Living with risk: Kampung Apung’s adaptation to flood

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Abstract. This paper focuses on community strategy in slum areas to adapt to the flood in Jakarta that occur every year. Sea-level rise and land subsidence are some of the causes of Jakarta’s flood. Jakarta is affected by floods every year. Communities need a development strategy to be able to survive from the unpredictable floods each year. This paper aims to identify the application of community strategy as an effort to adapt to Jakarta’s flood in Kampung Apung, West Jakarta. Kampung Apung is one of the slum areas in Jakarta that has been affected by floods since 1995. The flood was caused by land subsidence and worsened by development around the kampung that ignore the environment in the ‘90s. Now, Kampung Apung has been submerged in water as deep as 2 meters. This paper uses the descriptive-qualitative method. Data obtained from field observations, documents from the internet, and online interviews with the key informant in Kampung Apung. The result of the paper is to find a community strategy to living with flood in the slum area which is one of the efforts to be able to improve quality of life.

Keywords: community strategy, slum area, flood, Kampung Apung

1. Introduction
Floods are one of the recurring problems that pose a threat to Jakarta [1][2]. These threats can affect community resilience from a social and economic perspective [3][4]. Several studies have stated that flooding in Jakarta is caused by sea-level rise and land subsidence. The rapid development in Jakarta has led to increased groundwater use so that Jakarta has decreased its land surface [5][6][7]. Land subsidence in Jakarta ranges from 1-15 cm per year and can reach 20-28 cm per year [5], meanwhile, the increase in seawater reaches 5.7 mm per year [7].

The increase in population also occurred in Jakarta due to the dense urbanization. The higher the population, the higher the need for housing [11]. The new settlements grow rapidly, so urban development was uncontrolled. Unplanned development and weak local government policies in dealing with development are also factors that cause various problems [1][12], one of them is the problem of flooding, especially in slum areas. Problems that occur in slum areas often affect the vulnerability and quality of life of the community. In 2017, the problems of slum settlements in DKI Jakarta were recorded as follows: 40% of residential buildings are irregular, 9% of dwellings have complete buildings but do not comply with technical requirements, 22% of settlements are not served by adequate road networks, 26% of settlements have drainage network conditions with good quality poor, 14% of the community’s water needs are not met, 5% of household toilets are not up to standard, 87% of sewage is mixed with environmental drainage, 22% of waste is not handled, and 89% of settlements do not have fire protection [13]. These poor drainage conditions exacerbated flooding in slum areas. ECLAC (2001) in Winchester (2005), this problem will increase as the number of needs for new settlements increases [11][14].
Strategies for dealing with flood disasters must be prepared properly by the community and the Government [15]. Adaptation is a currently chosen strategy by many people especially in slum area. Most of them use community adaptation strategies to deal with flood because rescue and relief from the government only comes in a short time after the floods hit so slum dweller must rely on their own resources to survive amid the flood risk [16]. Besides, even though government and others organization funds continue to be provided, this can’t be done optimally for all communities in Jakarta that has a large number of slum area, meanwhile floods hit every year [17]. Slum communities generally prefer to adapt to flooding due to various reasons, such as the economic reasons and proximity of residential locations to workplaces [18]. Adaptation to flooding can be done in three ways, namely, fortify / protection (keep water out), retreat (move to higher ground), and adapt (living with flood) [19][20]. Fortify and adapt can be carried out simultaneously for long-term flood prevention, but retreat only happens when the capacity of the community both from an economic and social perspective is decreasing.

Fortify / protection is carried out by holding water from entering residential areas, one of which is by making embankments, while strategy flood adaptation (living with flood) can be carried out with the following five principles, there are resilience, double solution (economic, ecologic, and cultural gain), strengthen community resilience, institutionalize preparedness, and phased plan [20]. Onishi (2005) in Wenger (2013), China implemented a retreat strategy using relocation to protect its people from the risk of flooding [21]. There are two relocation options, namely, single retreat and double retreat. A single retreat is carried out by relocating only residential areas, while a double retreat is relocating residential areas and rice fields/plantations as a source of food and the residents' economy. The three strategies are planned and pursued so that the community has a sustainable settlement in the face of disasters.

Indonesia is committed to implementing sustainable planned development (SDGs) and can handle disaster problems listed in the National Action Plan (RAN) [22]. Goals related to disaster management, namely zero poverty (goal 1), sustainable cities and settlements (goal 11), and addressing climate change (goal 13) [23]. The management of sustainable slums is more clearly implemented through the KOTAKU (Cities Without Slums) program. KOTAKU aims to accelerate slum handling by improving the quality, management, and prevention of slum settlement growth [13]. The program includes handling infrastructure, social and economic development for the sustainability of people's lives.

Therefore, the purpose of this paper is to identify the application of community strategy in the slum area as an effort to adapt to flood risk and to improve the quality of Kampung Apungs’ life. The slum area discussed in this paper is Kampung Apung in West Jakarta. Kampung Apung is chosen for this research because Kampung Apung has a different condition related to flood from others. Kampung Apung has experienced to change in environmental conditions due to prolonged flooding since 1996. Primary data were obtained by an online interview with a key informant and analysis results were obtained from previous research. Secondary data were obtained from Governments’ websites. The entire paper will be discussing the community strategy of Kampung Apung in dealing with flood risks.

2. Methods

2.1. Research Time and Location
The research was conducted in Kampung Apung RT\(^1\) 10 / RW\(^2\) 01, Kapuk, West Jakarta. Kampung Apung was chosen as the research location because it is one of the kampung that has made many changes to adapt to the Jakarta floods. The research was conducted from December 2019-August 2020, field observations were carried out two months before the COVID-19 pandemic, while during the pandemic all research activities were carried out online.

2.2. Research Methodology

\(^{1}\) Neighbourhood
\(^{2}\) Hamlet
The data collection method was done by collecting data from the internet and interviewing the key informant by online interview, and complementing with field observation data that had been carried out before the pandemic occurs. The selected key informant is a person (dweller) who understand basic information about the flood in Kampung Apung and every information needed in this research.

The data obtained from the internet are adaptation strategies in Kampung Apung (physical and non-physical) and other data that supports the writing of the paper. Physical adaptation includes housing adaptation and settlement adaptation. Non-physical adaptation includes behavior adaptation. Documentation and data on flood incidents in the field were obtained from interviews with the key informant, representatives of the Kampung Apungs’ neighbourhood, who are the original dweller of the kampung. He is familiar with the changing conditions of the kampung before being flooded and after being flooded. He was chosen by the community to help academics and journalists when doing research in Kampung Apung. Through him, the author obtained photos of the latest conditions of the kampung during the floods in Jakarta in January and February 2020, as well as other supporting data. Paper writing is also supported by data from field observations. Field observations were made two months before the COVID-19 pandemic occurred, precisely in January 2020. Field observations aim to determine the existing conditions of the Kampung Apung. The data obtained were the living conditions of the kampungs’ dweller, the physical conditions of the houses and the kampungs’ environment, as well as the conditions of the kampung when the annual floods came and during normal conditions which were obtained from the narrative of key informants.

The data analysis process is carried out by collecting data first, then identifying the strategies that have been carried out by the community and government. After that, the strategy is evaluated based on adaptation theory and living with flood. The identification results then concluded and obtained the most appropriate strategy to deal with Jakarta floods and improve the quality of life of the people of the Kampung Apung.

3. Data

3.1. Jakarta’s Flood

Jakarta floods are a problem that impacts the community continuously. Floods have occurred since the Dutch colonial era [24]. Generally, floods occur at the beginning of the year with different heights in each area. The water level will get higher every 5 years. February 2007 was one of the worst floods ever experienced by Jakarta’s resident. However, in a period of 5 years (2013-2017) flood points were recorded to have decreased from 62 points to 20 points [25], while in 2020, 41 points were submerged by flood; 5 points in West Jakarta, 22 points in South Jakarta, 1 point in Central Jakarta, 2 points in North Jakarta, and 11 points in East Jakarta [26]. One of the efforts carried out by the DKI Jakarta Provincial Government is the fortify / protection strategy by constructing embankments and dredging the city drainage at several points.

3.2. The Characteristics of Slum Settlement

KOTAKU or Cities Without Slums is one of the government’s strategic programs to be able to improve facilities and infrastructure, and improve the quality of slum community life [13]. This program explains the characteristics of slum settlement, such as (1) building condition (irregularity, density & non-conformity of requirements); (2) Environmental road access (road surface conditions, road width, & road equipment); (3) Provision of drinking water (unavailability of drinking water for each individual according to health standards); (4) Environmental drainage (clogged flow, causing the odor, & not connected to city drainage); (5) Wastewater management (system unavailability, poor quality, & pollution of the surrounding environment); (6) Solid waste (unavailability of systems, facilities, and infrastructure); (7) Fire protection (system unavailability, water supply, and fire engine access); (8) Open space (unavailability of green space).

These characteristics are used to assess the condition of the area to be handled. Several characteristics can be found in the Kampung Apung area so that the kampungs needs handling and quality improvement
to increase community resilience in facing floods and also become a sustainable settlement. Unfortunately, since Kampung Apung submerged by the flood there is not future plans for kampung improvement from related parties regarding the city without slum program.

3.3. Kampung Apung
In 2013, there were recorded 455 slum neighbourhoods in the West Jakarta area [13]. Most of the neighbourhood in the area require quality improvement with the right plans and strategies considering that floods in Jakarta continue to occur every year. Floods in the West Jakarta area were exacerbated by the development of unplanned areas so that several dweller settlements were affected. It also causes land level decline. The worst impact felt by the Kampung Apungs’ dweller, West Jakarta. Kampung Apung is one of the kampungs that is classified as a slum and needs quality improvement [13][27]. As shown in fig. 1, the yellow color shows areas that need improvement, while the green color is an area that needs prevention efforts so that they do not develop into slum areas.

Kampung Apung has been inundated by floods since 1996. Inhabited by 200 families, Kampung Apung has not yet recovered from the threat of flooding in Jakarta. In the 80s the kampung was in a quite high location compared to the surrounding area. However, in 1988, backfilling was carried out around the kampung area designated as an industrial area and the elevation of the Kapuk highway as an effort to avoid flooding, so that the kampungs is currently below road level and forming a basin. As a result of the backfilling activity, the kampungs drainage channels were clogged, so that the water trapped in the basin could not flow anywhere. Therefore, currently, people live above 2 hectares’ puddle (Fig. 2). This is exacerbated by the condition of Jakarta’s flood height which continues to increase as Jakarta’s land surface continues to decline and the location of the kampung is not far from the river flow. When the annual floods come the water can reach a height of 2.5-3 meters from the ground. Kampungs’ environment transformed into a basin, poor drainage conditions, the land surface that continues to decline, and the annual floods that hit Jakarta have forced the community to live amid the risk of flooding.

Kampung Apung dwellers have implemented community strategies such as building houses above of submerged houses with wooden and bamboo structures. The dwellers once used standing water to become fish ponds to improve economic conditions, but in 2014 the water was drained by the government and there was no further action, the impact was that the community suffered considerable losses. In 2015 the kampung area was submerged again as high as 1 meter.
4. Result and Discussion
Jakarta is one of the cities in Indonesia that is affected by flooding every year as a result of rapid urban development. Floods that occur in Jakarta have an impact on the social and economic conditions of the community, generally, people who live in areas prone to flooding. This is what is experienced by one of the kampung in West Jakarta, namely Kampung Apung.

4.1. Flood Adaptation in Kampung Apung
Living for years above a puddle makes people adapt to increasingly deteriorating environmental conditions. The condition of the people who are in the middle to lower economic level cannot improve their houses and kampung better. Each individual has different economic conditions so that the shape and dimensions of the house are different, but the house-form is dominated by the floating house. One of the characteristics of slum settlement is the shape and the dimensions of residential buildings are irregular and do not comply with technical requirements, such as structure, ventilation, and lighting [13]. Besides, environmental road access in Kampung Apung also in poor condition.

4.1.1. Physical Adaptation
Several efforts have been done by the community to survive amid the flood risk. However, not all efforts can run optimally. The community doing adaptation both physically and non-physically. The adaptation strategy carried out by the community is to build a house either one or two floors above the structure of their house which is already submerged in water. The communities built their houses on top of the submerged construction of houses with wooden and bamboo support structures, like houses on stilts (Fig. 3). The community use wood and bamboo as building supports. The construction of houses with local materials was carried out because the people were in a middle to lower economic condition.

Figure 2. Floating Kampungs, January 2020

Figure 3. Use of Wood in Home Construction
According to the dweller, the condition of the wood and bamboo is getting rotten due to being submerged in water all the time, often people fall into the water when the wood is unable to withstand the load. Even though the house has been elevated, it does not mean that people's lives are more comfortable, in fact, every time a flood comes the kampung is still submerged in floods as high as 0.5-1 meters from the surface of the kampung road access (Fig. 4).

![Figure 4. The condition of the Floating Kampungs during the Floods of January 2020](image)

Based on the theory of adaptation to flooding, fortify / protection strategies can be carried out by making embankments around residential areas to keep water outside the residential area [19][20]. However, the condition of Kampung Apung, which was already submerged in water, made it impossible for the construction of embankments around the kampungs area. The community only tries to stick their house door with wood so the trash does not enter the house when the water overflows (Fig. 5).

![Figure 5. Residential embankments, Jakarta Flood 2020](image)

The community does not only adapt to housing but also adapts to the form of kampung’s road access. The construction of the floating road was originally made of wood, but the use of wood did not last long. Hollow and rotten wood due to being submerged in water threatens the safety of the community. The change was made from an asphalt to a floating road as the main kampung’s access. Currently, kampung’s road access is better and stronger due to financial assistance from the private sector. Nevertheless, when the annual floods come, the kampung road access are still submerged, so that the road surface is not visible (Fig. 6). This condition is dangerous for the community because if they take a wrong step, they can fall into a pool of water as deep as 2 meters. For safety reasons the community make road dividers using wood and bamboo (Fig.7).
4.1.2. **Non-physical Adaptation**

The submergence of the Kampung Apung also disrupted the drainage channels. The people of Kampung Apung until now have to buy clean water from mobile water sellers for household needs, while bathing, washing, and toilet needs are supported by one well left in the kampungs. The water in the well is also not good enough for the community, sometimes causing skin diseases. It is difficult for the dwellers to get water due to clogged *kampungs* drainage channels by nearby buildings so that both clean water and wastewater cannot flow properly. Household wastewater that cannot flow is mixed with factory waste that is deliberately channeled into the puddle, sometimes the water creates an odor that makes people feel uncomfortable. However, some dwellers use the puddle as an entertainment place. This is one of the non-physical adaptation form that carried out by the community.

Poor water condition is exacerbated by the presence of garbage and wild plants on the surface of the water, which causes unpleasant odors and can harm the health of the local community. The government has provided a cleaning officer (orange team) to clean the puddles, but these efforts have not yet been maximized.

For the dwellers with better economic conditions chose to leave the *kampung* and look for a safer and more comfortable area. Their abandoned houses created a new problem for the *kampung* community, garbages were piled up. Efforts to relocate the community to safer areas were made in 2014, but the community refused. The community only hope that the government can minimize the impact of the flood risk they feel. *Kampung Apung*’s community choose to adapt amid the floods risk due to the location of the *kampung* which is close to the workplace and they already feel comfortable with the environment they live in. People think that flooding common in their lives. For dweller who have not been able to improve their houses, when the floods come they will evacuate to the musholla which is located higher than the dwellers’ houses.

All adaptation activities are carried out by the community using cooperation. Helping each other is a form of resilience that society has. If one family wants to repair their house, other family will help.
The community works together to be able to provide public facilities such as mosques and community halls with makeshift materials. Therefore, Kampung Apung dwellers feel safe living in the kampung because they feel they understand each other and protect each other. Increase community resilience is important for them to survive form the flood. Education about environment is needed by the community. Therefore, the adaptation strategy to run well must be carried out by the community and the local government.

4.2. Government Efforts to Overcome Flood Problems

The government forms a strategy to increase the community resilience related to disasters through sustainable development. Sustainable development is expected to minimize the impact of flooding on the economy and the social community. This can be done by formulating appropriate policies and development plans that comply with environmental standards.

By 2030 the government targets to protect for the poor and vulnerable to be able to face economic, social, environmental, disaster, and climate change problems. This target is achieved through cooperation between the government, BPBD, and the Ministry of Social Affairs. Cooperation in helping communities vulnerable to flooding must be carried out in a planned and gradual manner [20] so that the target can be achieved as a whole.

Protection for communities in slum settlements can be carried out by providing economic assistance, social services, as well as community education related to disasters to increase community capacity in dealing with floods. In the last few years, the economic and the social assistance received by the community when the flood occurred was in the form of food aid and assistance in cleaning the environment after the flood receded. These efforts are also supported by community workers. However, these efforts have not been able to run optimally, given the large number of slum settlements affected by flooding in the Jakarta area.

The next target in 2030 related to disasters is to build cities and settlements that are inclusive, safe, durable, and sustainable. Improving the quality of slum settlements is one of the targets that must be achieved to produce settlements that can withstand the threat of flooding in Jakarta. It is hoped that the improvement of the quality of life of the slum settlements will reduce the community's vulnerability to economic losses due to flooding. Slum indicators issued by the City without Slum program can be integrated with the government's target of creating sustainable settlements by 2030.

The improvement in the quality of residential buildings has not been going well in Kampung Apung. Only by capitalizing on local materials, the community continues to try to adapt even though the dangers threaten. Funds for repair the house support structures were allocated to houses that were already in very bad condition, while funds for road access were allocated to kampung’s main access. Access to Kampung Apungs is now better than before, due to financial assistance from the private sector. Concrete as a material, the road looks stronger and safer for community activities. Road construction is carried out by the community in cooperation. Kampung’s road, which is approximately 2 meters wide, used to be made of wood and often took its toll due to rotten wood and nails.

Another effort made by the government to improve the quality of Kampung Apung is draining the water in 2014. However, after drying there was no follow-up to improve environmental conditions, so that in early 2015 the kampung was submerged again by 1 meter of water and the water level continued to increase. According to residents, although there were a lot of media crews and academics who raised the problem of flooding in Kampung Apung, after the draining, no more assistance had come from the government to improve the kampung’s environment. The community hopes that the condition of Kampung Apung can return to normal and the children can play safely and comfortably.

All parties can immediately take action to survive from floods, one of the ways is by increasing the dwellers capacity to mitigate and adapt. Providing evacuation facilities and assistance during floods is one of the quick actions that can taken by all parties. The government has provided evacuation facilities such as places to evacuate during floods at several points near Kampung Apung. Nevertheless, the community choose to stay at their house because they feel safer. The provision of affordable housing
has also been offered but the community has refused because they are comfortable with the surrounding environment.

4.3. Community Adaptation Strategy
Increasing community resilience is one of the right adaptation strategies in dealing with flooding in Kampung Apung. This can be done by educating the public about protecting the environment, mitigation, and adaptation. Education about the environment, especially the problem of kampung’s drainage, can provide insights for the community to minimize the impact of larger floods by protecting the surrounding environment, while mitigation and adaptation can provide information about the first actions that the community can take before, during and after the floods hit, so that people can improve their quality of life even they living with risk.

Besides, the technical adaptation strategy to improve the quality of life of the community that can be carried out in stages is to improve the kampung’s drainage so that water can flow properly to the city drainage. A good drainage channel will make the water cleaner and can be used by residents for economic activities such as fish ponds and entertainment activities such as water tourism. With increased income, the community can improve the quality of life and the quality of the kampungs environment. The next stage of repair is to repair the supporting structure of the house with stronger materials so that the floating houses owned by the community can withstand the floods in Jakarta in the future. Home improvements can be done by mutual assistance or social gathering methods related to community funding so that they can reduce the cost burden of residents who do not have more income. Of course, these strategies must be carried out by the cooperation of all parties, including the community, government, and related institutions, so that in the future the people of Kampung APung can live by responding to floods better.

5. Conclusion
Living with flood risk is not an easy thing for the people of Kampung Apung. Decades of living in puddles with various problems remain an option because of feeling comfortable with the surrounding environment. An adaptation strategy is a community strategy to deal with flooding that is carried out by the community to survive amid uncertain flood conditions. Responding to flood by building a floating house is preferred by most people due to the location of the work which is close to settlements and the economic conditions that are not too high. The adaptation strategy must be balanced with the capacity of the community in dealing with disasters, one of which is education about the environment and adaptation efforts. This education can be facilitated by the government and related institutions. Besides, the immediate action that can be done is by improving the drainage condition of the kampungs so that the kampungs area can be utilized by the community and can improve the quality of community life both in terms of social and economic.

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