



The Role of Stakeholders in Flood Disaster Adaptation and Mitigation: A Study in Penjaringan, North Jakarta

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Abstract.

Jakarta, as a global city vulnerable to climate change, faces persistent challenges from flooding, especially in areas like Kelurahan Penjaringan, North Jakarta. This study explores the roles of key stakeholders—government, community, and development partners—in flood disaster adaptation and mitigation efforts in the area. Using a qualitative descriptive method, data were collected through interviews guided by the General Guidelines for Disaster Resilient Villages (BNPB Regulation No. 1/2012). Findings indicate that while the government contributes through regulatory frameworks and funding, its village-level response tends to be reactive. The community demonstrates strong adaptability and preparedness through structural modifications, coordination, and participation in disaster-related initiatives. Development partners complement these efforts by enhancing community capacity and bridging partnerships for resources. Despite some gaps, particularly in government coordination, the synergy among stakeholders is pivotal in fostering a resilient and sustainable urban environment in Penjaringan.

Keywords: Flood mitigation, disaster adaptation, stakeholder roles, Penjaringan, community resilience, urban flooding, disaster risk management, Jakarta

1 Introduction

For major cities like Jakarta, effective disaster mitigation and management are essential for achieving its vision as a global city. According to the Global City Index, which Jakarta uses to measure its achievements, environmental sustainability is one of the main pillars of its development. This pillar is divided into several indicators, one of which is natural disasters. According to Statista, Jakarta is one of Asia's Sinking Cities, with 1.8 million residents at risk and contributing to a 18% GDP decline. The BNPB clarifies Jakarta's position in terms of natural disasters, showing that flooding poses the greatest risk in Jakarta, according to Indonesian disaster information data.

Additionally, increases in air temperature, rainfall, and sea levels have the potential to intensify extreme events, such as floods, wave heights, coastal erosion, and seawater

intrusion. In the long term, these phenomena will impact public health, settlement conditions, infrastructure resilience, socioeconomic activities related to people's livelihoods, and the soil and water ecosystems (Department of Public Works, 2007). Climate change and global warming are inevitable global issues. DKI Jakarta, a metropolitan area of 11.24 million people, is also affected. Its location on the north coast of Java makes it more vulnerable to climate change effects (Dinas Lingkungan Hidup Provinsi DKI Jakarta, 2023). In recent years, changing weather, rising water levels, and increased tidal flooding have become very real impacts. According to Meiviana (2004), Jakarta's sea level rose 4.38 mm per year from 1925 to 1989. Another study by Abighail (2022) found that the sea level in Jakarta Bay rose 7 mm per year. Additional effects of rising sea levels include the reduction of coastal land, damage to infrastructure, and increased salinity that damages crops.

The potential for disasters in Jakarta poses a threat to future development. Moreover, Jakarta's vision as a global city requires resilience to disasters. In this case, resilience is not limited to infrastructure, but also includes community resilience. According to the United Cities and Local Governments (UCLG) Asia Pacific, a resilient city is one that can withstand, absorb, adapt to, and recover from disasters in a timely and efficient manner. Disaster resilience is assessed based on individuals', communities', institutions', and the government's capacity to respond effectively to disasters.

Mapping of land areas submerged due to sea level rise in Jakarta shows that 5.1% of the area was below average sea level in 2000. The percentage of land below the average sea level continues to increase. Over the twelve-year period beginning in 2000, this percentage increased by 7%. By 2025, 20.5% of Jakarta's total area is estimated to be below average sea level, and by 2050, this percentage is expected to reach 32.5% (Thamrin, 2021), presented in Figure 1 below.

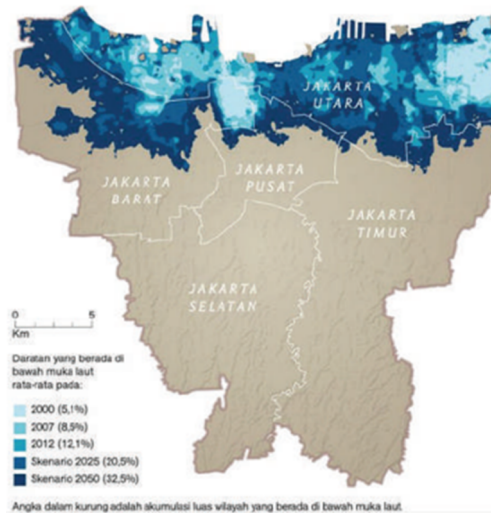


Figure 1 Land area submerged due to sea level rise in DKI Jakarta Province (Source: Thamrin, 2021)

Sea levels are rising worldwide due to this phenomenon, which has a significant impact on coastal areas such as North Jakarta. Rising sea levels exacerbate tidal flooding, which occurs when seawater enters land without rain, especially during high tides. Additionally, land subsidence in North Jakarta due to human activities, such as excessive groundwater extraction, further exacerbates tidal flooding.

To become a disaster-resilient global city, Jakarta must establish comprehensive mitigation and adaptation system to address with shocks and stresses, including disaster risks and the impacts of climate change. Among the most major challenges Jakarta face is flooding caused by both intense rainfall and rising sea level link to climate change. One of the most flood-prone areas in Jakarta is “Kelurahan Penjaringan” hereinafter referred to as Penjaringan. Penjaringan, located in North Jakarta, has been severely affected by flooding- most notably the massive tidal flood caused by the collapse of the sea wall in Penjaringan in 2007, along with routine annual flooding that continues to hits this area. The threat of flooding is also increased by its location at the estuary where all rivers and canals in Jakarta converge before channeled into the sea. As a result, Penjaringan also vulnerable to flooding caused by high rainfall in upstream regions around Jakarta, such as Bogor.

In overcoming the vulnerabilities in Penjaringan, a synergic of collaboration among stakeholders is needed through both mitigation and adaptation flood management efforts. In its implementation, the role of various stakeholders is vital in the process of adaptation and mitigation of disaster management. Referring to Freeman (2010) and Biset (1998), stakeholders are groups or individuals who can influence or be influenced in efforts to achieve a goal or solve a problem. Referring to this, Ningtyas et al. in 2020 divided stakeholders into seven groups based on their respective roles in handling a problem, including disaster management, presented in Figure 2 below.



Figure 2 The Role of Various Stakeholders in Disaster Management (Source: Ningtyas et al, 2020)

In this study, the emphasis on disaster adaptation and mitigation is directed at local-level management, so that roles in disaster adaptation and mitigation are grouped into several stakeholder groups consisting of: the government, development partners in the form of NGOs, and community representatives. The basis for grouping is based on the availability of data and the scope of disaster management at the local level.

Further, this study will examine how the role of various stakeholders in Penjaringan is in accordance with the indicators in the general guidelines for Disaster Resilient Villages, as outlined with the Head of BNPB Regulation No. 1 of 2012. It also assesses the role of community in contributing to the broader goal of building a resilient and sustainable city.

At the time of this writing, no similar research has been conducted in the same location as this study. However, there is a study on the same topic but in a different location titled "Stakeholder engagement in disaster recovery: Insights into roles and power dynamics from the Ahr Valley, Germany" (Olansukanmi, 2024). The difference between this study and the aforementioned research lies in the fact that this study places more emphasis on the roles of stakeholders before, during, and after disasters, thus having a broader scope than the previously conducted research. Practically, this study is expected to provide recommendations to the government, especially regarding role distribution and governance, to ensure that all stakeholders are effectively coordinated in disaster management.

2 Method

This research uses qualitative methods to gain a deep and comprehensive understanding of how a region can be resilient in the face of potential disasters. This study uses primary and secondary data. Primary data were obtained through interviews, while secondary data were obtained through desk studies of relevant sources.

The study began with collecting secondary data through desk studies by searching for information about the selected location's general description, disaster conditions, regional disaster resilience assessments, disaster-resilient city indicators, and other necessary information. Once sufficient secondary data had been collected, the study proceeded to the fieldwork stage, where primary data was collected and the earlier collected secondary data was confirmed.

Fieldwork entailed reviewing the research location in Penjaringan and conducting interviews with stakeholders, including government agencies, community members, academics, and NGOs. The research process business can be seen in the Figure 3 below.

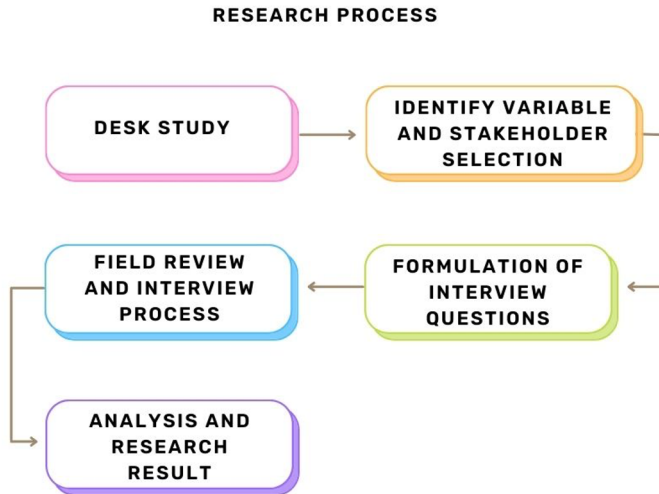


Figure 3 Qualitative Research Process (source: researcher's findings)

Several stakeholders who served as sources for this study were:

1. Penjaringan Village Secretary and staff;
2. The head of RT 20 RW 17 in Penjaringan;
3. Resident of Penjaringan, and
4. NGO "Human Initiative".

The interviews focused on disaster adaptation and mitigation, guided by the General Guidelines for Disaster Resilient Villages in accordance with the Head of BNPB Regulation No. 1 of 2012, which was then analyzed to understand the role of each stakeholder in flood disaster mitigation and adaptation in Penjaringan, North Jakarta, and to assess the community's role in achieving a sustainable and disaster-resilient city.

3 Result and Discussion

This research began with a review of the Head of BNPB Regulation No. 1/2012 on General Guidelines for Disaster Resilient Villages. The regulation outlines seven key variables to achieve disaster resilient villages/communities, namely planning, institutions, legality, capacity building, disaster management implementation, financing, and disaster risk. However, this study only used six variables due to data limitations. Based on these variables, the researcher developed a set of questions addressed to the three main stakeholders that were considered the most relevant to represent all entities involved, namely the government, the community, and development partners from non-governmental organizations. These seven variables were then broken down into specific indicators, which served as the basis for drafting interview questions. In this study, the selected stakeholders included: the local government representatives from Penjaringan Urban Village Officers and the central government from BNPB; the community,

represented by the head of RT 20 RW 17; and non-governmental organizations representatives, represented by the Human Initiative.

Based on the interview conducted it is known that in terms of pre-disaster planning, the Penjaringan Sub-District Office has mapped out flood-prone areas, namely RW 17. Pre-disaster mitigation measures have been taken in the form of a disaster alert system led by sub-district representatives on a weekly basis. In terms of institutional aspects of disaster management, the sub-district office assists in coordinating relevant agencies, such as the Water Resources Agency, Parks Agency, Social Agency, and so on. Each agency has its own technical procedures, with the sub-district office acting as coordinator for the disaster area. Volunteers during disasters are also formed on the initiative of local residents, for example Karang Taruna, without going through the formation of specific institutions. Evacuation routes and evacuation sites for residents are generally coordinated by the local neighborhood association (RT) chairperson through loud-speakers in mosques, places of worship, and schools. In addition, the Penjaringan sub-district does not have a specific budget for disasters, so disaster awareness, training, and simulations, as well as the provision of disaster preparedness equipment, are carried out by the Jakarta Regional Disaster Management Agency (BPBD). Flood control is entirely dependent on the monitoring system at the Pluit Reservoir Pump House. The Water Resources Agency in Penjaringan Subdistrict regulates the reservoir level to prevent flooding in residential areas.

In disaster management and response in Penjaringan Subdistrict, Human Initiative was involved during the major floods in Penjaringan in 2012 and 2017 and is still communicating with volunteers and the community to this day. Some of the initiatives carried out include providing logistical assistance, medical equipment, etc. In addition to providing assistance, Human Initiative also actively coordinates with the DKI Jakarta Provincial Government. According to sources, several key points in the process of providing assistance and disaster management are:

1. Active coordination and communication with key actors and sectors in the disaster area, including local government, community groups, volunteers, and other parties, so that the type of assistance provided can be tailored to the needs;
2. Coordination with fellow donors/aid providers to avoid duplication of aid;
3. Hearing and coordinating with local stakeholders regarding the history of disasters in the location to be able to analyze potential disasters that may arise in the future.
4. Appropriate allocation of resources with division of roles among actors in the disaster management and mitigation process; and
5. Openness of information between stakeholders, particularly regarding funding, to open up the possibility of co-funding so that programs can be implemented more effectively and efficiently.

Human Initiative, in disaster management and mitigation activities, has clear procedures as guidelines for classifying disaster responses, which of course refer to government regulations. One of the challenges in implementing disaster mitigation activities is the varying responses of communities in each location, which also affects the ease of access and information in the disaster management and mitigation process.

Regarding disasters in Indonesia, sources from human initiatives said that Indonesia needs to build disaster resilience for the community, especially in facing the impacts of climate change, because the potential for disasters continues to increase, marked by the increasing intensity of disasters, the growing characteristics of disasters, and the expanding distribution of areas affected by disasters. Therefore, in the future, it is hoped that:

1. The government can continue to disseminate information on disaster management, not only on emergency response but also on disaster risk prevention and building community resilience.
2. Pentahelix cooperation between all actors in disaster management can become more solid and educate the community about the potential disasters that can occur in the region.
3. The government can further involve social activists in disaster management and prevention so that mitigation and adaptation programs can be carried out throughout Indonesia.

From the community perspective, in the pre-disaster phase, local communities had received disaster mitigation training for several communities in the area, such as Karang Taruna and others. This training program was organized by BPBD and several NGOs. In addition, emergency response simulations have also been conducted in the area, although these activities are not carried out regularly. Beyond simulations, the community has also been taught how to manage aid, emergency response information systems, and evacuation mechanisms.

Furthermore, communication about the threat of disaster in the area was carried out through several media, such as WhatsApp groups, social media, and mosque loudspeakers. Disaster information was communicated by the BPBD to the sub-district office, then forwarded to the neighborhood and community associations to be communicated to the surrounding community.

When a disaster occurred, various mechanisms were implemented to minimize the impact and risk to the local community. Assistance such as clean water, food, and medicine is distributed to the community. The assistance comes from government agencies and several NGOs. In addition, to meet the needs of residents for food and drink, public kitchens are also set up. The evacuation of residents is carried out in predetermined locations such as places of worship and schools. If there is a rise in the water level of the Pluit reservoir, the pump will automatically work to drain the water to Mutiara Beach.

There are various obstacles encountered when a disaster occurs, including the fact that not all areas receive an equal distribution of aid. This is due to the difficulty of accessing certain points, as well as limited infrastructure that requires capacity building. After a disaster, recovery and reconstruction measures are needed to return the community to normal conditions. The community has taken steps to raise their houses by adding floors as a precautionary measure in case of tidal flooding or flooding due to the overflow of the Pluit reservoir so that the community can save themselves or their valuables on the second floor. Currently, the local community still depends on outside assistance, such

as from the government and NGOs. This is because most of the community works in the informal sector, so there are no emergency funds prepared by the local community as financial preparation in case of a disaster. Based on the interviews conducted, conclusions regarding the variables considered by stakeholders are presented in Table 1 below.

Table 1: Stakeholder Analysis Results

Variable	Government	Development Partners	Community
Planning	The Government (local and national) has the most prominent role. They prepare formal planning documents such as Disaster Risk Reduction (DRR) Plans, Contingency Plans, Flood-Prone Area Mapping, and comprehensive Disaster Risk Assessments. These serve as the foundation for determining the vulnerability of each area and designing intervention priorities.	Development partners contribute mainly by providing technical input and recommendations in the preparation of DRR planning documents, ensuring that global standards and best practices are considered.	Communities actively engage by giving feedback and approval to the DRR provisions. Their local knowledge ensures plans are realistic and context-specific.
Institutional Framework	Local governments, such as in Penjarigan, provide education and capacity strengthening programs to ensure institutional governance aligns with resilience targets. This includes building awareness within village administrations.	Development partners have had limited involvement in institutional strengthening activities and event facilitation (e.g., at Monash University). Their role could be enhanced through supporting governance structures.	Communities help by disseminating information and clarifying the roles and functions of each stakeholder, ensuring that governance structures are transparent and inclusive.

Variable	Government	Development Partners	Community
Legality	The Government focuses on providing legal certainty, especially land certificates for abandoned or unclear lands, which reduces vulnerability linked to insecure tenure.	Development partners are expected to support persuasive approaches with communities that face legal insecurity, helping them negotiate rights and reducing risks of displacement.	Currently, the community role in legality is minimal, as they depend on government facilitation and advocacy support.
Capacity Building	The Government plays a critical role by designing and implementing periodic training programs for citizens. These are usually hands-on training sessions aimed at disaster preparedness and response.	Development partners design and deliver training-of-trainers (ToT) programs in specific regions. These are intended to be replicated in other areas, though some initiatives are discontinued due to resource limitations.	Communities support by providing local information, participating in training, and engaging in capacity development initiatives coordinated by agencies like Bappenas.
Disaster Management Implementation	The Government leads and commands the disaster management process, from early risk identification to the execution of emergency and recovery programs. Their role ensures coordination and formal authority.	Development partners support governments during disaster emergencies, offering resources, expertise, and logistical assistance for risk reduction and response operations.	Communities act as first responders at the grassroots level. They play a key role in coordinating and synchronizing disaster risk management activities, particularly in early warning dissemination and local response.
Funding	Village governments have not allocated budgetary resources for disaster risk reduction. The Jakarta Regional Disaster Management Agency	Development partners, particularly NGOs, play a crucial role in helping governments secure additional financial support, often	Currently, communities have little to no role in direct funding allocation, though in practice they often contribute indirectly through collective action and in-kind support.

Variable	Government	Development Partners	Community
	(BPBD) carries out all the budget for disaster risk adaptation and mitigation.	from international donors, to cover gaps in local funding.	

4 Conclusion

The roles of different stakeholders in flood adaptation and mitigation in Penjaringan can be summarized as complementary. However, the role of the government in coordinating adaptation and mitigation is still considered as insufficient, particularly at the urban village level. The government tends to be reactive, responding to disasters after they have occurred, rather than proactively implementing preventive measures. The community has an important role in disaster adaptation and mitigation, including providing facilities, contributing to funding and cooperation, coordinating with various parties, and providing disaster warning systems for the entire community. Meanwhile, NGOs are considered to have played a sufficient role in terms of disaster adaptation and mitigation in Penjaringan, although it is hoped that capacity building activities can be further improved in the future.

Based on the findings, it can be concluded that stakeholder collaboration in disasters management play significant role in achieving a resilient and sustainable city particularly through the case flood-prone areas in Penjaringan. Through effective collaboration among stakeholders, the planning, funding, and implementation of disaster management efforts can be carried out appropriately and efficiently.

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References

[1.] Abighail, S., Kridasantausa, I., Farid, M., & Moe, I. (2022). Pemodelan banjir akibat perubahan tata guna lahan di daerah aliran Sungai Ciliwung. *Jurnal Teknik Sipil*, 29(1), 61–68.

[2.] Badan Nasional Penanggulangan Bencana. (2012). Peraturan Kepala BNPB Nomor 1 Tahun 2012 tentang Pedoman Umum Desa/Kelurahan Tangguh Bencana. Jakarta: BNPB.

[3.] Biset, 1998 Biset, (1998). Definisi stakeholder. Diperoleh 17 November 2024 <https://kumparan.com/berita-terkini/pengertian-stakeholder-secara-tradisional-dan-perkembangannya-22ic0YDM3L2/4>

- [4.] Departemen Pekerjaan Umum. (2007). Rencana Aksi, Mitigasi dan Adaptasi Terhadap Perubahan Iklim Bidang Pekerjaan Umum.
- [5.] Freeman, 1984 Freeman, R. E., Harrison, J. S., Wicks, A. C., Parmar, B. L., & De Colle, S. (2010). Stakeholder theory: The state of the art. Cambridge University Press.
- [6.] Ningtyas, T., Larasati, E., Warsono, H., & Purnaweni, H. (2020). Multi-stakeholder participation challenges in local disaster management policies: A case from Bojonegoro District, Indonesia. Proceedings of the 6th International Conference on Social and Political Sciences (ICOSAPS 2020). <https://doi.org/10.2991/assehr.k.201219.063>
- [7.] Meiviana A, Sulistiowati DR, & Soejachmoen MH. (2004). Ancaman Perubahan Iklim di Indonesia.
- [8.] Thamrin, M. (2021). Petaka dari dasar bumi dan luap laut Jakarta. Apakah kita siap? <https://Nationalgeographic.Grid.Id/Read/132639146/Petaka-Dari-Dasar-Bumi-Dan-Luap-Laut-Jakarta-Apakahkita-Siap?Page=all>.

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