In Search for Sustainable Coastal Management: A Case Study of Semarang, Indonesia

Sudharto P Hadi

Study Program of Environmental Studies, Diponegoro University, Semarang, Indonesia

sudhartophadi@yahoo.co.id and sudhartophadi@undip.ac.id

Abstract. As a coastal town, Semarang is currently facing environmental problems such as flood, tidal flood (locally called rob), coastal abrasion, emerging land, land subsidence and sea water intrusion. These phenomena severely affect to citizen, community and corporate, disrupting day to day activities, threatening people’s health, causing economics’ burden and reducing property value. Government policies in dealing with these problem are focused on its phenomena such as normalizing river for flood and building polder systems for tidal flood. Impacted people have been implementing various initiatives. People in Tanah Mas Estate set up collective efforts to reduce tidal flood by building pumping system project, while people in Kampong Tambaklorok conduct a regular mutual assistance in cleaning of waste and sedimentation, rehabilitating of local drainages and dikes, reconstructing of local streets and also maintaining of pumping system. People in Mangunharjo, the district of Tugu build a coastal belt and cultivate mangrove. Various government and local initiatives have been effective in dealing with flood and tidal flood temporarily. More comprehensive approaches and focused on the sources of problems are required to achieve sustainable coastal management.

Key words: coastal problems, government and community initiatives, sustainable coastal management

1. Introduction

Coastal area is a strategic area for various activities such as port, recreation, fishery, agriculture, industry, settlement, etc. However, coastal area is also vulnerable to change caused by activities within coastal area itself and other activities from the upstream. Local people live at coastal area also vulnerable because they rely on natural resources available at coastal area. If the area has been degraded, it will severely affect them economically and socially. As a coastal town, Semarang is encountering crucial problems such as tidal flood (locally called rob), flood and coastal abrasion. Because of various crucial problems, Semarang was chosen as one of 100 resilience city programs facilitated by Rockefeller Foundation. It is expected that the City of Semarang could formulate strategies to deal with these problems. The phenomena of tidal flood has been occurred since 1980s and threaten the north coast area of Semarang from Tawang Mas, Tanah Mas, Tanjung Mas, Port area, Bandarharjo, Tambaklorok, Kemijen, Johar, and Genuk. Tidal flood is currently befalling 7 districts out of 16 districts, with the width of impacted area reach to 3,915,16 ha. Other phenomena are coastal abrasion and flood occur at Mangunharjo and Mangkang Wetan, Tugu District at the west part of coastal area of Semarang, eroding fishpond and threatening the settlements. This paper explains the driving factors of tidal flood, land...
subsidence, coastal abrasion and flood, reviews the measures taken by the government and local people and explores the ideal measure for sustainable coastal management?

2. Literature Review
Tidal flood is stimulated by the effects of sea level rise and exacerbated by land subsidence. Land subsidence is caused by density of built up area and ground water exploitation. People can easily exploit groundwater and artesian well as an alternative water supply when PDAM (local water firm) do not work. Urban construction aggravates land subsidence. Sea water flows to the land subsidence causing inundated areas. The inundated area become worst during the rainy season. According to Miladan [1], during the period of 1985-2008, sea level rise in Semarang was 5,536 cm per year, while land subsidence at the port area reach 5-7.5 cm per year and has been accounted that up to 31.8 cm. Land subsidence in Tanah Mas Estate is between 4 to 9 centimeters on average per year.

The way the government responded to the coastal problems is characterized by hierarchical structure, top-down decision making, centralized authority and short-term orientation. This type of policy, according to Buchholz [2] is classified as traditional management and not eco-centric management. While Dunn [3] reiterates that what kind of decision taken by the government is linked to the value of decision-maker. In relation to the value, Fintersbusch [4] suggests that there are five principles in decision making process namely utilitarianism, libertarianism, justice rawls, democratic, and ethical pluralism. Utilitarianism is based on the principle of the greatest possible happiness for the greatest number. This type of decision is determined by expert based on quantitative technique. Libertarianism is based on the right of individualism and democratic decision making. Justice theory of Rawls relies on democratic, equity and justice. Democratic is based on supreme value of democratic and decision, not weighting. The last principle is ethical pluralism in which no value to be supreme and all value is equal. This is the ideal type of public decision making in which all stakeholders involve at the earliest stage of planning. However, utilitarianism has been widely utilized in decision making process sacrificing democracy and creating injustice #

3. Research Method
The type of research is analytical descriptive which is to describe the phenomena of tidal flood, land subsidence, coastal abrasion and flood, the measures taken and its effectiveness. The scope of research follows (a) the driving factors of tidal flood, land subsidence, coastal abrasion and flood. (b) the measures taken by the government and impacted people in dealing with tidal flood, land subsidence, coastal abrasion and flood (3) the ideal measures should be taken for sustainable coastal management. Two cases taken as object of studies namely tidal flood and land subsidence in Tanah Mas Estate and Kampong Tambaklorok, and coastal abrasion and flood in Kampong Mangunharjo and Mangkang Wetan. The data collection techniques consist of content analysis from mass media, analysis of secondary data, physical and social observation and informal interview with relevant interest. The data gathered is analyzed qualitatively.

4. Results and Discussions:
For local people, tidal flood disrupts day to day activities, potentially cause disease such as diarrhea and vomiting, typhoid, leptospirosis and respiratory tract infections. Miladan [1] found that when tidal flood occurs for several days, septic tanks in each house do not function and are inundated. The environmental condition are unhygienic, dirty and smells bad. This deteriorates quality of life of impacted people. In addition, the streets and walls become mossy and then ruined. Tidal flood also destroys house equipment such as cupboards, tables and vehicles. The damaged house equipment and corroded vehicles result from frequent inundations. Impacted people have to allocate budget for replacement and rehabilitation of house equipment and vehicles. Impacted people also bears burden of the rehabilitation of settlement infrastructures such as street and public facilities. Frequent inundation destroy these infrastructures. The
community collects dues for rehabilitation cost and these dues were demanded from all households in each RT (neighborhood association). Tidal flood destroys settlement lead to significant decrease of property value: land and house. Because the settlement is no longer a good place to live, the demand to live at impacted area are significantly decreased. For companies, tidal flood and land subsidence cause high economic cost. The maintenance cost increases 1.5 times th an other Ports. Port company requires Rp 40 to Rp 50,- billion to elevate three docks since 2010. The old dock could not be utilized because of being inundated [5]. Coastal abrasion caused lose people’s job and income. In addition, due to coastal abrasion, sea water infiltrate to people’s settlement disrupting day to day activities, deteriorate community health and also reducing property value.

Coastal abrasion is also caused by reclamation done in several part of coastal area of Semarang such as in Mororejo, nearby Kampong Mangkang and Mangunharjo, Tawang Mas for PRPP (recreation and development promotion complex), Marine Recreation area and Port area. According to Anggoro et al [6] the type of reclamation done in Semarang is the one that merged with the main land. This type of reclamation is potentially causing a change of natural current pattern, deterring sediment transport, stopping existing irrigation or drainage, and in turn causing coastal abrasion, accretion and flood at the mainland. In addition, the risk of flood will occur because of the river or drainage is lengthened. Coastal abrasion has been occured at Mangunhardjo since the beginning of 1990s. Based on research done by Anggoro et al[6], coastal abrasion was stimulated by the change of current pattern caused by massive construction in the form of dock built by a factory. This activity contributes about 65% of coastal abrasion causing 65 hectare of degraded fish pond. The length of degraded coast line reach to 3,5 km, while the abrasion erodes the main land up to 1.7 km and causing the infiltration of sea water to the settlement. People in Mangunharjo and Mangkang Wetan also experience flood coming from Beringin river nearby their settlement. Every rainy season, Beringin river frequently overflow because of high volume of run off from the upstream

5. Government Policies

In dealing with the tidal flood, the government built Polder System located at Kampong Tawang, Kemijen and Bulu Drain System. The Bulu Drain system is one of the devices to control flood in Semarang coast covering three Kampongs: Panggung Lor, Panggung Kidul and Bulu Lor. Polder system consists of retention tank, pumping station and flood gate. Retention tank located in Tawang, Semarang helps reduce the volume of tidal flood and flood temporarily. While Polder in Kemijen is still under construction. The proposed location of retention tank is owned by Railway Company and up until now has not been resolved about the status of the land. Pumping station has been built and local people has a plan to voluntarily manage the Polder System by collecting dues from member of the community for operation and maintenance cost of Polder System.

In dealing with coastal abrasion in Mangunhardjo and Mangkang Wetan, the government provided a seed funding for building a coastal belt. While in responding the flood in Mangunhardjo and Mangkang Wetan, the government has planned to normalize the river by compensating people’s land at the downstream. However, up until now, negotiation regarding the land compensated has not been achieved an agreement. During the rainy season, local government is currently elevating embankment of Beringin river. From the perspective of the government, this flood is mainly caused by narrowing of Beringin river caused by sedimentation. In fact, the main contribution of flood comes from the upstream of Beringin river which is at Mijen District where land-use change has been massive since 1980s causing run off and flow to Beringin river.

6. People Initiatives

The response of impacted people to these disasters has been done individually and collective action. Miladan [1] found that in Kampong Tambaklorok, individually, each household reconstructed their houses to reduce the impact of tidal flood. People elevate their houses foundations every 5 years. They
realize that this measure is only temporary but this is the only way to deal with this problem. The reconstruction of house consist of elevating the floor with piles of sand and soil or cement, terrace renovation and its roof and yard elevation. In addition, as collective action, people have been conducting a mutual assistance to reduce the impact of tidal flood by cleaning of waste and sedimentation, rehabilitating of local drainages and dikes, reconstructing of local streets and also maintaining of pump system built by government. The reconstruction work is aimed to elevate the local streets. They pile up these materials on the local streets in order to add 30 to 50 cm.

In Tanah Mas Estate, Miladan [1] further explains that individually, people have implemented mitigation efforts to reduce the impacts of tidal flood by elevating their house and streets. Each individual household constructed modest barriers around their houses, notably doors surrounding the houses. These efforts were only temporary solutions and in fact, their settlement to be inundated during the tidal flood occurrences. In 1996, people initiated to set up community collective efforts called Paguyuban Pengendali Air Pasang Panggung Lor (Association of Controlling and Handling of Rob (tidal flood) Risk in Panggung Lor Sub District (P5L). People consider that pumping system project was appropriated solution because the water surface of Asin River had been higher than the surface water of the settlement, so inundation discharge could be pumped. People realize that elevations of local roads and houses caused social and territorial problems.

People in Mangunhardjo and Mangkang Wetan conducted a mutual assistance to build a coastal belt with the seed funding from the Government of Central Java. Up until now, they have finished building coastal belt for 3.2 km out of 3.5 km of degraded coast. They also obtained funding from the Ministry of Fisheries and Marine, and other sources. To strengthen the coastal belt, local people planted mangrove parallel with coastal belt. Mangrove has a function to revitalize degraded fish pond. In fact, by having mangrove, fish pond can be planted again with shrimp and milk-fish. Coastal belt, in addition to prevent abrasion from the wave, also has a function as sediment trap to rehabilitate the degraded coast.

7. Conclusions and Recommendations

The measures taken both by the government and by local people are focused on the phenomena of tidal flood, land-subsidence, coastal abrasion and flood. These measures are successful in minimizing the impacts temporarily, however, at the long term, the measures will not able to deal with problems if the sources of problems are not dealt with. The causes of land subsidence are over burden building and ground water extraction. With regard to over burden building, it is required to remapping of the tidal flood area at north coast of Semarang and to revise spatial planning to determine the area need to be allocated for green open space. If necessary, buildings stand at the area which are not suitable with the spatial planning need to be demolished for green open space. It is also required to limit the permit issuance of ground water extraction. The permit that has been issued must be strictly controlled to comply with regulation. To prevent coastal abrasion, it is required to limit reclamation permit. The current man-made environment resulted from reclamation such as factories, recreation areas, ports need to be followed by environmental audit. This audit will show how their reclaimsations contribute to coastal abrasion and what measures need to be taken by them to minimize the environmental impacts. In dealing with flood in Kampung Mangunharjo and Mangkang Wetan, it is necessary to revise spatial planning at the upstream area by conducting strategic environmental assessment (SEA). SEA studies will calculate environmental carrying capacity and environmental carrying capability and recommending which area need to be used for green open space.

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