Adaptation Strategy of Urban Communities in Facing Environmental Problems Due to Climate Change

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Abstract. Cities have a high vulnerability to climate change. Rising sea levels that cause tidal flooding frequently happen in coastal cities, damaging the environment. People lost their houses and occupation, making them powerless. This research aims to identify the adaptation strategy used by urban communities in coastal cities to survive environmental problems due to climate change. This research is located in Tambak Lorok in Semarang City and Bedono in Demak Regency. Qualitative research was employed to gain an in-depth understanding of the adaptation strategy of urban coastal communities. Data were collected by interviews, observation, and literature study. The results show that environmental problems that occurred because of climate change are one complication of serious problems, but it is worsened by construction projects as a part of urban development. The two communities have similar but different strategies for survival in that situation. While the people of Tambak Lorok in Semarang City do not have any other better option than accepting the relocation, the people of Bedono in Demak Regency rely on mangroves to protect their settlements. This result concludes that although urban coastal communities have their adaptation strategies, they need long-term solutions from local governments and other parties to live without worry.

1. Introduction

Climate change is a global issue that has been frequently studied in recent decades. Various studies were conducted to discuss the extent of the impact and environmental damage caused by real climate change in the last 30 years. Annual conventions between countries are held to identify practical solutions and policies to minimize climate change impacts and losses experienced by almost all countries worldwide. The increasing incidence of natural disasters in various parts of the world is also allegedly due to climate change. As an example, look at how the icebergs in the Arctic are impacted due to rising temperatures caused by global warming. Climate change is a condition where there is a change in climate elements, namely temperature, rain, and humidity. The most visible indication is the increase in the average temperature of the earth's surface within a specific period of time, commonly called ‘global warming’ [1,2].

Cities are areas that are vulnerable to climate change. Regardless of the dynamic aspect, the city becomes a migration destination for people from various origins [3]. Climate change has become a severe threat to the development of urban areas. Climate change can affect public health by causing poor air quality, extreme weather, heat waves, and floods [4]. The physical aspects of urban space must be considered, but the human aspect, namely urban communities, needs to be prepared to adapt to the
impacts of climate change [5]. Moreover, urban communities tend to have a high level of vulnerability, especially in coastal areas [6]. Therefore, the city needs to have the ability to bounce back from shock and stress related to climate change, or as the scholars call it, ‘resilience’. It is related to the capacity of ecosystems, people, environment, economy, and urban systems to cope with disturbances [7].

Among many types of cities, coastal cities are probably the most vulnerable areas to deal with environmental damages due to climate change. Coastal communities in urban areas mostly are small-scale fishermen who does not have significant capital to sustain their fishing business. Two big problems surround them: climate change that causes rising sea level and abrasion, and urban development projects. Tambak Lorok in Semarang City is an example of this bad condition. Airport and port construction projects pushed back the local community to compromise with intensely crowded people who come for work and make their environment dirty [8]. In short, the quality of life of people in the urban coastal area in Tambak Lorok, Semarang City, is worse than ever, which made them vulnerable. The other location, Bedono, in Demak Regency, is a suburban area located in the border area of Semarang City. Some of the areas have been submerged due to sea abrasion for over two decades. Demak is also affected by the urban development in Semarang City that worsened the condition, mainly in Bedono. People in the two areas need to adapt to that poor environment quality that affects their daily lives. Although many research have already discussed environmental damages in coastal areas, there is little to be known about how the urban communities formed their adaptation strategy to live in such conditions. Therefore, this research aims to identify the adaptation strategy of urban communities in coastal cities to survive environmental problems due to climate change. This article will look closely at two locations; Tambak Lorok in Semarang City and Bedono in Demak Regency.

This research will contribute to the lessons learned from coastal communities to build a more resilient city. It can also be an input to other coastal areas that have similar environmental condition. Adaptability, flexible urban systems, and governance are the keys to a resilient city [9]. Realizing urban resilience must include people, politics, and power [10]. Thus, it will be easier to incorporate a disaster response into urban planning agenda to reduce the risk of climate change disasters.

2. Method

2.1. Case study location and period
This research is conducted as a case study with a qualitative approach. Qualitative research was employed to gain an in-depth understanding of the adaptation strategy of urban coastal communities. The case study was used to sharpen the process of data collection and data interpretation. This kind of research assumes that every case is unique. The case study is located in two areas Tambak Lorok, Semarang City, and Bedono, Demak Regency, which have a similar physical environment to coastal areas. These locations are interesting to be studied in depth because of cases of environmental damage due to coastal abrasion. The period of this research was from July until September 2020.

2.2. Data collection and analysis
The data were collected with interviews, observation, and literature. First was the interview with informants from Tambak Lorok, Semarang City, and Bedono, Demak Regency. The informants were government staff, local community figures, community members, and the representative managements of local and international NGOs. Second, observation in the locations was conducted to get valid information and authentic experiences on the human living condition and environment conditions. Third, literature analysis was conducted to comprehend how the impact of climate change on the environment affect the community. The literatures used were not older than ten years. During the data collection process, the authors continuously cross-checked the information that had previously obtained from the informants. So, the process of data validation was undertaken continuously during the data collection.
3. Results and discussion

3.1. Adaptation strategy of urban communities
In the past ten years, researchers have studied how urban communities adapt to climate change. It is understood that having a spatial planning model and developing urban physical aspects adaptive to climate change disasters is not enough. It takes the readiness of the human aspect; how urban communities adapt to climate change disasters that are detrimental to their socio-economic life. Community-based adaptation, a term often used to describe the range of social, cultural, environmental, political, and economic contexts that increase vulnerability and increase community resilience to climate change and other stressors, provides many benefits [4]. Urban communities need to be encouraged to be more adaptive and responsive because they are the ones who are badly affected by climate change disasters, especially the lower middle class [4,11].

Community-based adaptation can encourage social capital and build community resilience to climate change and other stresses. Studies on urban adaptation to climate change are still ongoing, and the current issue is building the capacity of local communities to internalize adaptation into societal values and norms [12,13]. In Indonesia itself, climate change and adaptation have received much attention from policymakers. For example, the Ministry of Environment and Forestry even has a Directorate General of Climate Change Control, which in 2017 launched the Climate Village Program Road Map. With a focus on community-based programs, the Climate Village Program combines adaptation and mitigation efforts at the Dusun/RW/Village/Kelurahan level by involving the active participation of the community [14].

3.2. Case study 1: Tambak Lorok, Semarang City
For the coastal city of Semarang, the impact of climate change is most felt by fishermen. Climate change that causes rising sea levels, high sea waves, tidal waves, and floods makes it difficult for fishers [1,15,16]. One of the affected areas in Semarang City is Tambak Lorok in Tanjung Mas, North Semarang Sub-district, which has a very high level of vulnerability to disasters compared to other areas. Tambak Lorok, located on the coast of the Java Sea and is crossed by the Banger River, has been known as a fishing settlement since 1950. Almost all coastal areas of Semarang City experience average land subsidence of up to 10 cm every year [17]. Based on the observation, the settlements in this village look shabby, even garbage is scattered everywhere due to the tidal flood (Figure 1). The environmental conditions affected by the tidal wave are very unhealthy due to damaged road infrastructure, poor water channels, and little clean water. However, many people still survive and adapt to the tidal conditions that regularly come with all the conditions.

![Figure 1. The condition of the house is due to the tidal flood.](image-url)

In order to continue live in Tambak Lorok, the people there had to adapt to the situation. The first and most common thing is to raise the house's surface every 3-5 years [16]. The capital to raise the house comes from their income savings or borrowing money from banks, family, or other parties. The
government also relocated hundreds family to other areas after the normalization of the river channel [8]. However, the study of Warsilah et al. found that the affected community refused to be relocated due to concerns about the new location [17]. It might be challenging to find work again and because of their attachment to their land. In 2018, the President of Indonesia officially supported Tambak Lorok development into Maritime Tourism Village. After three years, when this research was conducted, the physical environment condition in Tambak Lorok was better than before with clean settlements, more public facilities, infrastructure, fish auction places, and local markets to support the fisherman. Although the Marine Tourism Village improves the environment, the community, including fishermen, needs to solve future problems. For example, increasing cases of criminality, uneven distribution of aid for fishermen, and the development of tourism villages that impacts the community’s land.

3.3. Case study 2: Bedono, Demak Regency

Sayung sub-district where Bedono is located is the area most affected by seawater abrasion of around 250 hectares in the last two decades [18]. This condition also changed the coastline and destroyed some villages [19]. The phenomenon of sea abrasion is a natural process that occurs due to climate change. However, it worsened with the construction project of reclamation of Tanjung Mas Port in Semarang City, as stated by the village chief from the interview. This reclamation caused changes in the ocean that impacted the dynamics of the tidal wave and caused tides with an altitude of 0.5 - 1.5 meters [20]. All these made Bedono more vulnerable to environmental degradation. The condition forced some residents to move from their homeland.

However, the people who chose to stay in Bedono have various ways of adaptation as a form of defense to achieve comfort in life. Similar to the people of Tambak Lorok, people in Bedono also elevate the surface of their house every few years. Based on the interview with the local people, they have to stay alert and save money to keep their house from sea abrasion. Another strategy is to plant mangroves accompanied by local governments, universities, and non-governmental organizations both locally and internationally through community empowerment programs. They plant and maintain mangroves. For the people of Bedono, mangroves are a protector and source of life amid the abrasion/rob disaster that hit their village. Local wisdom helps to maintain mangroves, thereby minimizing the occurrence of violations. The Bedono Village Government and community leaders, through the results of the village discussion, agreed to impose sanctions on violators who damage mangroves. Various mangrove planting programs have been held. The results that can be seen are mangrove conservation forests scattered in the Bedono Village area (Figure 2).

![Figure 2. Mangrove area in Bedono.](image)

Women's groups also take care and play a role in protecting mangroves through socialization in the family. Women's groups have a role in resource management, especially those related to mangrove conservation. Environmental groups have started to involve women in the mangrove conservation cycle. The potential of women in mangrove conservation efforts includes being the driving force for the
success of mangrove conservation, as developers and processors of the results of mangrove plant management, and the potential to produce their mangrove seedlings. They get new business opportunities by utilizing mangroves. These various potentials and opportunities can be integrated into a mangrove literacy model. The level of community adaptation will be more robust by prioritizing their potential and knowledge as empowered community members in local organizations.

4. Conclusion
From the research results and discussion, it can be concluded that the environmental damages in the urban areas are an impact of climate change and massive urban development. Unfortunately, the urban coastal communities are a marginal group that has to deal with such conditions and low quality of life. These people choose to stay in their homeland even though they must adjust and make an adaptation strategy. The most common adaptation strategy from both research locations is to raise their house's surface every three to five years. To afford this, people in Tambak Lorok and Bedono keep savings or borrow from their relatives. This strategy was done by some residents who were reluctant to move to the relocation provided by the government. The bond with their homeland is why they do not want to move even if they experience tidal floods regularly. Besides, mangrove conservation, mainly in Bedono, is the best strategy to protect their community. Meanwhile, in Tambak Lorok, the development of Marine Tourism Village is the best way to improve the community's quality of life. Further improvements should focus on empowering urban coastal communities to sustain and improve the conditions in both locations.

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