

# Revitalization as An Approach to Sustainability of Flood-Prone Coastal Settlement

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Some problems faced by people who live in flood-prone settlement. They have elevated their houses several times, replaced building materials, daily activities also changed such as refused to use furniture, no place to socialize with neighbors and the loss of green space and vegetation because the expansion of houses. Low-income people live at home uninhabitable. Sanitation and poor drainage has degraded the quality of the environment. Nevertheless, people do not want to move from settlement or relocate because the coastal settlement has strategic value, close to various public facilities and the people can add economic activities at homes to increase their income. Renewal needs to be done to the flood-prone settlements, such as revitalization to increase the quality of environment for the sustainability of the settlements.

This research is qualitative and quantitative, propose various ideas for revitalization planning is based on research that had been done before in Muara Angke, North Jakarta. The problems in flood-prone settlement concluded from the results of the survey to Muara Angke on 120 respondents in 2014. Survey was conducted through direct measurements in the field to determine the changes at home, interviews with open-ended questions to determine the changes in daily activities, and observation the polder system (dikes, retention basins, and pump station) to protect the settlement. The results of the study found that the people changed their houses because avoid of flood and their needs for safety, comfort, and social status. These changes have some adverse impact on daily activities, and the problem of sanitation, drainage, odor which degrade the quality of the environment. Revitalization is needed for row house settlement, and should be supported by the government and community organizations. Government and private sector should provide financial assistance with low-interest loans to help low-income people. Government should implement the available Master Plan to create a healthy environment, increase economic, social, and cultural activities for sustainability of Muara Angke.

**Key words** : coastal settlement, flood, revitalization, sustainability,

## 1. The Threatening Flooding in Northern Jakarta

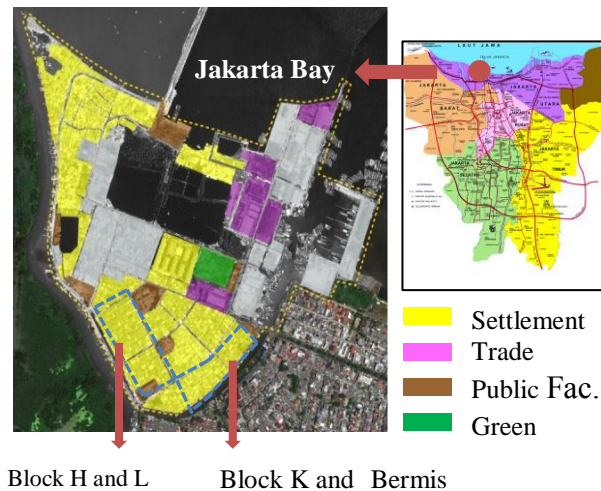
The coastal flooding became a big problem in the northern coast of Java Island, such as Jakarta, in the last two decades. Flood in Jakarta is not a new problem, but a latent one. It occurs due to several factors, such as: tidal waves, global sea level rise, storm surges, land subsidence, higher rainfall or water runoff from hinterland, and sediment deposition (silting) on the river bed and estuaries.

Land subsidence is a real phenomenon in Jakarta. In general the land subsidence exhibits spatial and temporal variations, with the rates of about 1 to 15 cm/year and a few locations can have the subsidence rates up to about 20-25 cm/year (Abidin, et al., 2009).

Subsidence may also enlarge the flooding inundation area, and subsidence along several coastal areas of Jakarta makes them more vulnerable toward sea level rise phenomena. The sea level rise in the northern coast of Java average was 1.45cm/year during the years of 2005 to 2011 (Hadi, et al., 2012).

Muara Angke is located in North Jakarta, Pluit Village, Penjaringan Sub District, and as a delta at the edge of the Jakarta Bay (see Figure 1.1). It has been well known that the urban areas adjacent to the shorelines are associated with large and growing concentrations of human population, settlements and socio-economic activities. Human activities cause additional pressures that may dominate over natural

processes, such as excessive ground water extraction and load of buildings and constructions, cause land subsidence rate is increasing (Syvitski, J.P. 2007).



**Figure 1.1** Muara Angke in Northern Jakarta  
(Source : Technical Unit of Muara Angke, 2011)



**Figure 1.2** Flooding in Muara Angke, 2011 and 2012  
(Source : UPT Muara Angke & foto.detik.com)

Flooding occurred several times in Muara Angke, the last floods occurred in 1999, 2002, 2007, 2012, and 2013 (Zaenuddin, 2013). Impact of the coastal flooding insists the communities to adaptive the hazards by adjusting their houses to avoid the flood, and government built polder system as flood protection strategy. This research will describe revitalization approaches have been done by the local government and community to sustain the settlement. The following are the research objectives: a) to identify the various government efforts; b) to identify the various community organization efforts; and c) to identify housing adjustments were done by occupants to obtain a better life.

This research needs quantitative and qualitative approaches. Quantitative method can be used to collect data on demographics of the population to obtain better characteristics of population measured at the study site. It is also used to collect data on the

physical changes of houses. Quantitative data collection is done through semi-structured interviews and field measurements. Meanwhile, qualitative method used to collect data on the flood history of the settlement, strategy of flood hazard mitigation, and descriptive explanation of field measurement. Findings of this research will contribute to the knowledge on revitalization approaches in flood-prone settlement.

## 2. Revitalization as An Approach to Settlement Sustainability

Rapid urbanization in coastal areas is causing the rapid deterioration of coastal and marine ecosystems. Floods also led to a loss of vitality in coastal settlements, interfere with daily activities, reduced social and economic activities, and environmental damage. Disasters are frequently caused by vulnerabilities created by human actions, such as uncontrolled or inadequately planned human settlements, and lack of basic infrastructure. Renewal needs to be done to the flood-prone settlements, such as revitalization to increase the quality of environment for the sustainability of the settlements.

Revitalization process is an integrated effort to bring back the vitality of underused urban areas (Martokusumo, W., 2008). Revitalization is not just a physical problem and repair the building, also connects with the socio-economic context of the community such as the opening of new jobs, resource utilization, and community involvement in planning and implementation. Revitalization is indeed an expression of institutional policy as direct consequences of physical and functional adaptations. Urban revitalization certainly provides potential for future urban growth.

Socio-cultural, environment and economic aspects have been the most important elements in creating sustainable environment. It also requires cooperation between government and society, creation of a better environment for human health, improve the living conditions of people, supported by effective management systems and plans of action that reflect local needs and capacities. Vegetation creates natural habitats and permits better absorption of rainwater by natural means, which implies savings in water management, also play an important part in reducing air pollution and in creating more suitable climatic conditions. (UN Documents, 1996). Therefore, revitalization as an approach to settlement sustainability.

### 3. Revitalization Approaches in Muara Angke Settlement

Muara Angke was built since July 7, 1977, this region was prepared to accommodate the fisheries that spread over several locations in Jakarta. It had been managed by Environmental Management Body of Muara Angke from 1977 to 1994, and since 1995 it has been managed by the Technical Unit of Muara Angke who represents the City Government of Jakarta (UPT PKPP and PPI Muara Angke, 2011).

It has been designated as center of fisheries development in Jakarta since 1990. Initially, this region had an area of 62 ha, but Jakarta Government reclaimed this region in 2006, so that this area covering  $\pm 71,7$  ha at present. This region consists of fishermen housing (21,2 ha), fish landing bases (5 ha), mangrove forests (8 ha), fish processing (5 ha), ship docking (1,4 ha), vacant land (6,7 ha), market (1 ha), terminal (2,6 ha), soccer field (1 ha), and ferry ports to Thousand Islands (2 ha).

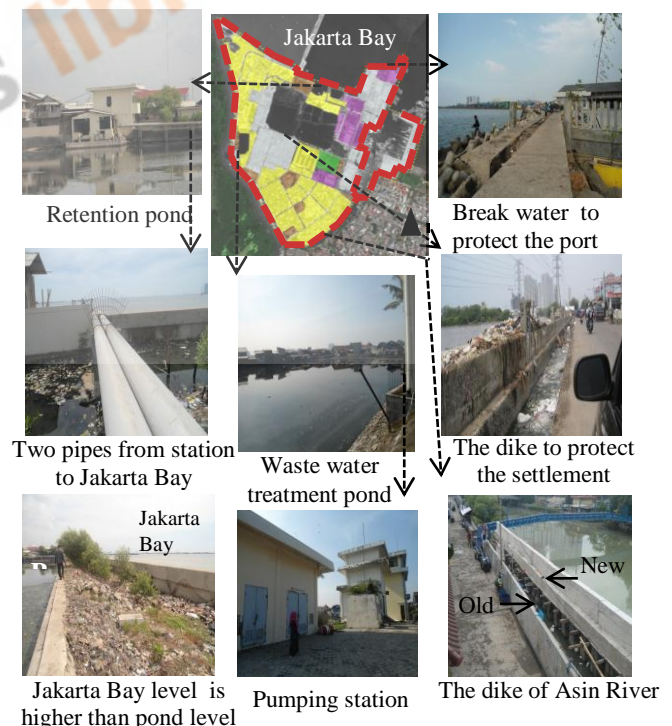
Muara Angke includes some blocks of housing, Block H, L, K and Bermis were chosen for this study (see Figure 1.1), because there are many housing adjustments in these blocks, and they will be retained as landed housing in Muara Angke Master Plan, while the surrounding slums will be converted into flat housings. Meanwhile, these blocks are the first housings which established by the government of DKI Jakarta in Muara Angke; Block H, L, and K were built in 1978 and Block Bermis was built in 1988. The total number of houses in research location is 708 units consisting of 220 units in Block H, 140 units in Block L, 164 units in Block K, and 184 units in Block Bermis.

#### 3.1 The Government's Strategy to Revitalize The Settlement

Repeated floods and rob has lowered the quality of the environment, adverse economic activities, and damaging homes and furnishings. Technical Unit of Muara Angke (government representatives) has sustainable responsibility to manage and maintain this settlement from floods. Therefore, the Technical Unit of Muara Angke has collaborated with the Ministry of Public Work and some technical consultants in order to construct the structural approach with a polder system, which often implemented to cope with floods (Anita, J., 2013). The advantage of polder besides being able to control the water, it can also be used as fisheries. The disadvantage of polder relies heavily on the pump. If the pump is off, the area will be flooded.

A polder system consist of :

- A flood storage pond or retention pond, wide of pond is about  $\pm 3800 \text{ m}^2$  ( $80 \times 50 \text{ m}^2$ ) which be constructed in 1999. It serves to control flooding caused by rainfall and tides, and become a reservoir of waste water from the port, terminal, fish market, fish industries and storage.
- Waste Water Treatment Plant (IPAL), wide of this pond is about  $\pm 7000 \text{ m}^2$  which be constructed in 1984. It serves to control flooding and become a reservoir of waste water from the processing of salted fish and houses.
- Two pumping stations, they are located on the edge of flood storage pond and Waste Water Treatment Plant. Each of pumping station has four pumps, two pumps operate at 6.00 am until 3.00 pm in dry season, meanwhile they operate for 24 hours in rainy season.
- Ring dike, wide of the dike is  $744.240 \text{ m}^2$  to protect the Muara Angke settlement from the ocean waves and overflow water from two rivers (Adem and Asin River) in the surrounding. Muara Angke is protected with break water from the ocean waves, see Figure 3.1 as below:



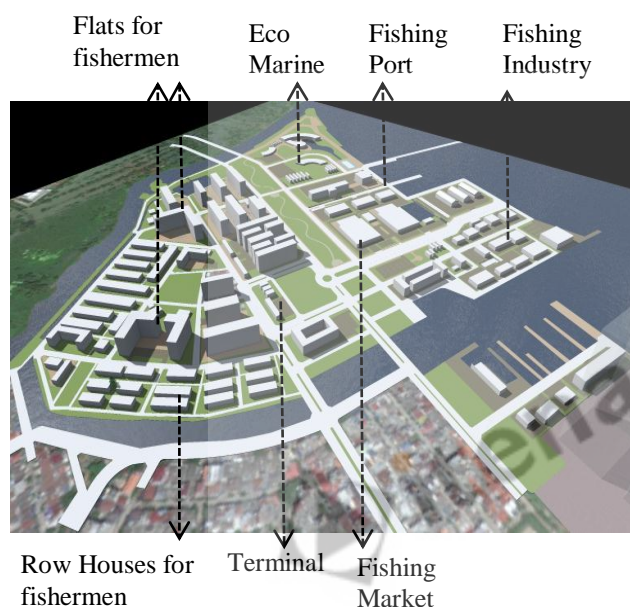
**Figure 3.1** Polder System to protect from flooding

Dikes, pipes must be elevated periodically because this structure will go down because of land subsidence and increasing of sea level rise. Technical Unit of Muara Angke also elevate the main roads periodically to avoid flooding. It planted



street trees to improve the environment coolness and expand the green space. It should do dredging waterways and pond periodically, maintenance of the pumps, and clean the trash from port and fish market every day.

Technical Unit of Muara Angke has a Master Plan for 2011-2015, planned for the development of the fishing industry, marine tourism, seafood center, flats and row houses for fishermen, and green space (UPT Muara Angke, 2011). It seeks to turn the settlement with economic, social, cultural activities and provide a better environment for people's lives, bring Muara Angke sustainability for the future. Nevertheless, it cannot be realized, is still in the process of funding schemes and cooperation with various parties to implement.



**Figure 3.2** Muara Angke Master Plan for 2011-2015  
(Source: Technical Unit of Muara Angke, 2011)

### 3.2 The Community Organization Efforts to Revitalize The Settlement

There are some community organizations, such as organization of family welfare education (PKK), Holy Mother Foundation (Bunda Suci), and youth organization (Karang Taruna). These organizations participated in the care of the environment, including helping the government to plant mangrove trees and medicinal plants. They do dissemination to communities about the flood and how to cope with flood through meeting periodically, giving information to mothers at infant health service activities, and explanations to teachers and pupils in the pre-schools. When event of flooding, they built soup kitchen through collaboration with the head of village and sub district, also the Technical Unit of

Muara Angke. They have received assistance packages from outsiders and distributed to the communities.

These organization's involvement was limited to the maintenance of the environment, they have not been involved to participate in the planning and design of settlements. Furthermore, many people anxious worry evicted because no explanation is transparent to them about the future development of Muara Angke.

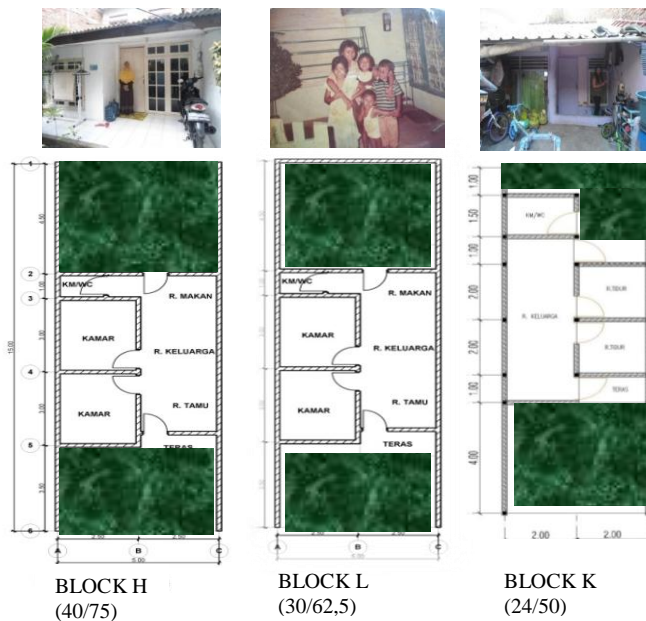


**Figure 3.3** Community Organizations maintain the environment  
(Source: Technical Unit of Muara Angke, 2011)

### 3.3 Housing Adjustment for Better Life

Data were collected through semi-structured interview with 120 purposive respondents selected based on the criteria that they have lived more than 15 years and have been flooded several times, and their houses have been renovated at least within the last 2 years. Data were also collected from field observation of physical changes of their houses. The number of houses become a sample based on the number of existing houses calculated proportionally, consisting of 37 units (31,6 %) in Block H, 24 units (20 %) in Block L, 28 units (23.3 %) in Block K, and 31 units (25 %) in Bermis.

Initially all of houses were single storey houses, size of houses 40 m<sup>2</sup> with land area of 75 m<sup>2</sup> in Block H; 30 m<sup>2</sup> with land area of 62.5 m<sup>2</sup> in Block L; 24 m<sup>2</sup> with land area of 50 m<sup>2</sup> in Block K, meanwhile 21m<sup>2</sup> with land area of 60 m<sup>2</sup> in Block Bermis (Anita, J. and Sudradjat, I., 2015). Building coverage ratio that was initially 45 % until 53 %, so each house has a yard in front and back of the house (see Figure 3.4). The existence of the polder system makes residents feel safe to live there, so they expand and elevate their houses for better living. Their houses will be low and sink if they do not do adaptation. The impact of this condition caused the houses no longer have a yard in front of the house for planting trees (see Figure 3.5).



**Figure 3.4** Original Floor Plan in Block H, L, and K



**Figure 3.5** Recent housing adjustment (left), low and sinking houses if it cannot be adjustment (middle & right) (Source: survey, 2013)

Characteristics of 120 purposive respondents are as follows :

- Respondents moved to Muara Angke 40.8 % in 1975-1980; 17.5 % in 1981-1985; 23.3 % in 1986-1990; 10 % in 1991-1995; and 8.3 % in 1996-2000.
- Ethnic distribution of household heads consist of 37.5 % Bugis; 25.8 % Javanese; 7.5 % Betawi, Banten, and Sundanese; 4 % Makassar and China; 2.5 % Lampung and Cirebon; 0.8 % Batak, Padang, and Manado.
- Education level of household heads consist of 40 % elementary school; 15.8 % junior high school; 37.5 % high school; and 6.67 % baccalaureate.
- Age distribution of household heads consist of 15.7 % aged 40-49 years; 38.6 % aged 50-59 years; 35 % aged 60-69 years; 10 % aged 70-79 years; and 1 % aged 80-89 years.
- Income per month consist of 22.5% < Rp 1.5 million; 41.7% Rp 1.5-2.9 million; 19.2% Rp 3-

4.49 million; 5% Rp 4.5-5.9 million; 4.2% Rp 6-7.49 million; 7.5% > Rp 7.5 million.

### 3.3.1 Elevating The Houses

All respondents said the main reason they changed the house because of flooding (100%) and they still want to stay at home despite flood (100%). The next reason for the increase in family members, space requirements, and furnishings are not damaged, and last reason for neighbors appreciated (improvement of social status). Housing adaptation includes elevating the house, if they do not elevate their houses, they will be buried as landfill (see Figure 3.5). They elevate their houses to avoid flooding and can stay comfortably at home despite flood. There are 3 methods of elevating the house, as follow :

- elevate the ground floor above the road level;
- elevate the ceiling;
- elevate the house become two and three storey house.



Elevating ground floors

Elevating the ceilings

**Figure 3.6** Elevating the houses

Respondents elevated the ground floor several times due to continuous land subsidence and avoid home from flooding. They elevated until 39 cm above the road level (10.8%), 40-79 cm (26.7%), 80 -120 cm (37.5%), and > 120 cm (7.5%), after the last housing adjustment in a few years ago.

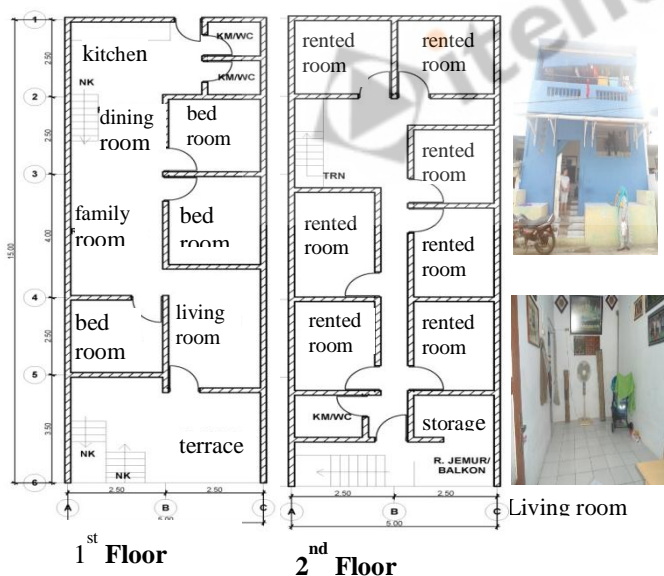
The ceiling of some houses are high enough, ceiling height < 199 cm (2.5 %); 200-249 cm (20.8 %); 250-299 cm (17.5 %); 300-349 cm (15.8 %); 350-399 cm (23.3 %), 400-449 cm (15 %), 450-500 cm (5 %). If the ceiling is high enough, the respondents would be easy to raise the floor of the house several times without having to dismantle the ceiling. All of respondents believe that they will elevate their houses in five to ten years later, because the road in front of their houses will be elevated to avoid flooding. The high ceiling of the house is also beneficial to add coolness in the house because the temperature is hot enough in Muara Angke.



When the respondents have enough money, they will renovate their houses become two and three storey houses to avoid flood. If they have the second floor, they will be safe from flooding and can stay at home despite floods. Elevation of the house is also to expand the rooms and increase the rooms such as bedroom, living room, drying room, and bathroom. There are 134 two-storey and 3 three-storey houses of 220 houses in Block H; 83 two-storey and 5 three-storey houses of 140 houses in Block L; 92 two-storey and 2 three storey houses of 164 houses in Block K; 102 two-storey, 4 three storey and 1 four-storey houses of 184 houses in Block Bermis.

### 3.3.2 The Expansion of Houses

Limited land make residents spend all land to be built, so that there are no more yard to plant trees. The houses were adjusted to the needs of occupants (Crull, et al., 1991) such as adding family members, needs a wider space, and add to the economic function at home to increase their income per month, such as rented rooms and a stall. However they will be old and need the extra income, especially when their children come to live with them. There are 32 houses that have a stall on the front yard and 38 houses that have rented rooms. The example of expansion become two storey-house (with additional economic functions) can be seen in Figure 3.7 as below.



**Figure 3.7** Sample of house expansion with additional economic function in Block H

### 3.3.3 Using Materials Easily Dismantled

Respondents tend to use materials that are easily dismantled. According to 120 respondents, there are 71 houses as two-storey and three-storey houses; 64.8 % houses use multiplex for the second floor, 31

% houses use concrete, and 4.2 % house use steel decking. The multiplex, besides cheap, it is also easy to be dismantled when the respondent would improve their houses in the future. All of respondents believe that they will elevate their houses in five to ten years later. This method will be cheaper than using the concrete floor, because the concrete floor should be destroyed when the house will be elevated.

Original material is zinc roof in Block H, L, and K and roof tile in Bermis. Recently, respondents tend to use asbestos as roof material (81.7 %), besides cheap, it is also easy to be dismantled, can reduce heat of sun shine and noise of rain. Respondents tend to use ceramic tile for ground floor (80.8 %), besides cheap, floor becomes cooler, and it is also easy to be cleaned after the flood. The rich respondents use granite tile (5 %), otherwise the poor respondent uses stucco floor (14.2 %).



**Figure 3.8** Using materials for the second floor and roof

## 4. The Impact of Housing Adjustments for Living Activities

The people changed their houses because avoid of flood and their needs for safety, comfort, and social status. These changes have some adverse impact on daily activities, such as many residents refused to use furniture. They will be busy and bothered when they have furniture during floods, and also damaged furniture submerged in water. Especially now that they are old, do not have too much money to buy new furniture. Recently, many respondents always sit on a carpet or mat when receiving guests, watching tv, eating, and chatting with family members (see living room in Figure 3.7).

Green space is lost because the houses have no longer a yard in front and back of the houses. There is no green space at the side of the road because almost the house was built to 100% building coverage ratio. There is no space for children to play and socialize with the neighbors, so the socialization that was originally in front terrace of the house or

front yard has turned into a chat in the stalls or chatting in the street or next neighbor's house, the children also play on the road, see Figure 3.9. Even the wedding ceremonies are also held in the main street.

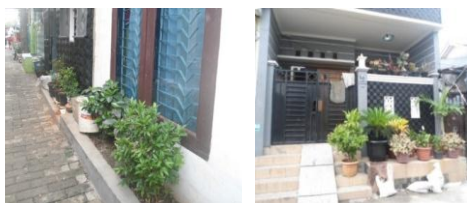


**Figure 3.9** Social interaction with neighbors on the road

The occupants moved the septic tank of the alley behind the house (previously communal septic tanks, 1 septic tank for a 4-6 houses) and build a new septic tank under the bathroom or under the kitchen, under the bed room, so the septic tank generally never been sucked by tank car. Water seepage from septic tanks discharged to gutter, so the smelly gutters and water becomes black. Many occupants cover the top of the gutter with wooden board or concrete to reduce odor, and use it for planting the flower, stairs on the terrace, or motorcycle parking. But gutter that closed it will make stagnant water on the road when it rains. Occupants cannot plan and design the housing adjustment well, they do not have a guide, thus causing environmental degradation.



Smelly gutters



Cover the top of gutter to reduce odor and use it for planting the flower and stairs on the terrace

**Figure 3.10** Smelly gutters and covering the top of gutter

## 5. Conclusion

Flooding caused the decline in the value and vitality of the Muara Angke settlement. Government, community organizations, and occupants do adaptations to revitalize the settlement. The conclusion of their participations to improve the settlement can be seen as below:



**Figure 3.11** Conclusion of stake holder participations to improve the settlement

Income has an important contribution to the ability of occupants perform adjustment. Government and private sector should provide financial assistance with low-interest loans to help low income people, so that they can elevate their houses, they can stay safe from flooding. The government also should plan some guidelines or public policy to guide the communities when they do housing adjustments, to reduce the negative impacts on daily activities and environmental damage.

The government should increase its role to help communities and local organizations, involve them in the planning and design of settlement, so that the environment remains vital and sustain, can overcome the negative effects of coastal flooding. It should implement the available Master Plan to create a healthy environment, increase economic, social, and cultural activities, well planned that has been laid out with more regularly, for sustainability of Muara Angke.

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