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Community Participation in Flood Management Systems in Aceh Utara Regency

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Abstract

Flooding remains a persistent challenge in Aceh Utara Regency, representing a complex, cross-sectoral issue. If not addressed through collaboration among various stakeholders, including community groups, it has the potential to lead to new societal problems. This research seeks to assess the effectiveness and impact of using a participatory model in flood management efforts in the region. A qualitative approach was employed, gathering data through in-depth interviews with stakeholders such as local communities, government authorities, and non-governmental organizations involved in flood mitigation programs. The findings emphasize the urgency of adopting a participatory model to enhance the effectiveness of flood management systems. Actively engaging the community in planning, execution, and evaluation processes leads to a deeper understanding of local conditions, needs, and suitable solutions. Key aspects of the participatory model include raising public awareness of flood risks and mitigation measures, improving flood management infrastructure based on community input, creating more accessible and effective evacuation plans, and strengthening the community's capacity for emergency response and simple mitigation efforts. In conclusion, this study aims to further explore the relevance and effectiveness of the participatory model in flood management in Aceh Utara Regency, ensuring the long-term sustainability of the region's disaster management system.

Keywords: *Community Participation, Flood Management, Disaster Preparedness, Risk Management*.

Introduction

Aceh Utara Regency, as part of a region in Indonesia prone to natural disasters, frequently faces serious flood threats. Flooding is one of the most damaging disasters, with the potential to endanger lives, destroy infrastructure, and disrupt the daily lives of the community. In the context of Aceh Utara Regency, floods have become a recurring problem that continues to impact the lives of residents and the region's development.

Located in the western part of Sumatra Island, Indonesia, Aceh Utara has geographical characteristics that heighten its flood risk. The area is crisscrossed by numerous rivers and waterways that serve as the main channels for floodwaters during heavy rains. Its flat topography worsens the situation, as rainwater tends to easily flood low-lying areas. Additionally, intense rainy seasons and irregular rainfall patterns further increase the region's vulnerability to flooding.

Aceh Utara Regency features several major rivers, such as the Krueng Aceh River and Lhok Me River, as well as smaller drainage channels that serve as the primary drainage system for towns and villages. This network makes the area particularly vulnerable to flooding during periods of heavy rain (Dinas Pekerjaan Umum dan Penataan Ruang Aceh Utara, 2023).

The generally flat topography of Aceh Utara, especially along the coastal areas, means that low-lying regions are easily inundated during floods. These areas are frequently disaster-prone and require special attention in flood management efforts (Badan Pusat Statistik Kabupaten Aceh Utara, 2022).

According to the Meteorology, Climatology, and Geophysics Agency (BMKG), Aceh Utara experiences intense rainy seasons, particularly from October to February. High rainfall during this period can lead to flash floods and waterlogging in various areas (BMKG Aceh Utara, 2021). Flooding in Aceh Utara Regency

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extends beyond physical damage to infrastructure, impacting both social and economic aspects of the community. Homes are submerged, roads become impassable, agriculture is threatened, and access to essential services like clean water and sanitation is limited. The social repercussions are severe, including loss of livelihoods, high levels of stress and trauma, and disruptions to daily life.

The Aceh Utara Regency Government has made significant efforts to address flooding issues. Measures such as constructing drainage infrastructure, building levees, and implementing early warning systems have been introduced to mitigate flood risks. However, the challenges remain formidable. The increasing complexity and intensity of floods require a more comprehensive and integrated approach.

In 2020, the Aceh Utara Regency Government launched a drainage infrastructure development program, focusing on improving the drainage systems in urban areas as a preventive measure against waterlogging during the rainy season (Dinas Pekerjaan Umum dan Penataan Ruang Aceh Utara, 2021). Additionally, building levees and polder systems has become a priority in flood management efforts. Levees are constructed along flood-prone rivers, while polders are used to manage excess water during the rainy season (Badan Penanggulangan Bencana Daerah Kabupaten Aceh Utara, 2022).

The early warning system has also been enhanced with the installation of sensors and weather monitoring equipment at various strategic points. Data from this system is used to provide advance warnings to the community when there is a high potential for flooding (BMKG Aceh Utara, 2023).

Addressing flood issues effectively requires direct involvement of the community in every stage of planning, implementation, and evaluation of flood management programs. The participatory model in disaster management provides an appropriate approach to enhance community engagement and responsibility regarding flood issues. By strengthening community involvement, the solutions developed are expected to be more sustainable and tailored to local needs.

The application of the participatory model in flood management has proven successful in various contexts. Direct involvement of the community in identifying risks, formulating solutions, and implementing preventive actions can improve the effectiveness of flood management programs. Additionally, community engagement can bolster social support and understanding of the importance of environmental stewardship to reduce flood risks.

A study by the Ministry of Public Works and Housing (PUPR) revealed that applying participatory models in flood management throughout Indonesia has notably enhanced community awareness of flood risks. Training programs and participatory dialogues have helped communities better understand risk mitigation and develop locally tailored solutions (Kementerian PUPR, 2020). Additionally, research from the Regional Disaster Management Agency (BPBD) in West Java indicates that flood management projects with community involvement are more successful. Community engagement in managing drainage systems and floodwater control in urban areas has substantially mitigated flood impacts (BPBD Jawa Barat, 2021). Moreover, a report from the Environmental Study Center at the University of Indonesia underscores the significance of community involvement in flood management. It notes that active participation in activities such as reforestation, waste management, and river maintenance can effectively lower flood levels and support a healthy ecosystem (Pusat Studi Lingkungan Hidup UI, 2019).

In Aceh Utara Regency, there is still a pressing need for research on the use of participatory models in flood management. A deeper understanding of local conditions, community needs, and existing challenges is essential for developing more effective and targeted strategies. This research aims to offer practical recommendations for local governments to create policies that are more adaptable and responsive to flood risks.

In addition to its practical benefits, this research is also expected to contribute theoretically to understanding how participatory models can be effectively applied in the context of flood management. Thus, efforts to mitigate flood risks and impacts in Aceh Utara Regency can become more targeted and sustainable, benefiting both the community's well-being and the overall development of the region.

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The importance of researching the application of participatory models in flood management in Aceh Utara Regency is also reflected in the urgent need to better understand community involvement in disaster mitigation. As key actors in disaster response, communities possess valuable local knowledge. They have a deep understanding of river flow patterns, flood-prone areas, and traditional strategies used to reduce disaster risks.

In this context, applying a participatory model can bridge the gap between local knowledge and the scientific and technological expertise of the government and related agencies. By complementing and collaborating with each other, the solutions developed will be more holistic, sustainable, and aligned with the actual needs of the community.

Furthermore, addressing justice aspects in flood management is crucial. Disasters often disproportionately impact vulnerable groups, such as the poor, women, and minorities. A participatory model can be an effective tool to ensure that the voices of these groups are heard and their needs are prioritized in the planning and implementation of disaster management programs

In Aceh Utara Regency, local communities have shown initiative in tackling flood issues, such as building simple levees and local irrigation systems. However, these initiatives remain limited and need additional government support in terms of resources, technical expertise, and access to information. A participatory model can empower communities to create more effective and sustainable solutions.

Beyond improving flood management, the participatory model also has the potential to enhance local capacity for handling other types of disasters. Aceh Utara is at risk of landslides, tsunamis, and earthquakes as well. By promoting active community involvement in flood management, a robust foundation can be established for managing various natural disasters.

Given the growing complexity of global challenges and unpredictable climate changes, it is essential for Aceh Utara to develop an adaptive and responsive disaster management system. The participatory model is crucial not only for boosting the effectiveness of flood management programs but also for strategically building community resilience against diverse disaster threats. For researchers, studying the application of participatory models in flood management in Aceh Utara represents a commitment to contributing significantly to regional development. Engaging various stakeholders, including government bodies, local communities, and other relevant parties, the research aims to provide a solid basis for sustainable change In conclusion, this research is highly relevant to the flood-prone conditions of Aceh Utara Regency. By examining the application of participatory models in flood management, the study aims to develop more sustainable solutions that are responsive to community needs and capable of enhancing community resilience against flood threats. Additionally, the findings are expected to inspire and serve as a model for other regions facing similar challenges.

Theoretical Framework

The Theory of Community Participation refers to the active involvement of the public in decision-making, planning, and the execution of programs or activities that impact their lives. Community participation takes various forms, ranging from participation in discussions, consultations, and the selection of representatives, to direct action in program implementation. Shirk et al (Shirk et al., 2012) describes participation as the active involvement of individuals or groups in the development process, whether through contributions of ideas, effort, time, expertise, capital, or materials, and by benefiting from the outcomes of development. (Dodman & Mitlin, 2013) highlights participation as the engagement of the community in identifying problems and potentials within society, making decisions on alternative solutions, carrying out actions to resolve issues, and evaluating the changes that occur. Emphasize that community participation is a fundamental right, allowing individuals to partake in decision-making across various stages of development, from planning and execution to supervision and environmental preservation. The community here plays a role not only as beneficiaries but as key contributors to sustainable development (Cornwall, 2008).

According to (Arnstein, 2019), community participation can be viewed as a ladder consisting of eight levels,

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ranging from the lowest level, which offers no power to the community, to the highest level, which grants full authority to the people. One of (Arnstein, 2019) famous quotes about participation is, "There is a critical difference between going through the empty ritual of participation and having the real power needed to affect the outcome of the process." In other words, genuine community participation is not merely a formality but grants real power to the community to influence the outcomes of the process

According to the Department for International Development (DFID) in the Guide to Implementing Participatory Approaches (Green, 2013), the principles of community participation are as follows:

a) Coverage: Ensuring that all individuals or representatives from every group affected by the outcomes of a decision or development project are included.

b) Equal Partnership: Essentially, everyone possesses skills, abilities, and initiatives and has the right to apply these initiatives in any process to foster dialogue, regardless of the hierarchical levels or structures of the parties involved.

c) Transparency: All parties should cultivate communication and an open, conducive climate for dialogue, promoting an environment where discussion and interaction can thrive.

d) Sharing Power/Equal Powership: The involved parties must be able to balance the distribution of authority and power to avoid dominance.

e) Sharing Responsibility: Various parties have clear responsibilities in each process due to equitable distribution of authority and their involvement in decision-making and subsequent steps.

f) Empowerment: The involvement of various parties includes recognizing both their strengths and weaknesses. Through active participation in each process, a mutual learning and empowerment process occurs, where parties support and enhance each other's capabilities.

g) Collaboration: Collaboration among various involved parties is essential to share strengths and address weaknesses, particularly those related to human resource capabilities.

According to (Ekman & Amnå, 2012), participation is divided into four types, namely

a) Participation in Decision-Making: This type of participation primarily involves determining alternatives with the community regarding ideas or concepts that pertain to common interests. Forms of participation in decision-making include contributing ideas or thoughts, attending meetings, engaging in discussions, and providing feedback or objections to proposed programs.

b) Participation in Implementation: This type of participation involves mobilizing resources, managing administrative activities, coordinating, and detailing the program. Participation in implementation is a continuation of the plans developed earlier, relating to both the planning and execution stages as well as achieving objectives.

c) Participation in Benefit-Taking: This type of participation is related to deriving benefits from the results achieved through implementation, whether concerning quality or quantity. In terms of quality, it can be assessed by the outputs, while in terms of quantity, it can be measured by the percentage of program success.

d) Participation in Evaluation: This type of participation is related to assessing the implementation of programs that were planned earlier. Participation in evaluation aims to determine the extent to which the program's objectives have been achieved.

According to (Mazzurco et al., 2018), community participation in development consists of three forms:

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a) Participation in Idea Planning Stage: This form of participation involves individuals being engaged in the development of plans and strategies, including organizing committees and budgeting for activities or projects. Community members actively participate by attending meetings and offering suggestions, feedback, and critiques during these discussions.

b) Participation in the Implementation Stage: This form of participation involves individuals being actively engaged in the execution of a project. Community members can contribute their labor, money, materials, or ideas as part of their involvement in carrying out the project activities.

c) Participation in the Utilization Stage: This form of participation involves individuals being engaged in the use of a project after its completion. Community members contribute their labor and funds to operate and maintain the project that has been completed.

(Robinson et al., 2016) identifies seven types of participation based on their characteristics, including

a) Passive/Manipulative Participation: Community members participate by being informed about what is happening or has happened; it involves one-way announcements by management or project implementers without considering community feedback. Information exchanged is typically limited to professionals outside the target group.

b) Informative Participation: Community members participate by answering research questions, such as those in surveys or questionnaires. They do not have the opportunity to be involved in or influence the decision-making process, and the accuracy of the research results is not discussed with them.

c) Consultative Participation: Community members participate by providing input during consultations; outsiders listen and form their own views to define problems and solutions, often modifying community responses. There is no opportunity for joint decision-making, and professionals are not obligated to consider community views as input for further action

d) Material Incentive Participation: Community members participate by providing resources, such as labor, in exchange for material rewards like food, wages, or compensation. They are not involved in the experimentation or learning processes and do not have a role in continuing activities once the incentives are exhausted.

e) Functional Participation: Community members participate by forming groups to achieve project-related goals. These groups are usually established after key decisions have been made. Initially, they depend on external facilitators but eventually become self-sufficient.

f) Interactive Participation: Community members engage in joint analysis that leads to activity planning and the creation or strengthening of social institutions. This type of participation often involves interdisciplinary methods that seek diverse perspectives in a structured and systematic learning process. Community groups have control over their decisions and are involved in the entire implementation of activities.

g) Self-Mobilization: Community members participate by taking independent initiative to change their existing systems or values, without external influence or pressure. They develop connections with other institutions to obtain necessary technical assistance and resources, and they retain control over the use of these resources.

According to Sumaryadi (2010), several factors influence community participation, including the following:

a) The willingness of a community to embrace empowerment depends on the situation they face.

b) The belief that empowerment is not for everyone and the perception among those in power within the community that empowerment could jeopardize their own positions.

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c) Dependency is a cultural norm, where the community is accustomed to hierarchy, bureaucracy, and strict management control, leading to habitual patterns of thinking and behavior.

d) The reluctance of community leaders to relinquish their power, as the core of empowerment involves transferring some authority to the community itself.

e) The limits of empowerment, especially regarding the empowerment cycle which requires a relatively long time, while individual abilities and motivations vary.

f) The trust of community leaders in developing community empowerment.

g) Empowerment is not conducive to rapid change.

h) Empowerment requires significant resource support, both in terms of financing and time.

According to Sherry Arnstein in her renowned work "A Ladder of Citizen Participation" (Arnstein, 1969), there are eight levels of community participation:

a)Manipulation: Community members are used as a tool by authorities to legitimize decisions that have already been made.

b) Therapy: Community participation is seen as a form of "therapy" intended to soothe tensions and reduce potential conflicts.

c)Informing: Authorities provide information to the community without offering opportunities for feedback or influence over decisions.

d) Consultation: Authorities consult with the community, but the final decisions remain entirely in their hands.

e) Placation: Authorities offer the community a chance to provide input, but the decisions often favor the interests of the authorities.

f) Partnership: The community plays a more active role in the decision-making process and collaborates with authorities.

g) Delegated Power: The community has the authority to make certain decisions without interference from authorities.

h) **Citizen Control**: The community holds full power in decision-making, implementation, and evaluation of programs or activities affecting their lives.

Participatory Decision-Making Theory

The Participatory Decision-Making Theory emphasizes the importance of actively involving all relevant stakeholders in the decision-making process. In the context of research on implementing participatory models in flood management systems in Aceh Utara Regency, this theory provides a crucial foundation for understanding how to engage communities in decisions related to flood mitigation and response. By incorporating community input, the approach aims to enhance the effectiveness and relevance of flood management strategies.

Principles of Participatory Decision-Making Theory:

a) Involvement of All Parties: This theory emphasizes that decision-making involving all relevant

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parties—such as local government, non-governmental organizations (NGOs), local communities, and the private sector—can lead to better decisions (Hasan et al., 2018)(Wilcock, 2013).

b) Transparency and Access to Information: Participatory decision-making processes highlight the importance of transparency and equal access to relevant information for all involved parties. This means that all information related to flood management, including data, risk analysis, and mitigation plans, should be openly available and accessible to the general public (Michener et al., 2018).

c) Consensus and Joint Approval: The main goal of participatory decision-making is to achieve consensus or joint approval among the various involved parties. This means that the decisions made should reflect a collective agreement among all stakeholders engaged in the process (Scolobig et al., 2016)

d) Community Empowerment: Participatory Decision-Making Theory also emphasizes the concept of community empowerment. In the context of flood management, this means providing opportunities for communities to be actively involved in decision-making processes, allowing them to directly articulate their needs, interests, and aspirations (Scolobig et al., 2016).

Community Resilience Theory

The Community Resilience Theory is an approach that emphasizes a community's ability to withstand, adapt to, and quickly recover from disruptions or external pressures (Carlson et al., 2012). This theory suggests that communities possess internal potential to endure and recover from challenges such as natural disasters or external changes. Community resilience involves not only individual strengths but also collaborative networks and capacities (Mayer, 2019).

Principles of Community Resilience Theory:

a) Strong Social Networks: Strong social networks, both within and outside the community, facilitate the exchange of information, resources, and emotional support needed during crises (Rachunok et al., 2021).

b) Active Engagement: Active participation of community members in decision-making, planning, and program implementation not only strengthens the sense of ownership but also enhances adaptability and innovation (Castro-Arce & Vanclay, 2020).

c) Utilization of Local Resources: Utilizing local resources, such as traditional knowledge, local wisdom, and community skills, helps create solutions tailored to the local context and boosts resilience capacity (Mulyono et al., 2020).

d) Commitment to Diversity: Valuing and promoting diversity in culture, beliefs, and traditions within the community can strengthen solidarity and mutual support among community members (Frémeaux, 2020).

e) Learning and Adapting Ability: The community's ability to learn from past experiences, evaluate strategies used, and rapidly adapt to environmental changes is a key factor in enhancing community resilience (Tschakert & Dietrich, 2010).

Community Capacity Building Theory

Community Capacity Building aims to strengthen and enhance the potential within a community so that they can become effective agents of change in addressing local issues. The focus is not just on providing aid but also on developing skills, boosting confidence, and improving the ability to adapt to changes (Franco

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& Tracey, 2019). Principles of Community Capacity Development Theory:

a) Strengths-Based Approach: This theory emphasizes an approach that focuses on the strengths, resources, and potential within a community. By identifying and leveraging these strengths, the community can address challenges and improve their conditions (Jones et al., 2018).

b) Participation and Active Engagement: Involvement of community members in decision-making and program implementation is crucial. This not only creates a sense of ownership of the program but also ensures that the program aligns with the needs and aspirations of the community (Jackson et al., 2018).

c) Skill and Knowledge Development: Through training, workshops, and access to information, communities can enhance their skills and knowledge in various areas, such as resource management, entrepreneurship, or social skills (Hilton & Pellegrino, 2012).

d) Network and Partnership Formation: Collaboration between various stakeholders and organizations, both within and outside the community, is a key aspect of community capacity development. These networks and partnerships can provide support, resources, and a broader understanding of the issues at hand (Liberato et al., 2011).

e) Evaluation and Continuous Learning: An ongoing evaluation process enables the community to understand the impact of the implemented programs, assess their success, and learn from the experience to improve strategies in the future (Wiltsey Stirman et al., 2012).

Community Empowerment Theory

Community Empowerment is an approach that emphasizes the importance of empowering various parties to take an active role in the decision-making process that affects their lives (Witt et al., 2000). The principles of Community Empowerment Theory:

a) Active Participation: The community is actively involved in the planning, implementation, and evaluation of policies and programs that impact their lives (Boothroyd et al., 2017).

b) Access to Resources: The community has fair and equal access to resources, including information, education, healthcare, and economic opportunities (Shields et al., 2017).

c) Skill Enhancement: Providing training and education to the community to improve their skills in managing resources and solving problems (Lansing et al., 2023).

d) Capacity Building: Encouraging the development of individual and group capacities to take responsibility for decisions that affect their lives (Chu et al., 2020).

e) Equity and Equality: Ensuring that all members of the community have equal opportunities to participate in and benefit from the policies and programs implemented (Chung et al., 2022).

The theory of Community Empowerment highlights that communities are not merely passive recipients of development but are active participants in social transformation. An empowered community possesses the knowledge and skills to identify issues, plan solutions, and manage resources in a sustainable manner (Flint, 2013).

a) Active Participation: At its core, this theory emphasizes that communities should be actively involved in every stage of decision-making that impacts their lives. This includes participation in development planning, budgeting decisions, program implementation, and the evaluation of outcomes (Dooris & Heritage, 2013).

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b) Access to Resources: Empowered communities have the right to fair and equal access to various resources, such as education, healthcare services, infrastructure, and economic opportunities (Sen & Mukherjee, 2017).

c) Skill Development: This theory emphasizes the importance of providing training and education to communities to enhance their skills in managing resources, understanding their rights, and solving problems independently (Hart, 2013).

d) Community empowerment also involves developing the capacity of individuals and groups to take responsibility for decisions that affect their lives. This can be achieved through the formation of working groups, leadership training, and mentoring in the decision-making process (Ahmad & Abu Talib, 2015).

e) Equity and Equality: Another crucial aspect is ensuring justice and equality in access and participation. Community empowerment must guarantee that all members of the community have equal opportunities to participate in and benefit from the policies and programs implemented (Ju et al., 2024).

Research Methodology

This study was carried out in Aceh Utara Regency, chosen for its recurrent and severe flooding events that occur almost every year, leading to significant losses both tangible and intangible for the community and government. A qualitative research approach was employed, utilizing qualitative data collection methods to gain a deep and comprehensive understanding of the flooding issues (Moleong, 2019).

Purposive sampling was used to select informants for this study. This non-probability sampling technique involves choosing subjects based on specific characteristics relevant to the research objectives. This approach enables researchers to identify knowledgeable and reliable informants who can provide valuable insights, thereby enhancing the validity of the data. It also allows for comparison of incidents reported by different participants. The study utilized an interactive analysis model, which consists of four stages: data collection, data reduction, data verification, and drawing conclusions (Moleong, 2019)(Lexy J. Moleong, 2019)(Sugiono, 2014).

Findings

Aceh Utara Regency, one of the administrative regions in Aceh Province, is an area frequently affected by flooding. Located in the northern part of Sumatra Island and directly adjacent to the Strait of Malacca, it is susceptible to various natural phenomena, including floods. Flooding in Aceh Utara is not a new occurrence but a chronic problem that recurs annually, causing significant economic and social damage. The region features diverse topography, with extensive lowlands along the coast and hills in the central and southern areas. It is also traversed by several major rivers, such as the Krueng Keureuto, Krueng Pase, and Krueng Peuto Rivers, which serve as primary water sources for agriculture and daily needs of the local population. However, these rivers are also major contributors to flooding, especially during the rainy season (Rahman et al., 2024).

High rainfall during the rainy season, particularly from October to December, often leads to a significant increase in river water volume. The geographical conditions with many lowlands exacerbate the situation, as heavy and abundant rainfall frequently cannot be absorbed by the soil, particularly in coastal areas with clay soil that is difficult to permeate

Additionally, global climate change, which results in extreme weather conditions such as heavy rainfall over short periods, exacerbates the risk of flooding in Aceh Utara. The periodic La Niña phenomenon often brings higher-than-average rainfall, further increasing the likelihood of flash floods that can devastate settlements and infrastructure.

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Flooding in Aceh Utara Regency has shown a fairly consistent pattern and frequency over the years. In the past two decades, major floods with widespread impacts on the community have occurred almost annually. These floods are typically caused by extremely heavy rainfall over several consecutive days, leading to the overflow of major rivers and the inundation of agricultural land and residential areas.

The high frequency of flooding is also influenced by environmental degradation, such as deforestation in upstream areas and land conversion for plantations or housing. Deforestation in hilly regions results in the loss of natural water retention functions, causing rainwater to flow rapidly and in large volumes into rivers, leading to river overflows. For instance, between 2020 and 2023, severe flooding impacted several districts in Aceh Utara, including Matangkuli, Lhoksukon, and Pirak Timu. The flooding was caused by heavy rainfall over several days, resulting in thousands of homes being submerged under 1 to 2 meters of water. Additionally, hundreds of hectares of agricultural land were inundated, leading to crop failures and significant economic losses for local farmers.

The impact of flooding in Aceh Utara Regency is extensive, affecting various aspects of community life. Economically, floods often devastate agricultural land, which is a primary source of livelihood for the people. Rice, a staple crop, frequently fails due to prolonged water submersion. Additionally, floods damage infrastructure such as roads, bridges, and irrigation systems, disrupting the distribution of goods and services and slowing down economic recovery after the disaster.

For instance, in 2017, a major flood caused estimated economic losses amounting to billions of rupiah, with thousands of hectares of rice fields submerged and crops failing. Many farmers lost their entire harvests, which in turn increased poverty levels in the region. Additionally, the destruction of roads and bridges led to the isolation of several villages, hampering aid access and extending the recovery period. The social impacts of flooding are equally severe. Flooding forces thousands of people to evacuate their homes and seek safer locations. In many cases, evacuees have to stay in temporary shelters under poor conditions, with limited access to clean water, food, and healthcare facilities. This situation increases the risk of spreading infectious diseases such as diarrhea, dengue fever, and acute respiratory infections.

In addition to the immediate effects, flooding also has long-term impacts on the quality of life for communities. Children often miss school because their schools are either flooded or used as temporary shelters. Public health is also affected by the poor environmental conditions following a flood, leading to an increase in diseases related to contaminated water.

Figure 1. Conditions during Flooding in Aceh Utara

The response to flooding in Aceh Utara involves various parties, including the local government, the Regional Disaster Management Agency (BPBD), NGOs, and the community. Each time a flood occurs, the BPBD typically activates emergency response centers and coordinates the evacuation of affected residents. Logistic assistance such as food, clean water, and medicine is also promptly distributed to evacuation sites.

However, despite the relatively swift emergency response, many parties argue that long-term mitigation efforts remain inadequate. Flood control infrastructure, such as levees and drainage systems, is still

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insufficient to handle large volumes of water. Additionally, reforestation programs and forest protection in upstream areas have not been effectively implemented, allowing the threat of flooding to persist. In recent years, efforts have been made to enhance community capacity to cope with floods through training programs and awareness campaigns. Local governments, in collaboration with NGOs, have organized training to build residents' skills in disaster mitigation, including how to create emergency levees, conduct flood risk mapping, and perform self-evacuations.

However, these training and awareness programs often face challenges such as budget constraints and limited human resources. Additionally, the low participation in some of these programs highlights the need for a more inclusive and participatory approach to flood management. Engaging the community more actively in the planning and implementation of flood mitigation programs is crucial for developing more effective and sustainable solutions. To mitigate flood risks and impacts in Aceh Utara Regency, various efforts have been undertaken by the government and related parties. A notable initiative is the construction of flood control infrastructure such as levees, reservoirs, and improvements to drainage systems. Yet, these projects frequently encounter obstacles such as funding issues, slow implementation, and inadequate coordination among involved agencies.

Figure 2. Map of Aceh Utara dan flooding risk index

One major project currently underway is the construction of the Krueng Keureuto reservoir in Matangkuli District. This reservoir is expected to control water flow from the upstream areas and reduce the risk of flooding downstream. However, the project has faced multiple delays and is not yet fully operational, so its impact on flood control has not yet been realized. Alongside infrastructure development, reforestation in upstream regions has been implemented as part of flood mitigation efforts. Planting trees in areas that were previously deforested aims to enhance water absorption and decrease surface runoff into rivers. However, the results of these initiatives will take time to materialize, as ecosystem transformations are gradual and require a long-term approach.

Flood control efforts also include strengthening institutional capacity and improving coordination between relevant agencies. The local government, in collaboration with the Regional Disaster Management Agency (BPBD) and other institutions, is working to improve the early warning system and enhance community preparedness through simulations and evacuation drills. However, stronger support is needed in the form of regulations and policies that promote more effective and sustainable flood mitigation.

Flooding in Aceh Utara Regency is a complex issue influenced by both natural and human factors. Despite

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various efforts to control and mitigate its impact, flooding remains a serious threat to the lives and well-being of the local community. The challenges faced in flood control in Aceh Utara Regency are diverse, ranging from vulnerable geographical conditions to limited resources and institutional capacity.

Discussion

Characteristics of Community Participation in the Flood Management System

Community participation is a vital element in flood management in Aceh Utara Regency. It encompasses various forms of community involvement in the mitigation process, from planning to the implementation of actions on the ground. This discussion delves into the characteristics of community participation, focusing on the factors that influence participation, the challenges encountered, and the impact of participation on the effectiveness of flood management in the region.

The factors influencing community participation are diverse and can be viewed from various perspectives. One key factor is the community's awareness and understanding of flood risks. In villages that frequently experience flooding, such as Lhoksukon and Matangkuli Districts, there is a higher level of awareness about flood risks, leading to more significant participation. Direct experience with recurring floods has made the communities in these areas more sensitive and ready to engage in flood management activities. They recognize that floods can occur at any time, particularly during the rainy season, which motivates many to voluntarily participate in community efforts like clearing drainage channels or repairing basic infrastructure.

Local leadership also plays a crucial role in encouraging community participation. Proactive leaders, such as village heads or community figures, can drive community engagement. For example, in Blang Teurakan Village, Sawang District, the village head, supported by active community members, has successfully organized flood mitigation activities and increased both awareness and participation among residents. Their inclusive and participatory approach has made the community feel more involved and responsible for their environment. By holding regular meetings and involving residents in every stage of planning, the village head has fostered a sense of unity and collective responsibility.

The availability of resources whether financial, material, or time greatly influences the level of community participation. In villages with access to village funds or government support, community participation tends to be higher. For instance, the village funds used to improve levees and drainage systems in Gampong Serba Jaman Baro, Tanah Luas District, have enabled residents to actively participate in these activities. However, in financially constrained villages, limited resources often hinder participation. Communities without access to adequate technology or information may only implement basic mitigation measures, which may not be sufficient to prevent significant flooding.

Government and NGO support is vital for fostering community participation. When these organizations provide technical assistance, training, and outreach, they help improve community knowledge and skills, which boosts residents' confidence and willingness to get involved. However, when government support is ineffective or inconsistent, it can reduce community motivation. For instance, in Matang Munye Village, Matangkuli District, residents have expressed frustration over the inadequate government support following the flood. The delays or uneven distribution of aid left them feeling neglected and hesitant to participate further. This has resulted in decreased enthusiasm for active involvement, including in community activities like mutual aid, due to diverse and busy schedules.

Social and cultural norms also impact community participation. In Aceh Utara, the strong tradition of cooperation encourages residents to work together in disaster situations. Participation in collective activities, such as community clean-up efforts, is common and expected within the community. However, in some areas, these norms can also act as a barrier if people believe that flood management responsibilities should primarily lie with the government rather than with themselves.

While there are many factors that encourage participation, there are also several challenges that hinder community involvement in flood management. One major challenge is the uncertainty of weather and the

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frequency of floods. Climate change, leading to more frequent and unpredictable extreme weather events, makes residents hesitant to invest time and effort in mitigation efforts. They may feel that their efforts are futile given the increasing frequency and severity of floods. This situation creates a sense of helplessness among communities, especially in the most flood-prone areas.

Resource limitations, particularly in poorer areas, also present a significant challenge to increasing participation. Without adequate financial and material support, communities struggle to engage in larger flood management efforts, such as infrastructure development or acquiring mitigation tools. Additionally, a lack of access to technology and information further hinders participation. Communities without sufficient knowledge about effective mitigation techniques can only implement basic measures, which may not be sufficient to prevent major floods.

The lack of coordination among various parties involved in flood management often leads to ineffective program implementation. Overlapping or poorly coordinated programs can cause confusion among community members and reduce their participation. In some villages, residents have expressed frustration that government and NGO programs frequently lack alignment, leaving them unsure of which to follow. This highlights the need for effective coordination among organizations to ensure that flood management efforts are carried out efficiently and engage all relevant stakeholders.

Trust in the government and organizations responsible for flood management is a significant challenge. If people perceive that aid and mitigation programs lack transparency or integrity, they often become disillusioned and hesitant to engage. Past instances of corruption or misappropriation of aid funds have diminished public confidence in some government initiatives. This skepticism results in a belief that their involvement may be ineffective due to the perceived lack of honesty in implementing these programs.

High population mobility, especially in areas close to urban centers, presents a challenge in fostering sustainable participation. Many residents move to cities for employment or educational opportunities, resulting in a decreasing number of people available to engage in flood management activities in rural areas. Additionally, rapid urbanization without adequate planning increases flood risks in urban areas, which in turn strains resources and diminishes participation in rural regions. Despite the significant challenges, community participation remains crucial for the effectiveness and sustainability of flood management efforts in Aceh Utara Regency. Active involvement in flood mitigation activities, such as developing evacuation plans, constructing levees, and participating in community clean-ups, has proven to enhance community preparedness for floods. Greater community engagement ensures that information about early warnings and mitigation measures is disseminated more rapidly and evenly, making the community better equipped to handle disasters.

Another positive impact of community participation is the reduction of flood risk. Activities such as clearing drainage channels, constructing levees, and planting trees in river catchment areas enable residents to directly contribute to lowering flood risks in their regions. This involvement also helps maintain existing infrastructure, reducing the likelihood of damage from floods. Additionally, community participation raises awareness about the importance of environmental protection and the conservation of natural resources as part of flood mitigation strategies.

Community participation also enhances the resilience of communities in the face of disasters. This resilience is evident not just in physical terms but also socially and psychologically. Engaging in joint activities helps communities develop a strong sense of unity and solidarity, which is vital during emergencies. Collaborating to address challenges improves residents' physical readiness for floods and reinforces social networks that offer support in tough times.

Ultimately, it can be said that community participation in flood management in Aceh Utara Regency is influenced by various factors, faces several challenges, but has a significant impact on the effectiveness and sustainability of disaster mitigation efforts. By strengthening the factors that encourage participation, addressing existing challenges, and leveraging the positive impacts achieved, community involvement can become a major force in more effective and sustainable flood management efforts in Aceh Utara.

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The participatory model engages the community throughout different phases of flood management, including planning and execution, with the goal of improving both the effectiveness and sustainability of the programs. This discussion, informed by research findings, will explore the advantages of applying the participatory model, the obstacles faced, and the strategies that can be used to overcome these challenges.

The implementation of the participatory model in flood management in Aceh Utara Regency offers several significant benefits. Firstly, it enhances the sense of ownership and responsibility among the community. When people are directly involved in flood management processes, they feel a greater sense of accountability for the outcomes. This increased sense of responsibility is evident in the heightened awareness and preparedness of the community for floods. For instance, in Matangkuli District, residents who were involved in the planning and execution of mitigation efforts have demonstrated proactive behaviors, such as forming work groups focused on cleaning drainage channels and monitoring levees. This sense of ownership leads to greater concern for their environment and a stronger motivation to maintain the infrastructure that has been established.

Another benefit is the enhancement of flood management effectiveness. In a participatory model, the community's local knowledge of their area provides valuable input during the planning process. This knowledge includes insights into water flow patterns, flood-prone areas, and traditional solutions that may not be known to external parties. For instance, in Matangkuli, Tanah Luas, and Lhoksukon, residents have contributed their expertise on levee improvements based on their years of experience with floods. By incorporating this local knowledge into planning, flood management programs become more targeted and effective.

Additionally, the participatory model strengthens social networks within the community. Joint involvement in flood management activities, such as mutual aid and evacuation planning, fosters solidarity among residents. Working together toward common goals helps build stronger, more trusting relationships. This is particularly crucial in emergencies, where social support can significantly influence the success of mitigation efforts. For instance, in Serba Jaman Baroh Village, Tanah Luas District, residents involved in mutual aid activities have reported a heightened sense of camaraderie and trust among neighbors, which in turn enhances the community's resilience in dealing with floods.

However, despite the many benefits, implementing the participatory model in flood management in Aceh Utara also faces several challenges. One of the main obstacles is the lack of resources, including financial, material, and time. Many villages in Aceh Utara have budget constraints that limit their ability to support community-based flood management activities. Without adequate financial backing, it is difficult for communities to undertake larger mitigation measures, such as building infrastructure or procuring mitigation tools. In some areas, residents can only carry out basic tasks, like cleaning drainage systems, which, while important, may not be sufficient to prevent major floods. Additionally, time constraints are also a challenge, especially for those who must work daily to meet their livelihood needs. Participating in flood management activities often becomes an extra burden that is hard to fit into their daily routines.

Another challenge encountered is the lack of coordination and support from the government. Although the participatory model emphasizes community involvement, government support remains crucial for the success of the program. However, in some cases, government support in Aceh Utara has not always been consistent or effective. For example, some villages have reported that government flood management programs often lack proper coordination with local initiatives, leading to confusion among residents. Additionally, government aid is often delayed or unevenly distributed, causing communities to feel neglected and less motivated to participate. In other cases, a lack of transparency in the management of aid funds further diminishes public trust in the government, which in turn affects their participation in flood management programs.

Furthermore, resistance from some community members to changes or new innovations introduced in flood management programs is also an obstacle. While some residents may be eager to participate, others

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may be skeptical or fearful of change. For example, in certain villages, people are hesitant to adopt new technologies or follow approaches that differ from traditional methods they have used for years. This resistance is particularly common in older or more isolated communities, where change is often viewed as a threat to the status quo. Such resistance can hinder the implementation of the participatory model, as the success of the program heavily depends on the full engagement of all community members

To address these challenges, focused and collaborative strategies are essential. One strategy involves improving access to and allocation of resources. The government needs to ensure that villages involved in flood management have adequate access to financial and material resources. Increasing the allocation of village funds for flood management activities could be an effective solution. Additionally, partnerships with the private sector or non-governmental organizations (NGOs) can help provide the extra resources needed. For instance, in Blang Teurakan Village, Sawang District, collaboration with local NGOs and the government successfully brought in the technical and material assistance needed to strengthen flood barriers and provide other logistical support.

Another approach is to enhance coordination among the government, community, and relevant organizations. Local authorities should take a more active role in coordinating flood management programs to ensure that all parties involved work in a coordinated and harmonious manner. Establishing communication forums or working groups that include representatives from the community, government, and NGOs can be an effective way to improve coordination. Through these forums, stakeholders can share information, discuss challenges, and find solutions together. Additionally, increasing transparency in fund management and program implementation is crucial to rebuild public trust in the government.

It is also crucial to adopt a more inclusive approach to addressing resistance to change. Continuous education and outreach about the benefits of new innovations and modern technologies in flood management are necessary. This can be achieved through training sessions, workshops, or community meetings where residents are invited to discuss and share perspectives. Involving respected community leaders or local figures in these educational efforts can also help reduce resistance. For example, in Kecamatan Matangkuli, a respected community leader successfully persuaded residents to try new methods for building flood barriers by demonstrating positive results from other villages that had implemented those methods.

Community participation in flood management in Aceh Utara offers numerous benefits that can enhance the effectiveness and sustainability of programs. These benefits include increased community ownership and responsibility, improved flood management effectiveness, and strengthened social networks within the community. However, the success of this model is not without challenges, such as limited resources, lack of coordination and support from the government, and resistance to change. With appropriate strategies—such as improving access to and allocation of resources, enhancing coordination among agencies, and adopting inclusive educational approaches—these challenges can be addressed. This will enable the participatory model to be implemented more effectively and provide optimal benefits for the communities in Aceh Utara.

Participatory Model in Enhancing the Effectiveness and Sustainability of Flood

To enhance the efficiency and sustainability of flood management programs in Aceh Utara, the participatory model utilizes various elements related to community involvement in flood mitigation efforts. This model engages the community in planning, evaluation, and implementation of flood management activities, making the programs more effective and sustainable. Moreover, the participatory model boosts the effectiveness of flood management programs by encouraging active community participation in their execution. When residents are involved in activities such as cleaning drainage systems, constructing embankments, or developing evacuation plans, they not only benefit from the program but also become key contributors to the mitigation efforts. This involvement fosters a greater sense of responsibility and ownership over the outcomes achieved. Consequently, the community is more committed to maintaining the infrastructure that has been built. For example, residents involved in embankment construction in the Matangkuli District voluntarily continue to maintain the infrastructure after the project is completed,

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ensuring that it remains functional and resilient against future floods.

Additionally, the participatory model enhances the effectiveness of flood management programs by encouraging active community involvement in their implementation. When community members engage in activities such as cleaning drainage systems, constructing embankments, or developing evacuation plans, they not only benefit from the program but also become key contributors to the mitigation efforts. This involvement fosters a greater sense of responsibility and ownership over the results achieved. As a result, the community is more committed to maintaining the infrastructure that has been built. For instance, residents involved in embankment construction in Matangkuli District voluntarily continue to maintain the infrastructure after the project's completion, ensuring that it remains effective and resilient against future floods.

Flood management programs heavily rely on active community participation. Programs with sustained participation have a significant impact both in the short and long term. Sustainability is evident in various aspects such as intergenerational knowledge transfer, infrastructure maintenance, and ongoing mitigation activities. Even after official project completion, communities actively engaged in flood management are likely to continue mitigation efforts. This is achieved because they have internalized the importance of these efforts and understand that their collective actions ensure the sustainability of mitigation measures. For example, in Meurah Mulia District, residents collectively clean drainage systems every rainy season, even without direct guidance from the government or NGOs. This practice is crucial for long-term flood prevention and illustrates how active community participation becomes a sustainable habit.

Maintenance of infrastructure built through participatory programs demonstrates the sustainability of the initiative. For infrastructure such as embankments, drainage systems, and early warning systems to remain effective, they need regular upkeep. Since infrastructure can deteriorate or become ineffective without community support, active community involvement in maintenance is crucial. In several villages in Aceh Utara, communities have formed groups responsible for monitoring and maintaining infrastructure. These groups oversee the condition of the infrastructure and carry out minor repairs as needed. Their efforts ensure that the infrastructure remains functional even after the project is completed. The sustainability of this maintenance depends on the support from government and NGOs, as well as the community's commitment to maintaining and preserving their infrastructure.

However, the participatory model in flood management in Aceh Utara faces numerous challenges that can hinder the program's performance and sustainability. A major issue is the lack of community capacity and resources. Although communities possess valuable local knowledge, they often lack the technical skills and resources necessary for implementing more complex mitigation programs. This limitation can reduce the effectiveness of the program, especially when advanced mitigation actions or sophisticated infrastructure are required. Additionally, financial resource constraints are a significant issue, particularly in villages with limited access to adequate village funds. Mitigation measures that require high costs, such as constructing large embankments or purchasing mitigation equipment, become challenging for communities without sufficient financial support. Another issue is the lack of effective coordination between the community, government, and relevant agencies. Although the participatory model stresses the involvement of all stakeholders, in practice, coordination is often inadequate. This lack of coordination can confuse the community when flood management efforts by different agencies are not aligned. Discrepancies or conflicts in actions can disrupt the program. Some villages report that government and NGO initiatives frequently fail to meet local needs or consider local knowledge and experience. Inadequate communication among involved parties can also diminish community trust in the program, potentially leading to lower levels of participation.

Resistance to change is another challenge in implementing the participatory model. While some communities are enthusiastic about participating, others may be skeptical or apprehensive about new methods, especially if they deviate from long-standing traditional practices. Since the success of the participatory model depends on the full engagement of the community, such resistance can impede the program's effectiveness. Moreover, communities might believe that the government should assume greater responsibility for flood prevention rather than relying on their own efforts. This belief can result in reduced

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motivation to participate, especially among those who doubt the impact of their involvement.

To tackle these challenges, implementing effective strategies and fostering collaboration is crucial. One approach is to strengthen community capabilities through targeted training and outreach. Training programs that focus on technical skills, risk management, and resource management can enable communities to execute mitigation efforts more effectively. Ongoing outreach about the value of participation and program sustainability can also help overcome resistance to change. For instance, in Gampong Blang Village, Sawang District, local NGOs have successfully enhanced community skills in infrastructure development and maintenance, boosting their confidence and ability to implement better mitigation practices.

Improving the effectiveness and sustainability of programs requires enhanced coordination among government, community, and relevant agencies. The local government should take a more proactive role in coordinating flood management efforts to ensure cohesive and cooperative work among all parties involved. Creating communication forums or working groups that include community, government, and NGO representatives can significantly improve coordination. These forums allow for sharing information, discussing challenges, and jointly developing solutions. Additionally, increasing transparency in fund and program management is essential for rebuilding community trust in the government. Transparency reassures the community that their involvement is valued and that the programs being implemented are truly beneficial.

Building community awareness and understanding of the importance of active participation in flood management is another strategy. Educational and outreach campaigns that emphasize the long-term benefits of involvement in mitigation programs can help shift opposing attitudes. Additionally, the effectiveness of these campaigns can be enhanced by using respected community leaders to deliver the message. For example, in Matangkuli District, a respected community leader successfully persuaded residents to engage more actively in flood management efforts by showcasing examples of other villages that have successfully minimized flood impacts through active approaches. This approach not only changes opposing attitudes but also builds trust and encourages greater involvement in flood management programs.

Furthermore, strengthening collaboration between the government, community, and private or non-governmental organizations is also crucial. Such partnerships can help address resource shortages and improve community access to financial and technical support. For instance, corporate social responsibility (CSR) programs can encourage the private sector to support flood management projects. Partnerships with local businesses in several villages in Aceh Utara have helped provide the necessary resources for building mitigation infrastructure, such as repairing drainage systems and constructing embankments. NGOs can also enhance community participation by offering support and technical training.

Institutional strengthening at the community level should also be a focus of the long-term plan to enhance program sustainability. Flood mitigation activities can be carried out sustainably and become part of daily life by establishing community groups dedicated to flood management, such as embankment maintenance groups or flood alert teams. Additionally, these groups can act as intermediaries between the government and the community, ensuring that community needs and voices are heard in decision-making processes. For example, in Sawang District, the formation of flood alert groups has improved coordination of mitigation efforts at the community level, making responses to floods faster and more organized.

Ultimately, the implementation of a participatory model to enhance the efficiency and sustainability of flood management programs in Aceh Utara relies heavily on the commitment and collaboration of all involved groups. Despite challenges such as resource shortages, lack of collaboration, and resistance to change, these issues can be addressed with the right approach. To ensure that flood management programs are successful both in the short and long term, it is essential to focus on enhancing community capacity, improving coordination between government and community, building strong partnerships, and strengthening institutional frameworks at the community level.

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This discussion underscores that community involvement not only enhances flood management programs but is also a key factor in their success or failure. By engaging the community fully and promoting active participation throughout all stages of flood management, the effectiveness of the program can be greatly improved. Furthermore, when the community is actively involved, the program's sustainability is ensured, as people who feel responsible and invested will be more committed to maintaining infrastructure and continuing mitigation efforts even after the project concludes.

A comprehensive, collaborative, and sustainable approach is crucial to achieving these objectives. For programs to meet local needs and be effectively executed by the community, ongoing support and facilitation from the government and relevant agencies are essential. Therefore, the participatory model stands out as a valuable strategy for addressing floods in Aceh Utara, enhancing public health, and fostering a safer, disaster-resilient environment.

Conclusions

Community involvement in flood management involves active engagement in the planning, execution, and assessment of programs. This participation includes not only the contribution of time and effort but also the application of local knowledge and traditional practices, which enhance the effectiveness of flood management efforts.

The primary advantages of the participatory model are enhanced program effectiveness and sustainability, increased local capacity, and greater community cohesion. Nonetheless, there are challenges such as limited resources, inconsistent participation among different villages, and the need for improved technical skills within communities. The participatory approach has proven to boost program effectiveness by ensuring that solutions are relevant to local conditions and by instilling a stronger sense of responsibility among community members. Sustainability is supported through building local capacity, fostering economic empowerment, and implementing policies that promote active involvement. Despite these successes, challenges related to resource limitations and the need for better regulatory frameworks still need to be addressed to achieve long-term sustainability. In summary, the participatory model has delivered positive results in flood management in Aceh Utara, but it requires continued support and effective strategies to address existing challenges.

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