

Adaptive Behavior Assessment Based on Climate Change Event: Jakarta's Flood in 2007

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Abstract:

Response to reducing climate induced event such as flood is not only responsibility of community itself but also largely responsible of government agency in carrying out its mandate to be in the forefront of disaster risk management and climate risk management. Government must have adequate capacity to carry out its task for climate change adaptation because successful implementations of adaptation strategy will be depend on government's performance particularly government in local level. Beside that the role and contribution of community organization could be effective partners of the LGU and community in responding to climate change impacts. Hence, this study would be assessing adaptation behavior of local communities as well as decision makers in climate risk areas in Jakarta to determine the set of adaptation possibilities that would be appropriate to be implemented in Jakarta. This study is important to be conducted consider the fast rapidly of climate change that inducing many disaster in this region. Beside that as well as government agency and stakeholder need this study to perceive the preparedness of Jakarta to facing climate change disaster that would be conducted in the future.

Keywords: *climate change, adaptation, adaptive capacity, flood, projection, vulnerability*

1. Introduction

1.1 Background

The climate risk event that most perceived to population and urban area are a rise in sea level rise, flooding and landslide, and water quality and shortage. Among the populations that are particularly vulnerable to climate-shocks are those living in particularly dangerous locations (for instance on floodplains), those living in settlements

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lacking protective infrastructure and those living in poor quality housing. It does mean that the most vulnerable population is living in low-and middle income nations. There are limits to the damage or devastation that adaptation can prevent and also very serious deficiencies in the institutional capacities for urban adaptation in most low- and middle-income nations (Satterthwaite, D, 2007).

Indonesia is an archipelago country and took place the 4th longest coastal line on the world (UN,2008) with 75 of big cities and 80% of industries are in coastal area (Kusuma, I, 2007), it is certainly there are many cities in Indonesia are vulnerable to climate risk event particularly to sea level rise and flooding impact. Moreover 60% of Indonesia population and most of big cities in Indonesia are took place in coastal area. So that the damage and losses due to climate event it would be high. Indonesia is vulnerable to hazard and each region has specific disaster due to different topography.

Flood disaster was occurred in 2007 caused the devastation of one of the biggest city in Indonesia that is Jakarta. This flooding caused 70% area of Jakarta's inundated. High tide and heavy rain was the main cause of the event, while people behavior also contributes to the disaster. Muara Baru one of sub district in North Jakarta was the most severe affected area by Jakarta Flood 2007 as a part of Jakarta's inundated. This event affected more than 4000 houses was inundated and the flood reach about 2 meter high. Eventually, water flowing into Jakarta overflows some of the city's flood control systems and causes devastation in these.

There are differentials in how much they are affected by the hazard (influenced by, for instance, age, health status and gender) and in coping capacities. In all instances, people's capacity to avoid the hazard, to cope with it and to adapt (to reduce future risk) is influenced by individual/household resources (e.g. incomes, asset bases and knowledge) and community resources But in urban areas, it is also so much influenced by the extent and quality of infrastructure and public services, especially for vulnerable populations.

Because of this reason, in this study, the author will analyze some behavior factors that cause peoples are not to organize themselves (before, during and after the flood happened), how far the government roles on adaptation to climate change, particularly in flooding case, if there were policies which have made, then how its was going effectively. Finally, it will be also revealed things that have become the needs and gaps of adaptation program implementation of flood. Later on, such a study will be generated some effective policies in order to increase community adaptation behavior. Furthermore, it expected to eliminate the impact of the flood whether it will come in the following next years.

2. The Study Site : Muara Baru, North Jakarta

2.1 Profile of Study areas

North Jakarta has a coastline along the 32 km; the slope of the land is \pm 0-2% and 0-5 m height above sea level. The geomorphology of coastal areas which are not solid ground causing a low carrying capacity and the high sea water intrusion (Wikantika, K 2008). This condition causes high levels of water pollution and areas prone to floods. In general, a height of sea level in the Bay of Jakarta varies from 0.1 m until 1 m, with a period of 1 to 8 seconds, and has a wavelength from 1 to 12 m. The causes of the high waves are generally wind power, when the wind blew strong, the wave height also increases. (Astuti, S, et al). Conversion of land use being built up area, such as for housing, industry, commercial area, tourism etc are increasing vulnerable to flooding due to degradation of land's ability to absorb the water from high rainfall and upstream from river.

Muara Baru is located in the coastal area of Jakarta that has not more than 1 m above sea level and also through by river. Muara Baru one of sub district in North Jakarta was the most severe affected area by Jakarta Flood 2007 and affected more than 4000 houses was inundated and the flood reach about 2 meter in high.

2.3 Climate and Weather Condition in Jakarta

In general, North Jakarta City has a high climate temperate; the maximum temperature reaches 36°C during the day and minimum temperature 23.2 °C. The average temperature is 27 °C and Average temperature each month ranging changes 0.6 °C. - 3 °C. Meanwhile, rainfall average during the year 2007 of 199.5 mm², at the beginning of the year in the month of January to April and the end of the month from November to December showed the highest rainfall of the year ranged from 90.3 to 642.3 mm² with rainfall on average per year is 142.54 mm, where the highest rainfall occurs in February (642.30 mm) with the number of rainy days is 23 days.

2.4 Jakarta's Flood 2007

The 2007 Jakarta flood was a major flood in Jakarta, the capital of Indonesia and affected several other areas around the city, such as West Java and Banten. The flood, beginning on February 2, 2007 was a result of heavy rain, deforestation in areas south of the city, and waterways clogged with debris. The flood is considered the worst in the last three centuries, including the 1996 and 2002 Jakarta floods, which killed 10 and 25 people respectively. Flood in 2007 affected network telephone, internet, and electricity were disrupted. Thousands of people in Jakarta and surrounding areas were forced to flee in the post nearby. Some others for 2 days still trapped in the surrounding houses flooded up to 2-3 meters. They can not get out saving their self because the boat rescue team did not come. In the city, congestion occurs in many locations, including the High way in the City. Puddles in the streets until a meter also caused a mount of accesses from surrounding areas were disrupted. The undated street in Jakarta caused various damages that exacerbating congestion. An estimated 82,150 square meters of roads in Jakarta were damage by flood. Beside that flood also made some railway could not be operated.

3. Research Methodologist

3.1 Secondary Data Collection method

Document research method was conducted to enrich data and information related to study issues. Requirement data was obtained from various resources, for instance web-research, journal, research report from education institutional, and government agency. This method was used to combine the information that obtained from interview and literature or document research. The source of information was used to complete the data did not get from questionnaire survey to community.

3.2 Questionnaire Survey

Questionnaire survey was conducting to determine to the sample size that is likely to best represent the adaptation behavior of the household and communities in the project site. This survey was done by interview the community, with the number of community are 197 respondents. This survey is aim to get information about characteristic and adaptation of community in vulnerable area.

3.3 Data Processing and analysis

Data analysis was used SPSS software and includes qualitative method, which are qualitative analysis and stakeholder and multi-criteria analysis.

- a. Qualitative analysis
- b. Stakeholder and multi-criteria analysis

4. Results of Household Survey

As a mean to perform household survey activity, the information from five countries (Indonesia, Philippines, Thailand, Vietnam, and China) was used to design the form of questionnaire. The questionnaire consists of four topics, namely: (1) adaptive capacity indicators; (2) the extreme flooding event and its impacts; (3) adaptation behavior on that specific climate change event; and (4) adaptation gaps. Each topic has relevant questions that had to be answered by respondents.

4.1 Adaptive Capacity Indicators

This first topic includes questions about five indicators of infrastructure, economic, technology, social capital, also skill and knowledge indicator, respectively.

4.1.1 Infrastructure Indicator

In general, the condition of Muara Baru settlement has inadequate infrastructure as well as housing, path, and utility. There are some of house types in Muara Baru are semi-permanent with poor access and only have 1 m wide of path. Furthermore, drainage channel and channel discharge of waste water from the house being united only one channel that should be separated. In addition for the not permanent housing whereas located on the fringe of the river does not have a disposal channel but directly to river.

26.84% of respondents rent their house and most of the others have their own house. Unfortunately, although most of them (47.69%) have permanent or made of brick or strong wooden house, there are still lots (42.63%) of the respondents with semi-permanent or part of wall is brick and other is wood/bamboo. According to the survey, it can be seen that even the permanent houses are still built with poor condition and inadequate facilities.

4.1.2 Economic Indicator

The economic indicator of people in Muara Baru is very important to be measured due to its relation to prosperity. Based on Table 1 below, the ownership of land of respondents are already owned by most of respondents (71.6%). The people in Muara Baru only have their residential land, including garden, and none of them have land for other purposes such as irrigation system, agriculture, nor forest. Average of respondents has land 21 to 40 m² in area.

Table 1 Land and properties of respondents

No	Land type/ property type	Ownership (%)		
		Owned	Rented	Other
Land holding				

1	Residential land, including garden	71,6%	26,8%	1,6%
2	Cultivation/Farm land	0	0	0
	- In which : With irrigation system			
	Without irrigation system			
3	Forest land	0	0	0
4	Aquaculture	0	0	0
5	Others	0	0	0
Property				
6	Vehicle/car	4,2%	0,5%	0
7	Motorbike	51,9%	0	0
8	Boat	0%	0	0
9	Others	0	0	0

According to observation, most of populations in Muara Baru also already have their own vehicle. Most of vehicle they have are motorcycle and only few of them have a car. On table 2 explain there are only 47% of respondent that have car and 48.42% of respondents have a motorbike.

Table 2 Number of Vehicle

No	Vehicle	Percentage of HH that Have Vehicle			
		0 unit	1 unit	2 units	3 units
1	Car	95.26%	4.74%	0%	0%
2	Motorbike	48.42%	48.95%	2,11%	0.53%

Respondents in Muara Baru work in many fields of job. Most of the respondents are waged labor (44.62%). There are also 27.96% of respondents who work in non-farming self employment category, 5.38% in fishing, 20.97% and the other fields.

Most of the population of Muara Baru works with low income but with high number of dependent family members, it causes the high level of poverty in Muara Baru. Most of the respondents have monthly income only up to US\$ 150. The income from fishing, labor, non-farming self-employment business, remittance, or others, above 50% are categorized as low value, and on the diagram tends to distribute to the left of income value.

4.1.3 Technology Indicator

Muara Baru is surrounded by public facilities such as hospital, police station, education facility, shopping center, offices, industry and many more so it is easy to get to the public facilities from their house. About 3 kms distance of municipality hall from their house.

Population in Muara Baru already has adapted to live in flood prone area, since Muara Baru hit by flood almost every year. In case of Muara Baru hit by severe flood disaster only some of them evacuating to safer place. Most of people preferred to stay at home because they have built two-storied house. There are 50 % of respondents preferred to stay in their own house than evacuating.

More than 65% of respondents said that the accessibility to evacuation place was easy to reach and 15.79 % of them said difficult and there are 14.47% of respondents said a little difficult to reach evacuation place. Mean of transportation used to get the evacuation place are boat (16.44%), motorbike, car, and most other only by walking.

The channels available to almost all households for receiving the information are television (82.26%), information from neighbors (9.14%) and some of them by radio (1.08%), internet (0.54%), and others. Most of them prefer to television than others because it's faster updating information. So they could get more info fast, and accurate.

4.1.5 Social Capital Indicator

Based on observation most of population in Muara Baru are carried out mutual-help among the community. There are only 13.76% of respondents turned for help outside the household to cope with any problems especially from their relative and 9.47% of respondents turned for helps from the government agency. Most of respondent which is 53.71% respondents cannot find anyone can help them.

There are some organization local communities in Muara Baru such as Family Welfare Program (PKK), youth organization (Karang Taruna), Qur'an reading group and etc. There are only a few member of community who active in those organization.

Based on observation, almost half of respondents said there are no regular meeting among villagers but only 14.44% of respondents that conduct regular meeting among the community that usually held once in a month and once in a 3 month.

Beside that there are lacks of interaction among community to discuss about flood disaster, there are 93.68% of respondent are not member of community organization, only 5.2% of respondents are member in community organization and 83,3% of them are active member.

It can be concluded that only person with high intention to any organization that want to be a member. Since, there is low interaction in Muara Baru society, it is due to most population are immigrants from various place, and takes their own culture.

4.1.6 Skill, Knowledge Indicator

According to Interview in Sub district of Muara Baru, there were only little training, workshops and simulations have been carried out either by provincial or by municipal governments, on disaster management (especially on flood). Most of the participants of the activities were activists, such as chiefs of RW and RT, local safeguard officers and member of youth organization (Karang Taruna). In some sub district, there was socialization through sub district meetings where activists and ordinary people invited to enhance community awareness on disaster.

Based on observation, there are 64.21% of the respondents have not ever participated in workshop or training on disaster. The participants mainly were limited to small number of community. The workshop or training only carried out once or two-times, and not in regular basis. These training and counseling was considered important in order to avoid or reduce losses and damages due to disaster and 58.24% of respondents said that the disaster preparedness class that they attended was very useful.

Topic of workshop and training session at least covers enhancing community awareness of hazards and risks, understanding nature of natural disaster, how to prevent or reduce losses and damages due to natural disaster, how to response when natural disaster strikes and post the disaster (e.g. first aid treatment, search and rescue, epidemic control, etc). Trainer and resource person of the sessions from government officials of relevant agencies (e.g. Dinas Kesehatan / Health Agency; Dinas Sosial / Social Agency; PMI / Indonesian Red-cross, etc) and the participants should be broadened not just covers sub district officials and activists of RW and RT, but ordinary people and children as well. Number of male and female participants should also be maintained balance. Including women as participants are important, since women usually deal with potential risks at home e.g. on their daily life. Ensure optimal result, respondents proposed use of audio visual, leaflet / brochure as media and training; workshop, or simulation / drill as alternatives of method. Training, workshop or other forms of method should be carried out in regular basis and sustainable manner. Almost all respondents said that there is no traditional knowledge on disaster management that was useful in dealing with natural disaster (as shown on Table 3).

Table 3 Traditional Knowledge

No	Traditional Knowledge on Disaster Management	Number of HH using and not using Traditional Knowledge
1	NO, I don't have traditional knowledge on disaster management	159
2	Evacuate to higher places	3
3	Yes, moving things into higher places	2
4	Yes, See full moon which is the sign of high tidal	20
5	Yes, Keep the environment health and clean	2
6	Yes, Make a simple boat	2
7	Yes, Prepare the small dyke in front of house	2
Total		190

4.2 The Extreme Flooding Event and Its Impacts

The second topic has only a few questions about with when flood occurred and its impacts. This is including extreme flooding frequency, damage costs, life-related impacts, recovery time, and benefit that they might gain.

Based on observation, the majority of respondents (81.05%) said that they experienced annual flooding. Although some of them say that they are not always suffered from floods, 7.89% of them still think that rarely happens more flooding in 5 years. This is because some areas in Muara Baru have a higher ground level than other regions.

The most respondents thought the water level during floods is about 1 m, both outside and inside their homes. 17.34% of respondents said only 50 cms of water on the outside and quite a lot of respondents who experienced high flood up to 2 ms of water level. Almost 20% of respondents experienced the floods but did not enter the house (0 m inside the house), it is for the reason that they have anticipated flood by a raised floor of a house or building house with more than 1 story house.

There is a balance between respondents who suffered seriously, just a little, even no damage or loss at all. The survey was conducted on three categories of losses, namely: household property, lost income, and loss of life or safety. Household poverty includes loss of homes, equipment, vehicles, facilities (water, electricity, and communications).

17.89% of the respondents have to spend money up to \$ 100 for the restoration of their houses themselves. And also, for the loss of equipment, 19.47% of them have to spend money \$ 1 to \$ 100. For some reason, that kind of money is quite a lot of money for them. However, according to observations, the loss of respondent property every

flood event decreased, because they had anticipated and took lesson every flood occurred.

The second damage or loss was analyzed based on their income. There are two types of income that measured, namely the loss of income from wages, and from the business. 15.79% of the respondents lost their wages up to U.S. \$ 50, it is because they can not reach the place of their industry or the office where they works a few days during the flood event. Loss of business is relatively insignificant because they do business with small businesses of their own homes aims only to support or increase the family income.

4.3 Adaptation Behavior on Flood Event

The frequency of flooding behavior in Muara Baru area has made the people to adapt to that condition. However, adaptation strategies of households are not yet strong enough to deal with flooding. It because of people is still moving individually, especially in disaster preparedness / mitigation. Even to handle floods, households in Muara Baru and pragmatic surrender but do not be afraid for losses and damage can still be tolerated. As a result, they do not have culture of disaster resilience.

Muara Baru is often affected by floods create communities that are used to living with such conditions. Most local communities have a disaster early warning from their neighbors. But there are a few of those who did not receive early warning if there will be disaster.

Survey related to adaptation behavior was done by measuring three reference points, especially the adaptation options that households have adopted before, during, and after the event. Table 4 shows that before the event, the majority of respondents (19.47%) decided to strengthen and improve housing, and the parts that are vulnerable, then analyzed by combining Table 5, their actions have been effective value of 12.11% effectiveness, even though 4.21 % of them said that it was quite effective. Another adaptation options that most of them have been adopted to move livestock and goods

of household to safer place. 14.21% of the respondents who took that action, and 8.42% of them thought it was effective.

Adaptation options that not many respondents took are the cutting, trimming trees near the house, and contributing to local funds in cash and in the form of anti-disaster local community activities. This was normally because both adaptation options demand high intention from the society. In Muara Baru, there are few places that can be planted with trees around of the house, because their house is relatively small even with no yard. Local communities have not taken action for local funds in cash, perhaps because not many respondents participated in community organizations.

Table 4 Adaptation option that household adopted before the event

No	Adaptation Option	The Number of HH According to Reason for Choice an Adaptation (%)						% of Total HH Adopted
		It is cheap	Recommended by of neighbor/ experts	Government Recommended	Everyone doing it	Our ancestor Have Been doing it	Other reason	
1	Reinforce and repair house, and vulnerable parts	2,63%	5,26%	0,00%	9,47%	0,00%	2,11%	19,47%
2	Building Mezzanine	1,58%	2,11%	0,00%	4,21%	0,00%	0,00%	7,89%
3	Reinforcing breeding facilities, pond and dykes	0,00%	0,00%	0,00%	1,05%	0,00%	1,05%	2,11%
4	Prepare evacuation means	0,00%	1,05%	1,05%	0,00%	0,00%	0,00%	2,11%
5	Plant trees along the river, around garden	0,00%	0,53%	0,00%	0,53%	0,00%	0,53%	1,58%
6	Cutting, trimming trees near the house	0,00%	0,53%	0,00%	0,00%	0,00%	0,00%	0,53%
7	Moving family member to safe place	1,58%	3,16%	0,00%	4,21%	1,05%	1,05%	11,05%
8	Moving livestock, and household items to safe place	2,11%	2,63%	0,00%	8,42%	0,00%	1,05%	14,21%
9	Updating regularly warning information	0,00%	0,00%	1,05%	1,05%	0,00%	1,05%	4,21%
10	Contributing to a local fund in cash and in kind for anti-disaster activities of local communities	0,00%	0,00%	0,00%	0,53%	0,00%	0,00%	0,53%
11	Buying and storing foods, drinking water and other necessities	0,53%	0%	0,53%	2,11%	0,53%	1,58%	5,26%

12	Others	1,05%	0,53%	0,00%	3,68%	0,00%	1,58%	6,84%
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Table 5 Effectiveness of adaptation before the event

No	Adaptation Option	The Number of HH According to Reason for Choice an Adaptation (%)				%of Total HH Adopted
		Not effective at all	Fairly effective	Effective	Very effective	
1	Reinforce and repair house, and vulnerable parts (e.g. window, wall)	0,00%	4,21%	12,11%	3,16%	19,47%
2	Building Mezzanine	0,00%	1,58%	5,79%	1,05%	7,89%
3	Reinforcing breeding facilities, pond and dykes	0,00%	0,00%	1,05%	1,05%	1,05%
4	Prepare evacuation means	0,00%	1,05%	1,05%	0,00%	2,11%
5	Plant trees along the river, around garden to protect against wind and prevent soil erosion	0,00%	0,53%	1,05%	0,00%	1,58%
6	Cutting, trimming trees near the house	0,00%	0,00%	0,53%	0,00%	0,53%
7	Moving family member to safe place	1,58%	1,05%	8,42%	1,58%	11,05%
8	Moving livestock, and household items to safe place	0,05%	2,63%	10,00%	1,05%	14,21%
9	Updating regularly warning information	0,00%	2,63%	1,58%	0,00%	4,21%
10	Contributing to a local fund in cash and in kind for anti-disaster activities of local communities	0,00%	0,00%	0,53%	0,00%	0,53%
11	Buying and storing foods, drinking water and other necessities	0,00%	4,21%	1,05%	0,00%	5,26%
12	Others	0,00%	1,58%	3,68%	1,58%	6,84%

The second reference point is the adaptation options households adopted during the event. Table 6 in combined with Table 7 below, shows that most respondents at the time of flood events take three actions the most, namely: to stay in a shelter and wait for the disaster over, moving family members to safer place, and clean the house or goods when the flood water down. 9.47% of the respondents who took the first action said that was very effective. They thought that the wait at the shelter until the water level drop is the best choice. There are a small number of respondents (only 1.53%) who monitor disaster information. As can be seen from both tables, this illustrates that the level of disaster education in Muara Baru is still categorized as low education. The respondents

do not really care about the information, and focus on what they can do to help their homes first.

Table 6 Adaptation option that household adopted during the event

No	Adaptation Option	The Number of HH According to Reason for Choice an Adaptation (%)						% of Total HH Adopted
		It is cheap	Recommended by neighbor/experts	Government recommended	Everyone doing it	Our ancestor have been doing it	Other Reason	
1	Reinforcing Hosuses	0,53%	0,53%	0%	0,53%	0%	3,16%	4,74%
2	Cutting, trimming trees near the house	0%	0%	0%	1,05%	0,53%	0%	1,58%
3	Moving family member to safe place	1,58%	8,95%	0,53%	12,63%	0,53%	1,58%	25,79%
4	Moving livestock and HH Items to safe Place	0%	2,11%	0%	4,21%	0%	1,05%	7,37%
5	Keep Staying in Shelter, waiting the disaster over	4,21%	2,11%	2,11%	13,16%	1,58%	3,16%	26,32%
6	Cleaning house or items when flooding water down'	10,00%	0%	0,53%	12,11%	1,05%	0,53%	24,21%
7	Keeping the tract of disaster information	0%	0%	0%	0,53%	0,53%	0%	1,05%
8	Helping neighbors injured and evacuating to safer place	1,58%	1,58%	1,05%	3,68%	0%	4,74%	12,63%
9	Others	1,05%	0%	0,53%	1,05%	0%	0,53%	3,16%

Table 7 Effectiveness of Adaptation During The Event

No	Adaptation Option	The Number of HH According to Reason for Choice an Adaptation (%)				% of Total HH Adopted
		Not Effective at all	Fairly effective	Effective	Very effective	
1	Reinforcing Houses	0%	2,63%	2,11%	0%	4,67%
2	Cutting, trimming trees near the house	0%	0%	1,05%	0,53%	1,58%
3	Moving family member to safe place	0%	2,63%	20,00%	3,16%	25,79%
4	Moving livestock and HH Items to safe Place	0%	3,68%	3,68%	0%	7,37%
5	Keep Staying in Shelter, waiting the disaster over	0,53%	4,21%	12,11%	9,47%	26,32%
6	Cleaning house or items when flooding water down'	0%	4,21%	12,63%	7,37%	24,21%
7	Keeping the tract of disaster information	0%	0%	1,05%	0%	1,05%
8	Helping neighbors injured and evacuating to safer place	0%	0,53%	11,05%	0,5%	12,63%
9	Others	0%	0,53%	2,11%	0,53%	3,16%

After the event, household has adopted more various adaptation options. Most of respondents (31.58%) decided to treat water source and cleaning environment (Table 8). 30% of respondent choose to repair or strengthen their items and houses. Not a small number of respondents also reconstructed their houses, and consolidated dykes, road, etc. Based on effectiveness indicator on Table 9, can be seen the actions that they had taken, valued effective for reducing the negative impact of the even.

Table 8 Adaptation Option That Household Adopted After The Event

No	Adaptation Option	The Number of HH According to Reason for Choice an Adaptation (%)						% of Total HH Adopted
		It Is Cheap	Recommended by neighbor/experts	Government recommended	Everyone doing it	Our ancestor have been doing it	Other reasons	
1	Repairing/strengthening houses and items	3,16%	3,68 %	1,05%	7,37%	1,05%	13,68%	30,00%
2	Reconstructing houses	0,53%	0%	2,11%	4,21%	0 %	9,47%	16,32%
3	Consolidating dykes, roads, etc	0%	0,53%	4,74%	6,32%	0,53%	0	12,11%
4	Treating water source and cleaning environment	0,53%	1,58%	6,84%	21,05%	0%	1,58%	31,58%
5	Repairing dams	0,53%	0,53%	0,53%	1,58%	0,53%	0,53%	4,21%
6	Migrating to other area job	0 %	0%	1,05%	0,53%	0 %	0%	1,58%
7	Coping with financial shortage	0 %	0 %	0%	0%	0 %	2,00%	2,00%
8	Asking for aid from govt	0 %	0%	0 %	0 %	0%	0,53%	0,53%
9	Asking for support from relatives	0,53%	0,53%	0%	0%	0 %	0,53%	1,58%
10	Contributing person-day and money	0 %	0%	0%	0%	0% %	0,53%	0,53%
11	Others	0%	0%	1,58%	0%	0,53%	0,53%	2,63%

Table 9 Effectiveness Of Adaptation After The Event

No	Adaptation Option	The Number of HH According to Reason for Choice an Adaptation (%)				% of Total HH Adopted
		Not Effective at all	Fairly effective	effective	Very effective	
1	Repairing/ strengthening houses and items	1,05%	6,32%	24,74%	2,63%	34,74%
2	Reconstructing houses	1,05%	3,68%	14,74%	1,58%	21,05%
3	Consolidating dykes, roads, etc	0%	2,11%	6,84%	4,21%	13,16%
4	Treating water source and cleaning environment	0,53%	3,16%	26,32%	3,68%	33,68%
5	Repairing dams	0,53%	0,53%	2,63%	0,53%	4,21%
6	Migrating to other area job	0%	0,53%	1,05%	0%	1,58%
7	Coping with financial shortage	0%	1,05%	0%	0%	1,05%
8	Asking for aid from government	0%	0,53%	0%	0%	0,53%
9	Asking for support from relatives	0%	1,05%	1,05%	0%	2,11%
10	Contributing person-day and money	0%	0%	1,05%	0%	1,05%
11	Others	0%	0,53%	1,58%	0,53%	2,63%

The collective adaptation was also measured to analyzed corporate community value. Although 37.37% of respondent thought they are more individual because do not really know how to act collectively. There are also classified as others reason not to act collectively, those are because they think that all of that actions is the government's responsibility, they don't care each other, there are no initiation, save their family is more important, and even some agree that community tends to individualist.

The less of collective adaptation supported on Table 10 that shows number of household member who participate in collective adaptation. The family members being involved most were in after the event time. They tend to focused on their own family and house before or during the event.

Table 10 Household member who participate in collective adaptation

No	Adaptation measures	% of HH that Family Member being Involved	Contribution Time (man-day)
Before event	Provide early warning system and disseminate early warning	1,57%	1-2 days

	Coordinate with commune level in order to provide evacuate equipment	2,1%	1-2 days
	Raise the awareness of disaster prevention	3,7%	1-3 days
	Mobilize fund for disaster risk reduction	0,5%	1 day
	Prepare evacuate roads	-	-
	Help people to reinforce and harvest crop	-	-
	Other, please specify: Build a sand dyke	1,1 %	1-3 days
During event	Assist in evacuation	10%	1-7 days
	Participate in rescue operation	6,3%	1-7 days
	Organize and provide necessities at evacuation centers	-	-
	Assist in relief operation	0,5%	4 days
	Monitoring the situation	9,5%	1-4 days
	Other, please specify :	-	-
After event	Assessment of social condition as basis for relief distribution	1,1%	7 days
	Repair/reconstruction of damaged dwellings	13,2%	1-30 days
	Extension of credit to members	0,5%	1 day
	Sending goods/disaster assistance for affected people	4,2%	1-7 days
	Working together to cleaning up the environment	32,1%	1-30 days
	Mobilize disaster goods assistance to community	2,1%	1-7 days
	Other, please specify	-	-

5. Adaptation Option, Barriers, and Recommendation

The latest topic of the survey which is about adaptation option, the barriers that community did not undertake it, and recommendation to overcome the barrier. It provides set of adaptation possibilities before, during, and after the event that should have undertaken but were not able to do. This topic also measured the intention of respondents in doing adaptation option that offer by experts.

5.1 Adaptation Option Before-Event, Barriers, and Recommendations

There are three adaptation options that respondents did not take before the event, namely build, strengthening, and heightening the dyke ; heightening the house ; and moving the valuable goods to high places. Figure 1 below shows that almost half of respondents (47.83%) who did not concern to dyke gave reason that it should be done by government. Some of them feel the own responsibility about dyke but they have barrier according to financial problem (30.43%). They also gave recommendation from their own opinion:

- Collective work with all community,
- Readiness of flood event to come,
- Improve financial aid from government, NGO, or others.

The important recommendation to notice is respondents expect that government must be more responsive, responsible, and care with community, because it is government's duty to build and repair the dyke.

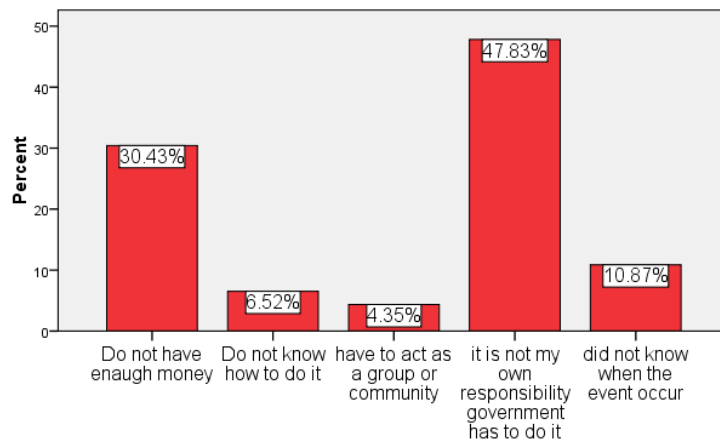


Figure 1 Barriers to did not take adaptation option build, strengthening, and heightening the dyke

On Figure 2 below, it can be seen that most of respondents (70.83%) has financial problem in doing adaptation option of heightening houses. According to them, it is important to do option mentioned, but comparing money of losses after the flood event that is cheaper than spending money for heightening their house. It illustrates that people in Muara Baru has to be raised their long-term awareness of disaster. The recommendation to overcome are :

- Giving financial aid, term of soft loan from government or NGOs,
- Collecting and save money, and
- Be more responsive to disaster.

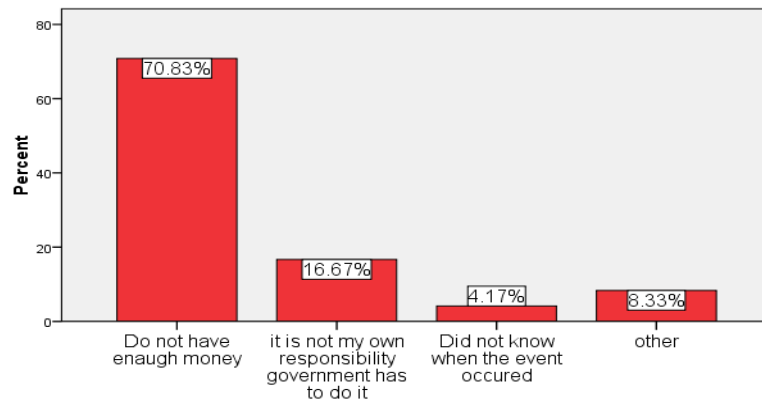


Figure 2 Barriers to did not take adaptation option Heightening houses

More than half of respondents (66.67%) in Muara Baru did not move valuable thing to higher places as shown on Figure 3. This is due to they did not know when the event occurred, flood often come suddenly that they did not ready to prepare anything. According to this problem, there are some recommendations to overcome the barriers:

- Providing an early warning system in this community area in order to community could be prepared.
- be more responsive if hit by flood.

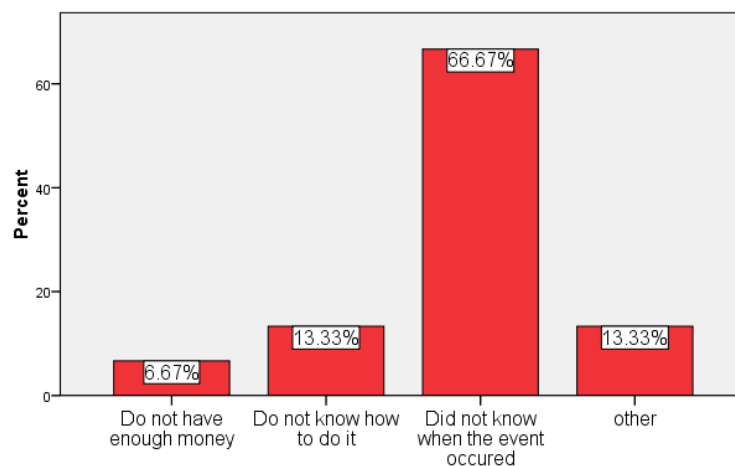


Figure 3 Barriers to did not take adaptation option
Moving valuable good to higher place

5.2 Adaptation Option During The Event, Barriers, and Recommendations

During the event, there are two adaptation options that respondents did not take, namely: evacuating family member to safe place, and moving item to higher place. Figure 4 shows that there are still less disaster management in Muara Baru. Half of respondents said that they do not know how to evacuate their family. It can be overcome by providing simulation in local community in order to know about rescue action, providing evacuation way and shelter, and more labor assistances from local community nor external assistances. The second adaptation option of moving item to higher place describes on Figure 5. The reason for not doing this second action is not very different with the first one. It is recommended to provide early warning system, provide higher place in houses to evacuate valuable goods, and provide shelter place in community to keep affected community's item for interm time.

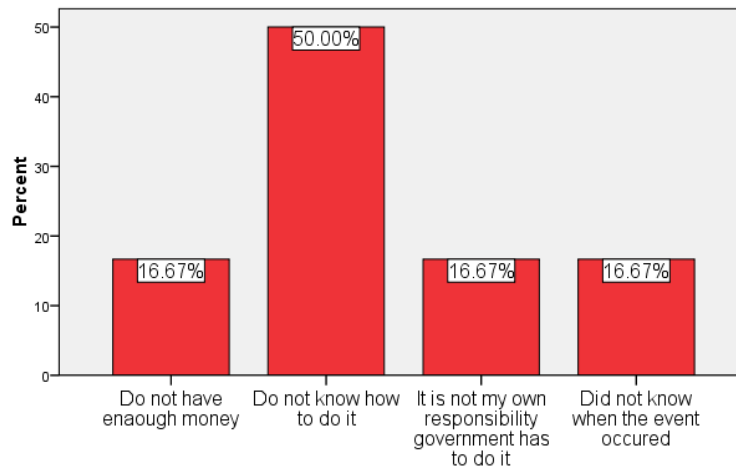


Figure 4 Barriers to did not take adaptation option Evacuating family member to safe place

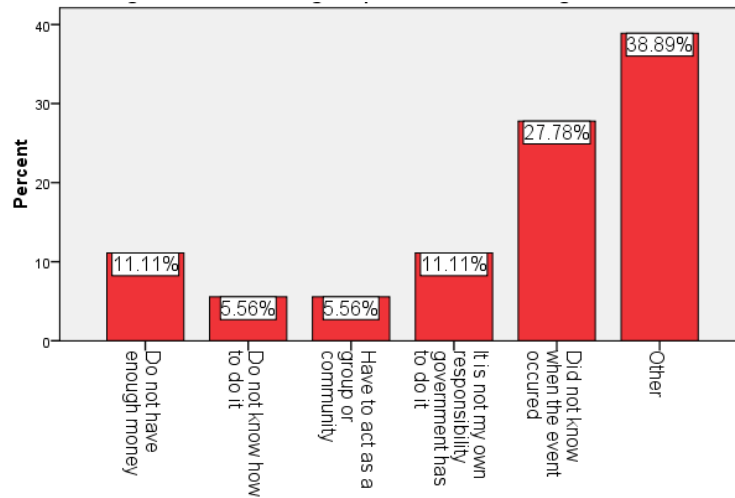


Figure 5 Barriers to did not take adaptation option
Moving item to higher place

5.3 Adaptation Option after The Event, Barriers, and Recommendations

Observing adaptation options after the event, there are three actions that respondents did not take, namely: reconstruction dyke and drainage, repairing damaged items, and reconstruction house using more durable material. 40.91 % of respondents said that repairing dyke should be done collectively, community have to work together in awareness to environment residence. Almost one per third of them said it needs financial aid. In addition, there are people in Muara Baru who had a notion that this action is one of government responsibilities, and require neither government assistances nor experts. Also describes on the next Figure 6 and 7, that government has to help affected community to repair nor reconstructive houses, in term of subsidy or soft loan. They did not take repairing or reconstructed houses with more durable materials due to financial problem. The solution also related to people's preparation in saving money for emergency condition.

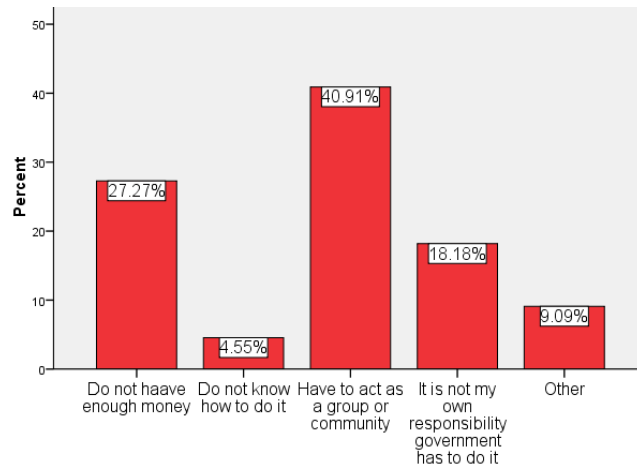


Figure 6 Barriers to did not take adaptation option Act collectively to repair dyke and reconstruction drainage

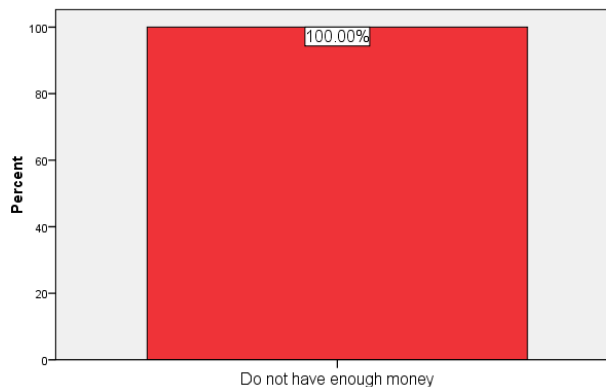


Figure 7 Barriers to did not take adaptation option Repairing house and damaged items

5.4 Community Acceptance to the Adaptation Possibilities from Expert

On the survey this adaptation topics measured opinion of people in Muara Baru concerning to set adaptation possibilities by experts. The option that were considered for Indonesia are : build the community safe shelter; relocate community at risk to safer place; and provide emergency response equipments such as lifebuoy, life vest, medical kit, and medicines.

A half of respondents (58% to 64.21%) are agreed for each possibility action offered by experts. The reason for agreeing to build community safe shelter because there is no safe shelter in Muara Baru. The respondents also concern to protect

community from disease because of the flood, and considered that shelter as community needs. In the other hand, it will prevent from stealing the appliance and other vulnerable goods. While, on Figure 8, also illustrate that 25.79% of respondents are not agreed or considered that building shelter is not the best option. It is due to it will cost a lot of money, not very important and effective because some their houses already safe from flood, even they still doubt to government.

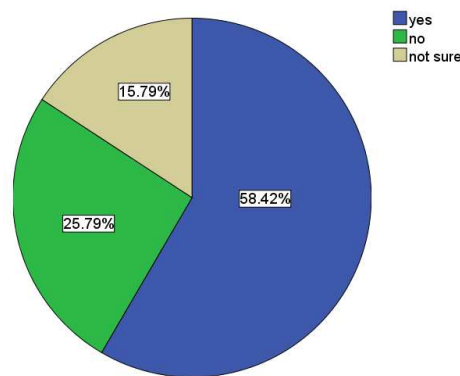


Figure 8 Building The Community Safe Shelter

The second option is to relocate community at risk to safer place (see figure 9). Most of respondents showed their intention to do mentioned action. They are agreed to have better quality live but with affordable place and accessible location. They think that they need safer place from flood disaster for their own prosperity or safety. They also consider living in healthier place than Muara Baru. However there are the gaps to relocate the community because some people said that would be difficult to find another job and they depend on their income resource in current place. Some respondents are already comfort and happy to live. It due to not small number of them already live for years, and according to them, they got memorable moment of life in Muara Baru. The problem also related to hesitancy to government.

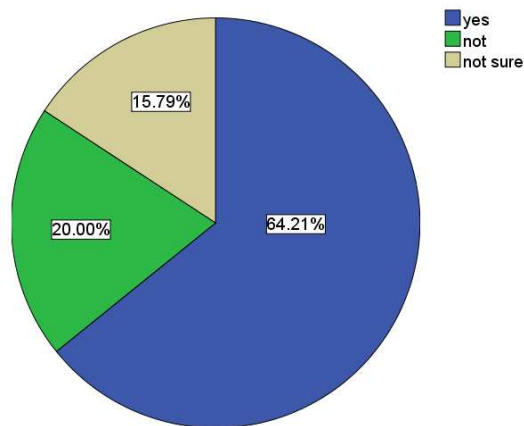


Figure 9 Relocate communities at risk to safer place

Related to providing emergency response equipments (Figure 10), majority of the respondents considered as important adaptation option to take since it will decrease the damage, and would be useful for emergency condition. This action would describe the preparation value whenever disaster will come. While they also said that if should be done without government assistance, they will not have adequate financial to provide those equipments. Besides, it will not practically easy since people in Muara Baru are not accustomed to do that. It requires increasing of people knowledge, and information is given for them.

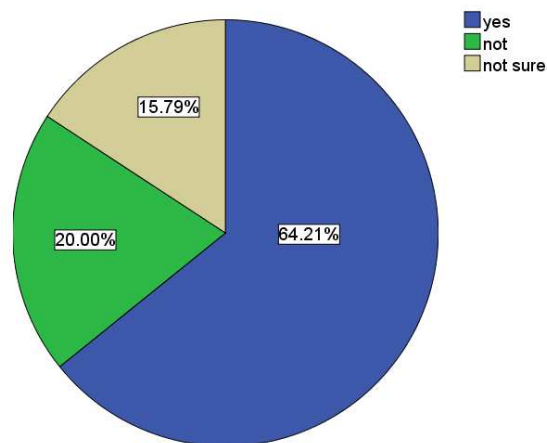


Figure 10 Emergency response equipments

The last subject known from respondents of the survey are about what they have learnt from flood disaster. It can be concluded that all of 190 respondents tend to get constructive things to learn from disaster. They are more aware and responsive to deal with disaster, they already getting earlier preparation for disaster. People in Muara Baru are increasing awareness to help each other and improving solidarity among community as a victim flood disaster. They even said that keeping environment healthy and clean is important thing to do.

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