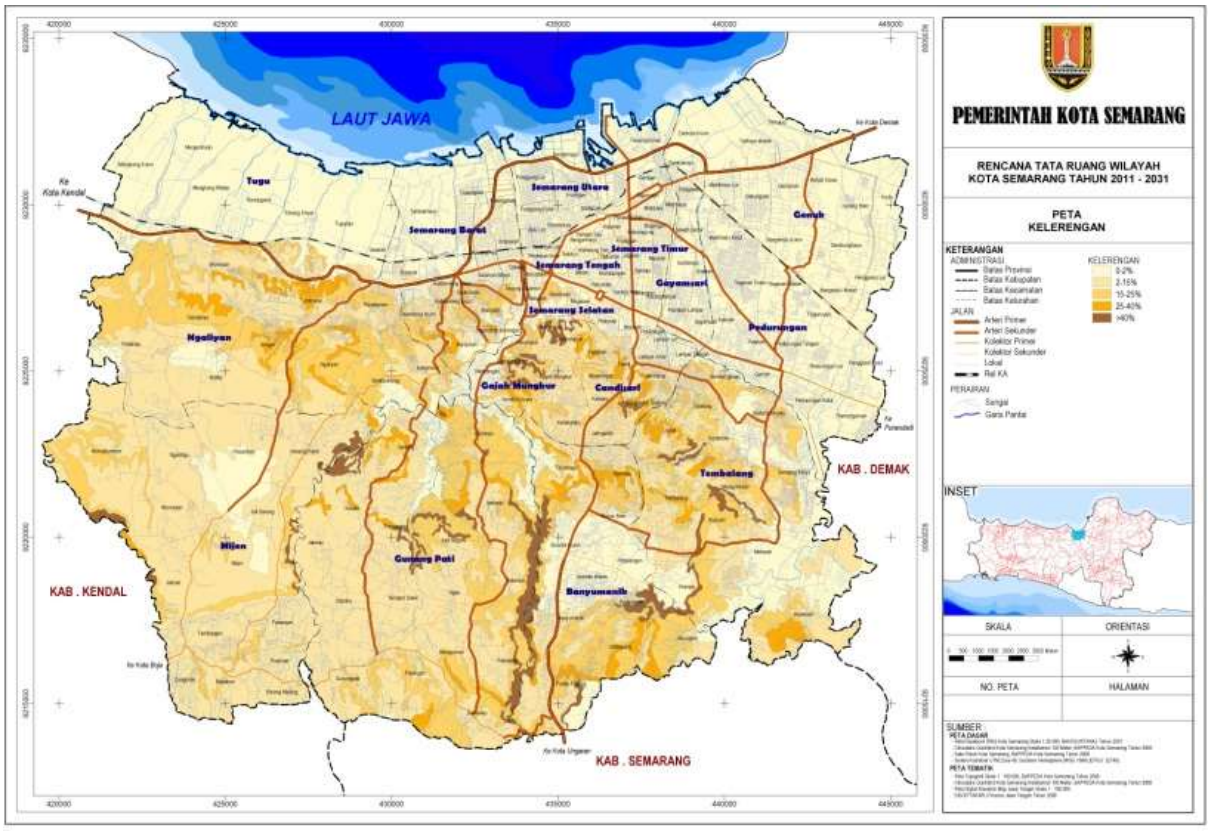

Figure 3.3 Slope Map of Semarang City

Source: www.semarangkota.go.id

While the slope IV (> 50%) include most of the Banyumanik Sub-district (southeast), and parts of Gunungpati Sub-district, especially around Kaligarang and Kali Kripik. Lower City is largely soil composed of sand and clay. Use of the land is more widely used for roads, settlements or housing, building, industrial areas, ponds, and paddy fields. In contrast to the hills or Upper City the geological structure mostly consisting of igneous rocks.

Semarang is strongly influenced by the state of nature it is forming a city which has a characteristic that is comprised of hills, plains and coastal areas. Thus, the topography of the Semarang City shows the various slope ranges from 0 to 40% and a height of between 0.75 to 348.00 masl.

Climatologically, Semarang has the general condition in Indonesia, has wet tropical climate influenced by the wind western monsoon and eastern monsoon. From November to May, the wind was blowing from the North West (NW) creating the rainy season bring a lot of steam and rain. The nature of this period is frequent and heavy rainfall and high humidity. More than 80% of the annual rainfall falls in this period. From June to October the wind blows from the South-East (SE) creates seasons drought, because it brings a little bit of moisture. The nature of this period is small fraction of rainfall, lower humidity, and rarely cloud. Based on existing data, distribution rainfall in the Semarang City is not evenly distributed throughout the year, with a total average rainfall 9891 mm per year. It shows the typical pattern of rainfall in Indonesia, especially in Java, which follows the monsoon wind patterns SENW in common. The minimum average temperature measured

in Semarang Climatological Station is 21.1°C to 24.6°C at September and maximum average temperature varies from 29.9°C to 32.9°C in May. The average monthly humidity varies from a minimum of 61% in September to a maximum of 83% in in January. The average monthly wind speed in Semarang Climatological Station varies from 215 km/day in August to 286 km/day in January. The duration of sunshine, which shows the ratio actually up. The maximum duration of sunshine a day, varies from 46% in December to 98% in August.

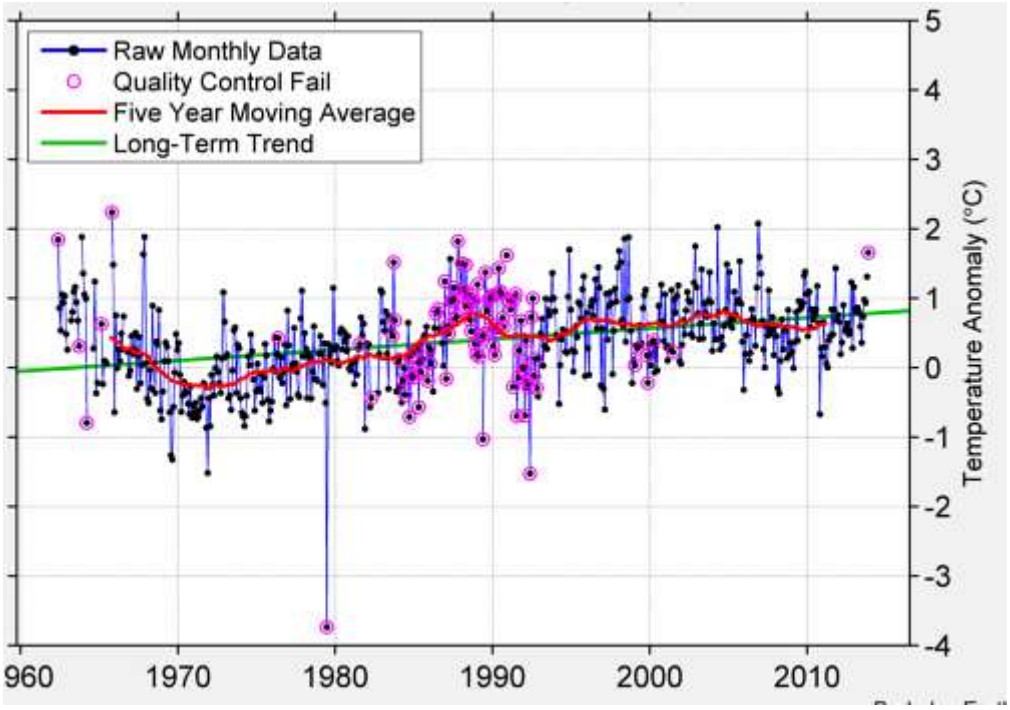

Figure 3.4 Average Temperature in Semarang City 1960-2010
Source: semarangkota.go.id

3.5.2 Social and Economic Characteristic of Semarang City

Demographically, according to statistics the population of Semarang City period 2006-2010, an average increase of 1.4% per year. In 2006 were 1,419,478 people, while in 2010 amounted to 1,506,924 people, comprising of 748,515 male population and female population of 758,409.

An increasing number of the population is affected by the number of births, deaths and migration. In 2006 the number of births as much as 19,504 people, the number of deaths as many as 8,172 people, which come as many as 38,910 inhabitants and a population of people who go as much as 29,107 inhabitants. The amount of people who came to Semarang due to the attractiveness of the city as a city of trade, services, industry and education.

Figure 3.5 shows that most of the populations are live in the central part of Semarang City which is shown by the dark color and the highest population density in Semarang City is in the Semarang Timur sub-district.

Nowadays economic development of Semarang grow as the major towns of the province of Central Java, which is the goal of urbanization of rural communities in Central Java region, this is caused by the high urbanization.

Semarang was the destination of urbanization in Central Java, given the development of large and small industries in Semarang. Lack of employment opportunities in the village led to increasing interest of the villagers to relocate. Industry in the city requires a lot of labor that many workers flocked to the city and settled in the city of Semarang with close consideration of the work site. Economic circumstances of different workers, workers who have a high intermediate level of the economy rather stay outside the city center are more comfortable with the facilities planned settlements. For workers with middle-level economy would prefer to live near their work sites. This is what causes the high population density in the Semarang City, whereas land area thinned by the absence of evidence is agricultural land or vacant land as well as the increasing number of hills in Hyderabad which functioned converted to new residential areas. This condition will lead to the emergence of new problems in the Semarang City and surrounding areas.

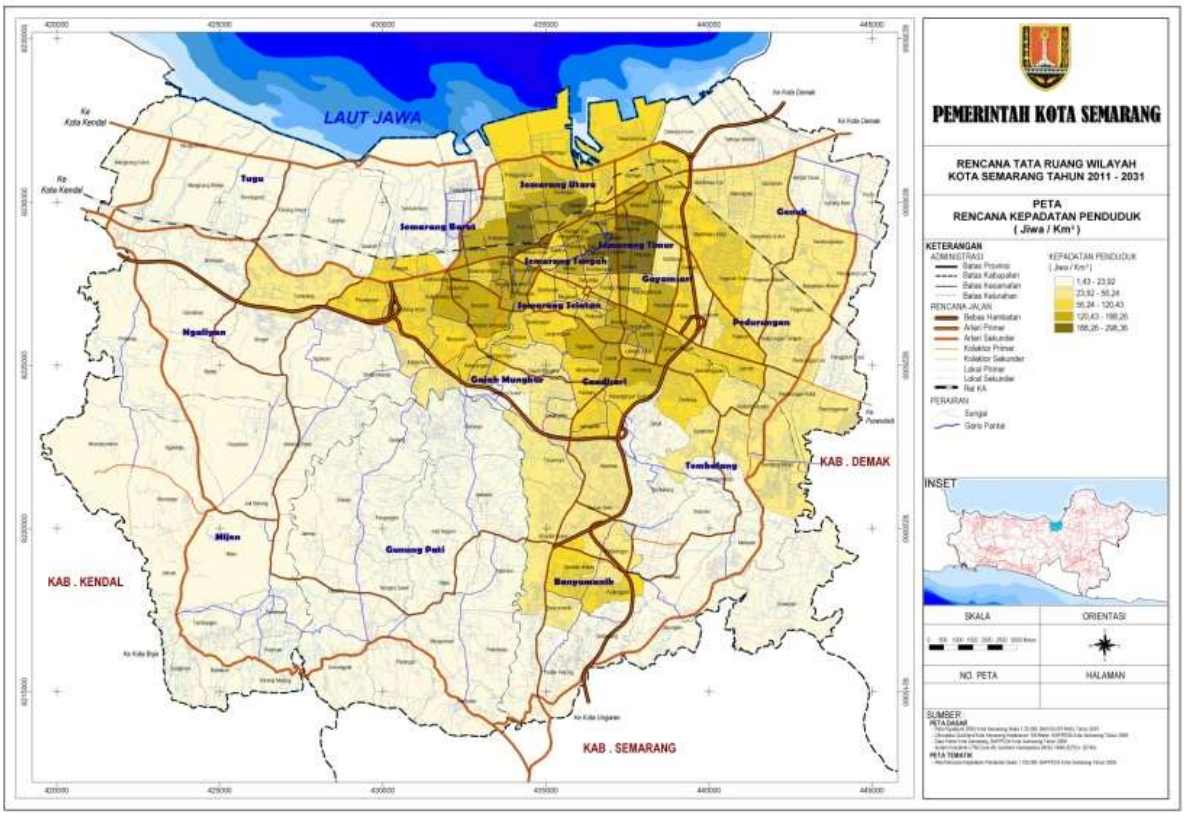

Figure 3.5 Population Density Map of Semarang City
Source: www.semarangkota.go.id

3.6 Flood Disaster in Semarang City

Semarang City has long prone to disasters such as drought, land subsidence, landslides, and floods. Vulnerabilities will continue or increase as climate change. A publication of the study by UNFPA (United Nations Population Fund) and IIED (the International Institute for Environment and Development) states that the impact of global climate change in the city of Semarang seen from the increase in surface temperature, sea level rise and changes in extreme weather patterns.

Some areas in Semarang has been identified as an area that is vulnerable to climate change are as follows: the flooded lowland tidal and sea level rise; settlements along the river prone to flooding; hilly areas prone to high winds; areas that have movement and soil erosion; suburban residential areas away from water sources; central area of movement and transportation (airports, ports, train stations, terminals); regional trade and industrial areas; and protection of the region's history and cultural assets.

Figure 3.6 Floods in February 2014 in Semarang City
Source: antarafoto.com

Research by the UNFPA analyzes Threat Hazard Map issued by BNPB and The Village Potential that is secreted by the BPS. Following their analysis of Semarang is considered at risk. First, Semarang has a beach with low elevation; most of the city of Semarang is located on the Lowland Coastal Zone or LECZ, i.e. regions with a height of less than 10 meters above sea level. Second, a high dependency ratio of the population occurs in most areas with the highest risk of flooding. Population dependency ratio describes the population age group nonproductive, i.e. below 15 years and above 64 years. This relationship is very important to understand that groups of young people and the elderly are very vulnerable to the impacts of flooding and waterlogging. The challenge is to evacuate to the age group if a disaster occurs and the likelihood of flooding and waterlogging disease.

Third, the risk of flooding is highest in areas with the highest population density as well. About 840,000 inhabitants live in Semarang lowlands with an average population density reaches 10,201 people/km2. Most

of the villages with high population density is located in the coastal area and the city center of Semarang, as Bangunharjo, Jagalan, Sarirejo, and Rejosari. This leads to the need for evacuation strategy preparation and provision of temporary shelter.

Figure 3.7 Flood Prone Area Map of Semarang City
Source: BNPB Semarang

Figure 3.7 shows that almost 50% of the area in the Semarang City are vulnerable to flood. The area along coastal area which are Sub-district of Semarang Utara, Semarang Barat, Gayamsari, Semarang Timur, Genuk and Pedurungan are prone to the coastal and inundation flood. Meanwhile, the area where located in the central part of the city which are Tugu, Gajahmungkur, Candisari and Gunungpati also affected by river flood. On the other hand, there are some area which is affected by river flood and inundation flood included Tugu, Semarang Timur and Gayamsari.

Since the 1990s, the city, especially in the northern part of the coast and some areas lowland population increased and with rapid urbanization (Marfai and King, 2008b). Increasing the number of buildings construction as a result of population growth will lead to increased building load resulting in subsidence. According to Friedrich rich et al. (2010) many of the buildings in the city Semarang affected by land subsidence because of excessive ground water extraction and burden of high land for settlement.

Due to the rapid growth of population and industrialization in the Semarang City, one of the impacts is groundwater over extraction. According to data provided by Ministry of Public Works the demand of water supply was 57.28 million m^3/yr and75.89 million m^3/yr in 1995 and 2000 respectively. To meet the demand of water, the people are using the groundwater. So, it causes the land subsidence in the Semarang City and the sinking area is gradually increasing year by year (Marfai and King,2007). They estimated the increase of sinking area is from 362 ha in 2010 to 1,377.5 ha in 2015 and 2,227 ha in 2020.

Fourth, changing rainfall patterns and rising temperatures have a significant impact on soil stability and increased incidence of landslides. Generally metropolitan area in Semarang has a relatively small risk of landslides, but for the hills in Semarang district, a significant risk of landslides.

In addition, there are two main things besides facing Semarang sea level rise resulting tidal flood, is land subsidence. Last only land there already down 10 cm. The years ahead could be getting down again; some researches assumed that the land subsidence caused also by the rainfall pattern is indeterminate and rising sea water intrusion due to higher sea levels.

Semarang vulnerability to catastrophic impacts of climate change makes the city an urban study climate change by UNFPA and NCCC (National Council on Climate Change). The results of this analysis become a reflection of the other urban cities in Indonesia to look for.

Table 3.2 Annual Averages Economic Loss due to Flood in Semarang City 2010

Assesment Aspects	Year 2007 (USD)	Year 2010 (USD)
Housing	500	5000
Productivity	100	1080
Education	0	111
Health	0	1.44
Total	600	1135.4

Source: Bintari (2011)

Tidal flooding in Semarang in addition to causing damage to infrastructure and residential areas, also have an impact on people's lives, household and individual basis simultaneous (Marfai and King, 2007). Continuing impact that will result from tidal inundation is increasing the rate of erosion, changes in the condition of coastal ecosystems, pullback shoreline, increasing damage buildings near the beach and disruption resident activity in residential areas, aquaculture and industrial. with reason mentioned above, it is important to do This research, to be known extent of the area to be inundated by rob in 2015 and 2030, both of which caused by sea level rise and land subsidence, so it can be arranged a plan to cope with or reduce the impact caused by coastal flood.

3.6.1 River Flood in Semarang City

Flooding is a natural phenomenon that often occurs and facing all countries in the world. The phenomenon of flooding caused by the flow of water cannot be accommodated in the bodies of water or rivers that overflowed and flooded the surrounding area. In recent years, the incidence of flooding tends to increase with higher intensity and greater magnitude of flooding. In the city of Semarang, not only flooding caused by the overflow of water from drainage channels due to high rainfall or flooding caused by tides, but it is also affected by flash floods.

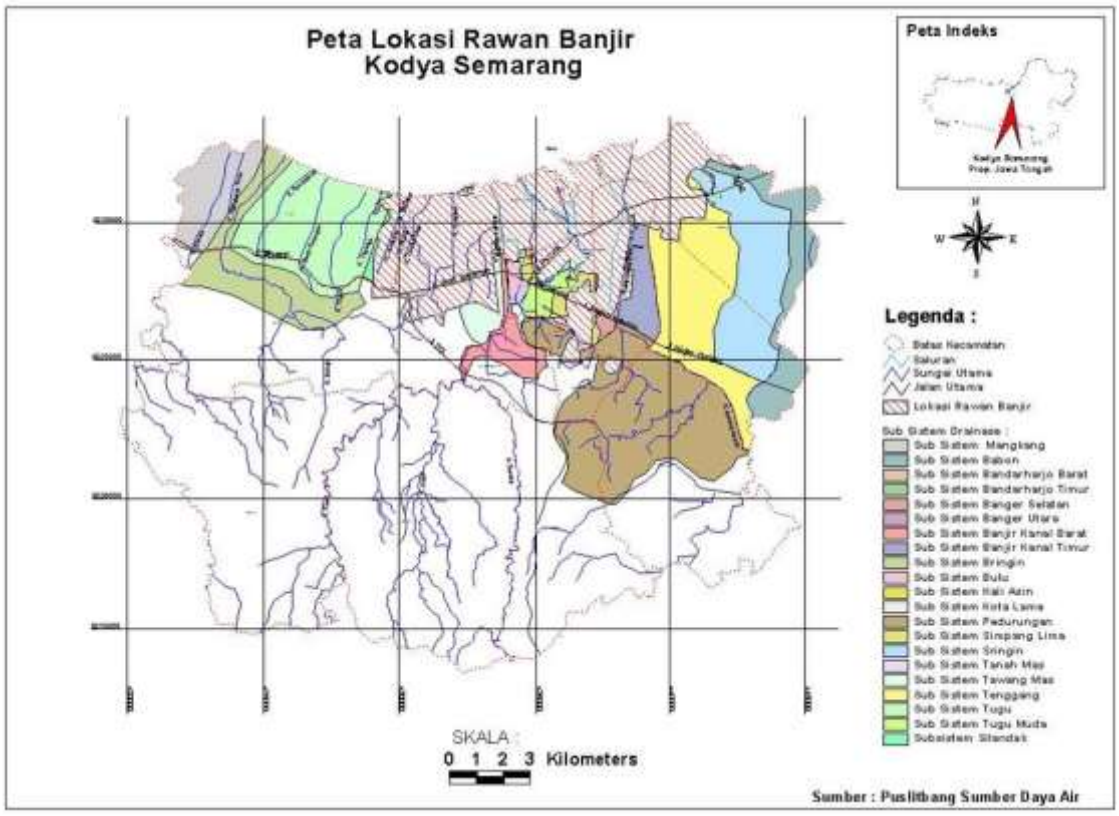

Figure 3.8 Semarang City River System
Source: Puslitbang Sumber Daya Air

According to Kodoatie RJ. and Sjarief R. (2005), there are several things that can cause flooding: changes in land use in the watershed, garbage disposal, erosion and sedimentation, slums along the river and drainage, flood control system planning imprecise, rainfall, influences the capacity of the river, inadequate drainage capacity, tidal influence, land subsidence and flooding, land drainage, building weirs and water, as well as damage to the flood protection structure. In case of flood in Semarang City influenced by some potential factors (Pramono SS, 2002) as follows:

- Geographical characteristics, Semarang have areas of potential flooding due to the high plains differences between the northern and southern regions. This condition occurs because of the flood from the southern region of the City of Semarang and Semarang district.
- Changes in land use from forest rubber into a residential area. In addition to deforestation, land use changes that occurred in the district of Semarang from agricultural areas into a new residential area.
- Hills dissection at some point lead to changes in the pattern of water flow, erosion, and enhance the speed of the water, thus burdening the irrigation area.
- Construction of houses on the banks of the river.
- People behavior. People who live in the river surrounding area used to throw the garbage in the river. These behaviors cause sedimentation in the river-body.

One of the river floods in Semarang City occurred in Banjir Kanal Timur watershed. At first, the Canal enabled to drain flood water from the upper area of Semarang directly to the sea. It means, the water that comes from the Mount Ungaran that flows through several major rivers passed to the Java Sea. According to the design made, both channels function merely that, nothing more. Banjir Kanal Timur not intended as disposal of water from the city. So that the drainage system in the city are made at the time did not lead to the channel it, but directly into the Java Sea (Indriyanto, 2002).

The river is one of the important water sources for Semarang City. The sustainable water supply from the river is, however, hardly secured due to the extremely low flow discharge during the dry season. As a result, Semarang City and its vicinities currently suffer from chronic and severe shortage of the municipal water supply, while flooding is recognized as another major problem.

To anticipate floods, the government needs to make flood control reservoirs because rainfall significantly affects flooding in the Banjir Kanal Timur. They also proposed that the government also needs to increase the capacity of the river channel downstream of the flow because the capacity is now only able to cope with the flood period of 15 years. No less important, the government needs to disseminate early warning models, specifically for flood flash, because floods are very huge catastrophe.

In addition to disaster data, it also had to get a track record of Banjir Kanal Timur Watershed when floods. One of the expert of hydrology study says that there is a big flood cycle of ten years, five years, and three years. With the experience of the existing flood, we should have time to do the rescue of the threat of sedimentation, so that when there is a large accumulation of water that does not have a negative impact on the bottom region. In this case handling should be integrated, given its presence not only in one area just because it is located in Semarang Timur Sub-district.

Currently, it's time to conserve the region upstream to downstream areas not affected by flooding. Regardless, it was stated not as easy as it to make it happen. The character of the community and government at different upstream and downstream, given the development needs and interests of the other. Clearly, it takes an understanding that both can run and Banjir Kanal Timur Watershed back to recover from damage is fairly severe.

3.6.2 Coastal Flood in Semarang City

Floods have many impacts not only physical, social, economic but also on environment. Physical impact is the damage to both private and public facilities. Social impacts include death, health problems, traumatic, and economic declining.

Flood tide is one of the phenomena of the natural disasters that frequently occur in the coastal area of Semarang. The impact of flooding "rob" the greater concurrently with changes in land use in coastal areas and land subsidence in coastal area this. In the future, the impact of tidal flooding is predicted even greater for scenarios of sea level rise as the effects of global warming. Tidal flooding caused considerable influence on society Semarang, especially those residing in coastal comrades. Even coastal tidal flooding will be more severe with rainwater or flood, and local flooding caused by poorly maintained drainage channels.

In this condition the public still adapting to survive in the existing environment, no wonder the northern coastal city of Semarang society still choose to stay in the area even though the area is not convenient to residential. The things that motivate people to stay in the area, according to the research community due largely industrial workers and livelihood as fishermen, so reluctant to move because it feels are closer and easier if staying in the area. Semarang coastal communities in this area is assessed has also made some adaptations to coastal flood by making a dike and permanent levees, add street level around the house and some residents have taken the initiative to make a house on stilts. To reduce the impact of floods rob, community coastal areas need to be done in a comprehensive prevention program that involves the government and society.

The same thing also recognized by Aris Marfai (2010), the phenomenon of tidal flooding in Semarang coastal area is the result of various processes of land use change in the coastal area with the construction of ponds, swamps and rice fields can be used to naturally accommodate the tide has changed and now land into residential, industrial and other uses. Changes in common uses of this land is done by elevating the hoard and ponds, swamps and rice fields for a variety of other uses, so that when the ocean tide cannot be accommodated anymore and then inundate lower areas.

Mentioned Aris, from about 790.5 land in the northern districts of Semarang no longer farm land, and a total of about 585 acres of land in the western districts of Semarang are only around 126.5 hectares of farm land.

While the process of land subsidence face of the land in coastal areas, according to Aris, highly variable ranging from 2 to 25 centimeters per year. Even in Bandarharjo, Tanjung Mas and partly Terboyo Kulon village reached 20 cm per year. The sea level rise as the effects of global warming, between 1990 to 2010 is predicted to Aris Marfai will increase the average temperature of the earth's surface by 5.8 degrees Celsius. Global warming will lead to changes in Earth's climate, and sea level rises one meter.

3.7 Characteristic of the Study Area

As describe in the figure 3.7, there are some area which are affected by river floods as well as coastal floods in Semarang City. In this city there are three types of flooding, which is coastal flood, river flood and inundation flood. Of the three, coastal flood is the most dangerous. This research will focusing on two kind of floods in three different area. This research conducted in three sub-districts, which are: Tugu and Genuk sub-district for coastal flood and Semarang Timur for river flood. The population distribution and the population density for each village are showed in the figure 3.9.

Tugu and Genuk Sub-district are the most affected area caused by coastal flooding. On the other hand, Semarang Tengah, Pedurungan and Semarang Timur sub-district are affected by river floods. But since 2013 when the polder construction in the river mouth in Semarang Utara, flooded areas in Semarang Tengah and Pedurungan sub-district decreasing. Meanwhile, the flooded area in Semarang Timur is increasing because the river branch in the Semarang Tengah and Pedurungan is closed so water come to the branch which located in the Semarang Timur Sub-district. Since river branch in Semarang Timur is not big enough to collect the water, during rainy season in last February 2014 it was overload and caused very big flood.

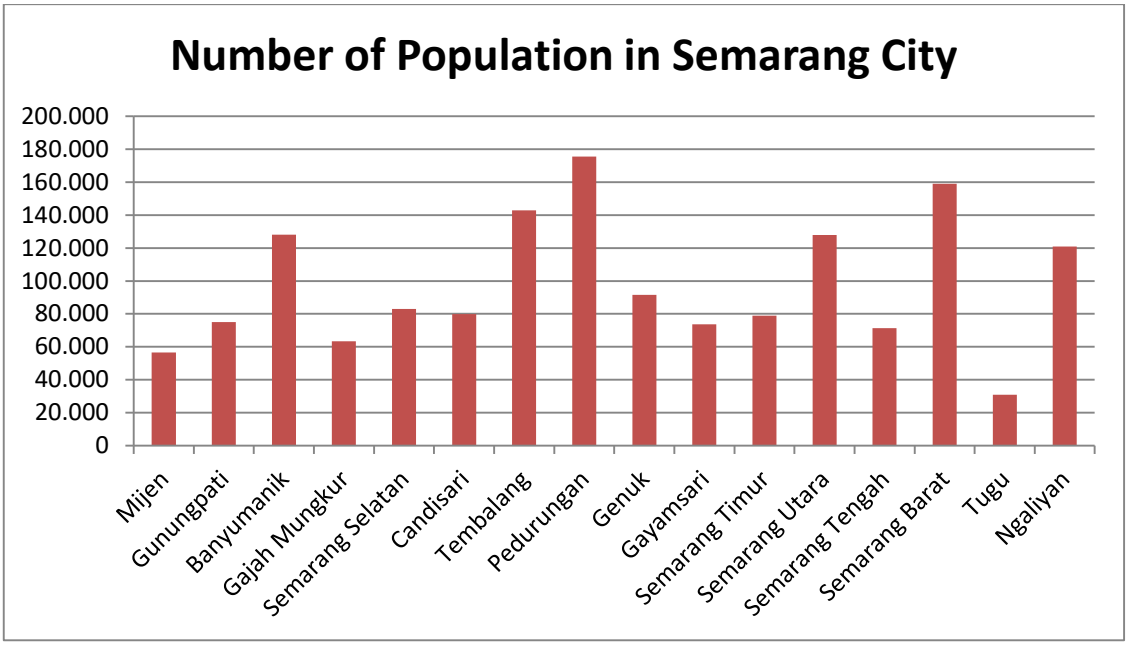

Figure 3.9 Population Number in Semarang City

Source: Semarang City in Figure: 2011

Figure 3.9 describes the number of population in the Study Area including the three research area. The areas which are prone to flood are mostly high populated. In some cases the number of population in Tugu and Semarang Utara has been decreased since the inundation are cannot be tolerated so people are relocated to a new shelter provided by Semarang City government located in Gayamsari.

3.7.1 Kecamatan Semarang Timur

Semarang Timur located in the central part of Semarang City. This is the most populated area in Semarang City with 82,588 of population in 2010 (Kecamatan Semarang Timur in Figure: 2011). This Sub-district consist of 10 villages.

Semarang Timur was originally built upon a trash dump site in the industrial district of the port area. The Sub-district is dominated by an oil refinery, a large tidal pond (of stagnant water), a major railway line, a river and drainage canal all crisscrossing it. In between these features are located urban poor housing.

These settlements are very close to the edge of the sea and suffer from abrasion, flooding from the river during the rainy season, sea-level rise and most acutely from subsidence. One area visited suffered from 10cm subsidence a year, provoking the resident to continually invest in rebuilding their homes as they sink into the ground. For the resident however the location is very strategic as it provides access to port area wage paying jobs, such as porters, where the majority of the population lives.

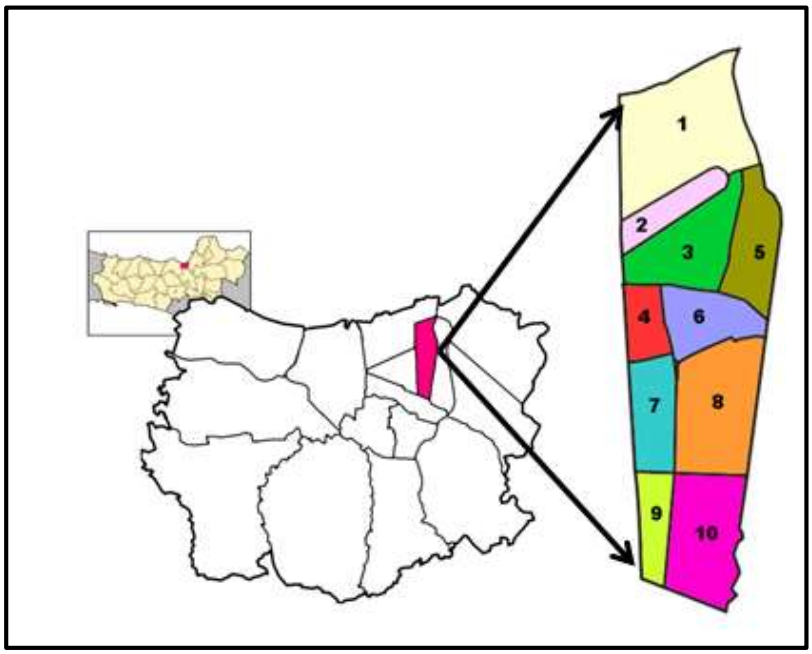

Figure 3.10 Administrative Map of Semarang Timur Sub-District
Source: semarangkota.go.id

Figure 3.11 Semarang Timur in Figures

3.7.2 Kecamatan Tugu

Kecamatan Tugu located in the North West part of Semarang City along the sea line. Tugu Sub-district devided into seven villages with 26,454 of population in 2010 (Kecamatan Tugu in Figure: 2011).

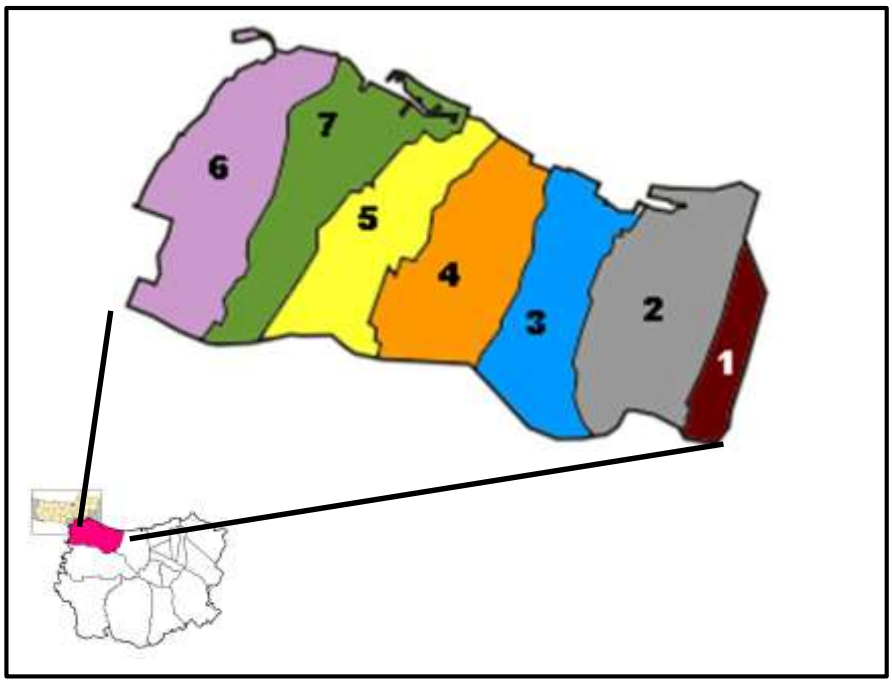

Figure 3.12 Administrative Map of Tugu Sub-district
Source: semarangkota.go.id

Kecamatan Tugu occupies a large area on the coast the vast majority of which is made up of tidal flats used for agriculture and fish and shrimp farming. It appears to be largely a rural community other than a linier settlement that follows the access road.

Figure 3.13 Tugu in Figures

Abrasion is the major environmental hazard and the area is directly in the way of sea-level rise given its low level and proximity to the sea. The local fish or shrimp market suffered from a drop to prices in 2000, since the developing home industries related to shrimp related products. It is very isolated from the city and access and service are limited.

3.7.3 Kecamatan Genuk

Kecamatan Genuk located in the North East of Semarang City with 13 villages. The number of population in this Sub-district in 2010 was 77,196 (Kecamatan Genuk in Figure: 2011).

Genuk Sub-district has a strategic location in the northern part of Semarang and traversed by paths Pantura (North Coastal Line). Having traversed Sentra Industry Having Sentra Industry Genuk traversed path close to the coast and harbor make Genuk as one district that is focused on the development of the industry. Hopefully with this industry may provide more revenue for the Genuk Sub-district.

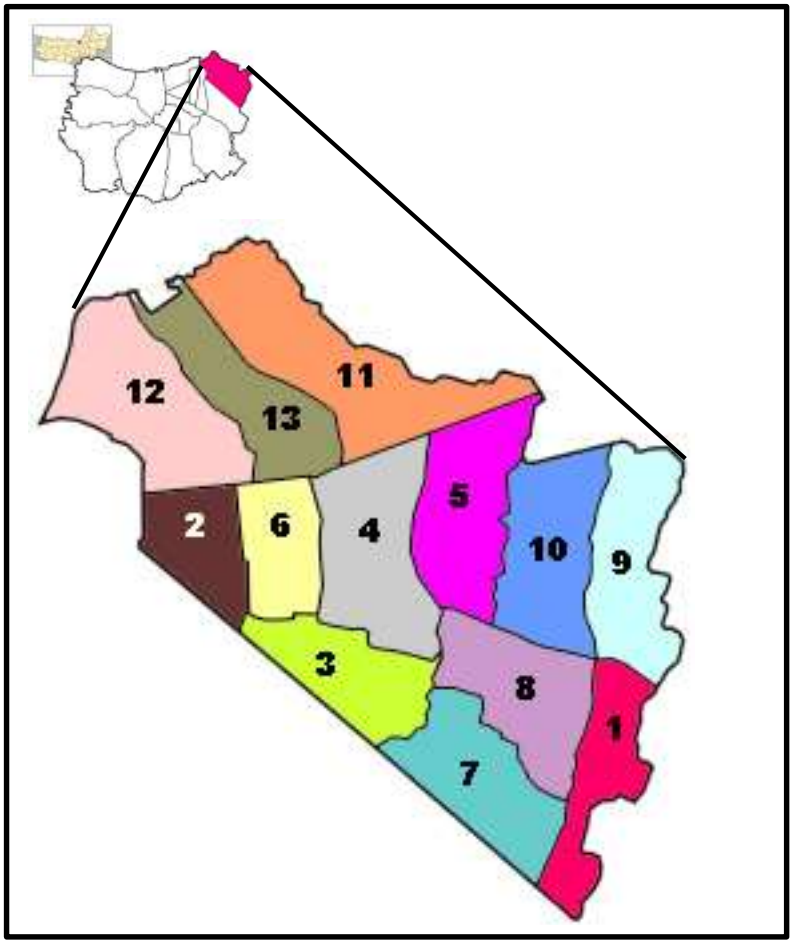

Figure 3.14 Administrative Map of Genuk Sub-District
Source: semarangkota.go.id

Figure 3.15 Genuk in Figure

One of the problems in Genuk Sub-district is prone to disasters which are flood and land subsidence. Genuk Sub-district often has tidal flood due to low contours, poor drainage and sanitation make the Genuk prone to tidal flooding every year. The existence of the industry does not necessarily make its own benefits but also have negative impacts in the form of solid and liquid wastes. As well as the bustling coast path traversed large vehicle impacts of air pollution in the environment result in poor in northern part of Genuk Sub-district.

3.8 Methodology

To answer he objectives of this research is by using correlation analysis among community perception, adaptation and action. From this correlation it can be categorize the level of community participation to community based disaster education.

The research pf community based analysis is focused on identifying the level of community perception, adaptation and action and how each process influences the other. In order to achieve the goals of this research, the methodology used in this research is divided into three main phrases: (1) Pre-Field, (2) Field Work and (3) Post-Field.

3.8.1 Pre-Field

In this pre-field phrase, conducted literature review to strengthen the concept of this research. The literature review activity consisted of problem definition, research objectives and research question, study area delineation, the identification of the required and data availability.

3.8.2 Field Work

The two main activities of the fieldwork phrase are the additional secondary data collection and the primary data collection. The fieldwork was conducted in June-July to collect primary data by doing interviews with community and to verify the secondary data used for the pre-field phrase such as maps and research location.

In this case, there is changing on research location because the previous research location is not flooded anymore.

A survey on flood impact and community knowledge was conducted during the fieldwork. A hundred and twenty eight household within flood prone area both for coastal and river flood residential areas were identified and details of housing damage ever happened were sought and entered into database.

A hundred and twenty eight household of the respondents located in three sub-districts which are Kecamatan Semarang Timur, Kecamatan Tugu and Kecamatan Genuk and five villages called Kelurahan were selected using purposive multy-stage area sampling. This methodology of sample selection intended to get the desired unit of analysis. This methodology enables each of household in the study area has the same change to be selected. The household-basis interview was intended to collect information about the people knowledge about flood in their area. This information is considered as important information in order to understand do the community knowledge about flood have correlation to the community preparedness and action to the flood.

Table 3.3 Questionnaire Structure

No	Variable	Number of Questionnaire	Question Number	Clacification Level
1	Background Information	12	1,2,3,4,5,6,7,8,9,10, 11,12	
2	Community Knowledge	6	13, 14, 15, 16, 20, 22	Low: 1-2 Medium: 3-4 High: 5-6
3	Community Preparedness	4	23, 24, 25, 29	Low: 1 Medium: 2 High: >2
4	Community Action	7	31, 32, 33, 36, 38, 43, 45	Low: 1-2 Medium: 3-4 High: >4

A housing and household questionnaire was completed confirming the presence or absence of flooding at the address. If flooded, the level of flood depth was measured based on how many meter water entering the house. The distance between their house and river or coastal area was measured as the limitation. An interview of the individuals who were normally full-time residents at the study area and present there at any time during the flood was taken. Based on personal observation during the interviews, the local community in the surveyed villages had given good response toward the research. Generally, there was no difficulty to interact with the local people in the study area.

During the fieldwork time, consultation and discussion with some officials from related local authorities were held. An interview with officials of the related local authorities was conducted. Interviews with some officials

from Local Planning Agency (BAPPEDA) and Local Disaster Management Agency (BNPB) to collect information related with flood within the city, especially in the study area of sub district Semarang Timur, Tugu and Genuk. An interview was also held with the local community leaders, the leaders of RT. RW and representatives from local government officer in Kelurahan, as well as with the Head of Semarang Timur, Tugu and Genuk Sub-districts.

3.8.3 Post-Field

The post-field phase is the final phase in this research. The post-field phase is come up with the conclusions and recommendations which will be discussed more detail in chapter 4 and 5.

Data collected during preparation and fieldwork phase were analyzed according to the purpose of this research. Questionnaires were double checked for differences and corrected. And individual and housing records linked using SPSS software. The main variables collected from the households interviews such as : height of water level during flood, and the duration. flood history, coping mechanism, and the socioeconomic were analyzed.

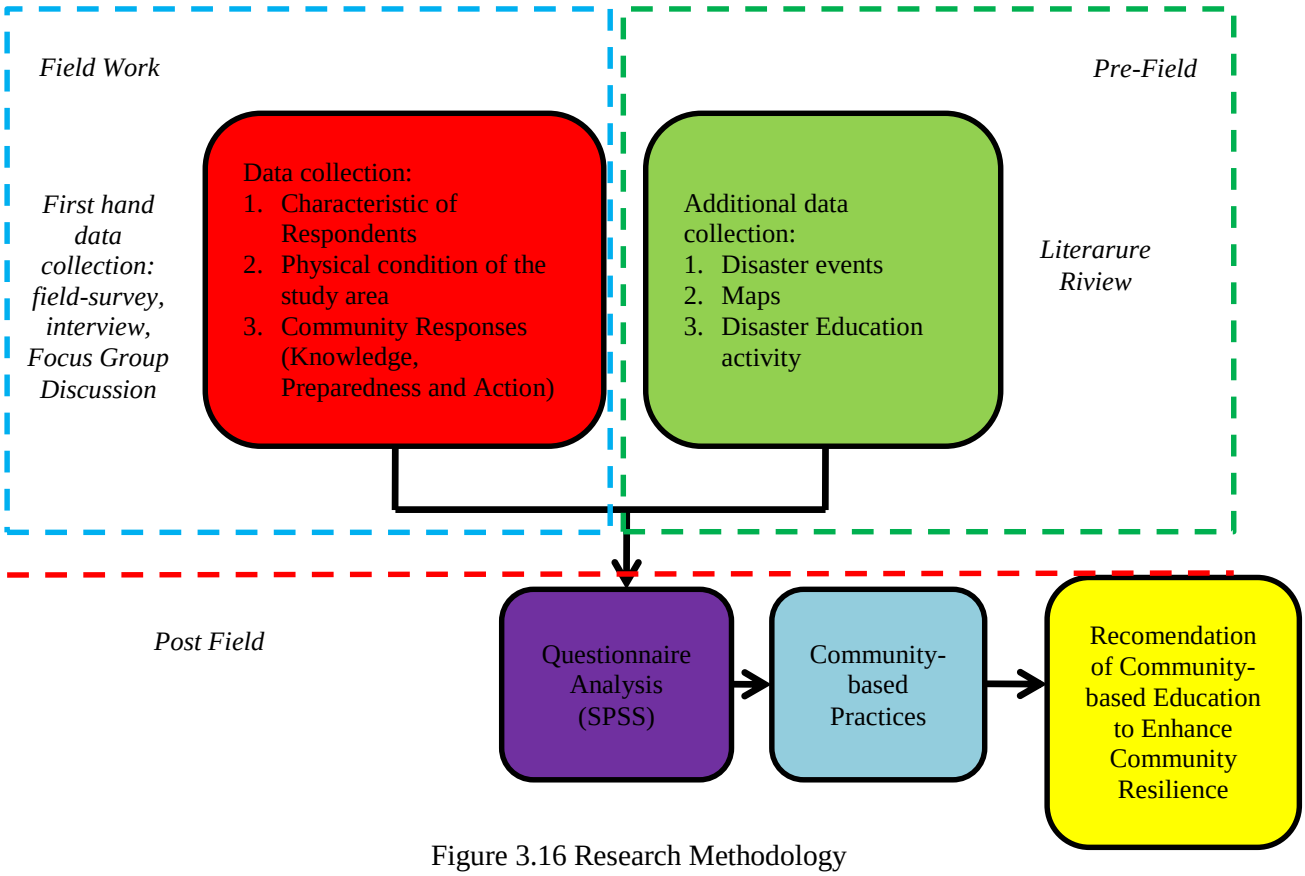

Figure 3.16 Research Methodology

References

Bintari. 2007. Kajian Kerugian Ekonomi Akibat Banjir di Kelurahan Kemijen Kota Semarang. Semarang

CC-ROM IPB for Mercy Corps Indonesia, 2010. Vulberability and Adaptation Assessment to Climate Change at Semarang City.

Dewi, Anggraini. "Community-based analysis of coping with urban flooding: a case study in Semarang, Indonesia." *International Institute for Geo-Information Science and Earth Observation, Msc Thesis, Enschede, The Netherlands* (2007).

DKP, 2008. Strategi Adaptasi dan Mitigasi Bencana Pesisir sebagai Akibat Perubahan Iklim terhadap Pesisir dan Pulau-Pulau Kecil. Jakarta

Harsastro,Priyatno.(2012).Desentralisasi dan Kerjasama Pemerintah- Swasta.Semarang:Forum, Majalah Pengembangan Ilmu Sosial.

Kodoatie, Robert J., and Roestam Sjarief. *Tata ruang air*. Penerbit Andi, 2010.

Marfai, Muh Aris, et al. "Natural hazards in Central Java Province, Indonesia: an overview." *Environmental geology* 56.2 (2008): 335-351.

Network, Asian Cities Climate Change Resilience. "Responding to the urban climate challenge." Boulder, Colorado, USA (2009).

Pramono, Sigit Setiyo. "Analisis Penyelesaian Masalah Banjir di Kota Semarang Dengan Pendekatan Sistem Peringkat Komunitas (SPK)." Jurnal Desain dan Konstruksi 1.2 (2002): 108-115.

Statistik, Badan Pusat. "Kecamatan Genuk Dalam Angka." (2011).

Statistik, Badan Pusat. "Kecamatan Semarang Timur Dalam Angka." (2011).

Statistik, Badan Pusat. "Kecamatan Tugu Dalam Angka." (2011).

Statistik, Badan Pusat. "Kota Semarang Dalam Angka." (2011).

Sutarto, Ratri, and Jim Jarvie. "Integrating climate resilience strategy into city planning in Semarang, Indonesia." ISET− International (2012).

Taylor, John. "Community-based vulnerability assessment: Semarang, Indonesia." Resilient Cities. Springer Netherlands, 2011. 329-337.

Chapter 4
Flood Coping Mechanisms in Semarang City

This chapter contains the result of the research. The analysis of the questionnaire, correlation analysis, key findings from interview with stakeholders and focus group discussion will be described in this chapter.

4.4 Introduction

One of the objective in this research is to identify and analyze community respnose and its relation to their knowledge, preparedness and action level. In order to understand better the level of community knowledge, preparedness as well as community action to the flood in Semarang City. Furthermore, some recommendation can be proposed to give an input to the government and community in order to enhance community resilience to the flood disaster.

4.5 Community Response to the Flood

In this research, some research activity such as questionnaire survey, interview, and Focus Group Discussion are conducted to have describesation about community response to the floods and community-based practices to cope with floods.

4.5.1 Questionnaire Survey

As described in Chapter 3, a questionnaire survey has been conducted in three research area with 128 respondents including:

- 41 respondents in Semarang Timur Sub-district
- 43 respondents in Tugu Sub-district and
- 44 respondents in Genuk Sub-district.

Forty-five questions has been given to the respondents to get describesation about the background describesation of the respondent, respondents knowledge about flood, preparedness and action to the flood (Appendix 1).

4.5.1.1 Information of the Respondent

In this research, basic information about respondent such as age, sex, occupation, income, education level and information about respondent are needed as a main information of the respondent. This is related to the pre assumption that there is relationship between this basic information with community knowledge, preparedness as well as community action to flood.

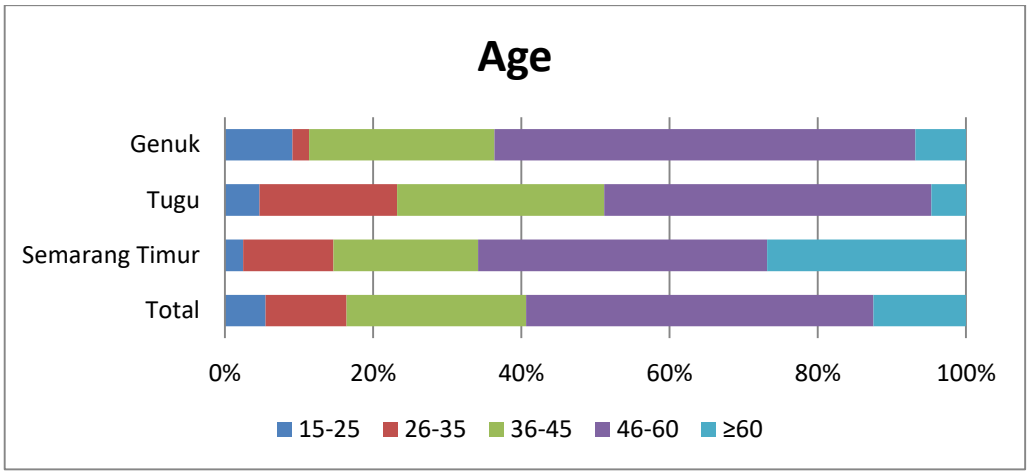

Figure 4.1 Distribution of Respondent by Age

Figure 4.1 describes the distribution of age respondent for this survey. Variable of age of respondents is used for this research with the pre-assumption that the age of the respondents have correlation with the knowledge, preparedness and action to flood. The age of the respondents is ranging from 15 to more than 60 years old. It can be seen from the graph that mean of the age of the respondents is 46-50 years old. The reason to choose respondents in this age group is that people in this age group have more experiences of flood.

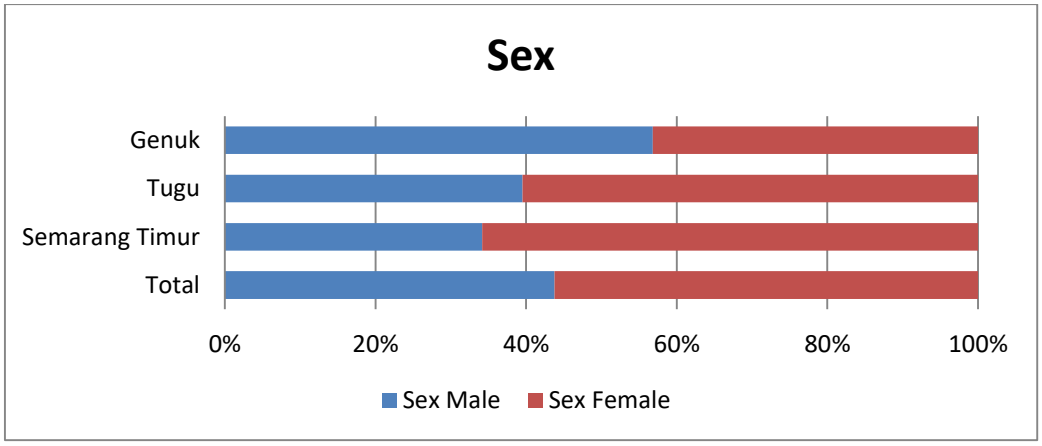

Figure 4.2 Distribution of Respondent by Sex

Figure 4.2 shows that 57% of the respondents are female. The reason to choose female group as respondents is women have an important role in disaster education in their family. Women have more time with the children so that they can easily to transfer information to their children and also women are more vulnerable to flood disaster than men.

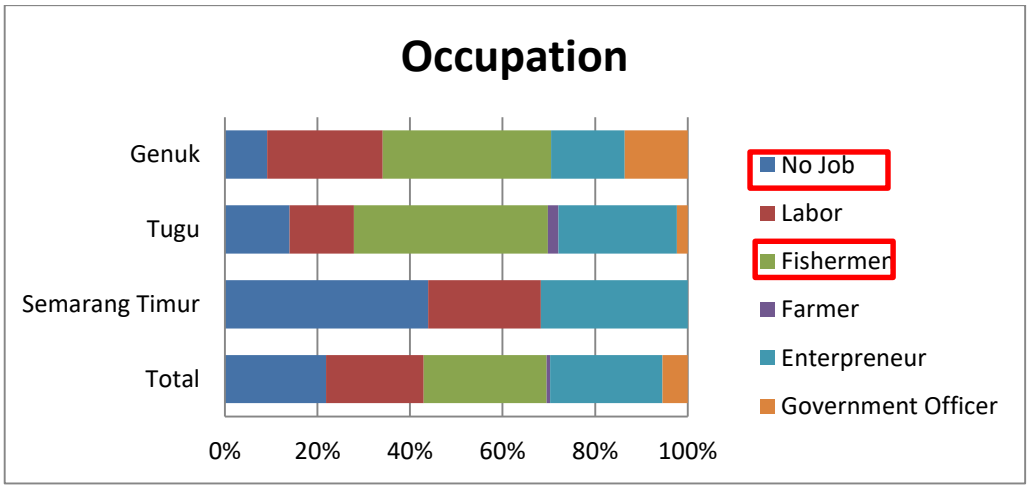

Figure 4.3 Respondent's Occupation

Variable occupation of respondent is being considered in this research based on the assumption that the occupation as a part of economic activity has close correlation with the community preparedness to flood. From total 128 respondents, the highest percentage of the occupation is fisherman which is 26,6% followed by entrepreneur 24,2% and no job (housewives) 21,9%.

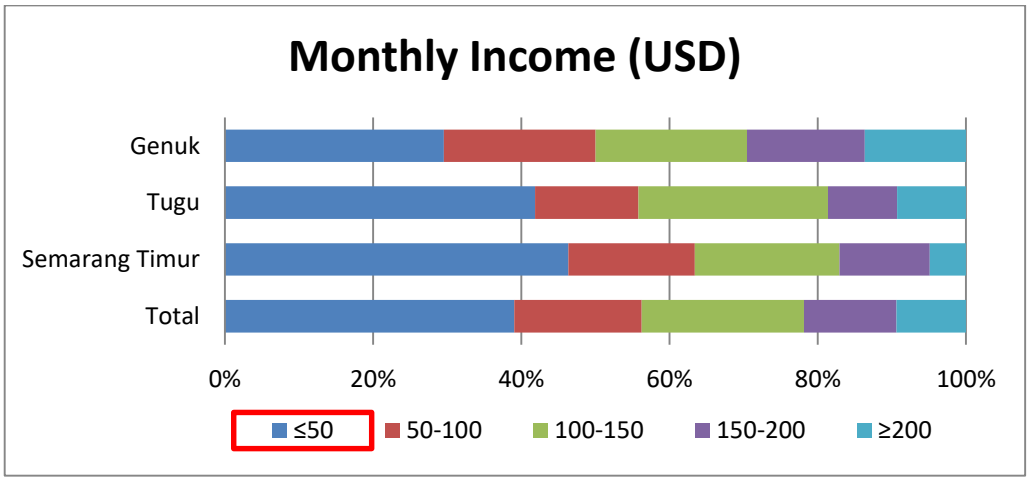

Figure 4.4 Monthly Income of the Respondents

The graph above gives information about the monthly income of the respondents. Almost 40% of the respondents are people with low income level. Most of them are fisherman and housewife. Fisherman, their income is decrease year by year because of the impact of sea level rise and flood. On the other hand, housewife they do not have any job or income.

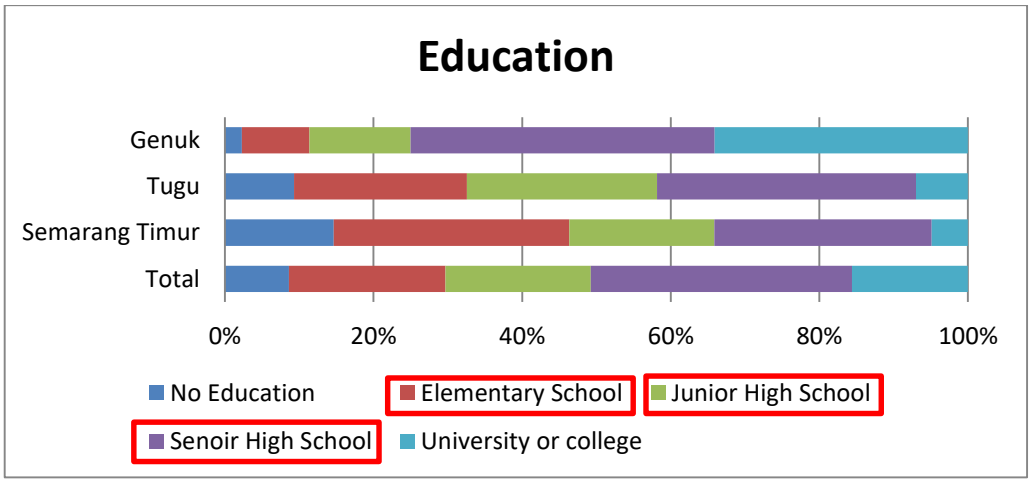

Figure 4.5 Education Level of the Respondents

Figure 4.5 illustrates that the education level of the respondents. It is presumed that the level of education of the respondents has relationship with the community knowledge about flood and it will lead to the community preparedness and action to flood. From the figure we can see that the highest percentage of the respondent's education level is senior high school (35%) followed by elementary school (21%) and junior high school (19%).

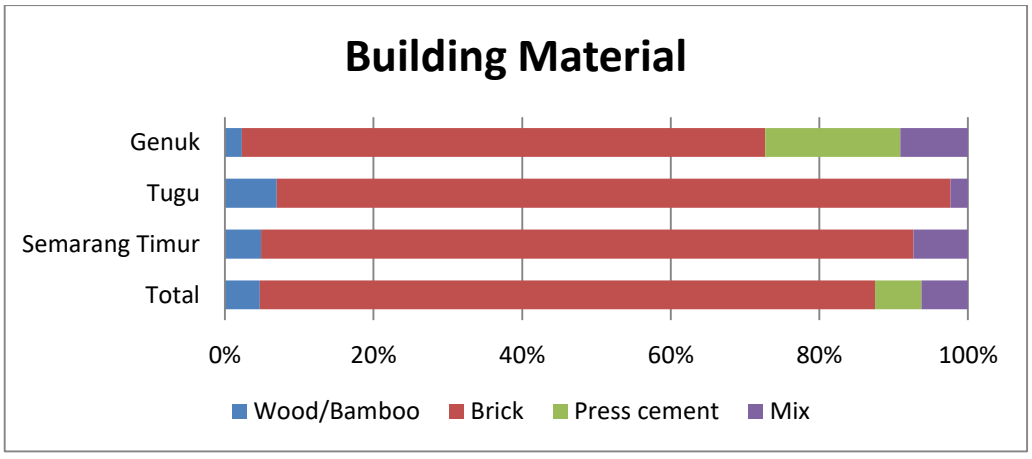

Figure 4.6 Building Material of the Respondent's Houses

Around 75% of the respondent's houses made from brick. This is one kind of preparedness action that a building made from brick is cheaper and secure to flood even though they have to make their floor higher in every 2-5 year. Before, most of their houses are made from wood or bamboo. But it is easy to broke when flood coming, so they adapt their house building to be more resistant to flood.

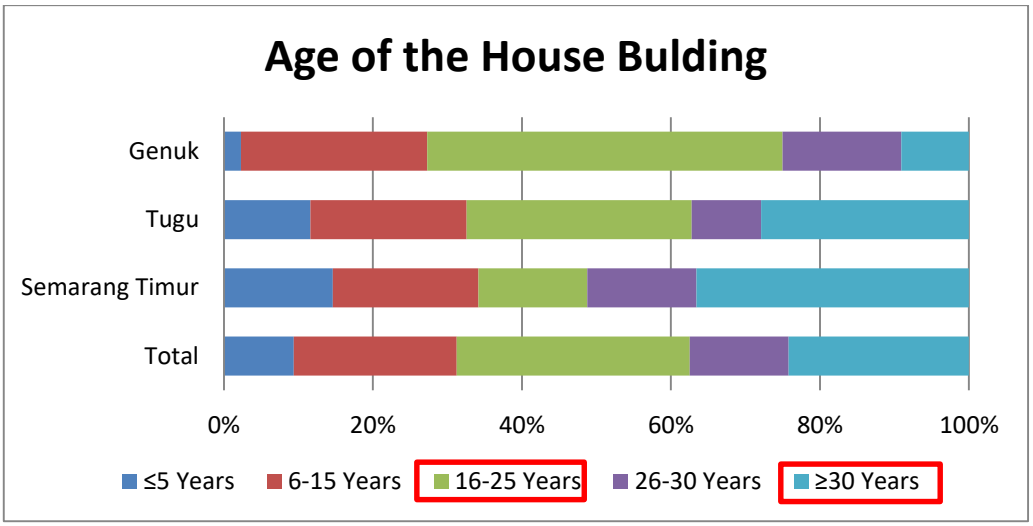

Figure 4.7 Age of the House Building

Around 25% of the respondent's houses are 16-25 years old. It means that the building is already affected by flood for more than 5 years. In some houses, we can see some of the sign how high flood occurred in this area.

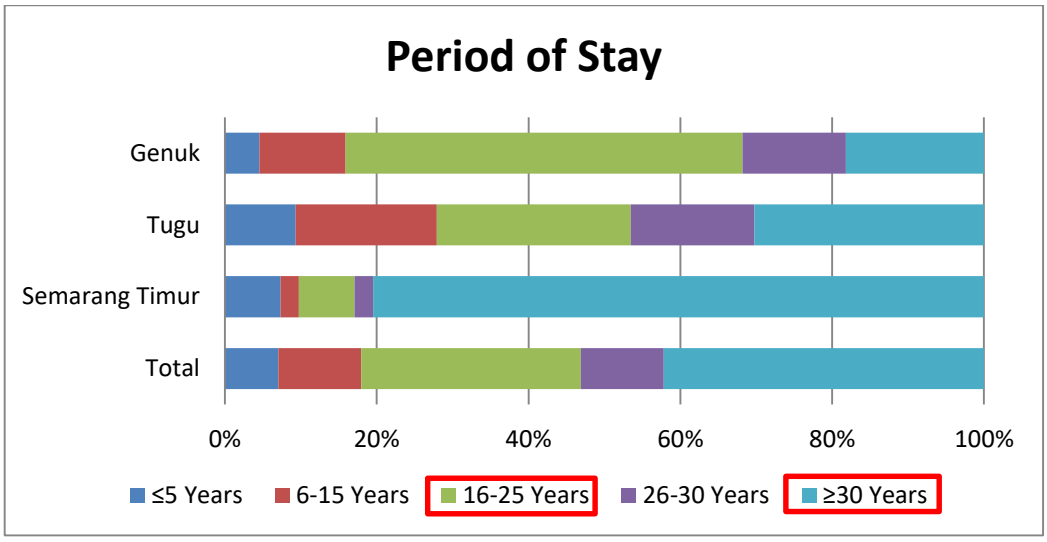

Figure 4.8 Respondent's Period of Stay

Most of the respondents (42%) already stay in flood disaster prone area for more than 30 years. Some of the respondents said that their houses are not affected by flood before, but in last 15 years flood come to their houses.

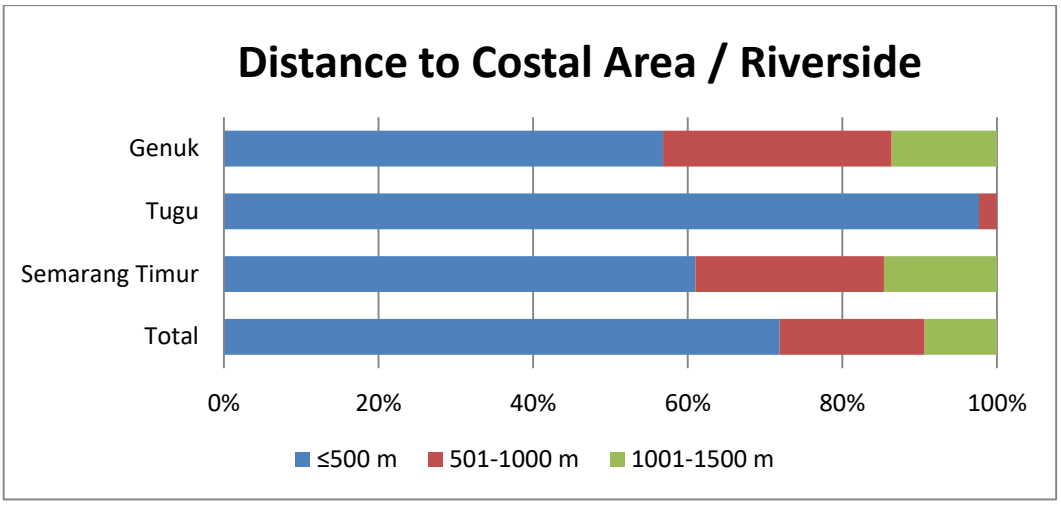

Figure 4.9 The Distance of Respondent Houses from Coastal Area or Riverside

75% respondents stay very close to the coastal area or riverside. Both in Coastal area and riverside the distance between their houses to the water body is getting closer year by year. Some people who live more than 1km from coastal area are not only affected by coastal flood but also inundated by the tidal flood.

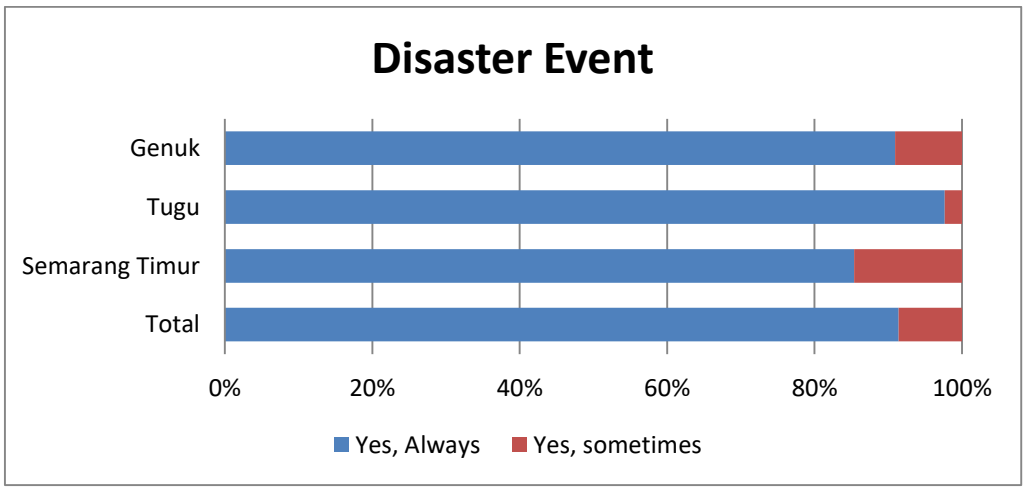

Figure 4.10 The Experience of Respondent Houses Affected by Flood

In Genuk and Tugu, when flood is coming there is no house which are safe from flood. Even though they already raise their floor and make a dike, the water level is higher and higher year by year. But in Semarang Timur, because flood is a new thing in this area so not all of the areas are flooded. The flood intensity in this area is depending on the level of their house.

4.5.1.2 Community Knowledge about Flood

To get information about community knowledge about flood, this research provides some question to determine community knowledge about flood in their particular area. There are 10 questions in this section.

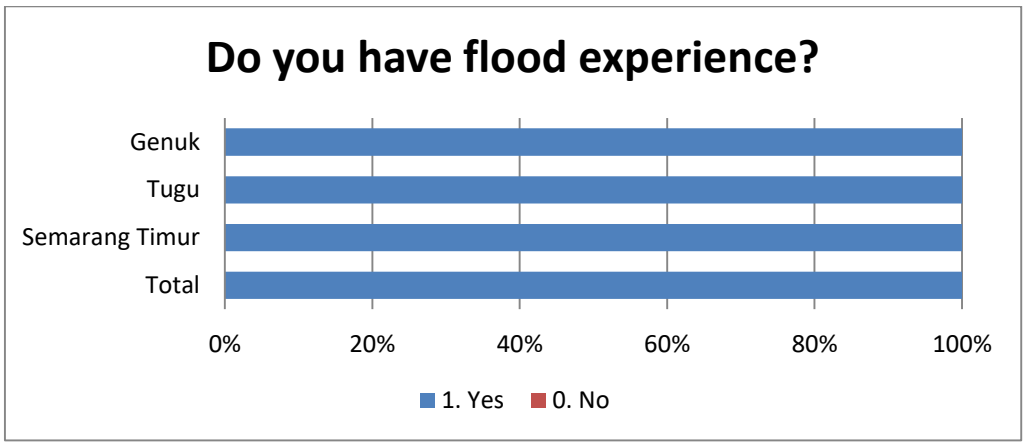

Figure 4.11 Respondent's experience of flood

The people who can be the sample of this research is people who have experience of flood. So people who live ≤ 500m from riverside or ≤1500m from coastal area are choosen as respondent in this research. It can be seen in the graph above that 128 respondents have experience about flood.

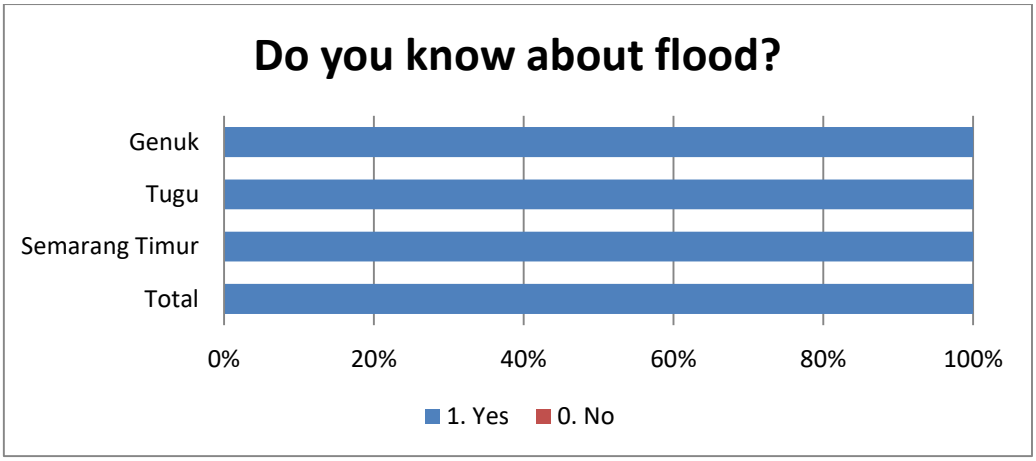

Figure 4.12 Respondent's knowledge about flood disaster in their particular area

All of the respondents are know about flood. They can describe at least what the main factor of flood is and when flood is happen. There are different factor cause flood in coastal area and inland. For the coastal area, the flood is cause by the tide and sedimentation in the mouth of the river but in the inland flood cause by some factors such as heavy rainfall, poor drainage system, waste, and some other factors.

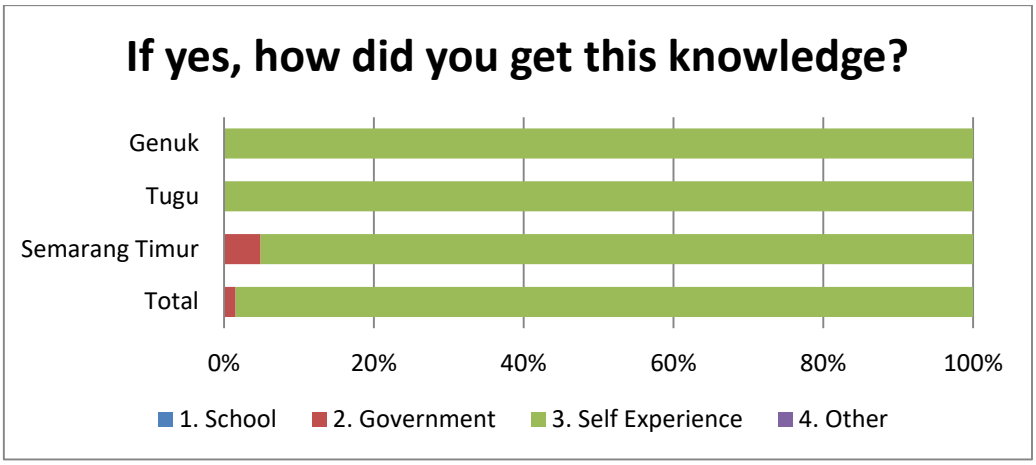

Figure 4.13 The resource of information about flood

Almost 98% of respondents get their knowledge about flood from their own experience. Since most of them are 46-60 years old, they already live with the flood for a long time and they have their own experience even observation about the periodic of big flood.

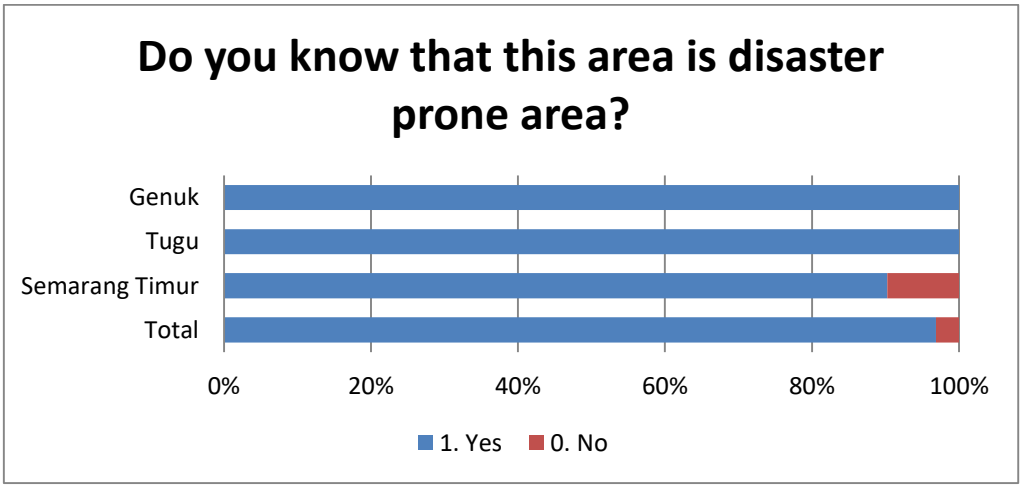

Figure 4.14 Respondent knowledge about their area as flood prone area

People in the coastal area they already know that they are living in the disaster prone area since flood is occurred in every month. But people in the riverside, some of them did not know before if their area is prone to flood. Especially for Semarang Timur, flooding is occurred in this area just in last 8 years. Flood in Semarang Timur mostly caused by the construction of the tunnel in the Semarang Utara. Because of this project, water can not go directly to the sea that the water goes to the other section which is located in the Semarang Timur. Meanwhile, the huge amount of sedimentation in the river mouth also hold up the water flow.

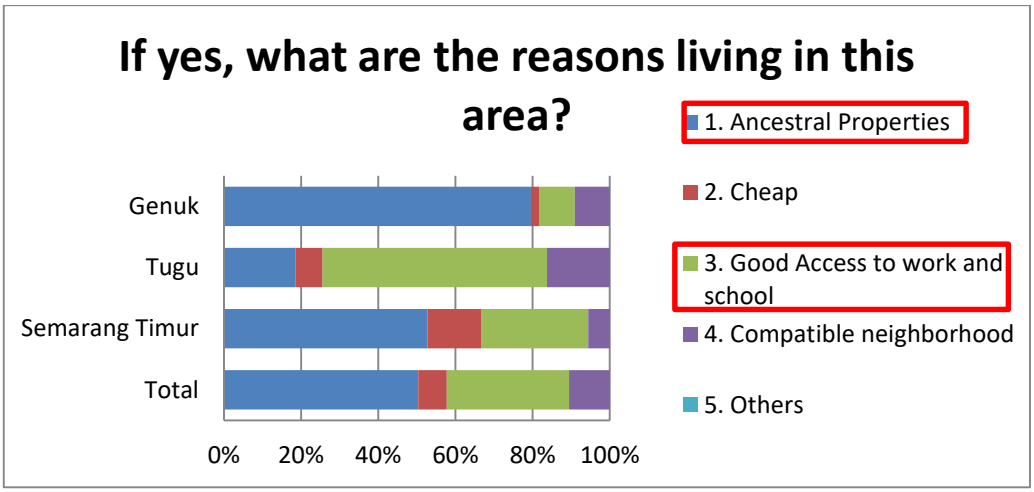

Figure 4.15 The reasons of respondent to stay in their area

Figure 4.15 shows that there are three main reasons people to stay in their area even though they have been affected by flood for years. 80% of the sample in Genuk, stated that the reason to live in their area is because they want to keep their parents land. Furthermore, around 60% people in Tugu said that they have a good access to their work place or school. It well known that most of them are fisherman. So they want to stay close to the sea. On the other hand, more than 50% people in Semarang Timur they want to stay with their whole family. Javanese people, they have their motto which is “mangan ora mangan sing penting kumpul” (it is not important we can eat or not, the more important is gathering with family). So that, people are prefer to stay in their area even though they have to face flood every year.

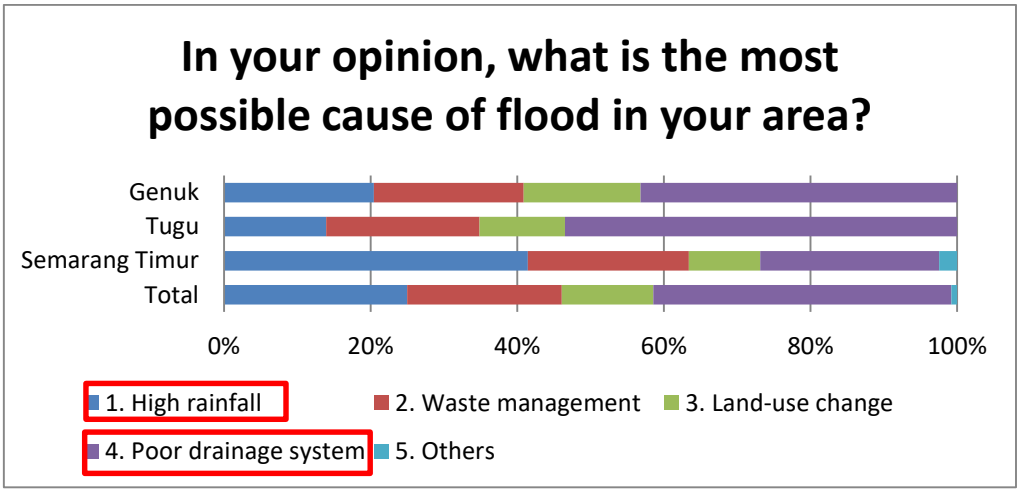

Figure 4.16 Respondent opinions about the main cause of flood in their area

Figure 4.16 shows three different cause of flood in the research area. People in Semarang Timur said that poor drainage system is the main cause of flood in their area. There are some land use changing but the drainage system is very poor. Meanwhile, people in Tugu and Genuk argue that the increasing of rainfall cause flooding

in their area. It became more insecure when the tidal flood meet the condition of the estuaries which filled by sedimentation.

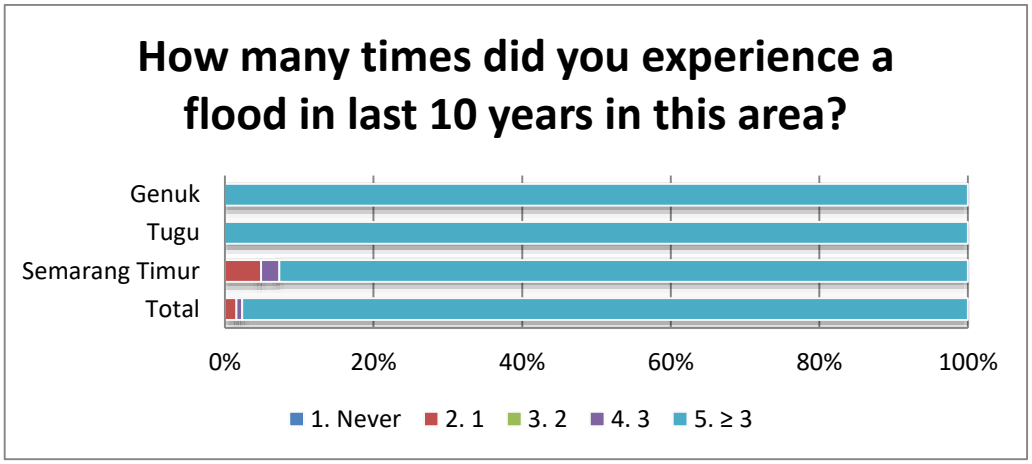

Figure 4.17 Respondent experiences of flood in last 10 years

Most of the people have more than 3 times flood experience. It is because in last 10 years flood occurred at least three times in a year. And for coastal area, flood is occur in every full moon. As mentioned before that in Semarang Timur, flood is a new thing because it just happen in last 8 years and it depend on the level of people houses. So that not all of the respondent have experience to flood.

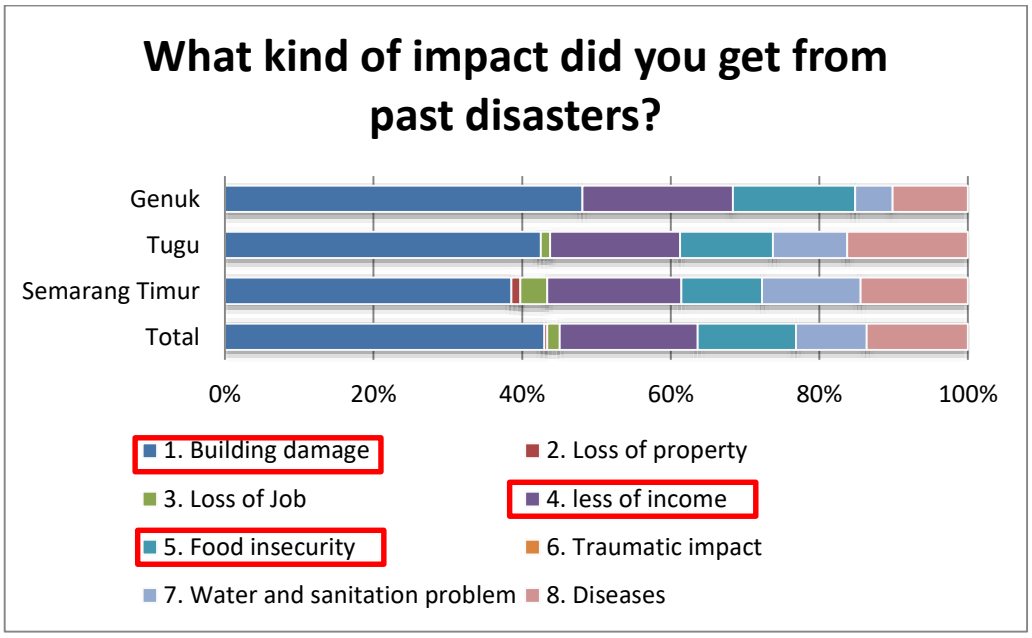

Figure 4.18 Impact of past flood to the respondent

Figure 4.18 describes that building damage is the most impact of the flood (42%) followed by less of income (19%) and diseases (13%). Even though people do the preparedness by increase the floor level or create a dike in their surrounding area, but the level of flood is getting higher year by year. So their houses still affected by

flood. This is one of the economic losses due to flood. In one hand their houses are affected by flood and they have to do an preparedness but on the other hand their income are decrease because they can not go to the sea to do fishing activity.

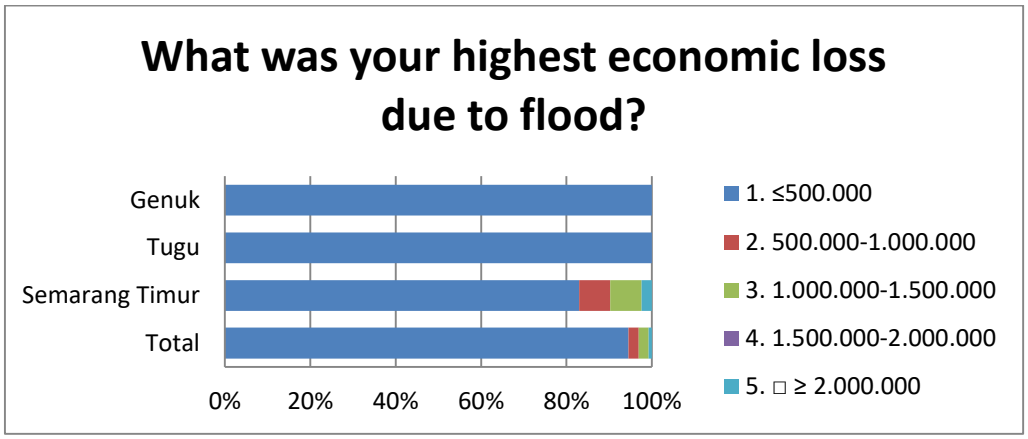

Figure 4.19 The highest economic loss of the respondent cause by flood

Figure 4.19 shows that 95% of the respondent loss no more than 500.000 IDR (50 USD). This losses usually because of there is some part of the house were broken. This number is not so much high since people already have some experience to flood so they already prepare their family to face flood whenever they came so that they can minimize economic loses. The amount usually they use to clean up their houses or to repair something that broken during flood.

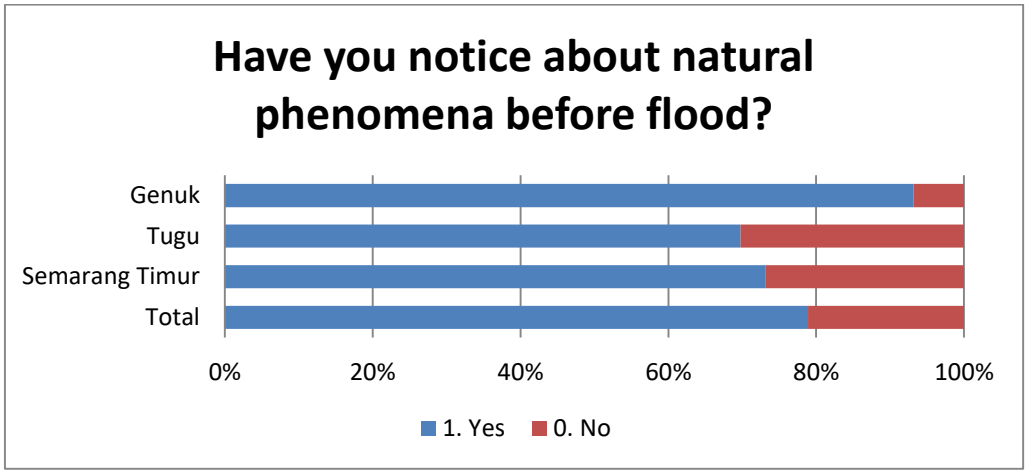

Figure 4.20 Respondent attentions to natural pheomena before flood

Most of the fisherman, they use their calendar calculation and some observation on the astronomy phenomena. They have to make it sure that the weather will be fine and suitable to do fishing activity. Not only that, they also can notice when and where they can get a lot of fish based on their own experience. Some of the natural phenomena can be proven by scientific analysis.

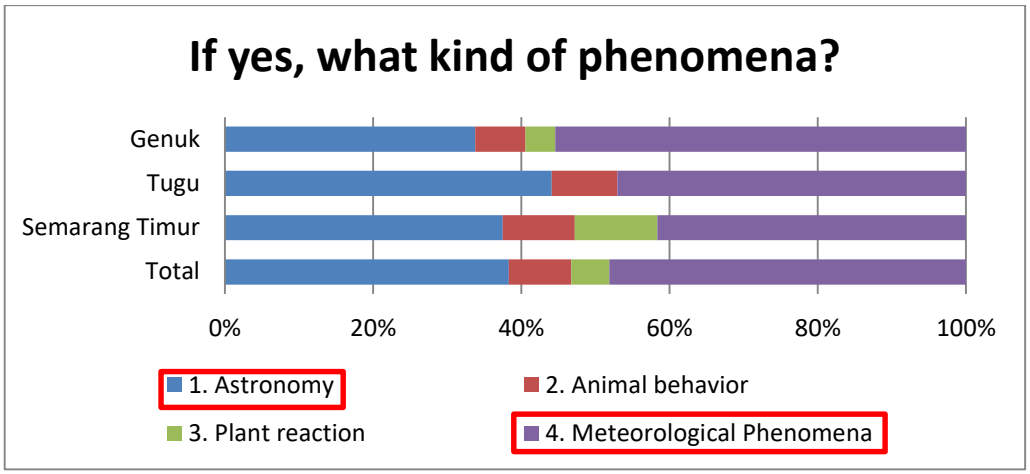

Figure 4.21 Kind of phenomena has been notice by respondent

Almost 50% of the respondent are notice about the meteorological phenomena in their area. Especially fisherman, they use their javanese traditional calendar to decide do they will go to the sea or not. They notice to the star position to determine North direction so that they can find the way to come home. For the old people, the wind pattern and cloud shape before rain can be an early warning before flood.

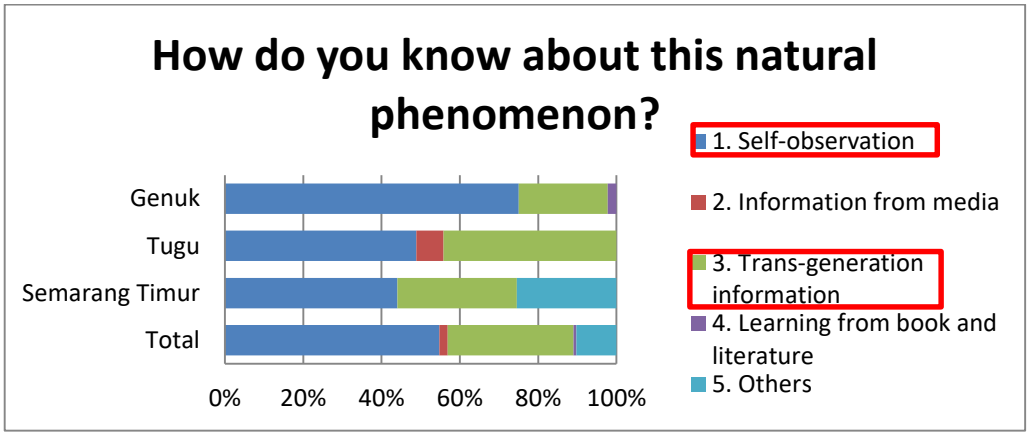

Figure 4. 22 How people know about natural phenomena before flood

Figure 4.22 illustrates that 55% of respondent know about the natural phenomena before flood from their self-observation. Based on the describesation from the respondent, usually only fisherman do the transfer describesation generation and after that they do their self-observation.

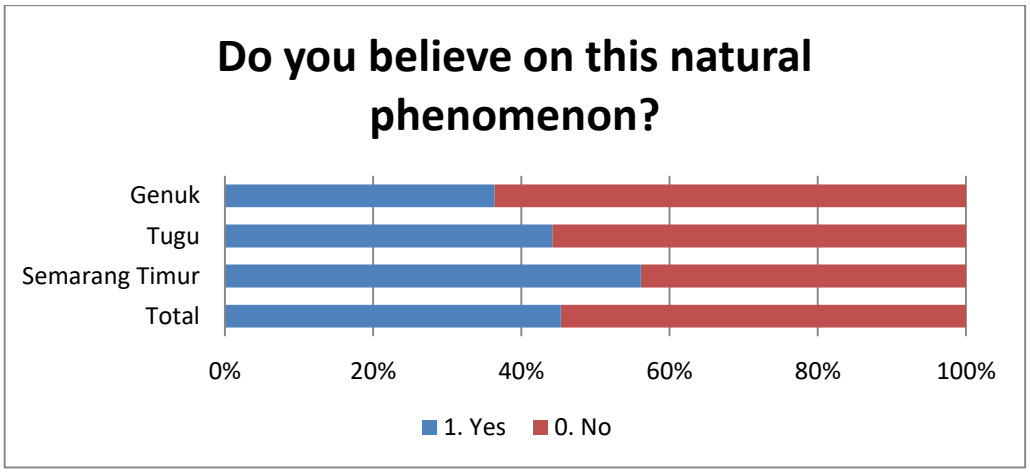

Figure 4.23 People's response to the natural phenomena

Figure above shows that even though people are notice about the natural phenomena but they do not believe on this. More than a half of the respondent (57%) are not believe in this natural phenomenon because the climate has change recently and sometimes their analysis about the phenomena was wrong. But still some of the fisherman keeps this especially to go to the sea.

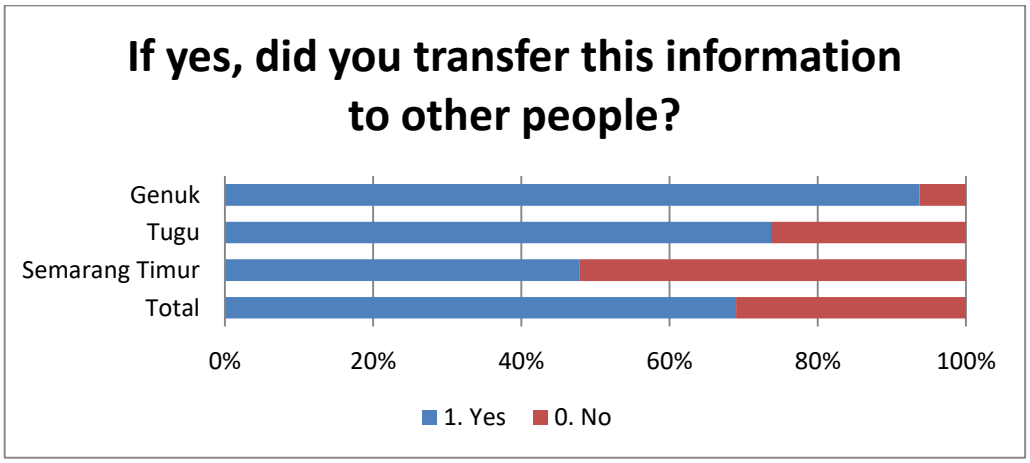

Figure 4.24 Information transfer about natural phenomena by respondents

Even though people are not believed to the natural phenomena, but still some people (68%) do the transfer describesation to the next generation as an Indigenous Knowledge in their area. The reason to keep this Indigenous knowledge is to keep them as a part of the local culture.

Table 4.1 below describe how this to devided the level of community knowledge about flood. From the questionnaire.

Table 4.1 Clacivication Level of Community Knowledge about Flood

Variable	Number of Questionnaire	Question Number	Classification Level
Community Knowledge	6	13, 14, 15, 16, 20, 22	Low: 1-2 Medium: 3-4 High: 5-6

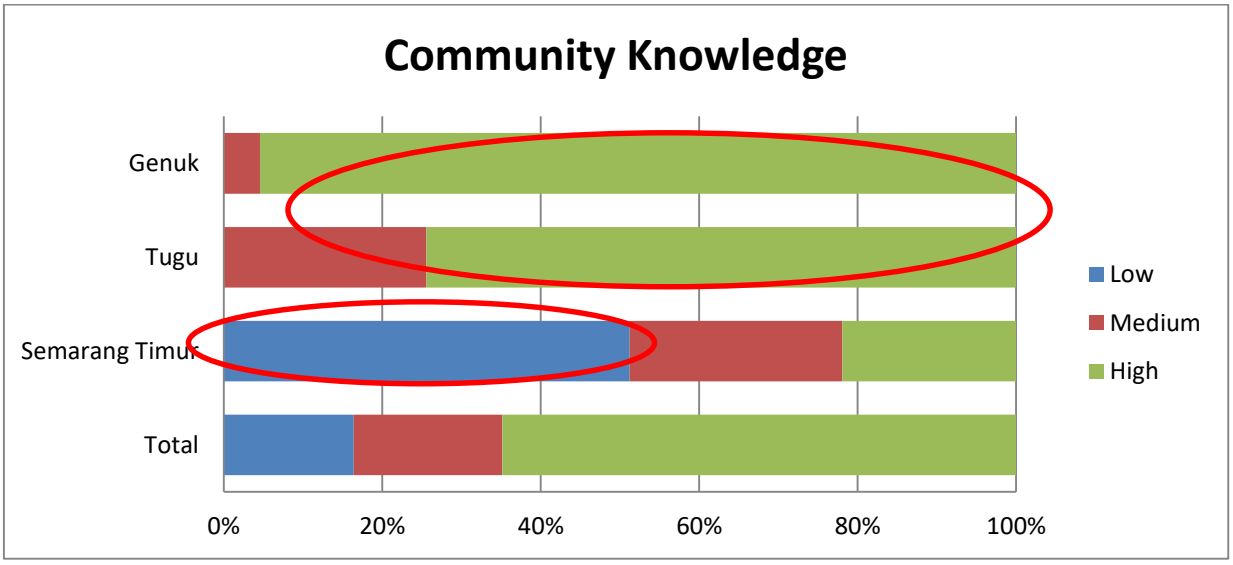

Figure 4.25 Community Knowledge about Flood

From the questionnare, we can see that 66% of the respondent have a high perception about flood disaster followed by medium 18% and low 16% (figure 4.25).

For the people who lives in the coastal area, they have high level of knowledge because they already stay in flood prone area for more than 10 years so that they have more experiences about flood. Furthermore, some of native people also observe some Indigenous Knowledge related to the flood. For example tidal flood will be occured during fullmoon in every month. On the other hand, people in the Semarang Timur, they do not have enough knowledge about flood since flooding is occured in their area in last five years. It means that people do not have much experiences to flood. The other factor is also river floods can not be predicted so people with a few experience will more vulnerable to the flood.

4.5.1.3 Community Preparedness to Flood

Community preparedness to flood in this research determided by how people can cope with flood and what kind of preparedness people do. There are seven questions in this section.

Figure 4.26 below describes that there are three preparedness effort has been done by the community those are strengthening the building (54%), provide an emergency saving or insurance (25%) and looking for describesation about evacuation route in their area (21%). They argue that if their building are save, they do

not have to evacuate and also they can save their money because they do not need to spend money to repair the building. In this case, they usually raise the level of the floor in every five year since the level of flood is getting higher than before.

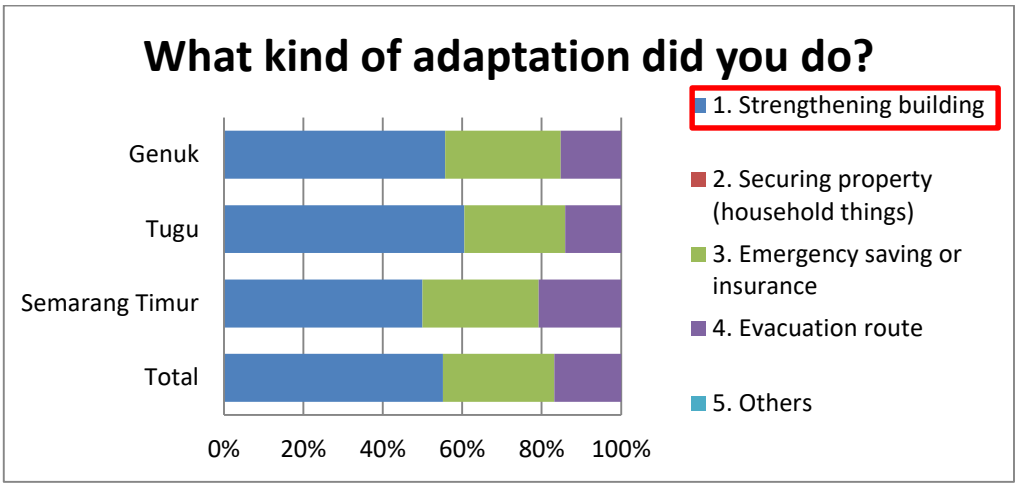

Figure 4. 26 People adaptation to flood

Figure 4.27 below describes that even though people are living in the flood prone area and they have to face this disaster every year, more than 60% of the respondents can not swim. They argue that so far the flood events are not so dangerous, they still can walk during flood.

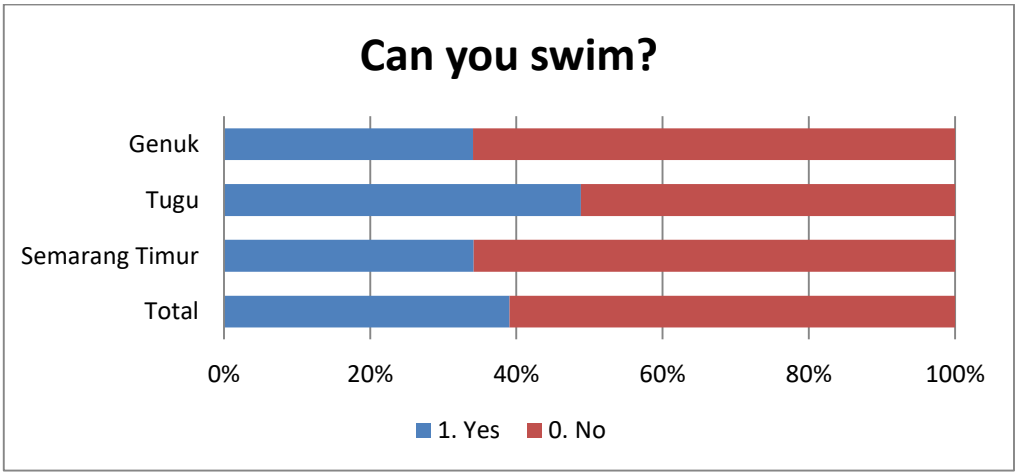

Figure 4.27 Swimming ability of the respondents

From 61% respondent who can not swim, 32 people (34%) they would like to learn swimming because they agree that this is one of the preparedness effort to stay in the flood prone area. On the other hand, 46 people (66%) would not like to learn swimming (figure 4.28).

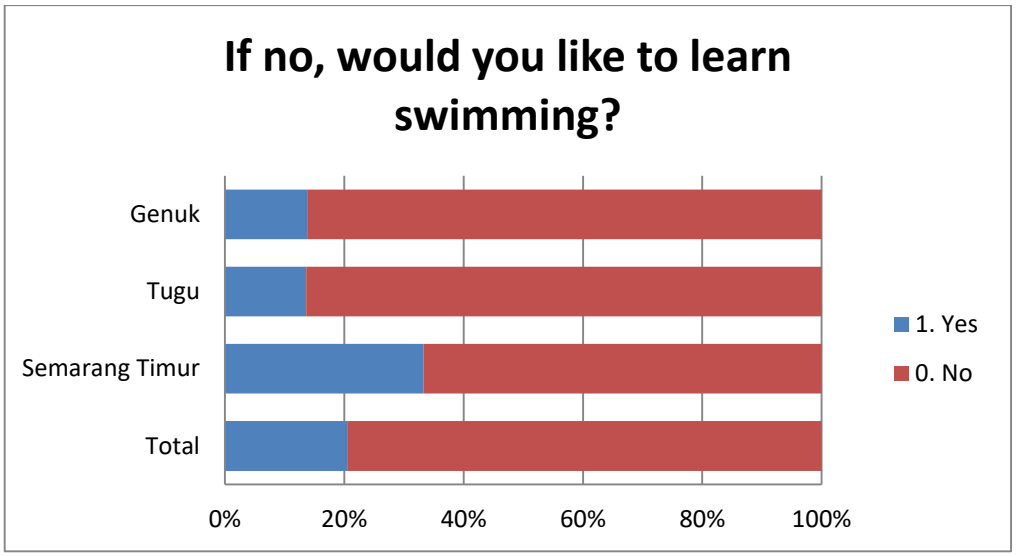

Figure 4.28 Willingness of people who can not swim to learn how to swim

Figure 4.29 below illustrates that from 46 people who would not like to learn how to swim, 68% argue that it is to late to learn how to swim, and 32% people do not have any reason, they just said that they do not want to swim.

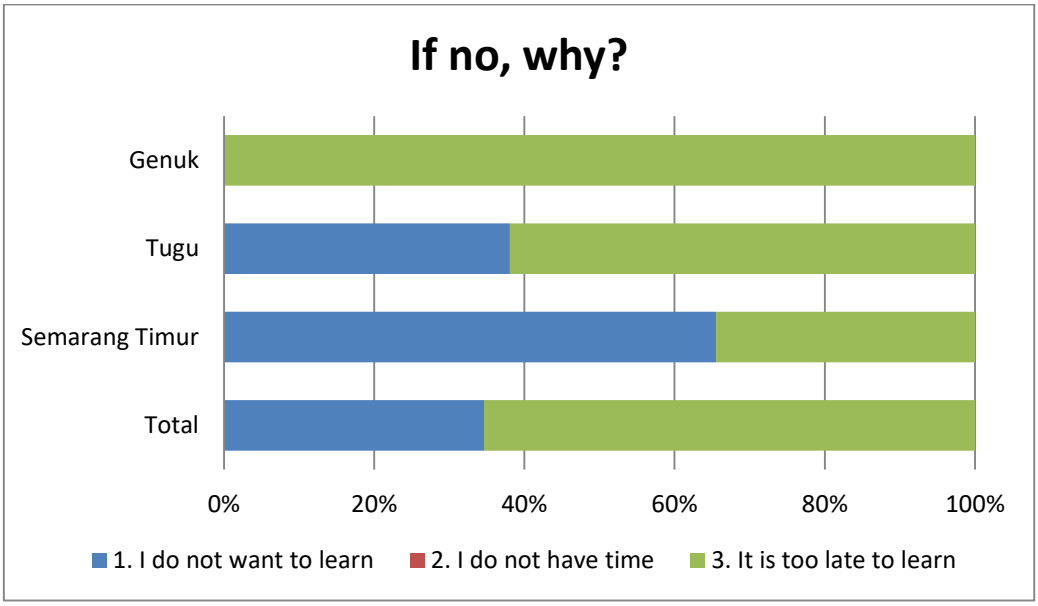

Figure 4.29 The reason of the respondent to do not learn how to swim

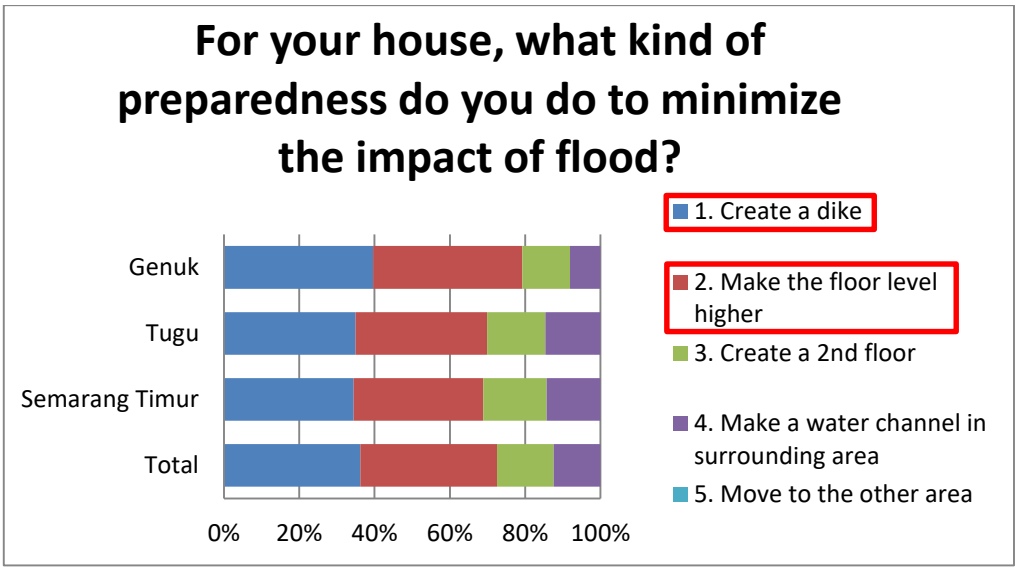

Figure 4.30 People preparedness in case of building content

Figure 4.30 above describes that preparedness effort has been done in case of building are create a dike, raise the floor level and create a second floor for those who have high income.

Figure 4.31 Building adaptation to flood

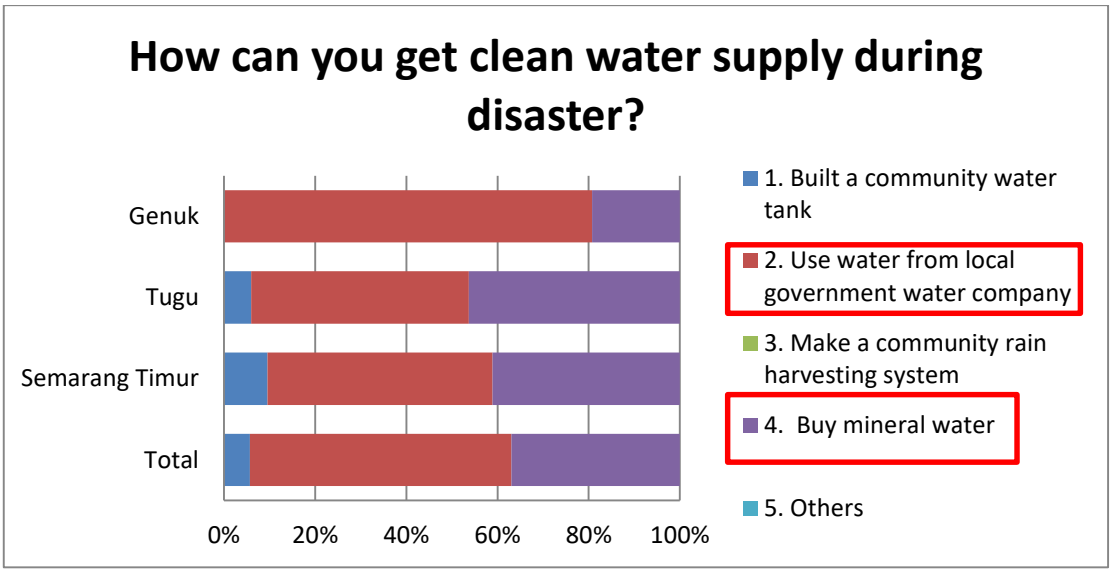

Figure 4.32 Water resources during flood

Figure 4.32 describes that during flood, people get their water resources from local government office for take a shower and washing. On the other hand,they also buy mineral water for drinking and cooking. This water tank can collect 3000litre of water and can be used for 10-20 households. Government will supply water to this tank once a day during flood. Every people can collect water from this tank for free.

Figure 4.33 Community water tank to collect water from the government during flood

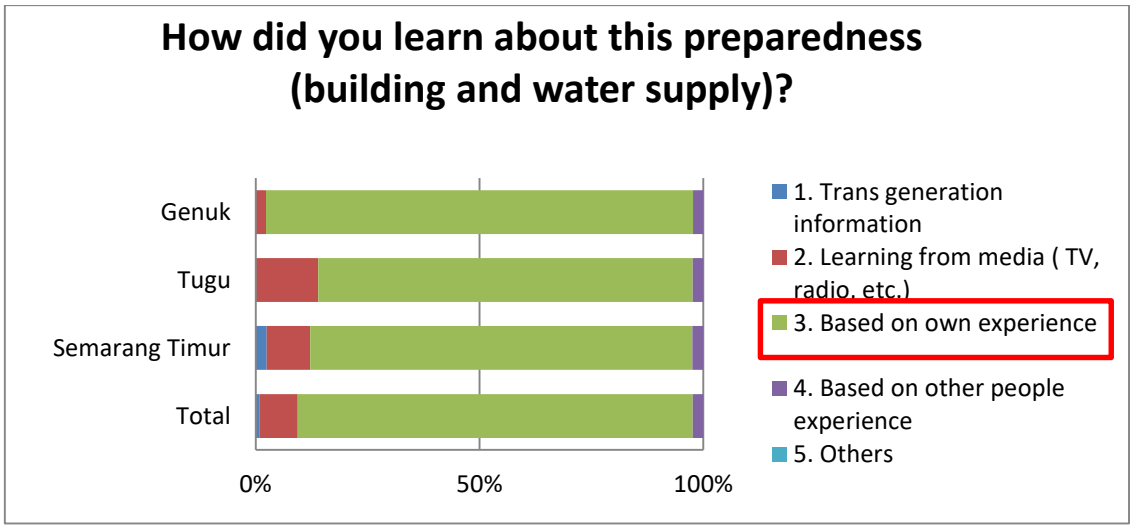

Figure 4.34 People way to learn about building preparedness

Figure 4.34 shows that 90% of the respondent learn about building and water preparedness effort from their own experience. Meanwhile, 10% of the respondent learn from media.

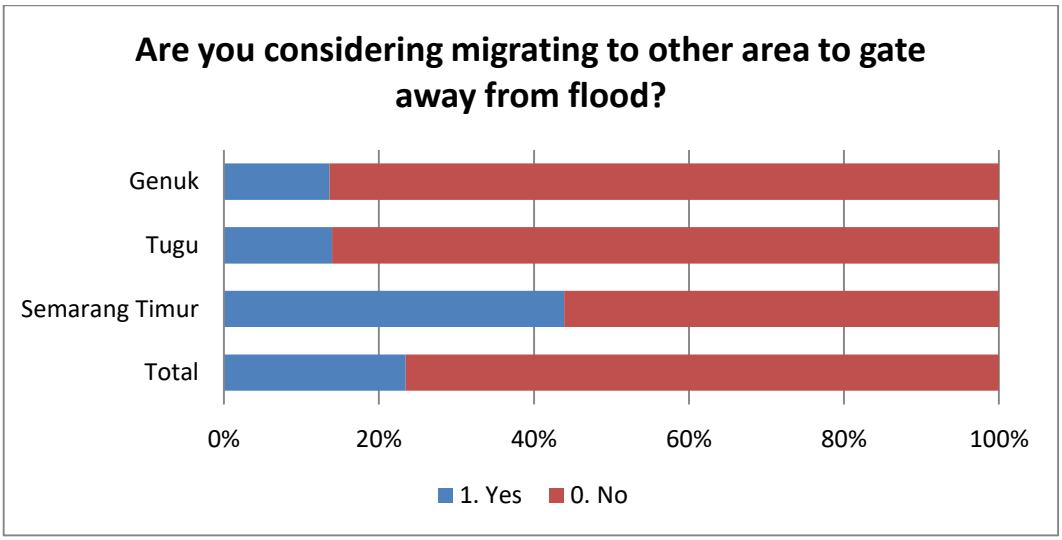

Figure 4.35 People willingness to move

Figure 4.35 illustrates that 77% of the respondent would not like to move from their area. The reason to stay in their area is show in figure 4.35 which describe that more than 50% of the respondent decide to stay in their area because they already have a comfortable neighborhood and they argue that if they move to the other area it will be difficult for them to do adaptation with the new people as well as new environment.

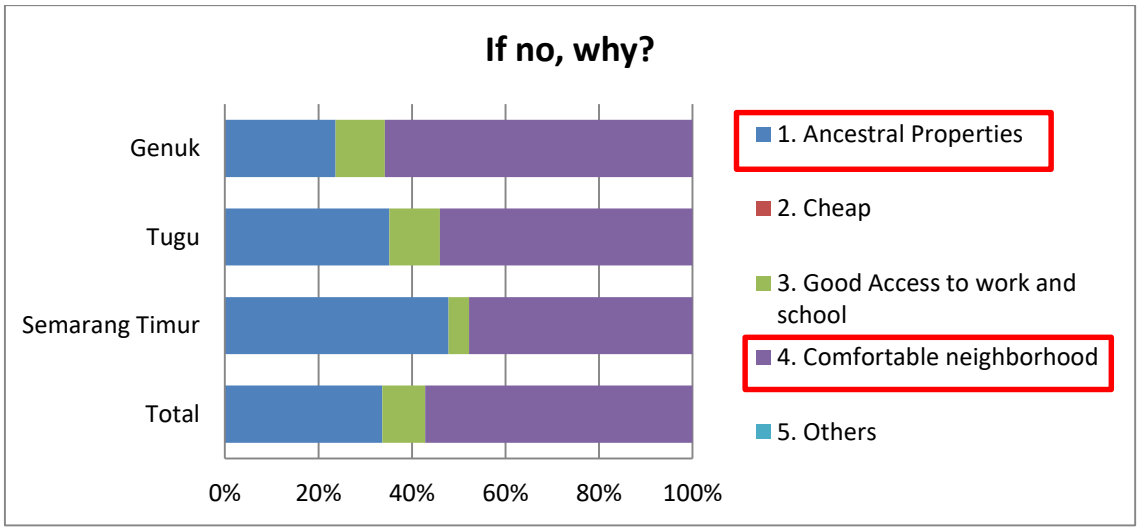

Figure 4.36 The reason of the respondent to stay in their recent area

Figure 4.36 shows some reasons people do not want to move from their area even though their area are prone to floods. The main reason is they already feel comfortable with their community and they do not want to start a new life with new people.

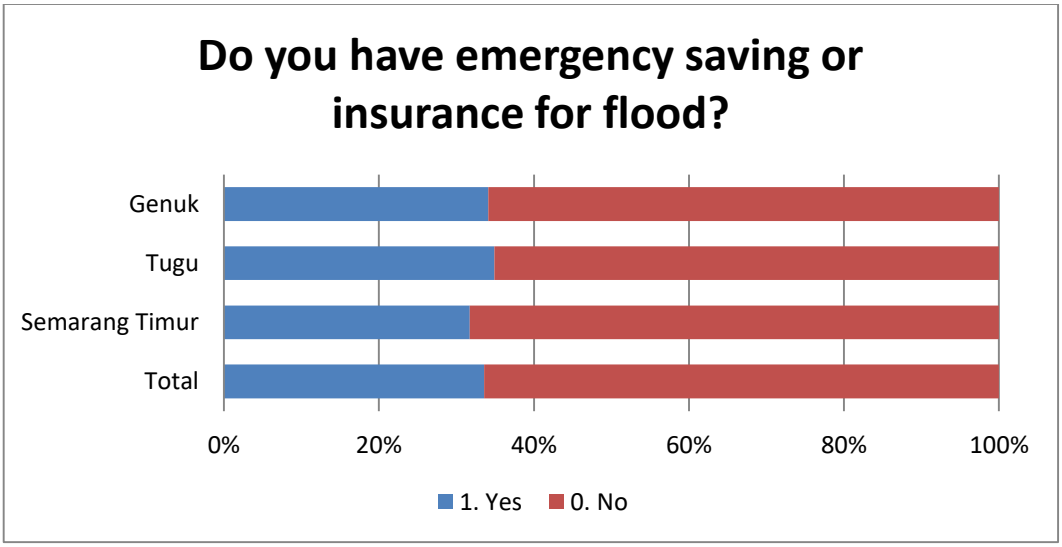

Figure 4.37 Emergency saving of the community

Figure 4.37 describes that 66% of the respondent do not have emergency saving for flood preparedness. They have their personal saving but this is not emergency saving for flood (figure 4.38).

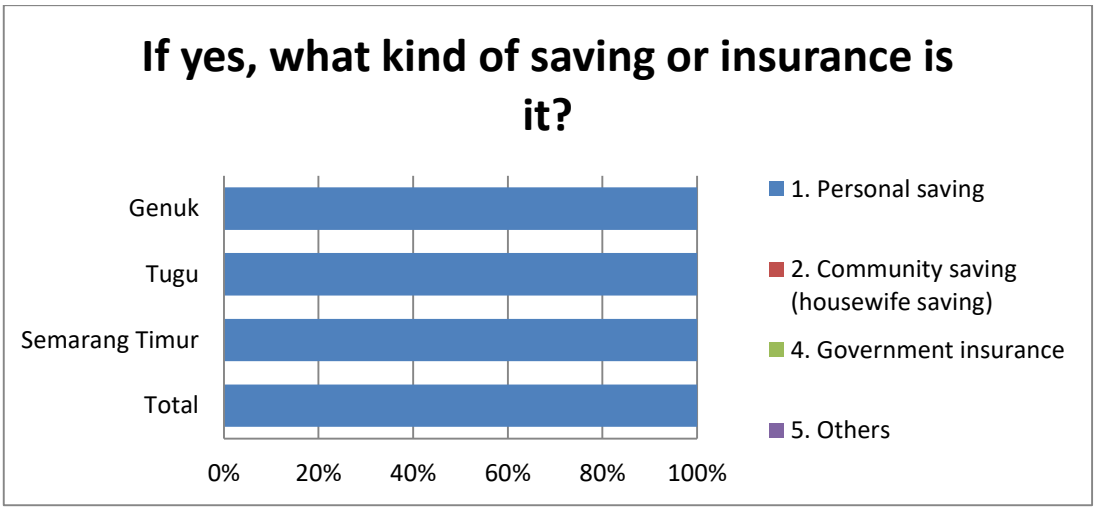

Figure 4.38 Community emergency saving

Table 4.2 below describe how this to devided the level of community preparedness to flood.

Table 4.2 Clacivication Level of Community Preparedness to Flood

Variable	Number of Questionnaire	Question Number	Clacification Level
Community Preparedness	4	23, 24, 25, 29	Low: 1 Medium: 2 High: >2

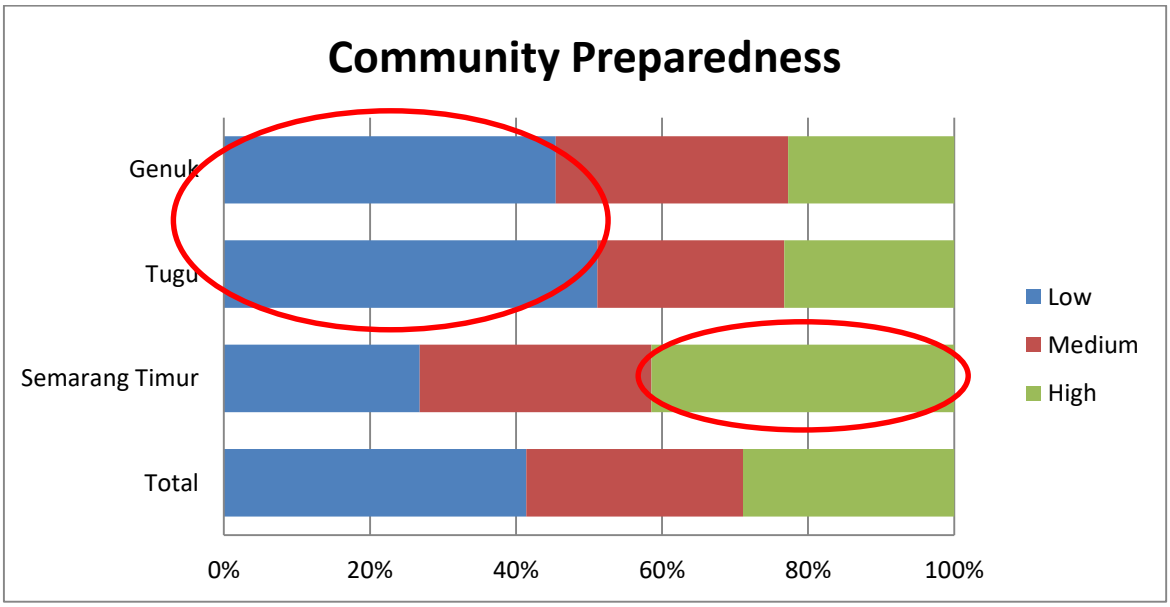

Figure 4.39 Community Preparedness to the Flood

Figure 4.39 describes that 43% of the respondent have low level of preparedness to flood followed by medium level (31%) and high level (24%). This preparedness effort are mostly related to the economic level of the respondent because to do an preparedness for example to raise the floor level they have to provide some amount of money from their income whereas most of the respondent are in the low income level.

4.5.1.4 Community Action to the Flood

Community action in this research are how people act when flood is coming. There are 16 questions in this section.

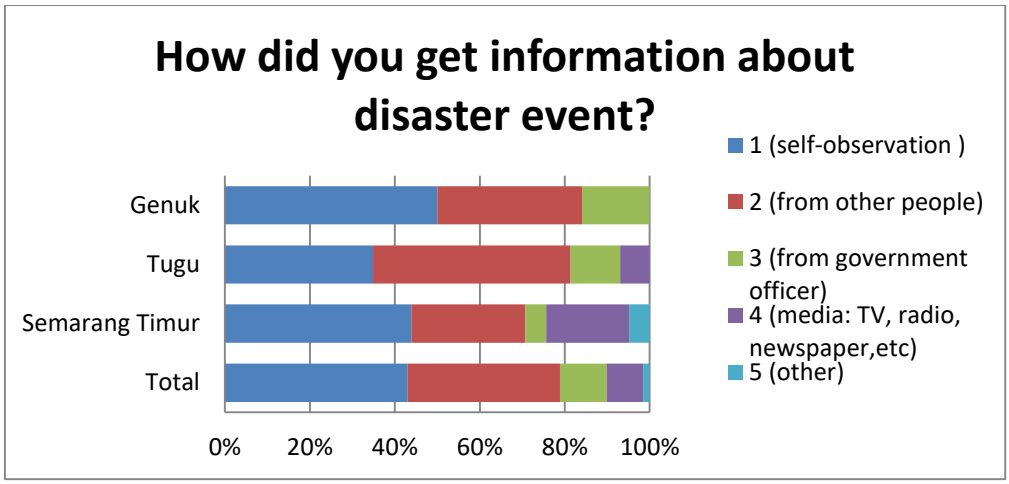

Figure 4.40 Information resource about disaster event

Figure 4.40 shows that more than 40% of the respondent get describesation about flood disaster event from their self observation. They will observe some phenomena that indicate flood.

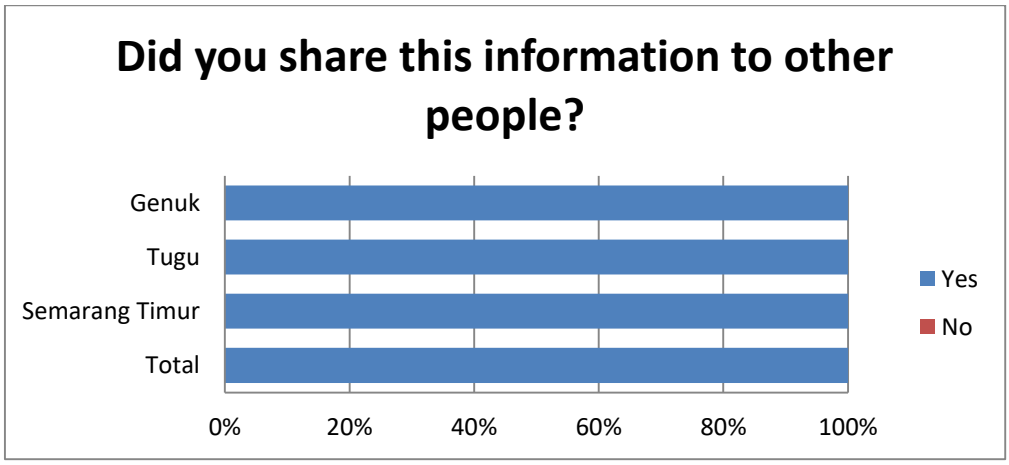

Figure 4.41 People willingness to share describesation about flood disaster event

Figure 4.41 indicate that 128 (100%) respondent are willing to share describesation about flood disaster event to other people. Its indicate that people are aware that when they share this describesation, they can save people as well as reduce the damage.

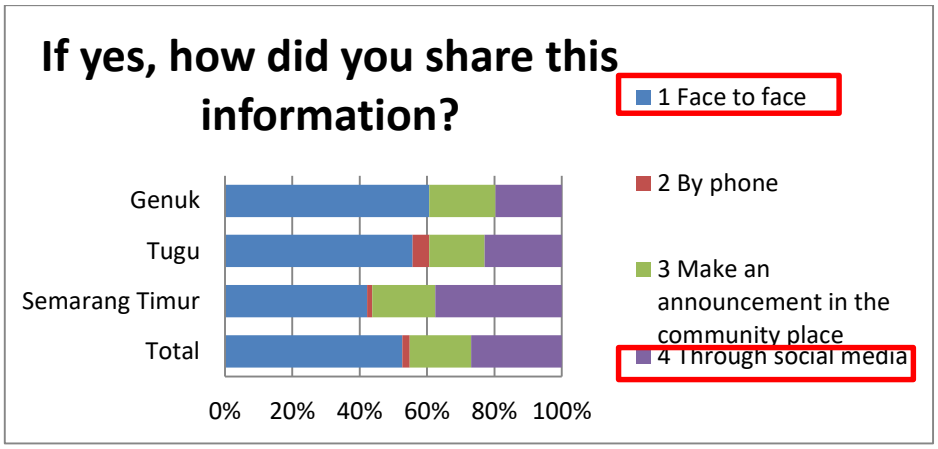

Figure 4.42 The way people transfer describesation about flood disaster event

Figure 4.42 describes that 54% of the respondent are give describesation to other people face to face. When they meet someone, they will describes those people about flood which happening. And the second option is through social media such as facebook and twitter. Nowdays, social media has been very famous and effective media to share describesation to other people around the world. This is usually doing by young age people.

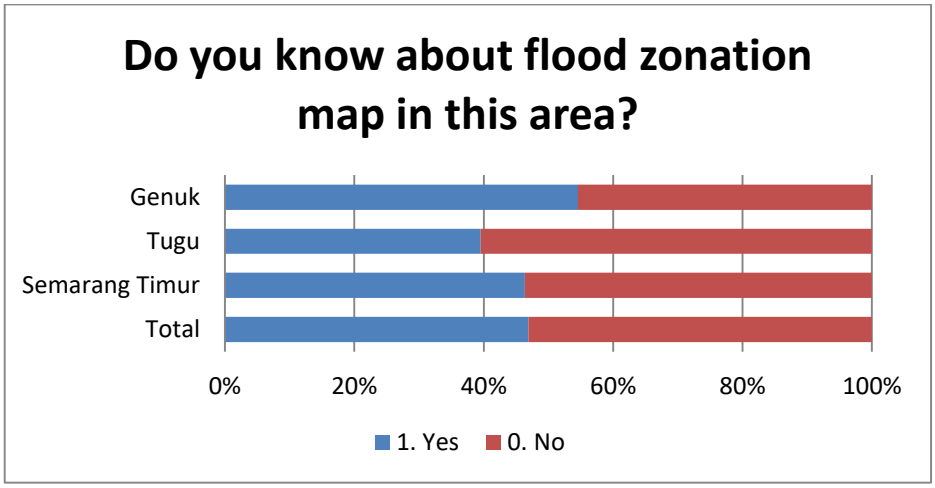

Figure 4.43 People knowledge about flood zonation map

Figure 4.43 above show that more than a half of the respondent they do not know aboout flood zonation map in their area. They said that they notice there is a flood zonation map in front of Village Government Office (Kelurahan) but they do not pay attention on this.

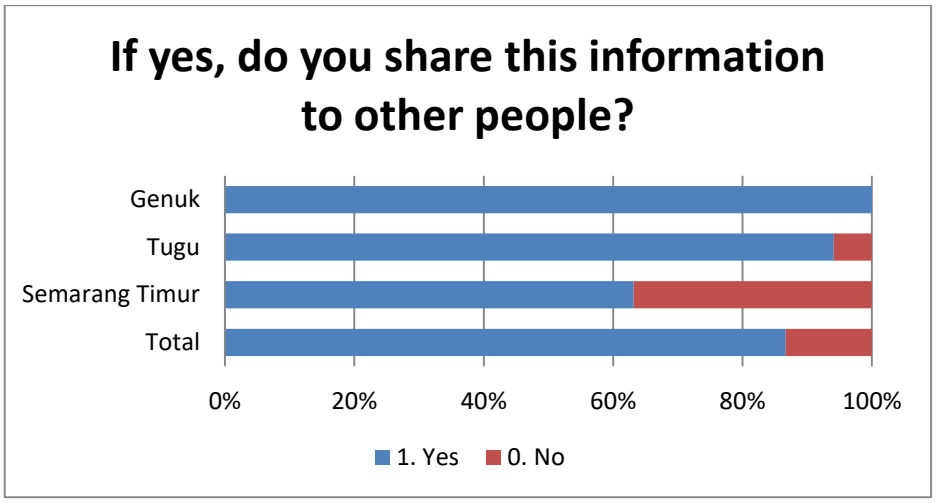

Figure 4.44 People willingness to share describesation about flood zonation map

From 60 people who know about flood zonation map, almost 90% of them are willing to share this knowledge to other people (figure 4.44).

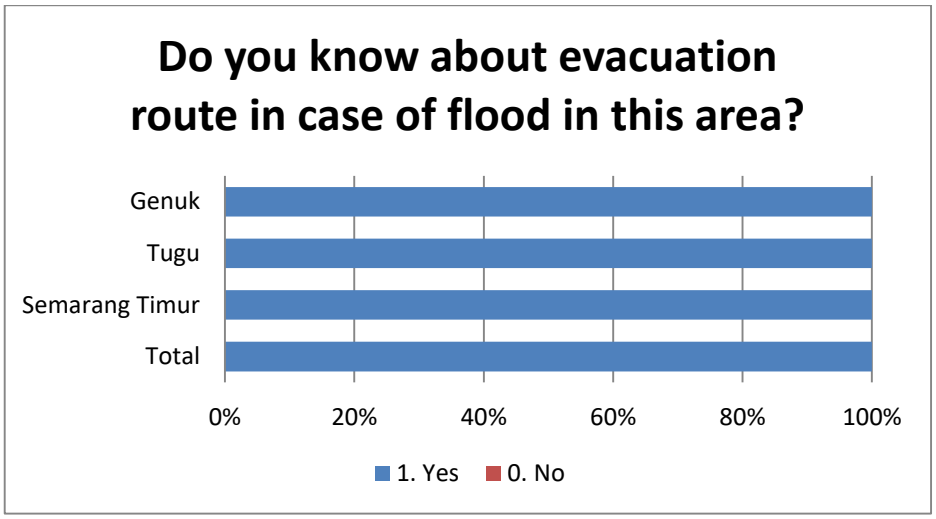

Figure 4.45 People knowledge about evacuation route

Figure 4.45 show that 128 respondent (100%) they know about evacuation route. They get describesation about this from the government officer. At least once a year, government office arrange a community gathering to update describesation about the village.

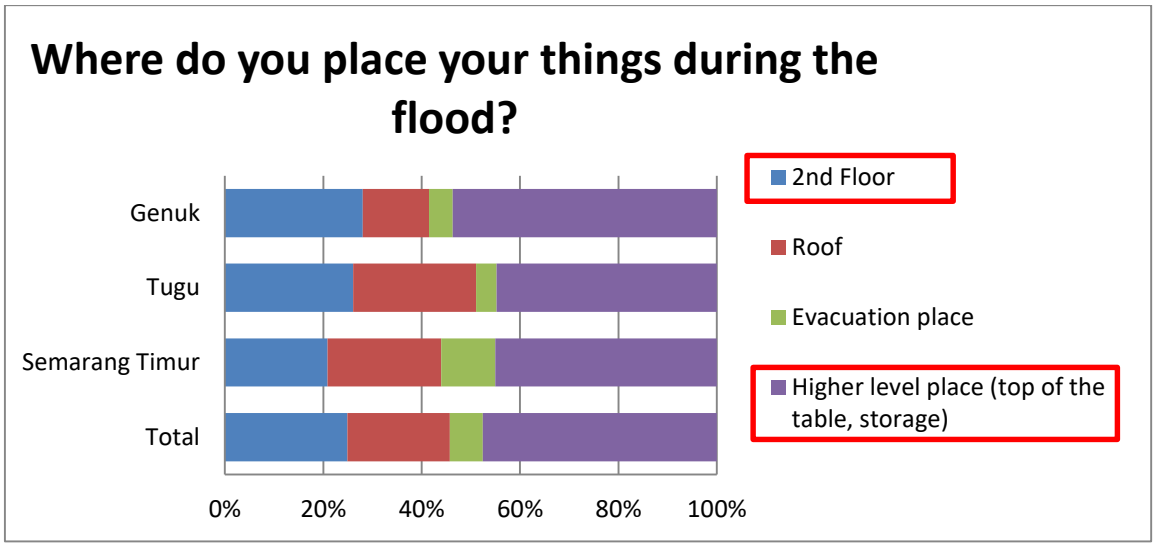

Figure 4.46 People evacuation place to save their belonging

Figure above illustrate that almost 50% of the respondent they save their belonging in the higher level place in their houses. Usually people who do not have second floor in their house building, they place their belonging on the top of table of storage or if the flood is more than 2 metre, they place it on the top of the roof.

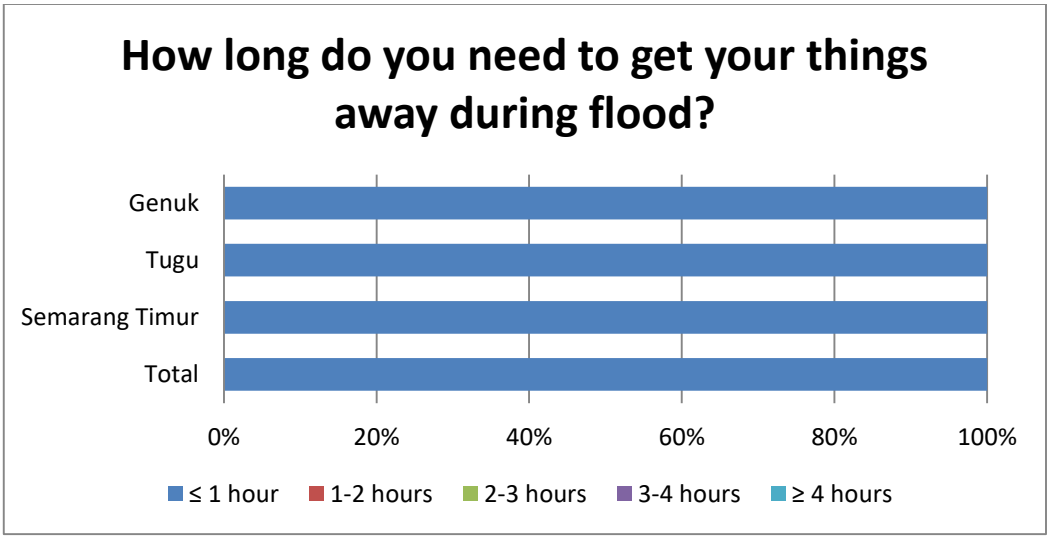

Figure 4.47 Time needed by people to evacuate their belonging

From the figure above we can know that people need just one hour to evacuate their belonging because they already prepare all this thing. So that when flood coming, they will do it fastly.

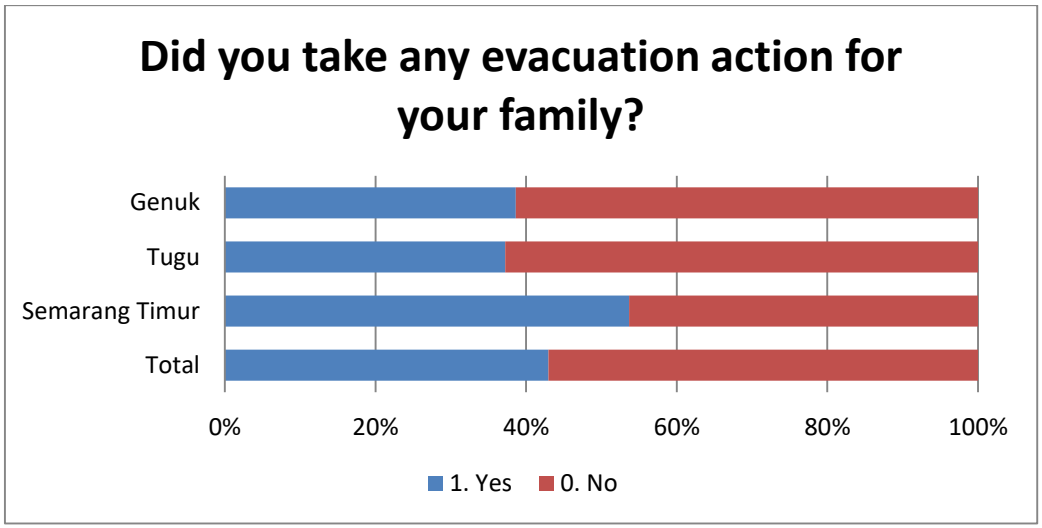

Figure 4.48 Family Evacuation Action

Figure 4.48 describes that 56% of the respondent do not evacuate their family. They argue that if they still can walk in the flood they do not need to evacuate. But sometimes, they go to the evacuation shelter in the daytime to get food and water supply from the government and they will comeback to their house in the night because they worry about their belonging.

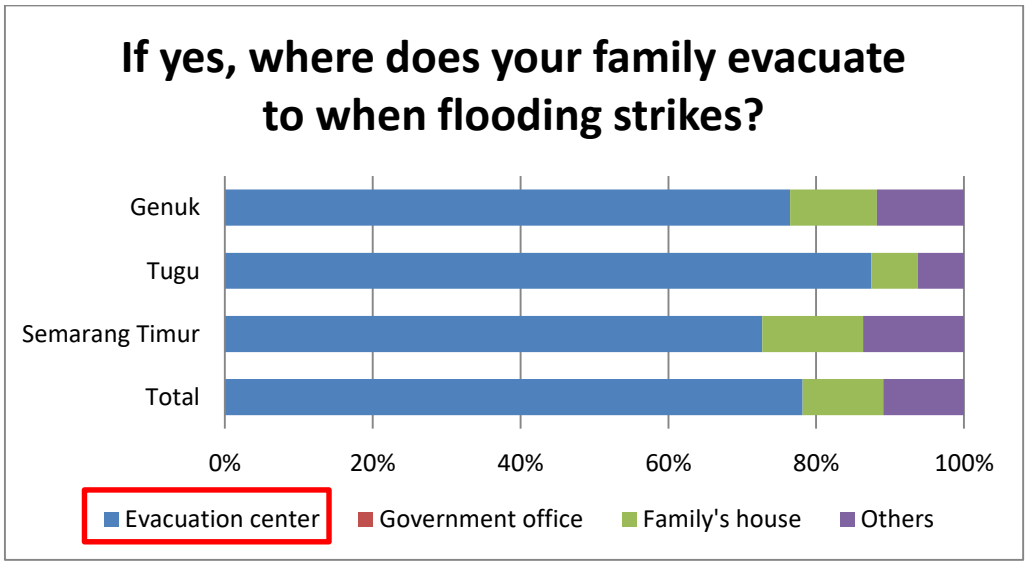

Figure 4.49 Evacuation Place

Figure 4.49 show that most of the respondent are going to the evacuation center provided by the local givernment. It can be school building, mosque, cruch, sport center, etc.

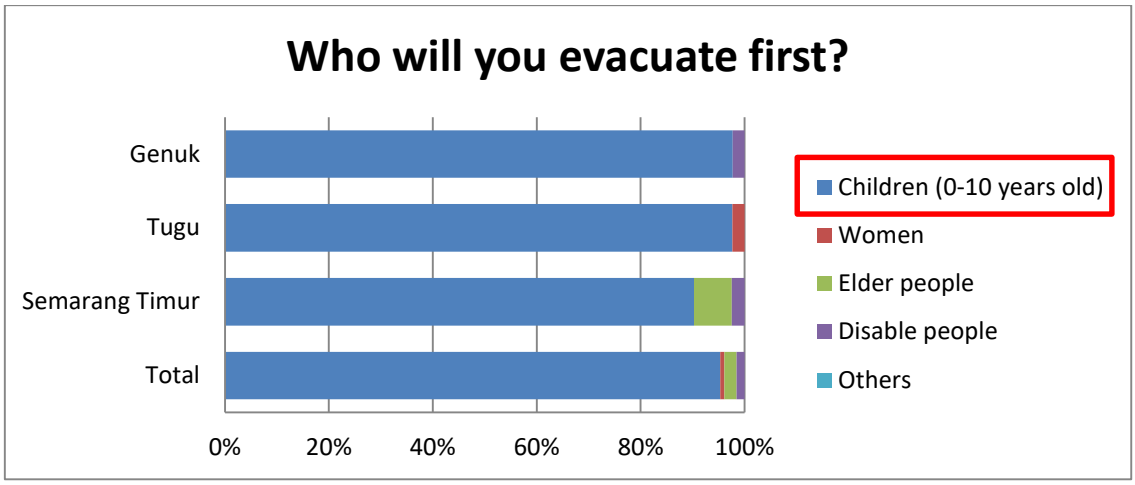

Figure 4.50 Evacuation order

Figure above show that almost 98% of the respondent they know that the first person who have to evacuate fisrt is children followed by eldery and women.

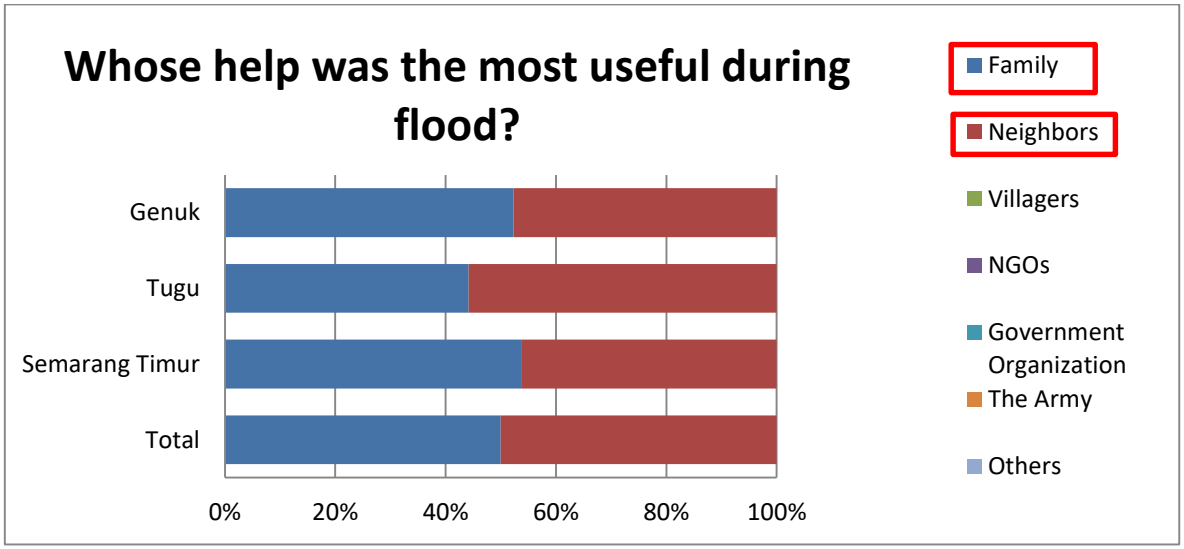

Figure 4.51 Parties help during flood

Figure 4.51 show that the parties who most helpfull during floodis neighboor followed by family. In this case, government and other parties help are coming after the first disaster happen.

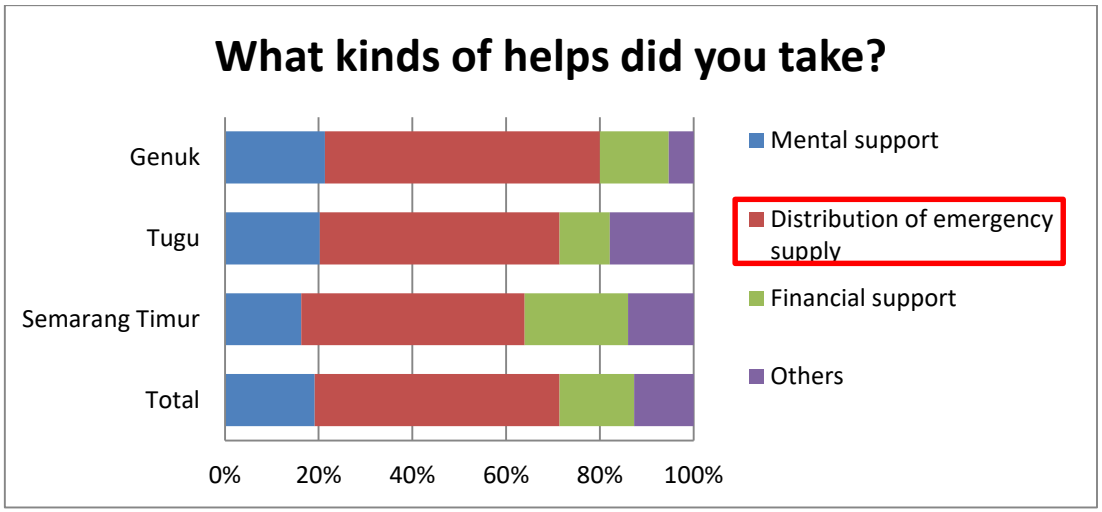

Figure 4.52 Kind of help take by the community

Figure 4.52 shows that distribution of emergency supply such as food, water and medicine is the most important things that people will take during flood followed by mental support especially for the children.

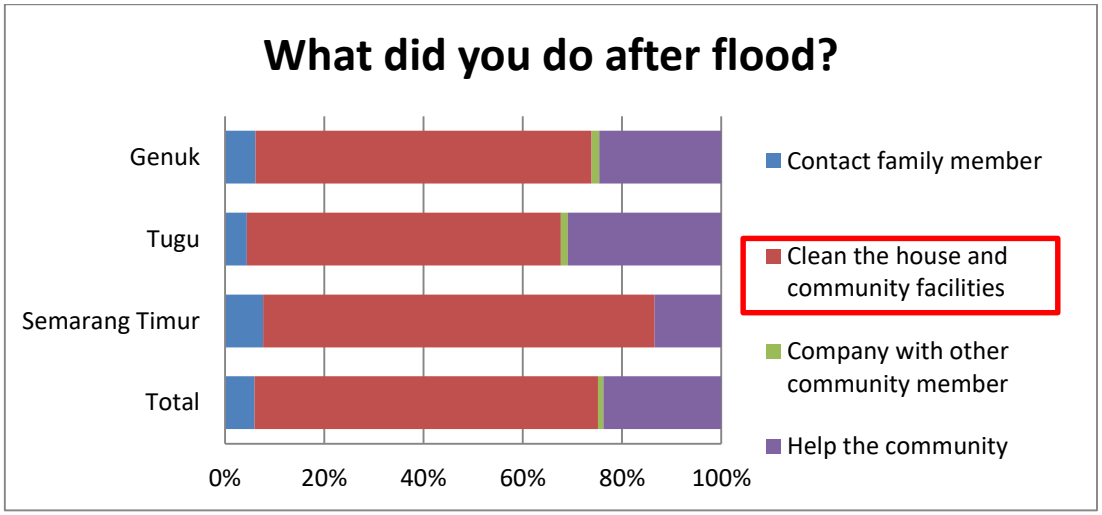

Figure 4.53 People activuty when flood is over

From figure 4.53 we can see that almost 80% of the respondent they would like to clean their house and help the community to clean their surrounding.

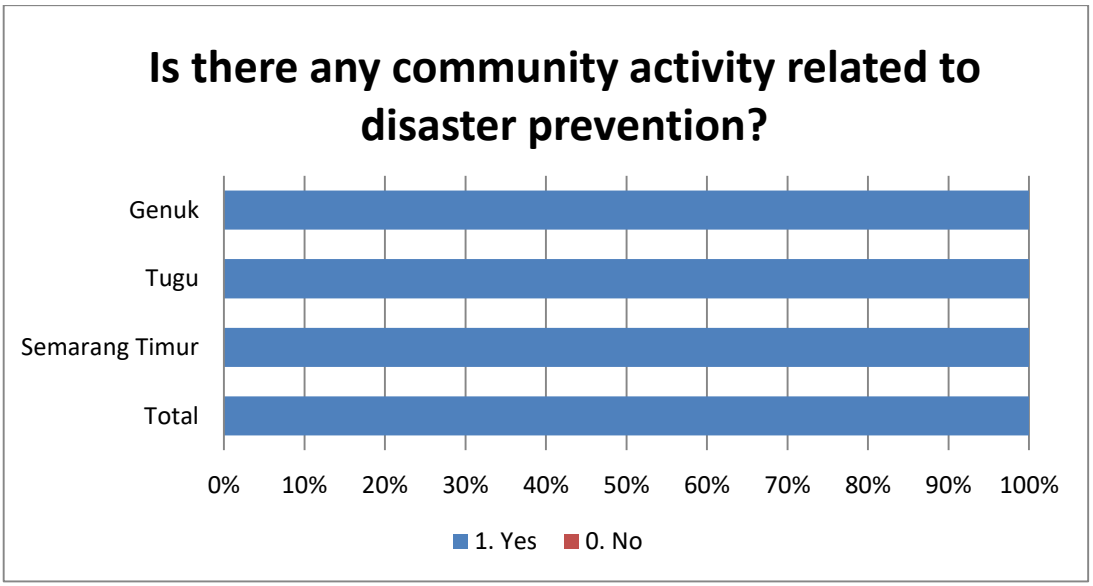

Figure 4.54 Community activity related to disaster prevention

Figure above describe that all of the respondent said that there is some activity related to disaster prevention such as counseling, and kerja bakti (figure 4.55)

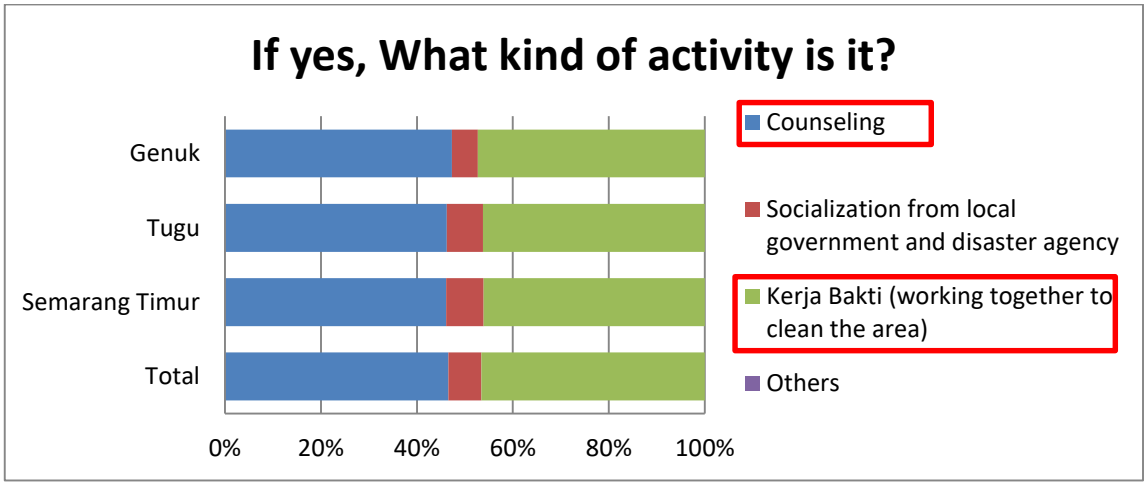

Figure 4.55 type of activity related to disaster prevention

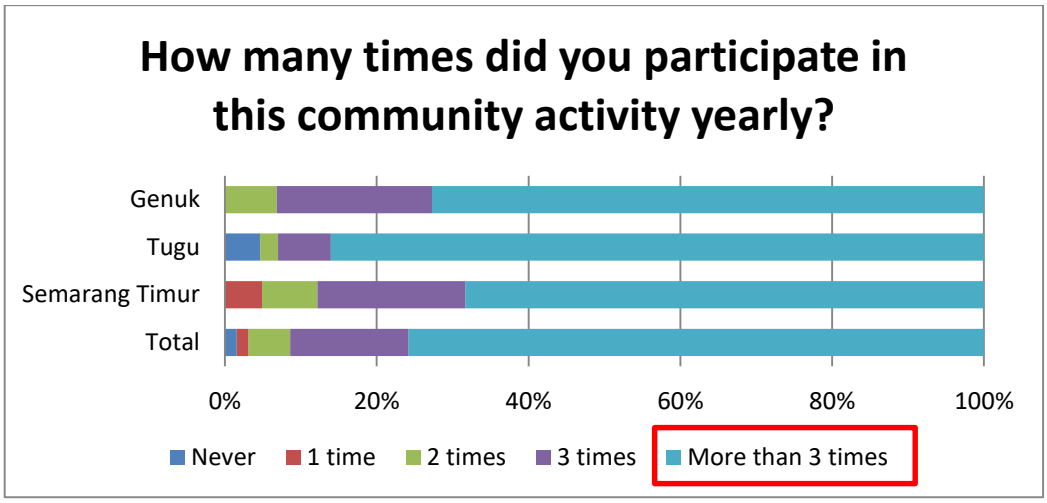

Figure 4.56 Number of people participation to disaster related activity

From the figure above, we can see that 76% of the respondent they take a part in the disaster related activity for more than three times a year. It sign that the community is active in participating in the disaster related activity. They already aware that they are the most vulnerable to disaster.

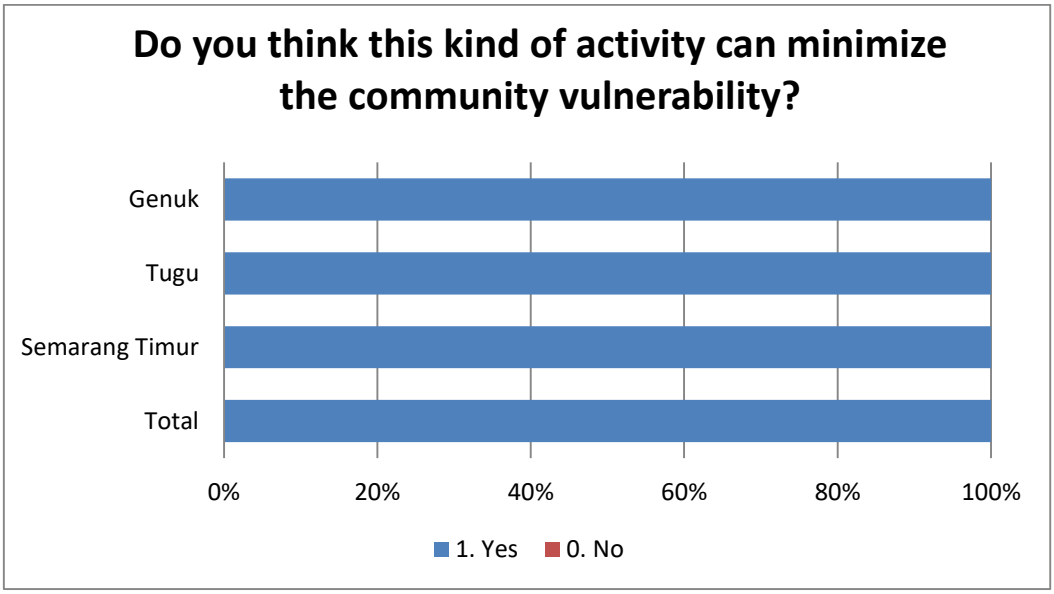

Figure 4.57 People opinion about disaster related activity

128 people (100%) said that this disaster related activity such as counseling and kerja bakti can minimize the impact of the disaster. It is ecause from this kind of activity they can get describesation about disaster.

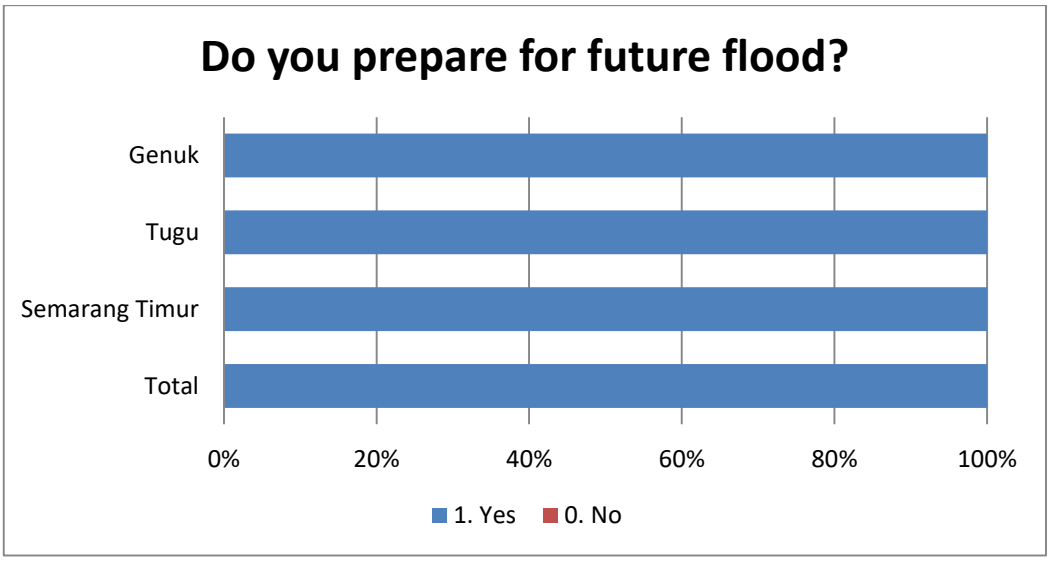

Figure 4.58 People preparedness to future disaster

100% of the respondent said that they prepare theirself to face the future disaster.

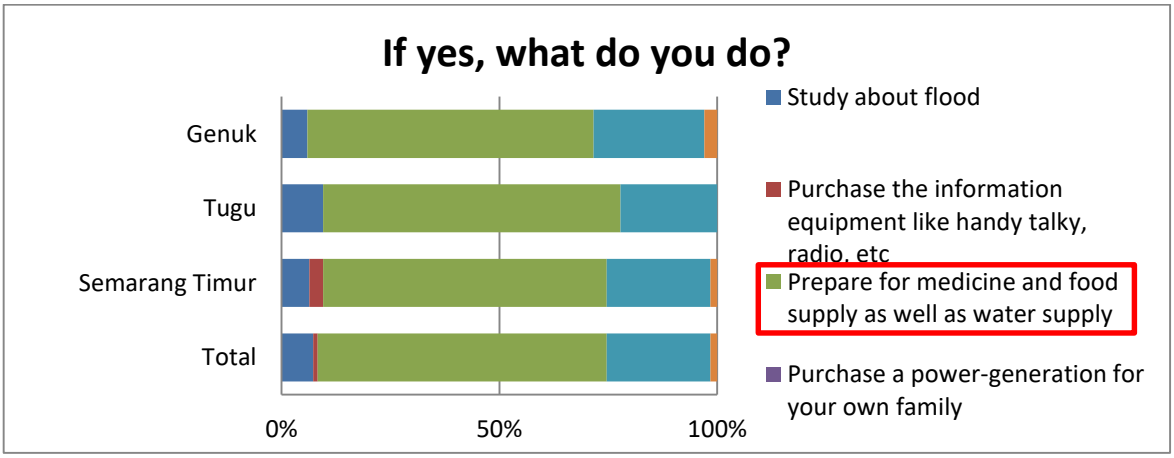

Figure 4.59 People preparedness to the future disaster

Figure 4.59 show some of the people preparedness to the future disaster such as preparing for medicine and food supply followed by study about flood.

Table 4.3 below describe how this to devided the level of community action to flood.

Table 4.3 Clacivication Level of Community Action to Flood

Variable	Number of Questionnaire	Question Number	Clacification Level
Community Action	7	31, 32, 33, 36, 38, 43, 45	Low: 1-2 Medium: 3-4 High: >4

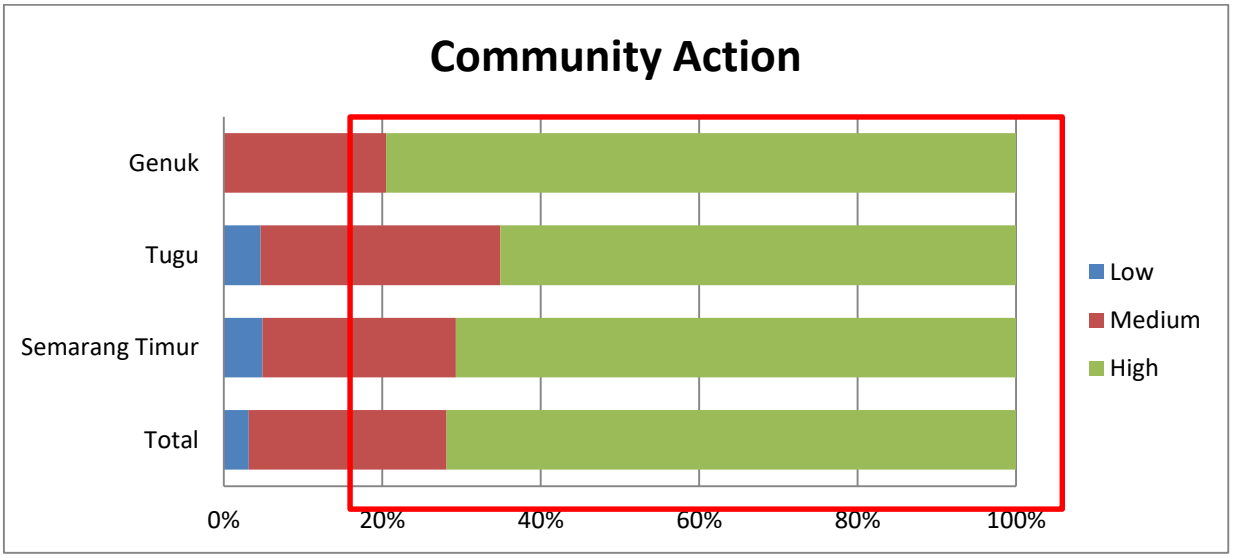

Figure 4.60 Community Action to the Flood

From the analysis of the questionnaire, 71% respondent have a high level of action to flood. It means that people can act fast and well with flood. Good action to flood indicate that they have a good preparedness so that they can minimize impact of flood.

In the coastal area, high level of action mostly influenced by their experience and observation on natural phenomena and some indigenous knowledge aplication. But in the inland, a good action during flood it because people in this area have a good resource of information as well as inforamation transfer.

Figure 4.61 Community Action Activity (left: community gathering; right: kerjabakti)

There are some action activity during flood. For example, we can see in the picture above. In the left side, people consist of the representative of youth group, women group, and community leader are gathering to discuss about flood. In this time, they are talking about emergency supply, how many people are affected in their area, what kind of help thei need, and so on. Meanwhile, picture on the right side show community activity

called *"kerjabakti".* Kerjabakti is a voluntary activity by the community to clean their area or doing some community activity. In this picture, people are working together to rise the level of road during flood.

4.5.1.5 Correlation Analysis

To analyze the correlation between Community Knowledge, Community Preparedness and Community Action in this research determine by some of the question in the questionnaire. This analysis is using SPSS software.

Table 4.4 Correlation Analisys

Correlations			
		Knowledge	Preparedness
Pearson Correlation	Knowledge	1.000	.690
		Preparedness	Action
	Preparedness	1.000	.710

Source: SPSS analysis

From the calculation, obtained a correlation between community knowledge and community preparedness is 0.690. This means that the relationship between the two variables is sufficient. The positive correlation indicates that the relationship between level of knowledge to the level of preparedness in the direction. That is, if a high level of perception, the action rate is also higher. Based on table above, because probabilities much larger than 0.05, the regression can be used to predict that there is no significant relationship between the level of knowledge on the level of preparedness. ***So the first hypothesis which states "there is significant relationship between the level of knowledge on the level of preparedness of community to face flood disaster" is not accepted or rejected.*** It means that there is no relationship bewteen level of knowledge with the level of preparedness. People who has a high level of knowledge about flood do not ensure to have a good preparedness. It is because the level of preparedness is influence by any other factors.

Meanwhile, the calculation about correlation between community preparedness and community action is 0.710. This means that the relationship between the two variables is sufficient. The positive correlation indicates that the relationship between level of knowledge to the level of preparedness in the direction. That is, if a high level of perception, the action rate is also higher. Because probabilities much larger than 0.05, the regression can be used to predict that there is no significant relationship between the level of perception on the level of preparedness. ***So the hypothesis which states there is significant relationship between the levels of preparedness on the level of action of community to face flood disaster is accepted.*** It means that people who have a good preparednees will have a good action during flood because they have a good preparation in context of building, food and water supply, as well as emergency saving.

4.5.2 Interview

The interview was done with the local government and stakeholders in Semarang City especially in the research area which are Kecamatan Genuk, Kecamatan Tugu and Kecamatan Semarang Timur. We also collect

some information from BPPD (Local Disaster Agency) and BAPPEDA (Regional Planning Agency). The Interview guideline is described in the Appendix.

From the interview, there are three programs to cope with flood in Semarang City Regional Planning:

a. Jatibarang Construction

According to the BAPPEDA, Jatibarang Reservoir development in Semarang constituted by a huge flood that hit the city of Semarang in 1973, 1988, 1990, and 1993 In 1993 1992- created the master plan of making multi-purpose reservoirs, the water flowing from the Kreo River.

Development Jatibarang Reservoir is located in the village of Talun Nuts, Kandri Village, District Gunungpati, Semarang. This Jatibarang Reservoir dam the river Kreo as a water source. Dam construction project lasted for 1500 days from the date of October 15, 2009 until January 10, 2014 and cost around 56 million USD. Contractor on this project using the system Joint Operationantara PT.Brantas Abipraya, PT Waskita Karya and PT Wijaya Karya. In a joint operation, PT BAP holds a stake of 51%, PT Waskita 33% and 16% of PT Wika.

Figure 4.62 Layout Waduk Jatibarang
Source: projectmedias.blogspot.com

In 1990 the death toll reached 47 people. Administration Central Java then determined, and create a master plan 1992-1993. In the construction of the dam located in the Village District of Gunungpati, to fill the water carried Kreo River diversion. Thus Dam Rivers free from stagnant water.

The transfer is done by making diversion tunnel along the 421 meters with a diameter of 5.6 meters, where construction began in 2010 and finished 2011. After the dam was made dodger (coffer dam) so that the water goes into the tunnel.

Pre-fill this reservoir, a test phase behavior of the dam. If done in the dry season, it takes 7 months to reach the normal water elevation is 149.3 meters.

The reservoir is expected to reduce flooding, especially in Semarang City, with the design flood 170 m3 per second. The reservoir is also able to accommodate a total of as much as 20.4 million m3 of water and raw water supply especially for the region of West Semarang much as 1050 liters per second. There is also the potential for micro-hydro power plant of 1.5 MW, which can support the operations of the reservoir.

The building of the new dam has a height of 74 feet, crest length of 200 meters, and the width of the peak of 10 meters. Funds spent to build reservoirs Jatibarang and building equipment reached USD 655 billion in aid from JICA, Japan.

Later, this Jatibarang Reservoir will act as a reservoir multifunctional. Some of its functions include:

- Flood control for 50-year service life
- Drinking water providers with discharge of 1005 litre / sec
- Producing electricity with a capacity of 1500 Kw
- Place / new tourism objects in Central Java region
- Enhance environmental quality in the headwaters Kali Kali Garang and Kreo

b. Polder Banger

Pilot Polder is a twinning project in which Indonesia and the Dutch authorities are working together to realize the polder system and organization to operate and maintain the system in the Banger area in Semarang. Polder Systems Development is a collaboration between the Ministry of Public Works, Provincial Government of Central Java, Semarang City Government and the Government of the Kingdom of the Netherlands. Dutch fund technical design in 2007-2008 and formed the governing body Polder.

Figure 4.63 Polder Banger Master Plan
Source: simpanglima.wordpress.com

Currently the pump house was built is and will be followed by other physical building in parallel such as sea water retaining embankments, dredging Banger, Banger Dam, and Pool Retention. Retention pond

with an area of approximately 20 acres would be the parking lot of water before it is pumped into the sea. The total area to be protected System Polder area of 570 hectares, inhabited by about 84 families.

c. Integrating ACCCRN in to Semarang City Regional Planning

Asian Cities Climate Change Resilience Network (ACCCRN) in Semarang City has exceeded a number of milestone achievements. These achievements begin with the completion of vulnerability assessment (VA), implementation of pilot projects for climate change preparedness and sector studies.

Prior to the implementation of climate change preparedness in the city scale, all these achievements are very important to be studied more in depth and followed up through the preparation of City Resilience Strategy (CRS). Therefore, the CRS document within the ACCCRN framework is a basic foundation for the future intervention projects and activities to increase Semarang City's resilience to climate change.

4.5.3 Focus Group Discussion

Focus Group Discussion was conducted in three research area. This FGD was done with some representative of the community such as women association, youth group, community leader and religious leader. The guideline of Focus Group Discussion is describe in the Appendix.

Table 4.5 Focus Group Discussion Information

Location	Date and Place	Number of Participant	Picture
Tugu	Pemuka Agama (religious leader) June 22nd, 2014	6 Community Leader (1) Women Group (2) Youth Group (2) Religious leader (1)	
Genuk	Ketua RW (Community Leader) June 29th, 2014	9 Community Leader (4) Women Group (2) Youth Group (2) Religious leader (1)	

Semarang Timur	Kelurahan (Government Office) August 6th, 2014	7 Community Leader (2) Women Group (2) Youth Group (2) Religious leader (1)	

There are some good preparedness has been done in the study area:

- In both inland and coastal area, the most vulnerable groups in areas of greatest exposure to severe weather conditions brought on by climate change were the urban poor. Not only is poverty likely to be the cause of such populations locating in areas of risk, but it is also the reason why poverty and vulnerability is reproduced. Without other options the poor seek to live in areas that are uninhabited, these are also areas which are usually uninhabited because they are undesirable. Once there the living costs to maintain their existence is often so high that they are effectively tied to living there, there by reproducing their precarious situation and limiting their opportunities to move to safer areas.
- In the case of Coastal Flood, groups of urban poor live on unsuitable, sinking land exposed to flooding and incursion from sea level rise. Their homes sink at an alarming rate of 10 cm a year, requiring they continuously invest large proportions of their income in maintaining their homes 'above the water level'. Despite low entry costs (no payment is necessary for land or taxes) the cost of maintaining their homes is extremely and disproportionately high. It is also a continual burden; housing materials need to be renewed every six months, like a large mortgage burden for a family of scarce resources.
- *Reused and adaptable housing materials:* Those families who live in Genuk and Tugu, whose homes suffer from coastal flood have to repeatedly reconstruct parts of their homes that are damaged. Instead of building their homes out of cement or materials that require costly investment (but which may be vulnerable to cracking) they use recycled scrap materials. The materials come from a scrap yard nearby, mostly pieces of lumber and tin siding. This proves more adaptable to their situations as they can be incrementally improved, modified and worked with only a hammer and nails. If it breaks then parts can be replaced or used again. Importantly such materials are also inexpensive compared to the cost of cement and more permanent building materials and they are easy to transport.
- *Savings groups:* Community savings groups (Arisans) are made up of neighbors and friends who come together weekly to collect small amounts of money. Each member will contribute the same amount of money per meeting and every session an alternating member of the group will take the whole lot. The groups are organized in relation to the capacity of different families to save, the payout also varies depending upon the amount contributed. The average group seems to be made up of 8— 10 persons, usually women, who save between 10,000 and 20,000 IDR. per week. There are however groups who save in increments of 50,000 to 100,000 IDR. This preparedness to lack of capital leverages the collective savings

capacity of neighbors and communities and allows a degree of financial freedom for the beneficiaries to invest in larger than usual capital investments.

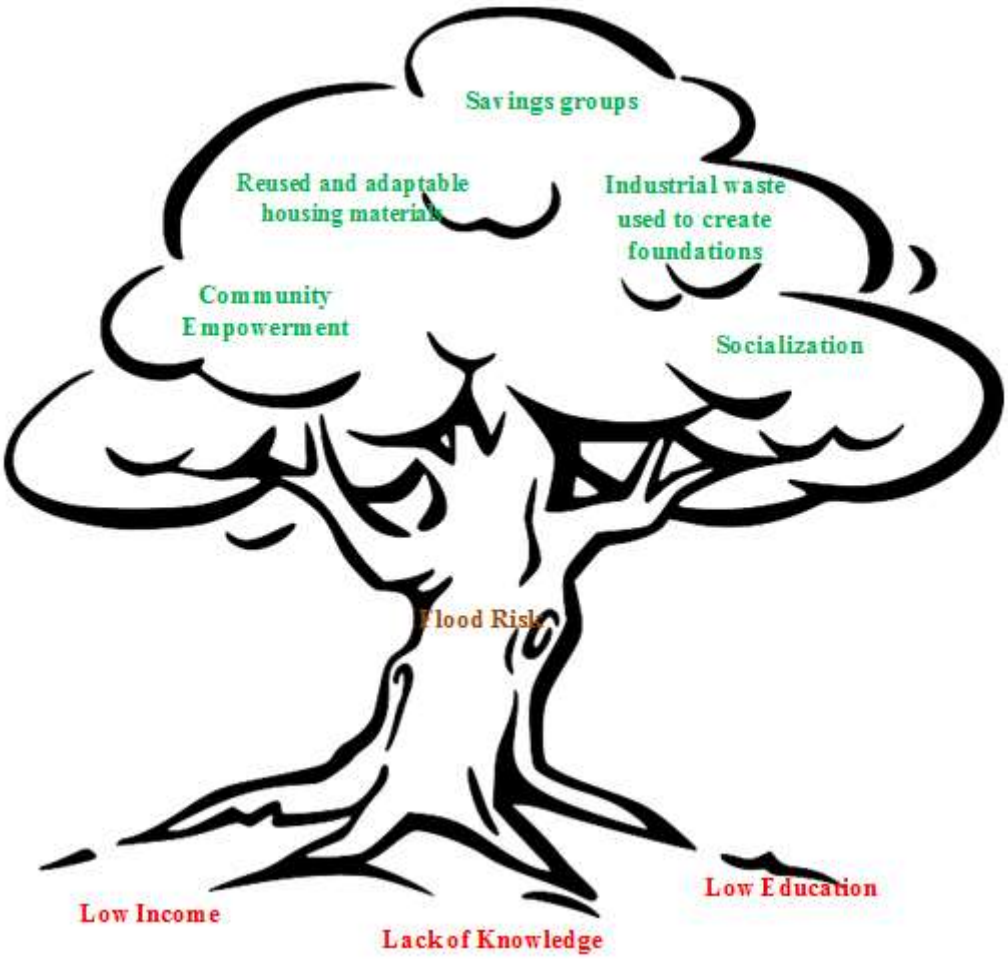

Figure 4.64 Problem Tree on Flood Managemen in Coastal Area

- *Industrial waste used to create foundations*: The use of industrial waste, such as ash in sandbags, to shore up housing foundations and provide walking paths is an example of an improvised preparedness in the face of a lack of natural resources. The community members in Kemijen, Semarang Timur who work in factories by the port and have access to industrial waste products, are able to carry them home and use them to improve the physical environment around their homes. Despite not being very durable they are free and respond to an immediate need.
- Socialization can also be performed through habit which later evolved into the tradition/culture in the middle of the community to tell children through the saga - saga or often called folklore. From poetry and folklore, parents especially mothers can tell just before the child to sleep, so it becomes an excellent education to tell the next generation that when it happens like what is heard in the poem, it must immediately seek a safe place. When you've been told since childhood, it will stick in their soul the sign will come like

a tsunami disaster for those who live on the coast and flash floods to the story in the mountains or other disasters.

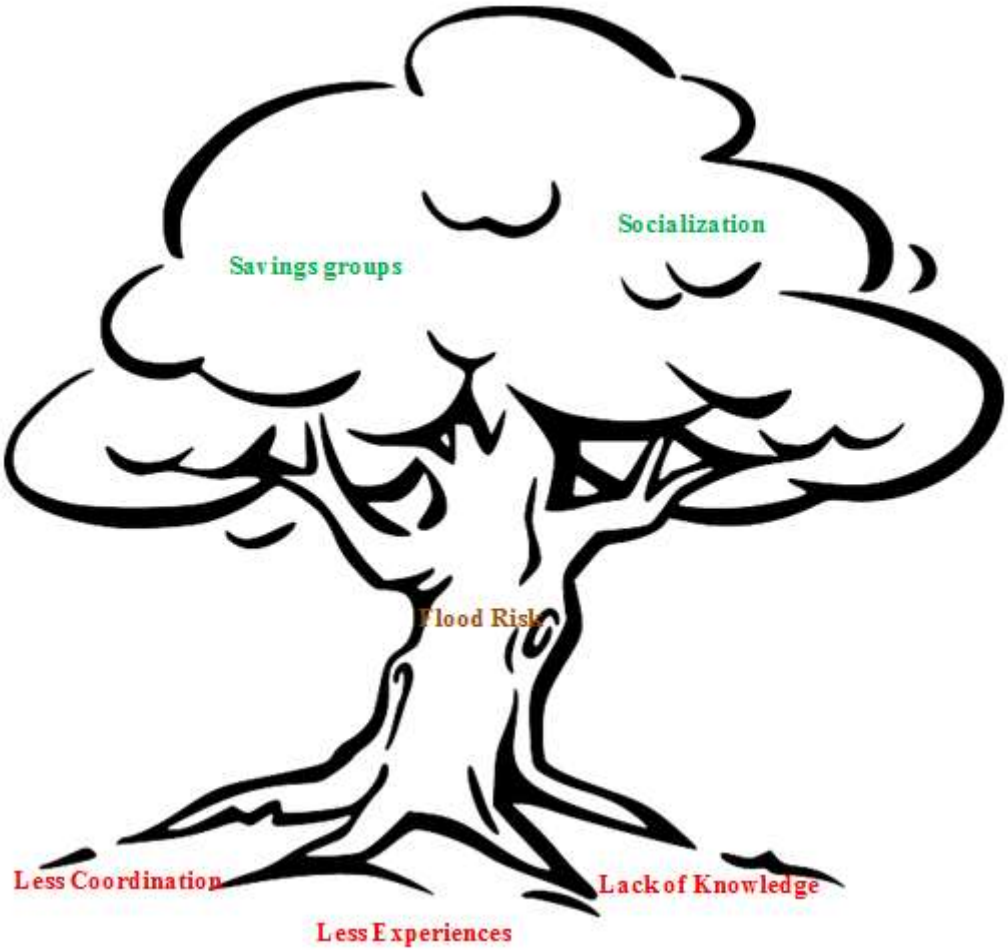

Figure 4.65 Problem Tree on Flood Managemen in Inland

4.6 Community-based Practices to Cope with Coastal and River Floods in Semarang City

The result of data observation shows that the community in the research area apply some good practices in order to cope with the negative impact of flood. The varieties of good practices were employed by the community to protect their lives and properties.

Result of the analysis showed that the community from the research area were apply the combination of economic, technological/structural and social coping mechanism in order to minimize the negative impacts of flood. In combination of the three types of strategies, they constructed their house using reinforced material, such as brick for its wall and tile/ceramic for its floor. For this local community, the social coping mechanism has an important role, for instance, they help each other during the house construction. The social good practices employed by the local community includes cleaning the house and surroundings. looking for alternative place to move, continue patrolling the neighbourhood (ronda), helping other's community member in doing work (gotong royong), guarding the house to ensure safety belongings, searching relief materials,

evacuating the family, especially children and elderly to the safer place, such as: factory building, kelurahan office (local building office), mosque, friend's or relative's place, evacuating the important things to the safe place, preparing temporary place at friend's or relative's place, preparing place for storage at the higher place, cleaning the canal surroundings the house.

During flooding the predominant coping mechanism apply by the community are continue working. Do nothing, move the appliances and valuable things to the safe place to the higher place within the house, if any and or at neighbours and relatives place, or the local government offices or factory buildings and join the ronda.

Table 4.6 Community-based Practices to Flood in Semarang City

Location	**Community Knowledge**	**Community Preparedness**	**Community Action**
Coastal Area	Relatively High: ▪ Experiences of flood disaster Good Practices: ▪ Indigenous Knowledge is applied ▪ Ocean observation is linked to their livelihod	Relatively low ▪ Low income ▪ Poor housing Good Practices: ▪ Community Emergency saving ▪ Reuse and adaptable housing materials ▪ Industrial waste used to create foundations	Relatively high ▪ Low level of individual response ▪ High community response Good Practices: ▪ Applied traditional tools "kentongan" for disaster announcement ▪ Applied community security system "ronda" ▪ Mosque and school for evacuation center
Inland	Relatively low ▪ Less of experience (new settlemen area) ▪ Different background ▪ Inproper development Good Practices: ▪ High education ▪ Good information	Relatively high ▪ Higher quality of the building ▪ Higher income Good Practices: ▪ Community saving ▪ Evacuation shelter ▪ High quality building	Relatively high ▪ High individual and community response Good Practices ▪ Information based on technology

Coping mechanisms employed by the households after flooding are dominated by structural and social coping mechanism. Repairing minor damage of the appliance, repairing important damage to the house, cleaning the house and surroundings, fixing things, looking for alternative place to move, continue patroling the neighbourhood (ronda), helping other' s community member in doing work (gotong royong) are among the predominant best practices apply by the community.

The result of this research shows that there is no correlation between community knowledge with the community preparedness to the flood. It can be seen that people in the coastal area who have a high level of knowledge about flood they do not have good preparedness to face the future floods due to low economic income. Menwhile, people in the inlad who has low level of knowledge they have a high level of preparedness since they have a high income so that they can do some physical adaptation on their building fo face the future floods.

Furthermore, people with high level of preparedness have a high level of action during flood. For people who are living in the coastal area, it can be accepted because they have more experiences to floods so that they already know what they have to do immediatly when floods coming. And for people who living in the inland, they can evacuate their belonging soon because they have second floor in their house building so that they can save them in hours.

There is some evidence that people in the research the local people in the study area tend to allocate some amount of money to prepare for the flood impacts, except they allocated some amount of money to buy the reinforced material for their houses. The other economic coping mechanism included saving money to buy basic food before and during flood. However, this kind of economic activities, such as saving money, as economic coping mechanisms can rarely be found in the surveyed households. Even though households have more than one source of income. Based on fieldwork observation that the economic condition of the households is not enable them to save money to prepare in case of flooding. Of 128 respondent, do not have emergency saving money as coping mechanism in case there is flood. The very little percentage of saving money explained that the economic condition of the households is not enable them to save money from their basic income.

To enhance community resilience in the flood affected community in Semarang City, there are some efforts can be done. In case of improving community knowledge there are at least two things need to be increase which are disaster mitigation activity and indigenous knowledge that already exist in the community. Forthermore, the disaster experience also contribute to the community knowledge. Meanwhile, community preparedness can be improve by giving some community empowerment and economic activity since the main problem of the preparedness stage in the coastal area in the Semarang City is about low income. On the other hand, this activity related to the community knowledge and community preparedness will lead to the good level of the community action to flood in Semarang City.

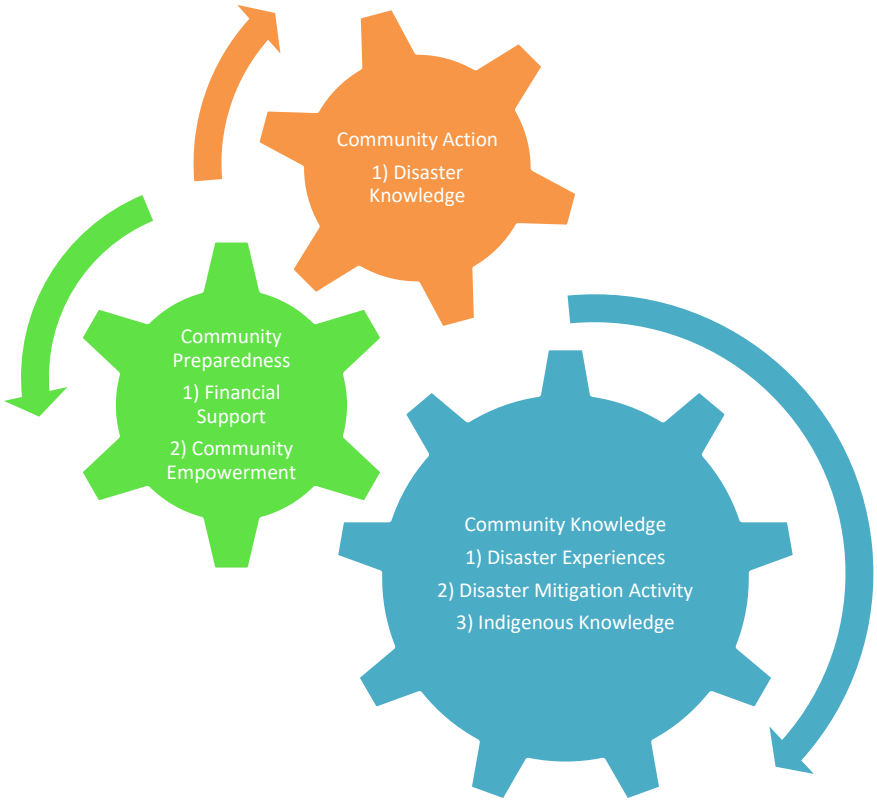

Figure 4.66 Efforts to enhance community resilience to Flood

Mainstreaming Disaster Risk Reduction in Semarang City

Disaster risk reduction (DRR) is a term used for reducing and preventing the effects of a disaster. DRR is founded on the belief that whilst disasters are inevitable, death and suffering from them is not and humans can take action to ensure this. DRR actions can be political, technical, social and economic. DRR takes forms as varied as policy guidance, legislation, preparedness plans, agricultural projects or insurance schemes. This includes projects such as building secure houses in flood areas, implementing early warning systems and managing food resources to avoid famine.

Climate change is expected to increase the frequency and magnitude of many types of extreme events, including floods. The relevance of reducing and managing climate-related risks has been increasingly recognised in both policy and practice. Adaptation to climate change and DRR both seek to achieve sustainability and reduce vulnerability. Subsequently there are growing efforts to closely link DRR and climate change adaptation, both in policy and practice.

It is important to acknowledge the social aspect of DRR. Those with better access to resources, stable housing, financial fallback and higher social status are at a distinct advantage. Social conditions, therefore, also mean that the poor are more at risk from a disaster and DRR activities must involve them. This can involve a plethora of challenges including language barriers, the need for cultural sensitivity and extensive consultation with local people. Women, children, youth and the elderly are most at risk during a disaster and yet as is clear from this collection of papers, they have an essential part to play in DRR.

Reducing disaster risk is not just about additional investments; it is also about ensuring that development interventions are sound. Like climate change adaptation, DRR is far more effective when mainstreamed within larger development projects and policies. This has been increasingly recognized since the 1990s. Before this, disasters were frequently viewed as spontaneous and unpredictable events. Disaster affects almost all aspects of life; it is important that preventative efforts are made for the success of sustainable development. This applies to governments, donors, NGOs, civil society and businesses involved in service provision and institutional structures. Mainstreaming of DRR within construction, women's projects, microfinance or water sanitation are just a few examples of areas, which have capacity to reduce the effects of a disaster. However, it is important that DRR elements have specific standards which are adopted early in the design stage. In many cases, climate change is placing added emphasis on mainstreaming DRR approaches, as it is believed that being able to tackle risks posed by current climate variability are the best frontline defense against longer-term climate change impacts. Various development organizations are now making an effort to mainstream DRR into their policies and processes, as are national donor governments.

In order to increase community-based disaster risk reduction in Semarang City, there are some factor need to be change. One of them is education sector. Through a community-based education the lack of knowledge in the community can be reduced. The following figure show the framework to propose a better community knowledge through community-based disaster education.

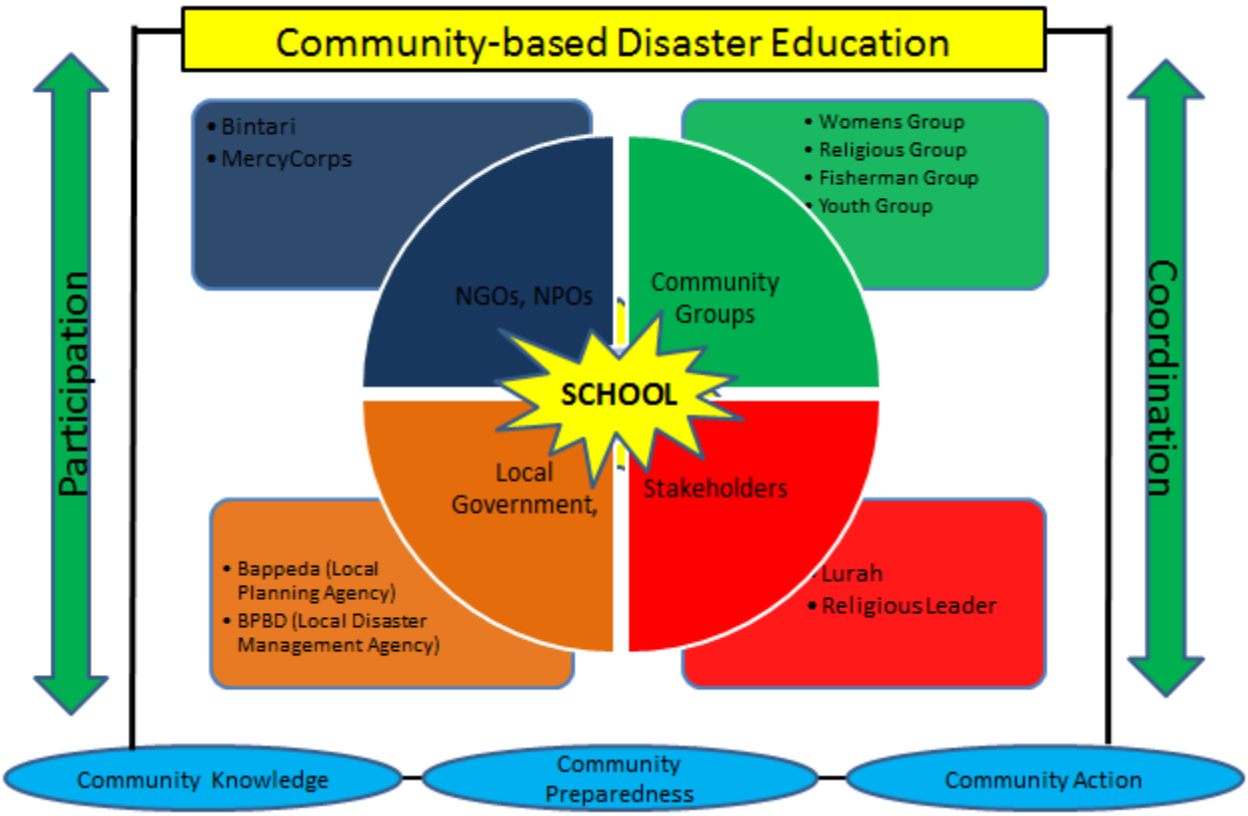

Figure 4.67 Community-based Education Framework

The framework shown above describes a framewok to enhance community resilience to the flood. As shown in the figure, to increase community knowledge, preparedness as well as community action to the flood need participation and coordination among parties in the community which are community groups, local stakeholders, local government as well as NGOs and NPOs. This parties should have a link to the school as a basic parties in this working group.

Establishing connections with community partners is an important first step in connecting with the public because it creates new channels for distributing warning messages. A simple communication model can help establish local strategies for effectively distributing warning information to the public.

Applying the concepts of this model to multi-hazard warnings is an important step in developing a warning system. In order for education and outreach about the warning system to be effective, all of these components must be clearly defined, established, and exercised prior to an event. When developing warning system education and outreach strategies it is best to start by defining the. Defining the audience will assist the community partners in determining the appropriate message and channel. In the case of the flood warning system, it is assumed that the primary source of knowledge will be the school. Furthermore, school need to transfer knowledge to the community through the parties in this framework.

References

Bakti, L. M. "Kajian Sebaran Potensi Rob Kota Semarang dan Usulan Penanganannya." *Program Magister Teknik Sipil, Program Pasca Sarjana Universitas Diponegoro* (2010).

Dewi, Anggraini. "Community-based analysis of coping with urban flooding: a case study in Semarang, Indonesia." International Institute for Geo-Describesation Science and Earth Observation, Msc Thesis, Enschede, The Netherlands (2007).

Marfai, Muh Aris, and Lorenz King. "Coastal flood management in Semarang, Indonesia." Environmental geology 55.7 (2008): 1507-1518.

Marfai, Muh Aris, and Lorenz King. "Potential vulnerability implications of coastal inundation due to sea level rise for the coastal zone of Semarang city, Indonesia." Environmental Geology 54.6 (2008): 1235-1245.

Marfai, Muh Aris, et al. "Natural hazards in Central Java Province, Indonesia: an overview." Environmental geology 56.2 (2008): 335-351.

Mulyasari, Farah, Rajib Shaw, and Yukiko Takeuchi. "Urban flood risk communication for cities." Community, Environment and Disaster Risk Management 6 (2011): 225-259.

Nugraha, Arief Laila, Eng Purnama, and M. ST. PENYUSUNAN DAN PENYAJIAN PETA ONLINE RISIKO BANJIR ROB KOTA SEMARANG. Diss. Universitas Gadjah Mada, 2013.

Ramadhany, Apriliawan Setiya, Petrus Subardjo, and Agus Anugroho Dwi Suryo. "Daerah Rawan Genangan Rob di Wilayah Semarang." Journal of Marine Research 1.2 (2012): 174-180.

Syawal, Syahru, and Widjonarko WIDJONARKO. Simulasi Pengaruh Pembangunan Waduk Jatibarang Terhadap Banjir Di Bantaran Sungai Garang, Semarang. Diss. UNIVERSITAS DIPONEGORO, 2010.

Wardani, Sri Prabandiyani Retno, and Robert J. Kodoatie. "Disaster management in Central Java Province, Indonesia." Geotechnical Engineering for Disaster Mitigation and Rehabilitation. Springer Berlin Heidelberg, 2008. 254-259.

Watiningsih, Wika, and Yuhanes Widi Widodo. NON STRUCTURAL METHOD FOR DISASTER MANAGEMENT (CASE STUDY: FL MARANG CITY). Diss. F. TEKNIK UNDIP, 2007.

CHAPTER 5

Conclusion

This chapter will discuss about the conclusion of this research. Conclusion comes from the result of the survey and analyze.

5.1 Conclusion and Main Finding

Natural hazards cannot be avoided, but timely, accurate prediction of hydro-climate extremes helps societies to prepare for and mitigate disasters and to reduce losses in infrastructure and productive activities. Early warning systems and forecasts provide lead time, which together with public awareness, education and preparedness, can allow people to act quickly in response to hazard information, thereby increasing human safety and reducing the human and economic losses from natural disasters.

Hydro meteorological ("hydromet") hazards such as storms, floods, droughts, and heat and cold waves are responsible for the greatest proportion of losses from adverse natural events, causing nearly 80 percent of disasters and over 50 percent of disaster-related deaths between 1980 and 201. As some studies indicate, climate change could make such events even more severe (GFDRR,2012).

The importance of mitigation on flood losses, cannot be over emphasized especially in the challenging atmosphere of climate change and the increasing occurrences of climate extremes. Early warning systems coupled with response, mitigation, awareness and preparedness are needed in many developing countries. Due to the current and projected impact of weatherinduced natural hazards, the effective functioning of hydrometeorological systems is critical for disaster risk mitigation, preparedness and response.

Governments and regional organizations engaged in providing comprehensive hydrometeorological services are bolstering the efficiency of disaster risk management systems through the knowledge and experience they are acquiring. For example, many governments have made advances in the application of hydromet technologies and data for better management of disaster risk. The hydrometeorological services are also instrumental to several other sectors, such as water resources, hydropower, agriculture, transport, urban development, health and others.

The study has revealed that the flood occurs in Semarang City. There are 3 sub districts with total inundated areas of 1.970 ha that have been suffering from flood for many years.

Semarang faces three types of floods which are local flood, river flood and tidal flood. All of those floods occur in low lying and coastal areas. Tidal flood occurs when the sea level rises to a critical height above the coastal land, due to tidal elevation. The tidal flood occurs almost daily, depending on the tidal oscillation. It is worsened by land subsidence and sea level rise due to climate change.

Tidal flood have been occurring in Semarang coastal areas for more than 30 years. It is periodically occurs every month, which 4 – 9 times the flood inundates the people's houses. Moreover whenever the flood occurs, it inundates within 24 hours, and in average height 0.5 meter. The worst inundation is when tidal flood

inundates 2 – 6 days and in 1 meter height. Up to now the houses of about 71.395 people have been inundated by tidal flood. Most of people in inundated areas are low-level income, however there are also low middle income and high income people. Most of them work as fisherman, small business entrepreneur, meanwhile the others work as government officers, labor and others. Most of the people in inundated areas live in their own house, which is later influence the adaptation measures in coping with tidal flood.

Flood has been affecting the social, economic and environmental condition of society in present inundated areas for years. In terms of social effects on people, health and education are the most affected by flood. People are suffering diseases (diarrhea, skin disease, dengue and others) which are related to the water condition. Contaminated water affects the health condition of people in inundated areas. In terms of education, flood affects children in the way that they cannot go to school. However the education terms are not significantly affected by tidal flood. Most of the children in inundated areas mostly still can go to school when the flood occurs.

Meanwhile flood also damage the school buildings located in the inundated areas. In terms of economic effects, the flood has significantly affected the condition of people in areas. People lose their income and cannot go to work on day of flood. The most affected profession is fisherman and small business entrepreneur, since most of these are located in inundated areas. However the flood does not affect people's opportunity to go to work significantly. They keep going to work even when the tidal flood occurs in their neighborhood.

In terms of environmental effects, tidal flood has been affecting drinking water and sanitation systems in inundated areas. People in inundated areas experience their water changed its color, taste and smell due to tidal flood. The changes in drinking water are related to health condition of inundated inhabitants, since contaminated water can threaten the health condition. Meanwhile people also experience effects to their sanitation system. The commonly effects are waste overflow, bad smell and damage in sanitation infrastructures. Consequently the environment effects and health effects of flood are linked each other, and the decreasing quality of water and sanitation system will decrease the people's health condition.

In dealing with flood problems, people in inundated areas and Semarang city government have been doing adaptation responses. The city government has been doing planned adaptation which in form nonphysical and physical measures. The adaptation measures are considered to react the present impacts (reactive adaptation) and to anticipate the future impacts (anticipatory adaptation). The flood management in Semarang is aiming to deal with all types of flood in Semarang. Nonphysical adaptation measures focuses on planning, management and institutional. Meanwhile for the physical measures, the city government focuses on protection and accommodation, such as develop drainage systems, sea walls, polders, dams and also provide pumps.

The city governments have been carrying out the adaptation measures based on their own planning and people's initiatives. The city government prioritizes to apply structural adaptation measures to the low income communities, since they have limited financial capacity and ability to do their own adaptation measures. Beside limited financial capacity, low of people awareness to maintenance the flood infrastructures and low of law enforcement in implementing the spatial planning are hampered the flood management in Semarang. For now,

the adaptation measures both physical and non-physical done by the city government are still inadequate to solve the entire tidal flood problems in Semarang. The people are still suffering from flood.

People in present flooded areas have been doing physical adaptation measures on their own houses and in their neighborhoods areas without any intervention from the city government. People in inundated areas are still living in their houses, meanwhile they are adapting their houses in order to reduce the effects of flood.

Community Response to Flood

The first main objective of this research is to identify and analyze community response and its relation to their knowledge, preparedness and action level.

For the people who live in the coastal area, 61% of respondent have a high level of knowledge because they already stay in flood prone area for more than 10 years so that they have more experiences about flood. Furthermore, some of native people also observe some Indigenous Knowledge related to the flood. For example tidal flood will be occurred during full moon in every month. On the other hand, people in the Semarang Timur, they do not have enough knowledge about flood since flooding is occurred in their area in last five years. It means that people do not have much experience to flood. The other factor is also river floods cannot be predicted so people with a few experience will more vulnerable to the flood.

43% of the respondent have low level of preparedness to flood followed by medium level (31%) and high level (24%). This preparedness effort are mostly related to the economic level of the respondent because to do an preparedness for example to raise the floor level they have to provide some amount of money from their income whereas most of the respondent are in the low income level.

From the analysis of the questionnaire, 71% respondent have a high level of action to flood. It means that people can act fast and well with flood. Good action to flood indicate that they have a good preparedness so that they can minimize impact of flood.

In the coastal area, high level of action mostly influenced by their experience and observation on natural phenomena and some indigenous knowledge aplication. But in the inland, a good action during flood it because people in this area have a good resource of information as well as inforamation transfer.

There is no significant relationship between community knowledgewith community preparedness to the flood. But there is a significant relationship between community preparedness with community action to the flood.

Community-based Good Practices to Cope with Floods

Result of the analysis showed that the community from the research area were apply the combination of economic, technological/structural and social coping mechanism in order to minimize the negative impacts of flood. In combination of the three types of strategies, they constructed their house using reinforced material, such as brick for its wall and tile/ceramic for its floor. For this local community, the social coping mechanism has an important role, for instance, they help each other during the house construction. The social good practices employed by the local community includes cleaning the house and surroundings. looking for alternative place to move, continue patrolling the neighbourhood (ronda), helping other's community member in doing work (gotong royong), guarding the house to ensure safety belongings, searching relief materials,

evacuating the family, especially children and elderly to the safer place, such as: factory building, kelurahan office (local building office), mosque, friend's or relative's place, evacuating the important things to the safe place, preparing temporary place at friend's or relative's place, preparing place for storage at the higher place, cleaning the canal surroundings the house.

Influencing Factors of Coping Strategies

Based on personal observation during the fieldwork and analysis of the data, the perception implies how the people view the impact of the flooding based on their own experiences and these perception influence the behaviour and decision they make to deal with negative flood impacts. The result of this research revealed that the type of best practices apply by the households are influenced most by the economic level. Economic level of the respondent influence the level of their preparedness to the floods. To deal with this economic problem, people are apply to use some recycle material to their house building. At the some time, some of women also try to do some economic acitivity to get extra income by making some goods from garbage. They set up ways of coping to minimize the negative impacts of flood.

This study leads to several recommendations especially to enhance the adaptive capacity of the city government and the people to cope with the present and increasing tidal floods.Dealing with flood problem should be not only about the flood infrastructures development. The tidal flood which occurs mostly in coastal areas should be understood as a development issue. The city government should focus to manage and to protect the coastal areas, since it is very vulnerable to tidal flood and other climate change variability.

The Integrated Coastal management (ICM) can be implemented in Semarang coastal areas to develop and protect the coastal areas, which should be in line the spatial planning of Semarang and the flood management. Moreover within ICM framework that involves stakeholders from national level to local community level, sustainability in coastal areas can be achieved.

Building the capacity of the local government and the community is important to succeed the adaptation to flood. Capacity building for the city government's staffs should be arranged continuously to keep up with the latest technology and trends in dealing with flood. The city governments should also build the capacity of the people in present and predicted inundated areas by creating community organization to participate in operation and maintenance the flood infrastructures. Moreover providing information about floods and manual of emergency action will be improve the people's capacity to deal with flood problems.

Adaptive capacity is related to economic resources. There is a need to prioritize low income people to in dealing with flood in Semarang, since the low income people are very vulnerable to the hazards. The city government should develop strategies to deliver financial aid to the low income housing to finance their adaptation measures. Consequently it will reduce the vulnerability of low income people to flood. In line with that, the city government should develop financial scheme to fund the flood infrastructures. It should involve not only the central government and the provincial government, but also the private sectors.

Community-based Disaster Education

In order to increase community knowledge about flood, there are some factor need to be change. One of them is education sector. Through a community-based education the lack of knowledge in the community can be reduced. The following figure show the framework to propose a better community knowledge through community-based disaster education:

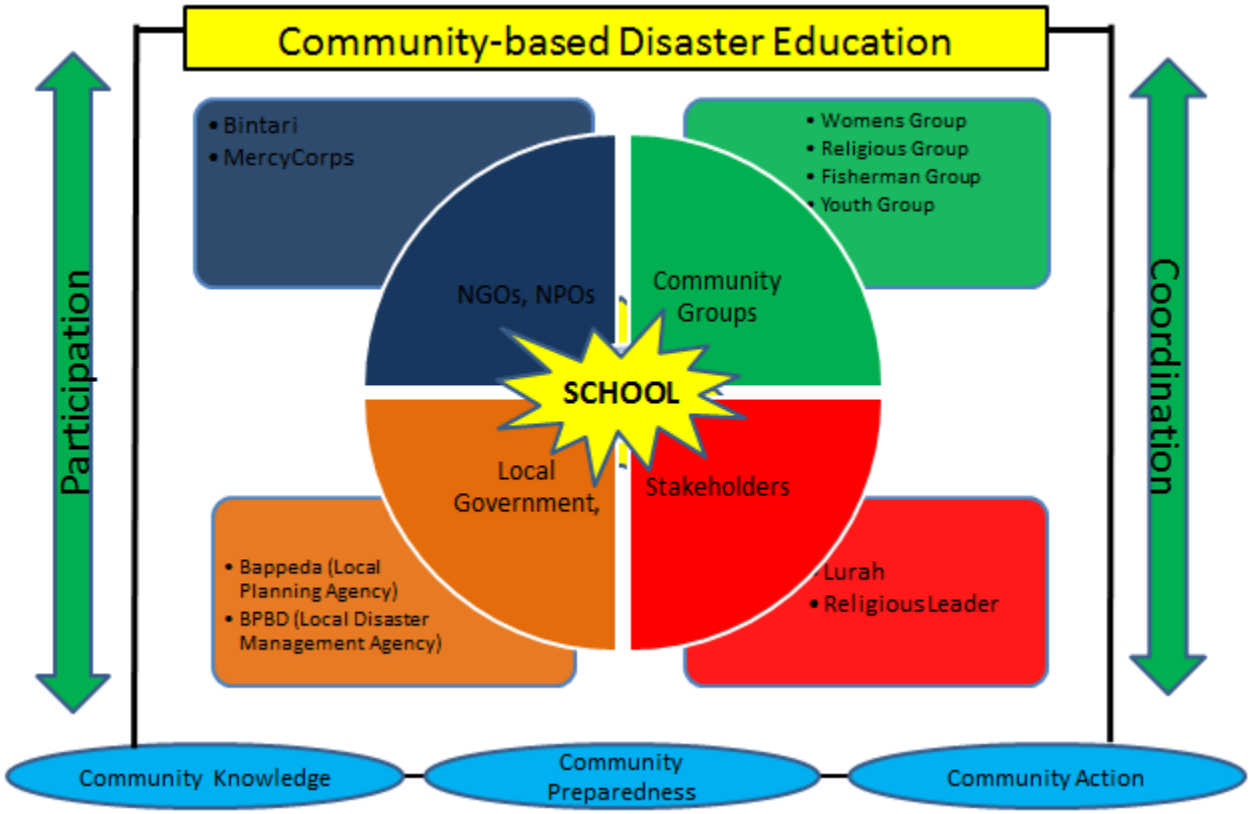

Figure 5.1 Community-based Disaster Education Framework

The framework shown above describes a framewok to enhance community resilience to the flood. Based on the figure, to increase community knowledge, preparedness as well as community action to the flood need participation and coordination among parties in the community which are community groups, local stakeholders, local government as well as NGOs and NPOs. This parties should have a link to the school as a basic parties in this working group.

Establishing connections with community partners is an important first step in connecting with the public because it creates new channels for distributing warning messages. A simple communication model can help establish local strategies for effectively distributing warning information to the public.

Applying the concepts of this model to multi-hazard warnings is an important step in developing a warning system. In order for education and outreach about the warning system to be effective, all of these components must be clearly defined, established, and exercised prior to an event. When developing warning system education and outreach strategies it is best to start by defining the. Defining the audience will assist the community partners in determining the appropriate message and channel. In the case of the flash flood warning

system, it is assumed that the primary source of knowledge will be the school. Furthermore, school need to transfer knowledge to the community through the parties in this framework.