Local resilience towards overcoming floods of local climate change for adaptation: A study of marunda community in north jakarta

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Abstract. Sea level rise due the climate change has emerged the coastal flood phenomena in North Jakarta. Coastal flood gives a negative impact on the environment and socio-economic life of the Marunda community, forcing the communities to be locally adapted towards the disaster. Community Local adaptation defined as an effort to reduce the risk of flooding based on their behavioral and cultural actions. The purpose of this study was to identify the community local adaptation strategies in confronting the coastal flooding based on the socio-economic and environmental perspectives in Marunda, North Jakarta, Indonesia. This study uses a narrative review analysis from in-depth interviews, observations, and literature studies. Data analysis includes the stage of action diagnosis and action evaluation. Based on the results, the local adaptation strategy in Marunda community are classified into three phases, namely at the step before, after, and during a flood. These three stages contain elements of physical and social adaptation derived from the ability of the community to remember experiences, learning from experience, and sharing experiences with individuals and other groups. These three abilities help the community to take adaptation actions so that the Marunda community becomes resilient to coastal flood.

Keywords: Resilience Community, Local Adaptation, Disaster, Coastal Flood

1. Introduction
Climate change is one of the crucial issues facing the world lately, namely a shift an average state of the climate or climate variability that is measured or identified that lasts for the long term. This fact refers to the process of climate change over time due to both natural variability and as a result of human activity [1] [2]. The results of research conducted by the IPCC (Intergovernmental Panel on Climate Change) prove that the earth's temperature has increased by around 0.8°C during the last century which has caused sea level rise between 20 and 100 cm in 2100. This is due to sea warming and ice melting occurring at which is faster in the last 100 years [3] [2]. So far, the world has focused on climate change at the global level, while it tends to ignore climate change at the local level, though local climate conditions influence
the impact of climate change that occurs globally. Therefore, attention to the local climate is vital in assessing and reducing the impact of global climate change [4] [5].

Some cities in coastal areas in Asian continental countries are vulnerable to the risk of climate change such as floods and storm surges [6]. Indonesia as an archipelago in Southeast Asia has many big cities that grow in coastal areas. An increase of one meter at sea level will overflow the flood 405,000 hectares of land and reduce Indonesia's territory by flooding lowland islands [7]. One of them is the capital city of Indonesia, Jakarta where some of its coastal areas have been damaged due to floods due to tides [8]. Marunda Region in Cilincing Subdistrict is one of the areas that experience monthly coastal flooding trend means. Coastal floods that hit the Marunda region were caused by a 0.5 m sea level rise and land subsidence due to excessive groundwater extraction [9]. The phenomenon of flooding takes place when high tides usually occur when full moon condition. At that time the moon's gravitational force on the earth was so large that the motion of seawater towards the coast was stronger than on ordinary days. This phenomenon causes seawater intrusion through water channels in the form of rivers, drainage, and water flow below the soil layer [10]. Although coastal flooding has an impact on disrupted activities that cause material and financial losses, people prefer to remain in areas prone to coastal flooding [3].

Disaster risk programs and climate initiative in the few decades was focus on the connection between vulnerability, recovery, adaptation, and coping mechanism [11]. By understanding the interaction between five domain, mainly environment, climate event risk, societal interaction, and community resilience, for the adaptive management will result in protecting as well as maintaining quality of life of the community itself [12]. However, the low attention to adaptive capacity will create a weak level of community resilience [13]. Meanwhile, the threats and dangers arising from the phenomenon of tidal flooding are predicted to be even higher. This situation can produce greater adverse effects and losses [3]. Therefore, it is necessary to focus on aspects of adaptive capacity in building local community resilience to deal with problems due to climate change [14]. This study wants to explore the local adaptive capacity carried out by the Marunda community in dealing with coastal flooding as an effort to build local community resilience. In this study, the behavior of people living in the Marunda region was evaluated to see the capacity of community adaptation to coastal flooding due to climate change.

2. Research Method

This article presents a case study of the community adaptations in facing the coastal flood disaster Marunda Region, North Jakarta. This study was conducted in 10 (ten) hamlets in Marunda Region, namely Hamlet 01 to Hamlet 10. Each hamlet consists of seven to ten neighborhood. Narrative review analysis based on Field Observation and Key informant interview are used as a methods in constructing the paper. Field observations were conducted in all 10 Hamlet, while interviews were conducted only in the most prone to coastal flooding area in Marunda region, namely Hamlet 02 comprises three of ten neighborhood, Hamlet 04 comprises two of seven neighborhood, and Hamlet 07 comprises three of nine neighborhood.

Key informants criteria were people who can persuade the community in adaptation efforts, namely community leaders, disaster cadres, and Hamlet administrators. The interview questions were based on three aspects that related to community capacity in creating local adaptations. The question consist of institutional memory (ability to memorize the experience), innovative learning (ability to use their experience to learn, develop, and organize the resources to adapt to environmental change), and connectedness (ability to connect with other people to share experiences and lessons). These three capabilities will help the community to adapt to environmental changes [15].

3. Results and Discussion

3.1. Marunda Region

Marunda Region consists of residential areas, industrial estates, and ports. Besides, Marunda Region is guided by a strategic economic area with a high complexity of land use with dense settlements adjacent
to the Blencong River estuary on the west side and East Flood Canal (BKT) on the east side. Based on data obtained from the Jakarta Regional Disaster Management Agency (BPBD) of the seven regions in the Cilincing Subdistrict, Marunda Region is the most vulnerable area with a high level of flood risk. These region experiences rob tidal every year in the last five years, from 2013 to 2017. As a densely populated urban village and low-income population, Marunda area is vulnerable to disaster risk.

Figure 1. Distribution of disaster event per district in Marunda Region.

Marunda is a coastal area located in North Jakarta, with an area of 7.87 km². Of the area, the distribution of coastal floods that hit the Marunda region is divided into three classes, namely low, medium, and high. Coastal flood distribution for low class covers 1.83 km² with a percentage of 23.25%, medium class covering 4.87 km² with a percentage of 61.79%, and a high-class area of 1.18 km² with a percentage of 14.96%. Based on data from the Central Statistics Agency of Cilincing District in 2017, the demographic conditions in the Marunda region are 16,075 male population and 15,372 female population, with a population density of 3,972.14 people / km².

3.2. Local Adaptation Marunda Community
Based on field observations, coastal flooding that struck the Marunda region occurred at least 4-5 times a month, with an average height of more than 50 cm. Coastal floods have a negative impact on their environment both physically and non-physically. Physically, coastal flooding has an impact on the destruction of people’s homes and public facilities, as well as disruption of accessibility and mobility of people towards transportation, clean water, electricity, and telecommunications networks. Whereas in non-physical terms, coastal flooding has an impact on the social, economic and health aspects of the community.

Based on the in-depth interviews with Hamlet 07 representatives, for physical adaptation, the community constructed their houses to be resistant to flooding by raising the ground floor of the building or by adding levels to buildings. Besides, they also make embankments made of wood or brick to hold sea water so as not to enter the house. As for social adaptation, the community carries out cooperation activities by cleaning the environment as an effort to reduce the risk of flooding that can have a negative impact on their health. This environmental cleaning activity has been carried out long ago by the community until in 2015 the government instructed Workers of Public Facilities and Infrastructure Handling to help the community in cleaning up the environment.
Figure 2. Settlement conditions in Hamlet 02 (left) and Hamlet 07 (right) in Marunda

Disaster preparedness training is also carried out as an effort to deal with coastal flooding. One of the informants from the Hamlet 02 disaster cadre member who had attended the training said the training was carried out before the rainy season, namely before the floods flooded so that the community was better prepared to face the floods. In training, the community was given material about self-rescue by the National Board Disaster Management or fire department. However, this is considered to be less effective in disaster mitigation training, because there are still many aspects that need to be prepared, one of them is the preparation of clothing, board, and food supplies when a flood occurs. Innovative learning is the ability of individuals and groups to use their memory and experience to learn, innovate, and reorganize resources to adapt to changes in the environment [15].

Figure 3. Cooperation in Marunda community to clean up the environment.

Coastal floods that come continuously have made Marunda people accustomed to the presence of floods. People tend to have no panic during coastal flooding. Even so, the community still feels anxious because the impact can harm them financially. According to Hamlet 02 informants, the community must prepare funds approximately Rp 100,000.00 - Rp 500,000.00 to repair property damage and diseases caused by the floods (i.e. diarrhea and skin diseases).

People who are accustomed to flood disasters make them rarely actively involved in disaster preparedness activities. The Hamlet 07 informant added that the Marunda people have considered coastal flooding as a reasonable natural phenomenon. This makes the community did not create an
optimal risk reduction efforts. Also, the collective sense of the community by sharing experiences with individuals and other groups makes people more confident in the risk reduction actions that have been taken even though these actions are still not optimal. This is following the ability of the community to connect with other people inside and outside their community to share experiences and lessons in dealing with coastal flooding [15].

Concerning the capacity of community adaptation, Marunda people can remember the experience of flooding well. Besides, the community is also able to accept the conditions of areas prone to flooding. However, the community's actions in dealing with disaster risk are less than optimal, making the adaptation process stagnant. Community adaptation to the community's ability to face disaster risk has a close relationship in realizing local sustainable development. The low implementation of community adaptation in development policies facing disaster risk will hamper the adaptation process itself [16].

4. Conclusion

Communities’ adaptation ability towards the flood disasters cannot be separated from the various adaptation elements including the ability to memorize, learn, and share the experiences with other individuals and groups. All capabilities including innovative learning, instutional memory, and connectedness help take adaptation actions so that the Marunda community becomes resilient to coastal flooding. Based on the interviews, it can be concluded that the community is more aware of the characteristics of floods, especially the signs of the arrival of floods during the full moon. Innovative learning makes people innovate in implementing adaptation actions, including physical adaptation by constructing buildings that are resistant to flooding, and social adaptation through cooperation in cleaning up the environment. Connectedness makes people more confident about risk reduction actions that have been done because these actions are the result of sharing community experiences with other individuals and groups. Eventhough there are some limitations in dealing with disaster risk, the resilience of the Marunda community can be achieved well and supported by high adaptive capacity. This research can be used as a reference for disaster risk reduction contingency plans for local governments. However, further research is needed on the relationship between the community and the government in facing of flood disasters.

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