Assessing the Effectiveness of Government Policies on Flood Mitigation in Vulnerable Southeast Asian Developing Countries: A Case Study of Vietnam and Indonesia

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

The research question of this study is "How effective are government policies in mitigating the impact of flooding on vulnerable developing countries in Southeast Asia, specifically Vietnam and Indonesia?" The significance of this question lies in the fact that flooding, as a frequent and destructive natural disaster, hits Southeast Asia especially detrimentally. The region is particularly vulnerable due to geographic reasons and the concentration of the at-risk population in low-income countries with underdeveloped infrastructure systems, such as drainage and flood protection (Van, 2010). Flooding often causes significant social disruption and economic losses: Lives of millions of people are impacted during every flooding season, and the resulting social turmoil causes the economic progression to halt (Torti, 2012). These far-reaching consequences affect not only individuals and communities but also the more comprehensive social and economic structure.

Given the severe consequences of flooding, it is crucial to understand what efforts people have made to mitigate its impacts. Government policies play a significant role in flooding prevention and impact mitigation. As a collective body rendered the power to protect the well-being of its residents, the government has the duty to mitigate the effects of natural disasters using all possible methods. Governments of countries in Southeast Asia have always been investigating and advancing ways of preventing flooding and mitigating its effects, and there are policies in place that have successfully made flooding issues less detrimental to the region. To get a more comprehensive image of the flooding issue, analyzing government policies is an essential step.

This study examines the impact of government policies on reducing the social and economic impacts of flooding in vulnerable developing countries in Southeast Asia, focusing on

Vietnam and Indonesia. Through a comparative analysis of government policies across countries, the study will provide a comprehensive understanding of the role of government policies in mitigating the impacts of flooding and identify the most effective measures for mitigating and supporting the development of disaster risk reduction and adaptation strategies in the region. The findings of this study will aid in the development of disaster risk prevention, reduction, and adaptation, as well as improving the resilience and sustainability of affected communities. By providing a deeper understanding of the interplay between government policies and the impacts of flooding, this study will contribute to the broader literature on natural disasters and human development.

The argument of this paper is as follows: The governments in Southeast Asia have been devoting unignorable efforts to mitigate the impacts flooding brings to society. While their policies are effective to some extent, there is room for improvement: The current flooding prevention system employed by governments in Southeast Asia has many limitations and can only alert the public of floods of specific kinds; thus, advancing the flooding prevention system to make it respond to all kinds of floods will contribute to flooding prevention. Also, governments should put more effort into infrastructure construction, as better infrastructure will mitigate the economic damages during floods. Moreover, a sophisticated community-based system, where the public participates in flooding management, is essential in the process of adaptation and restoration after floods. Lastly, governments of different countries in Southeast Asia should develop a mutual aid system to facilitate the reconstruction after floods.

Background

As mentioned above, flooding has long been a persistent issue in Southeast Asia, affecting millions of people and causing widespread damage to homes, businesses, and infrastructure. Southeast Asia is especially vulnerable to flooding for several reasons: Geographically, it faces the threats of high precipitation, unpredictable rainfall, and dangerous tides. Southeast Asia is an easy target for flooding as a coastal region with many countries situated in low-lying areas. Demographically, the concentration of susceptible populations in low-income countries with inadequate infrastructure exacerbates the impact of flooding, leading to massive economic losses and, more importantly, the disruption of millions of people's lives and livelihoods.

Records of flooding in Southeast Asia illustrate the significantly negative impacts it brought to society. According to the United Nations Office for the Coordination of Humanitarian Affairs, the number of people affected by flooding in Southeast Asia exceeds 10 million, as the severity and frequency of flooding have increased. Floods that occurred in 2011 in Southeast Asia resulted in over 1,300 fatalities, and the data only includes direct death during the floods (Torti, 2012). Besides the tragedy of people losing their lives, flooding also led to a disastrous economic downturn: housing and infrastructure were destroyed, and the damage was estimated to range from hundreds of millions to billions of dollars. The region's economy also suffered indirect effects such as reduced productivity, decreased income and employment opportunities, and increased poverty and wealth gap.

In response to these challenges, regional governments have implemented various policies to mitigate the effects of flooding. These include the development of early warning systems, the

improvement of drainage and flood control infrastructure, and the implementation of community-based disaster risk reduction programs, all of which will be further analyzed.

Literature Review

There is a growing body of literature on the effects of floods in Southeast Asia and the effectiveness of government policies in mitigating these impacts. A review article by Saleem Ashraf (2017) overviews recent studies on flood damage and mitigation strategies in Southeast Asian countries. The author discusses the factors contributing to flood damage, including urbanization and climate change, and reviews the policy measures that have been implemented to mitigate the impact of floods in the region. Standard policy measures identified by the authors include early warning systems, flood control infrastructure, land-use planning, and community-based disaster risk reduction programs. The policy measures mentioned by the author are potential targets this research aims to analyze.

Aside from the overview of flood mitigation policies, there are also studies that focus on specific aspects of flood management. For instance, Ren et al. (2018) focused specifically on risk prevention by comparing early warning systems in several Southeast Asian countries. The author found that developing flash flood warning systems using machine learning has effectively reduced flood impact. Moreover, Thi et al. (2012) discovered that a community-based disaster risk reduction program implemented in Vietnam increased the resilience of affected communities and diminished the social and economic impacts of floods.

The role of governance is also a critical topic among works of literature regarding flood management. Miller & Douglass (2015) offer a critical perspective on the role of governance in managing disasters in Southeast Asia, including floods. They argue that the region's disaster

governance often treated environmental disasters with routinized responses, assuming that specific characteristics of natural disasters are "reducible to a set of universalized operating procedures" (Miller & Douglass, 2015, p. 4). When discussions regarding natural disasters step away from development discourses, effective disaster management is hampered. The authors suggest that effective disaster governance necessitates a shift from reactive to proactive approaches, from narrowly defined technocratic solutions to more integrated and inclusive approaches, and from fragmented and uncoordinated actions to more coherent and collaborative efforts.

These previous studies underscore the importance of effective government policies in mitigating the effects of flooding in Southeast Asia and highlight the need for further research to assess the efficacy of these policies and identify best practices for flood mitigation in the region.

Methods

The methodological framework chosen for this study is a combination of a systematic literature review and a comparative case study analysis. This approach enables a thorough examination of the flood management policies and strategies in Vietnam and Indonesia and allows for the identification of similarities and differences between the two countries.

The systematic literature review was conducted to gather relevant literature on flood management policies and strategies in Vietnam and Indonesia. Multiple databases were searched, including Web of Science, Scopus, Google Scholar, and relevant government websites. The search was focused on identifying studies that discussed flood management, early warning systems, infrastructure development, land use planning, and institutional coordination in both countries. The inclusion criteria were studies published in English from 2000 to 2021. The search

results were screened, and relevant articles were included for further analysis. The literature review helped establish an understanding of the current state of flood management in Vietnam and Indonesia and identified the critical themes for comparison.

Based on the information obtained through the systematic literature review, a comparative case study analysis was conducted to identify and compare the flood management policies and strategies in Vietnam and Indonesia. The analysis was organized according to the key themes identified during the literature review, with inter-agency coordination and collaboration as an addition. The comparative analysis allowed a better understanding of the similarities and differences in flood management approaches in Vietnam and Indonesia. It also provided insights into the effectiveness of the two countries efforts to reduce the social and economic impacts of floods.

By utilizing a combination of a systematic literature review and comparative case study analysis, this study is able to rigorously examine the flood management policies and strategies in Vietnam and Indonesia, highlighting both the successes and challenges faced by these countries in managing flood risk. This approach facilitated the identification of areas where improvements can be made, as well as potential lessons to be learned from each country's experiences, providing support to the central claim.

Results

This section presents the findings of the comparative analysis of government policies and strategies related to flood mitigation in Vietnam and Indonesia. The results are organized according to the main themes identified during the data analysis, highlighting the similarities and differences between the two countries and their effectiveness in reducing the social and

economic impacts of flooding. Investigation of the policies in place facilitates further identification of the strengths and potential weaknesses of flooding prevention and effect-mitigation systems, contributing to the future refinement of policies.

(1) Early Warning Systems

In both Vietnam and Indonesia, early warning systems have been implemented to improve disaster preparedness and response. With the increasing availability of mobile devices and network facilities, there is an opportunity to develop smart cities and connected infrastructure that can improve flood warning and response systems (Vu, 2018). Ngo et al. (2019) conducted a review of early warning systems for flash floods and debris flows in Vietnam, highlighting that several pilot monitoring and warning systems based on rainfall and river water levels have been installed and operated. However, these systems were mainly suitable for flooding and flash floods in river basins; the early warning system for debris flows, defined as fast-moving landslides that usually start on hillsides or mountains, had not been studied and applied extensively in Vietnam (USGS). Since debris flows are common during seasons with intense rainfall in Vietnam, the development of a prevention system that encompasses this type of flood is essential in mitigating the effects of flooding.

In Indonesia, Djalante and Thomalla (2012) emphasized the importance of integrating disaster risk reduction (DRR), often defined as the "concept and practice of reducing disaster risks through systematic efforts to analyze and reduce the causal factors of disasters" (UNESCO), and climate change adaptation (CCA), referred to as "altering our behavior, systems, and—in some cases—ways of life to protect our families, our economies, and the environment in which we live from the impacts of climate change" (WWF), in managing climate-related risks. While DDR concerns about reducing the risk of disasters through reducing

vulnerability and increasing preparedness, CCA cares more about adjusting to reduce the potential effects of climate change. The two approaches are often separated by administrative and institutional boundaries (UNDRR). Through their interviews with 26 DRR and CCA stakeholders in Indonesia, they found that there was a need for re-orientation of institutional arrangements for DRR and CCA, more robust local-level support, and increased involvement of non-government organizations in community-based initiatives. The authors proposed practical suggestions for integrating DRR and CCA planning and implementation activities in Indonesia. The article stressed the significance of a more complicated governance system in which cooperation and collaborations are essential elements. The policies should not be restricted to only allow the participation of the government: The aids from the entire community are necessary.

In a more recent study, Gupta et al. (2022), which is co-authored by the writer of this paper, explored the validation of crowdsourced flood images using machine learning and real-time weather data in Vietnam. By creating a website for users to upload flood images and developing a Convolutional Neural Network (CNN) model to predict whether the images depict floods or not, the authors demonstrated the potential of using big crowdsourced data for flood prediction. When the system detects the risk of floods from a real-time image uploaded, it reacts by updating the cloud server monitoring system to analyze the direction and severity of the floods base on the location of the monitor device. The CNN algorithm achieved a 93.47% accuracy in predicting flood images, showing the scalability and reliability of this validation method for crowdsourced data. The system breaks the limitation of the current prevention system and takes all floods into consideration.

The findings from these studies indicate that the implementation of early warning systems in Vietnam and Indonesia has the potential to improve disaster preparedness and response. However, there is a need for further research and development of early warning systems that cater to specific hazards and the integration of DRR and CCA efforts, particularly at the local and community levels. The use of crowdsourced data, as demonstrated by Gupta et al. (2022), presents a promising approach for enhancing flood prediction and response capabilities in these countries.

(2) Infrastructure Development and Flood Control Measures

The governments of Vietnam and Indonesia have prioritized infrastructure development to mitigate the impacts of flooding. In Vietnam, this includes the construction of dykes, reservoirs, and drainage systems. In Indonesia, the focus has been on river and coastal embankments, as well as the development of urban drainage systems. Infrastructure development in the two countries has largely mitigated the effects floods brought to society; the beneficial results of infrastructure development prove the necessity of continuing infrastructure development.

Luo et al. (2018) assessed flood inundation and the effectiveness of the drainage system in the Hanoi Central Area, Vietnam, under historical and extreme rainfall conditions. Although the drainage system in place has protected Hanoi from flood inundation to some extent, they found that flash floods have become increasingly frequent and severe in Asian cities, including Vietnam, due to urbanization and extreme rainfall, and the system in place no longer suffices. An underdeveloped drainage system could not protect Hanoi from reaching the Probable Maximum Precipitation, which presents the highest risk in terms of water depth and inundation area. These findings prove the need for further development of the drainage system in the Hanoi Central

Area: the pump stations should be located more appropriately, and the flood prevention measures should be designed more carefully.

On the other hand, Ghozali et al. (2016) conducted a study comparing climate change mitigation and adaptation for flood management between Ayutthaya City, Thailand, and Samarinda City, Indonesia. They found that both cities have similar flood risk characteristics, but Ayutthaya's government played a more vital role in flood management. The study concluded that flash flood adaptation is the main challenge for the Indonesian government, which requires further planning for water management and water pump system while continue building the drainage system for underdeveloped areas. Cities in Indonesia should increase adaptive capacity to reduce flood damage during flooding and improve the toughness of urban infrastructures to control further damage after flooding.

In comparing Vietnam and Indonesia, it appears that both countries face challenges in managing flood risks due to urbanization and extreme rainfall events. Both Vietnam and Indonesia should pay efforts into advancing their infrastructure to mitigate the damages during floods: Indonesia needs a better water management system, and Vietnam should develop a drainage system that properly locates pump stations.

(3) Community-based Disaster Risk Reduction Programs

Vietnam and Indonesia have adopted flood risk management activities to minimize flood risks and promote sustainable development. Although both are still on their way to perfection, Indonesia gained more prominent achievements because the government employed a more community-based system; on the other hand, because of a lack of participation at the community level, Vietnam failed to develop a system that carries out flood risk management activities effectively.

In Vietnam, flood risk management (FRM) activities have been implemented according to the hierarchical structure of the political system, with a focus on centralized government roles at the national and provincial levels (Luu, 2018). However, there has been a lack of participation from experts, researchers, and scientists in steering committees and an urgent need for greater public participation in FRM at local levels, so the system was not fully realized. Empowering the community by rendering them the opportunity to participate in planning and decision-making power is necessary to improve the effectiveness of FRM activities in Vietnam.

In Indonesia, efforts have been made to alleviate flood problems through legal framework establishment, community participation programs, and flood-control projects. In the post-disaster stage, the authorities and the public have been quite responsive. The participation of the community contributed to the speed and effectiveness of adaptive and restorative processes, mitigating the effects of flooding. However, prevention and preparedness are still lacking: when recurrent flooding events take place, the damage could still be severe (Hapsari, 2016). Thus, to maximize the benefits of this sophisticatedly designed system and maintain the advantage of community-based programs, sustainable actions are needed to solve these problems, including environment-based flood-integrated countermeasures, improving water retarding function, eradication of deforestation, meteorological and hydrological prediction, and political will and law enforcement.

The analysis above proves that community-based disaster risk reduction programs are effective in addressing flood risks. These programs have facilitated the restoration and adaptation of communities after floods. However, the system could be improved in terms of enforcement, resource allocation, and public participation. Strengthening collaboration between government agencies, experts, and local communities, as well as enhancing prevention and preparedness

measures, can contribute to more effective flood risk management in Vietnam; expanding the system to take care of flooding prevention will mitigate the risk in Indonesia.

(4) Interagency Coordination and Collaboration

The comparative analysis underscores the significance of interagency coordination and collaboration for effective flood mitigation policies. In both Vietnam and Indonesia, the presence of multiple agencies with overlapping responsibilities has occasionally resulted in fragmented efforts and decreased efficiency. Nonetheless, recent initiatives in both countries, such as the establishment of coordinating bodies, have enhanced interagency communication and cooperation. Thus, the cooperation, coordination, and collaboration among regional governments will facilitate the mitigation of impacts brought by floods. If the governments adopt more deliberative governance and work together to foster a more inclusive and collaborative environment, the damages of flooding will be significantly mitigated.

Effective flood mitigation policies require interagency solid coordination and collaboration. Before floods, agencies across countries serve the roles of alerting and assisting each other to prepare for the disaster. After floods, mutual aids contribute to the process of recovery. While Vietnam and Indonesia have faced challenges due to overlapping responsibilities among various agencies, recent initiatives have improved communication and cooperation between these entities (Alfian, 2020; Bruun & Rubin, 2023). The growing communication is a good sign, but issues are waiting to be addressed: The controversy regarding hydropower construction and flood management between the two countries must be addressed to maintain better collaboration (Bruun & Rubin, 2023). Also, conflicts regarding political dynamics, regulatory changes, and other factors have limited the success of cooperation (Alfian,

2020). It is crucial for both countries to continue addressing these challenges and fostering a more collaborative approach to environmental governance and flood mitigation.

Discussion

This section discusses the comparative analysis of government policies and disaster reduction strategies in Vietnam and Indonesia. The discussion is centered around the identification of best practices and lessons learned and addressing potential counter-arguments in both countries.

(1) Identification of Best Practices and Lessons Learned

Both Vietnam and Indonesia have implemented early warning systems to improve disaster preparedness and response. However, the current system only covers flash floods and does not have the ability to alert the public of other types of floods that frequently take place. There is a need for further research and development to create warning systems able to report potential floods of all types and duration (Djalante & Thomalla, 2012). In terms of infrastructure development, both countries face challenges in managing urbanization and extreme rainfall events. Yet, Indonesia needs to focus more on improving water management systems, while Vietnam should concentrate on designing a drainage system that correctly positions pumping stations.

Moreover, although efforts have been made, a more sophisticated community-based flood management program is awaiting development in both countries, especially in Vietnam. Strengthening collaboration between government agencies, experts, and local communities, as well as enhancing prevention and preparedness measures by addressing the challenges of policy

enforcement, resource allocation, and public participation, can promote more effective flood risk management in both countries.

Institutional coordination and cooperation are also crucial for the effective implementation of flood mitigation policies. Recent initiatives in both countries, such as the establishment of coordinating agencies, have improved communication and collaboration among entities. However, there is still room for improvement as conflicts between the two countries regarding how to exercise flood management have not yet been addressed.

(2) Addressing Counter-Arguments

One could argue that the effectiveness of flood mitigation policies in Vietnam and Indonesia might be limited by political dynamics, regulatory changes, and other factors that hinder the success of watershed management. However, the ongoing efforts to establish collaborative management processes and improve interagency coordination are promising steps towards a more inclusive, collaborative approach to environmental governance and flood mitigation. When facing natural disasters, the boundaries of ethnicity, culture, language, and politics should no longer be barriers hindering cooperation and collaboration. The collective wisdom of humanity is always more powerful than individual effort. The challenges faced by both countries can be addressed by fostering an environment of open communication, learning from best practices, and tailoring strategies to suit specific local contexts.

The comparison of policy implementation and outcomes in both Vietnam and Indonesia highlights the importance of early warning systems, infrastructure development, community-based disaster risk reduction plans, and institutional coordination. By addressing the challenges

in these areas, both countries can work towards more effective flood risk management and mitigation.

Conclusion

In this comparative analysis of government policies and disaster reduction strategies in Vietnam and Indonesia, it was found that both countries have made progress in implementing the most effective means to flood control, including early warning systems, infrastructure development, community-based disaster risk reduction plans, and institutional coordination. However, the current systems are not ideal as challenges remain: The warning systems need to be tailored to specific disasters, and the infrastructure needs to be developed to avoid severe flood inundation due to urbanization and extreme rainfall events. Policy enforcement, resource allocation, and public participation need to be improved, and collaboration within the nation by government agencies, experts, and local communities needs to be strengthened to maximize the benefits of community-based flood risk management efforts. Lastly, international coordination, cooperation, and collaboration need to be strengthened by fostering an environment of open communication and mutual assistance. After addressing these issues, the effectiveness of flood mitigation policies and strategies in both countries will be enhanced.

Future research should explore innovative solutions and technologies for early warning systems and flood prevention measures, assess the impact of climate change on flood risks and identify effective adaptation strategies, and examine the role of non-governmental organizations, the private sector, and international cooperation in enhancing flood risk management efforts. Investigating the influence of political dynamics and regulatory changes on the effectiveness of flood mitigation policies is also crucial.

Potential next steps include sharing best practices and lessons learned between Vietnam and Indonesia to enhance their respective flood risk management strategies, establishing regional networks and platforms for collaboration in research, policy development, and implementation of flood risk management efforts, and conducting regular evaluations and updates of flood mitigation policies to ensure their effectiveness in the face of changing environmental and social conditions. By addressing these research directions and potential next steps, both Vietnam and Indonesia can work towards more effective and sustainable flood risk management and mitigation.

Concerns over the relationship between humanity and technology have risen recently, but technology and society have always been shaping each other mutually: The development of technology benefits society by making people's lives more convenient, safe, and enjoyable; by the meantime, a more stable and welcoming society nurtures the most desirable environment for technological advancement. When facing natural disasters that threaten humanity's well-being, like flooding, technology is utilized to save lives and reduce costs. However, as analyzed in this paper, technology itself can never achieve the goal alone, and human participation and collaboration are necessary elements. Technology is a fruit of human wisdom, but it is not the only fruit of human wisdom; it should be situated in society in a way that benefits the progression of culture and civilization.

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